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CONFERENCE PROCEEDINGS

RAND

Defense Modeling and Simulation Office Information/Data Base (I/DB) Task Group Meetings Held February 14–18, 1994, and Notes from the Previous Two I/DB Meetings

Iris M. Kameny, Editor

National Defense Research Institute

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The conference papers described in this report were sponsored by the Defense Modeling Simulation Office under RAND's National Defense Research Institute, a federally funded research and development center supported by the Office of the Secretary of Defense and the Joint Staff, Contract MDA903-90-C-0004.

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Defense Modeling and Simulation Office Information/Data Base (I/DB) Task Group Meetings Held February 14–18, 1994, and Notes from the Previous Two I/DB Meetings

Iris M. Kameny, Editor

CF-114-DMSO

Prepared for the
Defense Modeling Simulation Office

National Defense Research Institute

PREFACE

This document contains the proceedings from the Defense Modeling and Simulation Office (DMSO) Information/Data Base Task Group (I/DBTG) meetings held at the Institute for Defense Analysis (IDA) during the week of February 14–18, 1994. It also contains the notes from two previous DMSO I/DB Task Group meetings held March 4–5, 1993 and July 28–29, 1993 which were distributed to the I/DB membership through surface and electronic mail.

The work described here was performed for the Defense Modeling and Simulation Office as part of its initiative to strengthen the use of simulation and modeling throughout DoD. RAND's participation in this effort was performed for the Director, Defense Modeling and Simulation Office within the Applied Science and Technology Program of RAND's National Defense Research Institute (NDRI), a federally funded research and development center sponsored by the Office of the Secretary of Defense and the Joint Staff.

This work should be of interest to those working in the areas of interoperability of information systems, information resource management (IRM), data dictionary systems, resource directories, data modeling and use of IDEF tools, complex data, data verification, validation, and certification (VV&C), data quality, and assessment of data management technology.

CONTENTS

SUMMARY

This document contains the proceedings from the Defense Modeling and Simulation Office (DMSO) Information/Data Base (I/DB) Task Group meetings held at the Institute for Defense Analysis (IDA) during the week of February 14–18, 1994. It also contains the notes from two previous DMSO I/DB Task Group meetings held March 4–5, 1993 and July 28–29, 1993 which were distributed to the I/DB membership through surface and electronic mail.

The DMSO I/DB Task Group was formed in January 1992 from the Information Technology and Data Base Technology working groups who met from August 1991 through December 1991 to perform technology assessments in support of the DMSO Master Plan. The original task groups were mainly composed of representatives from federally funded research and development centers (FFRDCs). An earlier document, "Database Technology Activities and Assessment for Defense Modeling and Simulation Office (DMSO) (August 1991 – November 1992), RAND MR-130-ACQ, 1994, describes the activities from August 1991 – November 1992. This document describes the activities from November 1992 through February 1994.

The main and continuing purpose of the I/DB Task Group is to address issues affecting the interoperability, sharing, and reuse of databases and models throughout the Modeling and Simulation (M&S) community. The DoD Corporate Information Management (CIM) initiative continues to address many of the data related needs of the M&S community but not all. It is important for the M&S community to be aware of the data needs not being met by CIM and unlikely to be met by commercial or other DoD means. These data needs should be addressed by the M&S community. It is critical that the I/DB Task Group continue to monitor CIM activities and help DMSO develop compatible M&S guidelines and procedures whenever possible while pointing out possible incompatibilities with CIM.

The I/DB Task Group is currently co-chaired by Dr. Chien Huo from the DISA/JIEO Center for Standards who is working with the DMSO to carry out their data administration and standards program, and by Ms. Iris Kameny from RAND who led the first Data Base Technology Working Group and has been supporting DMSO since 1991 in their data related activities. Dr. Huo and Ms. Kameny are working with CDR Gary Misch (DMSO) and with LTC Jerry Wiedewitsch, the Deputy and Technical Director of DMSO.

The I/DB Task Group has grown from around a dozen members at its inception to over 100 members today. It consists of people from the Services, Joint Staff, DoD agencies, Intelligence Community, ARPA, NIST, NASA, OSD, FFRDCs, and contractors working on government M&S programs. The I/DB Task Group meets approximately every four months (except for a meeting in the fall of 1993 which was replaced by the first MORS Mini-Symposium on Simulation Data). The I/DB Task Group has created several Task Forces each of which has co-chairs who are predominantly from the Services and the Joint Staff. The I/DB specific Task Forces meet more frequently as needed.

Because of its size, the I/DB Task Group has become more of an information exchange forum for the data suppliers to the M&S community than an action body. Members make requests for information mainly about data standards, repositories, directories, data quality, complex data, etc. and the meeting agenda is developed according to the expressed needs. In addition, I/DB members and others are invited to brief about their M&S projects, database environments and centers to support M&S, and non-M&S oriented databases and systems used by the M&S community. This exchange has been very helpful in getting different organizations to know each other and work together toward exchanging and reusing databases rather than developing redundant databases. Over the past year, the I/DB community has begun to function as a community of people coming together to solve common problems.

Accomplishments of the I/DB include:

— Developing the M&S Information System at DTIC and the I/DB portion on an internet gopher server at RAND

— Development of initial data models and standards for a Database Directory and a Model and Simulation Directory (each can be used as a "standard" core by different organizations enabling sharing of directory information across the M&S community)

— Carrying out an initial pilot study of modeling complex derived data using the Army TRAC weapon performance data (e.g., probability hit, kill) and sharing the lessons learned with the community

— Development of a methodology to build subject area information data models through reverse engineering, and training organizations in carrying out these activities utilizing IDEF modeling techniques (the Joint Data Base Elements project)

— Supporting DMSO in becoming the delegated Functional Data Administrator (FDAd) for the M&S functional area

— Currently developing a Data Administration Strategic Plan (DASP)

— Being instrumental in getting CIM to address complex data and derived data in their new Defense Information Repository System data model

To expedite work in data related support for M&S, the I/DB Task Group has started three Task Forces for accomplishing work in the areas of Complex Data, Data Standards and Data Verification, Validation, and Certification (VV&C). Each of these groups met for a day during the week of February 14–18. Specific tasks being addressed are:

— Develop guidelines for data VV&C including definition of a certification profile that will describe the quality of a dataset and create an audit trail for derived and aggregated data

— Develop a directory and guidelines and define responsibilities for authoritative data sources and ways of identifying/specifying authoritative sources. Define the roles of M&S data centers that receive data from authoritative sources and prepare it for input to models

— Define and develop an M&S repository needed by DMSO to maintain such objects as directories, data models, process models, data standards, etc.

— Define and develop a taxonomy or index (e.g., keywords, phrases) to support access to models, simulations, and databases for browsing and reuse

— Develop a categorization of complex data types and a guideline as to how to model and develop complex data standards that may require extensions to the CIM data standardization process and the IDEF1X methodology (where complex data includes derived data, rules, objects, networks, images, voice, documents, etc.)

— Address the security threat resulting from the use of aggregation and inference techniques applied to the large M&S data collections

ACKNOWLEDGMENTS

The I/DB Task Group co-chairs would like to thank Mrs. Janice Hirst of IDA for her help in coordinating and supporting the I/DBTG meetings and Ms. Linda Quicker of RAND for her efforts in coordinating the meetings and in preparing this proceedings.

1. INTRODUCTION

PURPOSE

The purpose of this document is to provide the proceedings of the February 14-18 Defense Modeling and Simulation Office (DMSO) Information/Data Base (I/DB) Task Group meeting to members, to provide information to people who wish to participate in the I/DB Task Group, and those with an interest in data activities related to modeling and simulation.

BACKGROUND

In 1991 the Deputy Secretary of Defense instituted a major new initiative to strengthen the application of modeling and simulation (M&S) in the DoD. Its purpose is to promote the effective and efficient use of M&S in joint education, training and military operations, research and development, test and evaluation, analysis, and production and logistics by: (1) establishing OSD cognizance and facilitating coordination among DoD M&S activities; (2) promoting the use of interoperability standards and protocols where appropriate; and (3) stimulating joint use, high return on M&S investment. Achievement of these goals requires the development and implementation of a DoD M&S policy, establishment of a DoD-wide management structure to coordinate joint M&S activities and requirements, and the formulation and implementation of a long range M&S joint investment strategy.

A DoD Executive Council for Modeling and Simulation (EXCIMS) consisting of DoD Component representatives was established as a board to advise the USD(A&T) on M&S policy, initiatives, M&S standards, and investments for improving current M&S capability and promising M&S advanced technologies. The Defense Modeling and Simulation Office (DMSO) was established to serve as an executive secretariat for the EXCIMS and to provide a full-time focal point for information concerning DoD M&S activities. The DMSO promulgates USD(A&T)) directed M&S policy, initiatives, and guidance to promote cooperation among DoD Components to maximize M&S efficiency and effectiveness.

To carry out its functions and develop a master plan, the DMSO enlisted the help of several Federally Funded Research and Development Centers (FFRDCs). A number of functional and technology working groups were established to determine the M&S needs and to evaluate the state-of-the-art with respect to those needs. The functional groups are: education, training and military operations; research and development; test and evaluation; analysis; and production and logistics. The technical working groups are: experiments; architecture, standards, and interoperability; methodology/applications; information; networking; computers; software; graphics; databases; instrumentation; behavior; and environment.

As a result of initial activities, the Information Technical Working Group (ITWG) began to develop plans and design of a DMSO Information System to facilitate coordination among DoD M&S activities. The Database Technology Working Group (DBTWG) identified three efforts found critical to M&S needs: need for directories, dictionaries, encyclopedias, and repositories to support timely and cost effective access to, acquisition of, and validation of external and derived databases; interoperability, data integrity and consistency across distributed databases and simulations; and M&S community objective assessment of data management products such as relational DBMSs. COL Jim Shiflett of DMSO, asked that a special task group be formed from the ITWG and the DBTWG to address the DMSO Information System in coordination with the first DBTWG identified need for directories, dictionaries, etc. The DMSO I/DB Task Group was formed in January 1992 from the Information Technology and Data Base Technology working groups. The document "Database Technology Activities and Assessment for Defense Modeling and Simulation Office (DMSO) (August 1991——November 1992), RAND MR-130-ACQ, 1994 describes I/DB Task Group activities from August 1991——November 1992. This document describes the activities from November 1992 through February 1994.

THE I/DB TASK GROUP

The I/DB Task Group is currently co-chaired by Dr. Chien Huo from the DISA/JIEO Center for Standards who is working with the DMSO to carry out their data administration and standards program, and by Ms. Iris Kameny from RAND who led the first Data Base Technology Working Group and has been supporting DMSO since 1991 in their data related activities. Dr. Huo and Ms. Kameny work with CDR Gary Misch (DMSO) and with LTC Jerry Wiedewitsch, the Deputy and Technical Director of DMSO.

The I/DB Task Group has grown from around a dozen members at its inception to over 100 members today. It consists of people from the Services, Joint Staff, DoD agencies, Intelligence Community, ARPA, NIST, NASA, OSD, FFRDCs, and contractors working on government M&S programs. The I/DB Task Group meets approximately every four months (except for a meeting in the fall of 1993 which was replaced by the first MORS Mini-Symposium on Simulation Data). The I/DB Task Group has created several Task Forces each of which has two or more co-chairs who are predominantly from the Services and the Joint Staff. The I/DB specific Task Forces meet more frequently as needed.

Because of its size, the I/DB Task Group has become more of an information exchange forum for the data suppliers to the M&S community than an action body. Members make requests for information mainly about data standards, repositories, directories, data quality, complex data, etc. and the meeting agenda is developed according to the expressed needs. In addition, I/DB members and others are invited to brief about their M&S projects, database environments and centers to support M&S, and non-M&S oriented databases and systems used by the M&S community. This exchange has been very helpful in getting different organizations to know each other and work together toward exchanging and reusing databases rather than developing redundant databases. Over the past year, the I/DB community has begun to function as a community of people coming together to solve common problems.

OBJECTIVES OF THE I/DB TASK GROUP

The broad objective of the DMSO I/DB Task Group is to support DMSO in promoting the interoperability, sharing, and reuse of databases and models throughout the Defense M&S community. To accomplish this goal requires data and model administration policies, procedures, standards, and supporting tools compatible with those of CIM and the Services. It also requires access to information throughout the M&S community about what is happening as well as information about the existence and availability of models and simulations and the data they need. Of critical concern to the community is the quality of the models and simulations as well as the data they use and generate.

Current Status In Meeting Objectives

The data administration objectives are being addressed through the recent delegation of M&S functional area data administration responsibilities to DMSO. DMSO is now the Functional Data Administrator (FDAd) for M&S and is developing its first Data Administration Strategic Plan (DASP). More attention will be paid by CIM to M&S data needs now that there is an acting M&S FDAd.

Complex Data. One reason this has been an important accomplishment is because the M&S community through the I/DB has recognized the lack of attention in the CIM community to data standards for scientific and technical data. Much M&S data is not atomic single concept data addressed by the CIM data standardization process (in accord with DoD 8320.1-M-1) but is complexly derived (e.g., probability hit, kill), or structurally complex (e.g., a road network, an object-oriented engineering view of a weapon system), or multimedia data (e.g., images, graphics, voice), or conceptually complex (e.g., rules, operation orders) data. An I/DB task is to categorize complex data and develop better ways to model and standardize it so it can be shared and reused within the M&S community. Just recently, the I/DB has begun working with the CIM Defense Information Repository System (DIRS) project which, at I/DB recommendation, is including complex and derived data in its data model. This project is addressing future needs of DoD and offers an opportunity to get M&S data standards needs included in future DoD standards.

Support for Data Standards. The Joint Data Element Interoperability (JDBE) project sponsored by DMSO has developed a methodology (documented in a Military Handbook) to build subject area information models through reverse engineering of existing databases using IDEF1X tools. This is to be extended to support the development of data standards. The JDBE project is available to M&S data projects for IDEF training and help in developing their data models.

M&S Repository. The I/DB also has a repository group that will be determining the structure and functions required for an M&S repository to handle the directories, data and process models, and data standards being developed by the M&S community. Important questions about what should be maintained in the repository include: Should the repository store and maintain sharable databases and simulation models after projects are completed and there is no other place to maintain them? Should DMSO support the maintenance of repositories by Services and other organizations rather than at DMSO? How should different repositories exchange information? Will the community need a directory system of repositories and their wares? Of server systems and their services? Should the M&S Information System act as a server frontend to users to handle their requests by searching other servers and repositories?

M&S Information System. The M&S Information System was developed to meet the M&S community needs for access to information and it has become operational over the past year. An I/DB portion of the system is maintained on an internet gopher server at RAND.

Directories. One of the original M&S community requests (from all of the functional working groups) was for directories to M&S databases and models and simulations. This is being addressed. Data models for both directories have been developed and are undergoing community consensus with plans for speedy implementation. These directories, various M&S data centers and M&S program reuse libraries need a taxonomy or index (e.g., key words or phrases) to enable access to the stored objects and information in a user friendly way for browsing and reuse. Another I/DB group is working on developing such a taxonomy which will be available across the community.

Data Verification, Validation & Certification. The M&S community has established guidelines for verification, validation, and accreditation (VV&A) of M&S. The I/DB community is in the process of developing guidelines for verification, validation, and certification (VV&C) of data and will be working closely with the VV&A Task Force. It will be defining a certification profile that will describe the quality of a database including the types of verification and validation tests performed on the data. The profile would be available to all the potential M&S users of the database. It will enable them to understand what data is contained in the database, its quality, and aid them in deciding if the quality is sufficient for the task at hand. If the quality is insufficient, then the profile would aid them in making cost/benefit decisions about achieving the data quality they desire.

CIM has recently become interested in promoting data quality within the DoD. The main difference between their data quality program and this I/DB effort appears to be that they are engaged in establishing data quality standards within DoD while the I/DB is trying to develop a way to describe the quality of a database independent of a quality standard. Some M&S databases (e.g., intelligence force assessments, futures) are by their nature incomplete, of variable probability of belief, etc.—this is the type of information (as well as other kinds of data) that will be captured in the profile.

Authoritative Data Sources. Where the data standards effort is dealing with the creation and management of data about data (metadata) to enable data sharing, a part of the VV&C task effort addresses the owners of the "real" data. They will be developing a directory and guideline for authoritative sources of M&S data including specifying what their responsibilities are to the rest of the M&S community. Part of the task is to determine how authoritative sources will be identified and selected. Another part of the task is to define the roles of the M&S data centers that take data from sources and prepare it for input to a specific set of models.

Database Security. An additional area of interest to the I/DB community is the potential security threat resulting from the use of aggregation and inference techniques applied to the large M&S data collections as well as interest in multi-level security.

ORGANIZATION AND STRUCTURE OF THIS DOCUMENT

This document contains the proceedings from the Defense Modeling and Simulation Office (DMSO) Information/Data Base (I/DB) Task Group meetings held at the Institute for Defense Analysis (IDA) during the week of February 14–18, 1994. It also contains the notes from two previous DMSO I/DB Task Group meetings held March 4–5, 1993 and July 28–29, 1993 which were distributed to the I/DB membership through surface and electronic mail.

Section 1 contains the table of contents. The agenda and list of attendees for each meeting can be found in the Section reporting on that meeting.

Section 2 contains the highlights of the I/DB Task Group meetings during the week of February 14–18, 1994.

Section 3 contains notes for the main I/DB meeting held on February 16–17, 1994 which included an update on DMSO happenings, reports from other organizations, data administration, standardization and modeling activities, progress on the database and M&S directories, and reports from various M&S projects. The briefing charts from the I/DB meeting are in Appendix A.

Section 4 contains notes for the Data VV&C Task Force Meeting held on February 14, 1994. The briefing charts from this meeting are in Appendix B.

Section 5 contains notes for the Data Standards Task Force Meeting held on February 17, 1994. There were no briefing charts from this meeting.

Section 6 contains notes for the Complex Data Task Force Meeting held on February 18, 1994. The briefing charts from this meeting are in Appendix C.

Appendix D contains the notes from the 5th I/DB Workshop, held March 4–5, 1993 at IDA. These notes were previously distributed by surface mail and electronic mail.

Appendix E contains the notes from the 6th I/DB Workshop, held July 28–29, 1993 at IDA. These notes were previously distributed by surface mail and electronic mail.

Appendix F contains an acronym list.

2. I/DB TASK GROUP MEETING HIGHLIGHTS FEBRUARY 14–18, 1994.

This I/DB meeting was different from the previous ones in that we had Task Force meetings on the days before and after the I/DB. The highlights of the I/DB and the new Task Force organizations are shown below.

DMSO Deputy Director Jerry Wiedewitsch stressed the importance of data related efforts to the DMSO goal of promoting the efficient and effective use of M&S at the Joint and DoD levels. About 50% of DMSO funding goes to the support of databases, tools and methodologies and support for these areas is expected to continue at the same rate. He thanked the I/DB community for their enthusiasm, effort and support.

Howard Haeker (Army/TRAC) has taken responsibility for DIS data standards which will include applying data standards across data used in models and PDUs.

Jeff Wolfe (JIEO/CIM) discussed the Defense Information Repository System (DIRS) project which, if accepted, will be a single logical repository incorporating products from the four activities of functional process improvement, data administration, software reuse, and software engineering. An important point for I/DB is that he has incorporated the concept of complex data into his core data model and has asked for I/DB help in reviewing the data model including additional specificity of complex data. (The I/DB community shared its views on complex data with Wolfe last year.)

Mike Rybacki (Army Model and Simulation Management Office), on request, brought Jim Glymph (Army data modeler) to clarify the Army position on data standards with respect to how an M&S project could be responsive to AR25–9 and DoD 8320.1-M-1 simultaneously. There is still an open issue of missing guidance from JIEO/CIM as to the process to be followed by an M&S project in submitting data standards proposals for nomination to the DoD DDRS. Specifically, whether this should be done through the Component Data Administrator or through the M&S Functional Data Administrator.

Jack Teller (DMA) shared DMA's initial step in developing a spatial IDEF1X data model with JIEO/CIM support and their future plans. This addresses a critical I/DB recognized need for data standards for MC&G data and was on the Complex Data Task Force list as a high priority pilot study. The Complex Data Task Force will continue to track this work in detail.

The I/DB community showed much interest in active review of the M&S directory data model and IDA's prototype implementation plans since many need their own M&S directories and want to build them from a common data model. The next review meeting should be held shortly.

There was much positive feedback to Chien Huo and Iris Kameny from I/DB members on the importance of the M&S project briefs. Knowing who is doing what is leading to plans for data sharing and data exchange.

Duane Hufford (consultant for JIEO/CIM) presented a draft paper to the Complex Data Task Force (CDTF) on complex data categorization and IDEF1X methods for data modeling of complex data. Members of the CDTF will be reviewing the paper and getting comments back to the author and Hufford has agreed to be a member of the complex data categorization task.

HIGHLIGHTS OF NEW TASK FORCE MEETINGS

Three new Task Forces held meetings during the week of the main I/DB meeting. It was the second meeting for the Complex Data Task Force and the first meetings for the Data Standards and VV&C Task Forces both of which resulted from the November 1993 MORS SIMDAT working group recommendations.

The Data Verification, Validation, and Certification Task Force organized two subgroups:

Guidelines for Data VV&C (co-chairs Bob Hartling (Navy) and Mark Ralston (Army)): a major task will be to define a certification profile for a database that will describe its data quality characteristics including verification and validation methods used. The profile will be necessary for database certification.

Authoritative Data Sources and Data Centers (co-chairs Bill Dunn (Army/AMSMO) and Mike Hopkins (CENTCOM)): will identify Component authoritative M&S data sources, define their responsibilities to the M&S community, and identify and define the roles of M&S data centers that get data from authoritative sources and prepare data for input to models.

The Data Standards Task Force made specific assignments to several members and identified several subgroups: Coordination of Standards Development, Peter Valentine (Army/JDBE); Generic/Specific Data Models and Lessons Learned, Roy Scrudder (Army/JDBE); Reuse Library Framework (RLF), Luci Haddad (Army CCTT); Coordination of Data Standards Across and Within DoD, Luci Haddad (Army CCTT); Data Model Interchange Standards, Jim Augins (consultant for Navy ARMOR); Repository subgroup led by Jim Augins (consultant to Navy ARMOR) and Peter Valentine (Army/JDBE); and Database Security subgroup led by Mike Rybacki (Army/AMSMO) and Twyla Courtot (MITRE).

The Complex Data Task Force identified three subgroups:
Categorization of Complex Data (co-chairs Len Seligman (Mitre) and Pete Valentine (Army/JDBE)): will start with several recent categorization attempts including those offered in Duane Hufford's paper and the DMA data modeling effort and try to feed input back to Jeff Wolfe's DIRS project.

Pilot studies in Complex Data: UTSS, CCTT, CENTCOM, DIS (and keeping up with DMA data modeling), Chien Huo will coordinate and JDBE will support. An

Army/TRAC pilot study was done in August 1993 and reported on at the I/DB main meeting.

Taxonomy/Indexes (co-chairs Dan Hogg (JS/J8) and Iris Kameny (RAND)) (a subject area that is needed by the Repository subgroup and the database and M&S directories as well): task is to develop indexes to be used for accessing information about models and simulations and databases in DMSO directories as well as in reuse libraries. Will try to build off any available Component indexes. This is an important subject for M&S projects such as CCTT and UTSS as well as non-M&S efforts.

FUTURE MEETINGS OF THE TASK FORCES/SUBGROUPS

March 22, 1994, Data VV&C Guidance Subgroup Meeting (at IDA Room 119). Goals are: (1) finalized versions of the definitions for Data VV&C, (2) a proposal for conducting joint Data VV&C, and (3) a compilation of tools and techniques for ensuring/measuring data quality.

April 1, 1994, Data VV&C, Authoritative Data Sources and Data Center Subgroup milestone: first cut to compile the Services and Joint Elements efforts to: (1) provide agency names and responsibilities of the authorized (or perceived as authorized) data sources as necessary according to mission functionality (e.g., terrain, weather), level of resolution (e.g., engagement, campaign, theater), and customer/applications. What criteria constitute an authoritative source?; (2) provide agency names and responsibilities of data centers along with the customers and functionality they serve, (3) address sharing and reusing of data between/among these data sources and centers, and (4) address responsibilities of data customers.

April 6–7, Complex Data Categorization Subgroup meeting at IDA to get initial consensus on complex data for input to Jeff Wolfe's DIRS data model.

April 19, 1994, VV&C Task Force Meeting at IDA (0800—01700)

April 20, 1994, Data Standards Task Force Meeting at IDA (0800—1700)

3. I/DB TASK GROUP MEETING NOTES

3.1 AGENDA

WEDNESDAY, FEBRUARY 16

UPDATE ON DMSO HAPPENINGS

0800-0830	Welcome and DMSO Update Including FY94 New Project Starts: *LTC Jerry Wiedewitsch*
0830-0900	Overview on M&S Data Administration Achievements:*Dr. Chien Huo*
0900-0920	Report from M&S Data VV&C Task Group: *Ms. Iris Kameny*
0920-0940	Report from M&S Data Standards Task Group: *Mr. Howard Haeker*
0940-1000	Report from M&S Complex Data Task Group: *Ms. Iris Kameny*
1030-1100	Report on DMSO Standards Infrastructure Team: *Dr. Bill Flanigan*
1000-1030	*BREAK*

REPORTS FROM OTHER ORGANIZATIONS

1100-1130	Report from MORS SIMDAT Mini-Symposium and DIS Data Standardization: *Mr. Howard Haeker*
1130-1200	Update from TECNET Information System for the Test and Evaluation Community: *Mr. George Hurlburt*
1200-1300	*LUNCH*

DATA ADMINISTRATION, STANDARDIZATION AND MODELING ACTIVITIES

1300-1330	Update on DoD Data Model (including C2 Core Model): *Mr. Phil Cykana*
1330-1400	Defense Information Repository System (DIRS) Brief: *Mr. Jeff Wolfe*
1400-1430	JIEO Update on C2 Data Modeling: *Mr. Stan Plummer*
1430-1500	Report on IDEF Users' Group Meetings and Issues: *Mr. Peter Valentine*
1500-1530	*BREAK*
1530-1600	CCTT Data Standardization and Reuse: *Ms. Luci Haddad*

1600-1630	Report on TADS Weapon Performance Data Modeling: *Ms. Iris Kameny*
1630-1700	Army Modeling and Simulation Management Office Discussion on Data Standards: *Mr. Mike Rybacki/Mr. Jim Glymph*

THURSDAY, FEBRUARY 17

PROGRESS ON DIRECTORIES

0800-0845	Data Model for M&S Directory: *Mr. Roy Scrudder*
0845-0900	Security CONOPS for Intelligence Community Catalog: *Dr. John Griffiths*
0900-0930	Discussion of Next Steps for Database Directory and Model and Simulation Directory Implementation: *Dr. Mike Frame*

PROJECT REPORTS

0930-1000	JMASS Briefing: *Capt Bill Cashman*
1000-1030	*BREAK*
1030-1100	Update on Universal Threat Simulator System (UTSS) Project: *Mr. Mike Sarkovitz*
1100-1130	Update on Naval Warfare Tactical Data Base: *LCDR John Letaw*
1130-1200	DoD Project on Spatial Data Standardization: *Dr. Jack Teller*
1200-1300	*LUNCH*
1300-1330	AF Studies and Analysis Power Projection Data Base Project: *Mr. Stephen Boyd*
1330-1400	Joint Data Base Elements Project: *Mr. Steve Matsuura*
1400-1430	Equipment Characteristics of Data Bases (CCTT): *Mr. Rob Wright*
1430-1500	Update on CENTCOM Conventional Database Project: *Mr. Mike Hopkins*
1500-1530	*BREAK*
1530-1600	Experiences in Using Project 2851 Data: *Dr. Jed Marti*
1600-1630	Navy ARMOR Project: *Mr. Mike Dabose*
1630-1700	Wrap-up: *Dr. Chien Huo/Ms. Iris Kameny*

3.2 ATTENDEE LIST

I/DB GENERAL MEETINGS
16-17 FEBRUARY 1994

NAME	ORG	FAX #	PHONE #	E-MAIL ADDR
Erwin Atzinger	AMSAA	(410) 278-6242	(410) 278-6576	erwin@amsaa.army.mil
Jim Augins	ADS, Inc.	(619) 553-6083	(619) 553-9523	augins@nosc.mil
Thomas L. Beal	Logican	(703) 318-	(703) 318-1074	
Don Blanton	AMSAA	(410) 278-6242	(410) 278-3368	blanton@brl.mil.disa.mil
Stephen Boyd	AFSAA/SAG	(703) 697-1226	(703) 695-9019	sboyd@sun19.af.hq.mil
James Braud	NAVOCEANO	(601) 688-5196	(601) 688-4654	
L. Buchsbaum	Aircraft,Div.	(215) 441-1534	(703) 607-3384	buksbaum@nadc.mil
Linda Calvert	MITRE	(703) 883-5787	(703) 883-6326	calvert@mitre.org
Carl E. Carden	ISA, INC.	(619) 574-8111	(619) 574-8100	ccarden@nosc.mil
Bill Cashman	ASC/RWWW	(513) 255-3969	(619) 574-8100	cashmawm@revw.wpafb.af.mil
Ed Cavin	CNA	(703) 824-2949	(703) 824-2949	cavine@cna.org
Jeffrey Clouse	UNISYS	(703) 692-5379	(703) 692-5330	
B. Clydesdale	SPAWAR	(703) 602-5891	(703) 602-5889	clydesdb@stmp-gw.spawar.navy.mil
Deborah Cooper	Paramax Systems	(703) 620-7913	(703) 620-7778	cooper@rtc.reston.paramax.com
Mike Dabose	NCCOSC	(619) 553-6083	(619) 553-6095	dabose@nosc.mil
David Danko	HQ DMA	(703) 285-9397	(703) 285-9238	
Bill Flanigan	DISA/CIM	(703) 487-8038	(703) 487-8033	flaniganw@cc.ims.disa.mil
George Flax	SPAWAR-31	(703) 602-4541	(703) 602-5891	flaxr@smtp-gw.spawar.navy.mil
Kay Flood	UNISYS	(703) 692-5379	(703) 692-5360	
Mike Frame	IDA	(703) 845-6788	(703) 845-6668	frame@ida.org
John Freeman	DMSO	(407) 380-4829	(410) 380-4029	jreeman@dmso.dtic.dla.mil
James Glymph	DMD	(703) 806-3856	(703) 806-3858	glymphj@melpar-emh3.army.mil

NAME	ORG	FAX #	PHONE #	E-MAIL ADDR
John Griffiths	I.C. M&S	(703) 820-2841	(703) 820-2841	jgriffit@dmso.dtic.dla.mil
Howard Haeker	USA TRAC	(913) 684-3866	(913) 684-3030	haekerh@tracer.army.mil
Luci Haddad	RCI	(407) 282-1451	(407) 658-9549	haddadl@dmso.ditc.dla.mil
James Hammond	ARL	(512) 835-3259	(512) 835-3259	hammond.spgmsmail@msmailgwl.arl ut.utexas.edu
Ed Hughes	HQ DMA	(703) 285-9397	(703) 285-9344	
Chien Huo	JIEO/DMSO	(703) 487-3256	(703) 487-3538	huoc@dmso.dtic.dla.mil
Vicki Huo	Global	(703) 516-6058		huo@bs1.prc.com
Iris Kameny	RAND	(310) 393-4818	(310) 393-0411 x7174	Kameny@rand.org
Ed Khedouri	COMNAV OCEAN	)601) 688-5759	(601) 688-4556	n22%n2@cnoc@comis.cnoc.navy.mil
Scott Kinser	RCI	(407) 656-9549	(407) 282-1451	skinser@dmso.dtic.dla.mil
Ronald Kolbe	NRL	(202) 767-4798	(202) 767-1973	kolbe@lcp.nrl.navy.mil
Chris Landauer	Aerospace	(703) 318-5409	(703) 318-1666	cal@aero.org
John Letaw	OPNAV (N65)	(703) 697-	(703) 697-3033	
Donald Lewis	BATTELLE	(614) 424-3776	(614) 424-4350	lewis@malibu.dst.battle.org
Teresa Lunt	SRI	(415) 859-2844	(415) 859-6106	lunt@cls.sri.com
James Mailhot	HQ AFC4A	(618) 256-2874	(618) 256-9657	mailhot@afc4a.asfp.af.mil
Jed Marti	RAND	(310) 393-4818	(310) 393-0411 x6240	Jed_Marti@rand.org
Steve Matsuura	USA EPG/JDBE	(602) 538-4973	(602) 538-4967f	Matsuuras@huachuca-emh17.army. mil
Emily McCoy	MITRE (NASA)	(202) 646-9109	(703) 883-7692	emccoy@mitre.org
Ray Miller	AF/XOMT	(202) 504-5341	(202) 504-5352	miller@dmso.dtic.dla.mil
H. Messick	NRL 7441	(601) 688-4953	(601) 688-5257	mesick@erebus.nrlssc.navy.mil
C.Olson	VDS		(703) 685-7287	
Paul Oswald	DNA	(703) 325-	(703) 325-1227	oswald@hq.dna.mil
Paul Parker	VDS	(703) 683-8973	(703) 683-7287	
Nancy Pfeil	DTIC	(703) 617-7087	(703) 274-7661	npfeil@dgis.dtic.dla.mil
Michael Piercy	STRICOM	(407) 380-0667	(407 380-4433	piercym@dmso.dtic.dla.mil
Stan Plummer	DISAJIEO	(703) 487-8038	(703) 487-8024	

NAME	ORG	FAX #	PHONE #	E-MAIL ADDR
Clay Putman	GPS	(703) 271-8566	(703) 271-7700	
Mark Ralston	AMSAA	(410) 278-4694 or: x6610	|(410) 278-5344	ralston@arl.mil
M. Rybacki	AMSMO	(203) 607-3381	(203) 607-3385	rybacki@pentagon-hqdadrs.army.mil
J. Rothenberg	RAND	(310) 393-4818	(310) 393-0411 x7703	Jeff_Rothenberg@rand.org
Jim Santangelo	GPS	(703) 381-2386	(410) 381-7240	
Mike Sarkovitz	NASC HQ	(703) 692-1517	(703) 692-2641 x3006	michaelsarkovtz@airerew@pma205.navair.navy.mil
E. Schroeder	NAVOCEANO	(601) 688-4639	(601) 688-5501	eleanor@dmso.dtic.dla.mil **or:** eleanor@pops.navo.navy.mil
Roy Scrudder	CSC/JDBE	(602) 538-4933	(602) 538-4812	scrudder@huachuca-emh17.army.mil
Jack Sheehan	ARL, U./Texas	(512) 835-3259	(512) 835-3594	sheehan@msmailgwl.srlut.utexas.edu
Peter Smith	NAWC-TSD		(407) 380-8346	
Omar Spaulding	NASA	(202) 358-3098	(202) 358-0777	ospaulding@mtpe.hq.nasa.gov
P. Valentine	USAEPG/JDBE	(602) 538-4973	(602) 538-4976	valentinep@huachuca-emh17.army.mil
James Watson	SPARTA	(205) 837-	(205) 837-5200	watson@huntsville.sparta.com
Cheri Wallmark	NAVOCEANO	(601) 688-5701	(601) 688-4323	
Larry Williams	TWSTIAC	(614) 424-	9614) 424-5047	williaml@battelle.org
Rob Wright	RCI	(407) 658-9541	(407) 282-1451	wrig@dmso.dtic.dla.mil

3.3 UPDATE OF DMSO HAPPENINGS

LTC Jerry Wiedewitsch, Deputy and Technical Director of DMSO: Welcome and DMSO Update

LTC Wiedewitsch discussed the four objectives of the EXCIMS investment strategy for achieving the goal of promoting the efficient and effective use of M&S at the Joint and DoD levels. The goals are to: (1) promulgate standards to promote interoperability of the components of the M&S environment; (2) support development of databases, tools, and methodologies for community-wide use; (3) promote development of a communications infrastructure to support integration of Joint M&S activities; and (4) facilitate community-wide coordination and information sharing. The M&S infrastructure, as the foundation which will enable and support meeting the DoD objectives, is composed of four categories: policy and management, common structural definitions, common-use assets, and community-wide services.

Jerry stressed the importance of data related efforts to the DMSO goal of promoting the efficient and effective use of M&S at the Joint and DoD levels, as shown by the FY94 Focused Call in the M&S Common System Support area. About 50% of DMSO funding has gone to the support of databases, tools and methodologies and support for these areas is expected to continue at the same rate. Jerry thanked the I/DB community for their enthusiasm, effort and support.

Some important happenings in DMSO since the last I/DB meeting in July included: (1) DoDD 5000.59, Subject: Modeling and Simulation Management was signed January 4, 1994 and is available through the M&S Information System; (2) DMSO has been delegated the responsibility of the Functional Data Administrator for Modeling and Simulation, and the key responsibility rests with Dr. Chien Huo (supporting DMSO through DISA/JIEO/CFS); and (3) issuing of funds for the FY 94 projects has been put on hold temporarily awaiting DMSO investment guidance from the EXCIMS. Dr. Anita Jones has said that DMSO has spent two years developing consensus and standards by encouraging community "buy-in" and it is now time to support the broader DoD concerns of readiness, infrastructure and quality/value added. Dr. Deutsch has given authority to force conformance on M&S data standards but the DMSO community is working hard on voluntary concurrence.

There are four DMSO long term objectives: (1) seamlessly link live, constructive and virtual simulations on demand to support operational readiness of forces, (2) apply M&S more broadly and with increased validity throughout DoD, (3) Provide authoritative representations with appropriate scalability, fidelity and granularity, and (4) enable interoperability of M&S supporting technologies. Jerry went into some detail on objective #3, which directly affects the I/DB community activities. The considerations for FY95 investment will be to: orient on M&S objectives, verify infrastructure elements, use infrastructure as a foundation, focus on larger DoD concerns, and ensure compliance with DoDD 5000.59. This call will be different from the previous ones, the schedule is not yet determined, but DMSO will try to get it out by the March-April timeframe.

The community has done well at bringing weapons systems into the simulations but we now have to simulate at the people/person level (e.g., dismounted combatants, special operations forces, etc.). We need to address the level of fidelity needed with respect to requirements, doctrine, techniques and look at how we can push the system technology to the individual warrior level. We need to be able to rapidly generate terrain databases, and natural asset databases. We need pilot programs in the complex data area.

Dr. Chien Huo: Report on M&S Data Administration Achievements
We have finally been successful in getting DDR&E to delegate responsibility to DMSO to act as the Functional Data Administrator (FDAd) for Modeling and Simulation. Dr. Chien will be carrying out this role and asks for support and cooperation from the I/DB community. He plans to use the I/DB group to populate task forces to address particular issues and problems, and to be responsive to the DMSO focus calls.

The main data administration objectives are to promote the efficiency, validity and interoperability of M&S development and to address the longer term DMSO objective of providing authoritative representations, with appropriate scalability, fidelity, and granularity. The key issues are in the areas of: data standardization; data sharing, reuse and access; data verification, validation, and certification (VV&C); life cycle management of data; and data security. Identified M&S community needs/efforts are: complex data standards; M&S repository; Database and M&S Directories; data VV&C; M&S taxonomy (for data/software reuse); community use tool development; data security; and nomenclature and symbology standards. The five main responsibilities of the M&S FDAd are to (1) implement a M&S data administration infrastructure and to establish community consensus on policies, procedures and standards; (2) address complex data standardization; (3) establish an M&S repository and develop an M&S taxonomy, Database Directory, and M&S Directory; (4) identify and promulgate data administration methodology and tools; and (5) facilitate interchange of information and lessons learned. Dr. Huo reviewed current project activities and efforts and discussed ongoing DMSO supported data related projects many of which were reported on later in the I/DB program.

Ms. Iris Kameny: Report from the VV&C Task Force
Ms. Kameny reported on the results of the MORS SIMDAT Data VV&C Working Group November 16–18, 1993 and on the first meeting of the VV&C Task Force, February 14th. The MORS Data VV&C working group had over 40 participants, 10 papers were presented, and long term goals of data VV&C and issues were discussed. There were seven findings: (1) need for a VV&C group to address area; (2) need for policy, procedures, and guidelines for data VV&C; (3) need concise definition of terms; (4) VV&C needs to be addressed with strong interaction between analysis needs, model and data; (5) need to collect VV&C cost and cost benefit data; (6) there are automation tools to help with VV&C; and (7) data VV&C needs to deal with two types of databases, generic (e.g., DMA, DIA) and M&S supportive (TADS, CENTCOM CFDB). The seven findings were combined into three recommendations: (1) DMSO pursue establishment of an effort to further address these issues; (2) need for DoD to develop policy, procedures and guidelines for data VV&C management processes applied to data sources and data centers to enhance affordability, efficiency, and data

consistency; and (3) define Data VV&C terms and promulgate to MORS community. The first recommendation was carried out by DMSO's establishment of the Data VV&C Task Force that will be addressing recommendations 2 and 3. The first meeting of the VV&C TF on February 14, 1993 continued the issue discussion particularly of a certification profile describing the quality of a dataset and definitions for the terms "verification," "validation" and "certification." Two subgroups were formed: Guidelines for Data VV&C (co-chairs Bob Hartling (Navy) and Mark Ralston (Army)), and Authoritative Data Sources and Data Centers (co-chairs Bill Dunn (Army/AMSMO) and Mike Hopkins (CENTCOM)). The report of the first VV&C Task Force meeting is given in Section 4 of this report.

Mr. Howard Haeker: Report from M&S Data Standards Task Force
Mr. Haeker gave this report for Ms. Twyla Courtot who led the MORS SIMDAT Data Standards Working Group and the DMSO Data Standards Task Force which met for the first time on February 15, 1994. The overarching issues from the MORS SIMDAT meeting were: life cycle of standards, standards' enforcement, and information about standards. Standards begin with a need, they continue by people conforming and using them, and they get extended by usage/products that add value to the standard which over time results in extension to the standard. The point is that standards should be regarded as extensible and evolutionary, changing over time. Before CIM, there was no strict enforcement of standards rather the use was incentivized by cost savings through interoperability and reuse. There is a question whether this can work or if strict enforcement may be needed. More information is needed by the M&S community about: what standards are being developed, de facto and official; the availability of tools, products and methods supporting various standards; and the M&S community needs and priorities for standards. The MORS SIMDAT working group recommendation was that a standards group be formed and this recommendation was carried out by formation of the DMSO Data Standards Task Force.

The Data Standards Task Force made specific assignments to several members and identified a repository subgroup: Coordination of Standards Development, Peter Valentine (Army/JDBE); Generic/Specific Data Models and Lessons Learned, Roy Scrudder (Army/JDBE); Reuse Library Framework (RLF), Luci Haddad (Army CCTT); Coordination of Data Standards Across and Within DoD, Luci Haddad (Army CCTT); Data Model Interchange Standards, Jim Augins (consultant for Navy ARMOR); Repository subgroup led by Jim Augins (consultant to Navy ARMOR); and Database security subgroup led by Mike Rybacki (Army/AMSMO) and Twyla Courtot (MITRE).

Ms. Iris Kameny: Report from the M&S Complex Data Task Force
Ms. Kameny reported on the results of the MORS SIMDAT Complex Data Working Group November 16–18, 1993 (led by Mr. Roy Reiss) and on the first meeting of the Complex Data Task Force, October 28, 1993 (led by Ms. Iris Kameny). Activities having to do with complex data include:

May 1993:	meeting at AMSMO
August 1993:	pilot study TRAC weapon performance data model
October 1993:	first meeting of Complex Data Task Force
November 1993:	MORS working group on Complex Data

February 1993: second meeting of Complex Data Task Force

The definition of "complex data' from the MORS Complex Data WG: "complex data is data which contains inherent embedded information."

The long term goals of the Complex Data Task Force (CDTF), are to categorize complex data types, and to develop a guideline to data modeling and standardization of complex data types for the M&S community. In the near term, several activities are being conducted: (1) a subgroup was formed to address categorization of complex data co-chaired by Len Seligman (Mitre) and Pete Valentine (Army/JDBE)); (2) a subgroup to deal with pilot studies in complex data was formed of representatives from UTSS, CCTT, CENTCOM, DIS, and DMA efforts with Chien Huo coordinating and JDBE supporting; (3) a subgroup was formed to look at taxonomy/index issues co-chaired by Dan Hogg (JS/J8) and Iris Kameny (RAND)); and (4) coordination with CIM is ongoing with the participation of several CIM people.

Dr. Bill Flanagan: Report on DMSO Standards Infrastructure Team
In the spring of 1993, COL Ed Fitzsimmons, Director of DMSO, chartered ten Infrastructure Task Force (ITF) teams (in addition to the I/DB): architecture, behavioral representation (automated forces), C3I M&S interfaces, DIS testbeds, information clearing house for M&S, instrumentation, networks, security, standards, and VV&A. ITF missions were to: identify unaddressed infrastructure needs that cut across the M&S community; identify shortfalls and opportunities; and recommend products/ processes/proposals to meet the shortfalls.

Bill Flanigan (DISA/JIEO/CFS) and Marv Hammond (IDA) are co-leaders of the Standards Infrastructure Task Force Team (SIT). The SIT vision taken from DoDD 5000.59 is "To facilitate the identification, establishment, acceptance, and implementation of standards, protocols, and other appropriate mechanisms to promote efficient and effective interoperability, open systems, and the reusability of hardware, software, and data for applications of M&S. These standards, protocols, and other mechanisms will be consistent with and build upon current national, federal, DoD-wide, and, where practical, international standards." The SIT purpose is to provide: (1) a focal point for guidance/leadership for standards to DMSO and the broader M&S community; (2) build consensus and pro-actively foster cost reduction through defense conversion and dual use, migration to vendor-neutral open systems, and promotion of cultural change to DIS and related environments; (3) publish periodic assessments and studies; and (4) evolve a "national planner's" point of view from a "city planner's" point of view. The SIT membership is extensive, consisting of representatives from defense agencies, other federal departments, FFRDCs, intelligence agencies, joint staff, manufacturing associations, medical community, NASA, etc.

Issues and shortfalls (more fully described in SIT Report 01–94 available through the M&S Information System) includes: lack of availability of standard processes and models for "complex" data and "objects"; lack of software reuse and repository access; uncoordinated standards development/use within and between DoD and federal components; most M&S documentation is nonstandard/informal/non-existent; existing standards lag behind time frame needs of M&S community; and proliferation of nonstandard/non-interoperable M&S information systems across DoD and federal components.

The Standards Infrastructure Task Force Team (SIT) recommendations to DMSO include: investigate lower-cost alternatives to standardizing M&S data types/models; identify/reduce/eliminate non-standard, redundant data/object activities; formally adopt a standards' framework (suggested DoD Technical Architecture Framework for Information Management (TAFIM)); ensure DoD interests are represented in all appropriate nongovernment standards bodies; provide automated, expert system to generate hardware and software standards/standardization profiles for program managers; and counter heterogeneous information system proliferation by promoting seamless interoperability. Latest version of the TAFIM is dated 22 June 1993 and is available through the Defense Technical Information Center (DTIC). For now, if anyone needs a standards profile, Flanagan said the DISA/JIEO/CFS has one available. He stressed that we need a way to automate standardization, a way to "COTS" your requirements, possibly an interactive question and answer process.

The SIT visionary, high level road map for M&S is being reviewed now. A review of standards activities and issues involving DMSO projects funded in FY94 is also being done, and SIT is furnishing standards language for DMSO's FY 1994–1995 infrastructure RFPs.

Twyla Courtot (MITRE) is a member of the SIT and can report I/DB activities to the SIT and report back to the I/DB about SIT activities.

Questions and Answers:
There seems to be two VV&A groups, the M&S VV&A WG and the Infrastructure VV&A Team.

For investigating lower-cost alternatives to standards for M&S data types, it was suggested that the SIT come to the data source people within the I/DB.

A question was asked about what the SIT wanted to get from the I/DB (a wall or a city)? (I wasn't clear on the answer) It seemed to have something to do with things that were not in the Component's rice bowls.

Flanagan said the SIT will have two tiers of members: core members and subject matter experts that will be invited to participant on an as-needed basis.

3.4 REPORTS FROM OTHER ORGANIZATIONS

Mr. Howard Haeker: Report from MORS SIMDAT Mini-Symposium and DIS Data Standardization
The MORS SIMDAT Mini-Symposium (November 16–18, 1993) was chaired by Michael Bauman (TRAC) and the technical program chair was Howard Haeker (TRAC). There were 178 attendees, 109 were government and 69 were from industry and academia. Plenary speakers were: Mr. Walter Hollis (DUSA(OR)), Ms. Belkis Leong-Hong (CIM, DISA), LTC Jerry Wiedewitsch (DMSO), and Mr. Ed Fitzsimmons, Office of Science and Technology. There were six working

groups: VV&C, Tools and Techniques, Complex Data, Standards, Research, and Data Suppliers as well as a Synthesis Group.

Overarching issues from the Synthesis Group were mainly in the areas of standards and VV&C, with recommendations to form new groups in both areas and questions as to who pays for activities in both of these areas, and how do we keep up with what is going on? how do we or should we define data? how do we 'tag' data to indicate quality, meaning, source, etc.? Other recommendations: develop a data source catalog that identifies "subject matter experts"; develop a standard taxonomy for categorization of data; develop standard nomenclature for forces and equipment; respond to increased need for accurate and accessible unclassified data; support a M&S bulletin board for information sharing; prioritize standardization efforts using importance/priority of individual models and simulations as a guide.

DIS Data Standards: The vision is of synthetic theaters of operations shared and simultaneously operated on by the Army, sister Services, and the defense community. The M&S standards foundation consists of: data element standards, communication standards, standard services (e.g., data centers), physical and algorithm standards, all form basis for different M&S which are then linked to form DIS. DIS data standards will allow for more efficiency and stronger V&V but there are concerns with standards having a life cycle——standards may be based on past practices, use may institutionalize out-dated processes and may stifle creativity that would lead to improved results. In spite of this, standards are the foundation for common capabilities and interoperability in DIS. A library of standard items such as terrain, nomenclatures, icons, approved data, algorithms, and subroutines are critical to all phases of warfare, VV&A, computer generated forces, accurate terrain and environmental effects, etc.

Overview of data standards includes efforts in areas of: (1) dictionary/directory (AR 25–9, DoDD 8320, DDRS); (2) interoperability standards (IEEE 1278 PDU standards, NATO STANAG 4482); (3) common nomenclature (long names, short names, US, DIA, TRAC/AMSAA/STRICOM); (4) expanded DBMS for data providers (atmospheric aerosols and optics at Battlefield Environmental Directorate (BED), global electro-optical environmental matrix, weather library at BED, AMSAA); (5) center data systems (OASIS, J-MASS, UTSS, Extended Air Defense Test Bed, MIIDS, CFDB/MSDS, TADS); (6) information sharing (MOSAIC Army, CCTT data library, TWSTIAC, DMSO); and (7) education (DIS, MORS, AUSA, I/DB).

Mr. George Hurlburt: Update from TECNET Information System for the Test and Evaluation Community

TECNET has had a ten year evolution. The key 1993 research initiatives are: database evolution, query/search capability, and attention to a multi-level secure system. George went through the evolution of TECNET from 1983–1993 ending with the current configuration of an unclassified TECNET on a Sun 670 serving users over the DDN/INTERNET and direct dial-in, and a secret system high TECNET on a Sun SPARC-10 system connected through DSNET and also servicing STU III dial-in users. He went over TECNET management showing the makeup of the TECNET steering committee. The 1993 nearterm developments include cursor driven database access, combined Test and Evaluation resource databases, improved repository and enhanced facsimile. Work in progress includes hypersearch, gopher/WAIS/World-Wide-Web and windows interface. Longer term developments include groupware and PC based mail interface.

The TECNET databases that have data elements standardized into a common data dictionary controlled by the Range Commanders' Council are: ARRIIPS, TESTFACS, T&E Assets, Range Schedules, OTECC, LRPS, and MSTIRC. TECNET is developing an integrated database called the Joint Test Asset Database (JTAD) through rapid prototyping. This will be based on data elements from ATRIS, TESTFACS, and Test and Evaluation Assets databases. During 1992 -1993 they were developing an IDEF1X data model for data elements from the common data dictionary. They were also using IDEF0 during 1993 to develop a process model of how the JTAD group of data managers and users will function utilizing JTAD data. They will then do a functional mockup based on the IDEF0 and IDEF1X models to arrive at a technical specification for the JTAD by 1994 and use that to arrive at a full scale networked relational database JTAD by 1995.

George showed the Test Resource relationships of DMSO M&S to environmental impact data, reliance data, and threats and threat simulations and those relationships to the Test Resource Description which also gets data from Resource Utilization, Financial Tracking and Execution, and Resource Investment and Execution databases. He also showed the planned TECNET secure information base that will consist of EVADE (ECM database), TIDES (threat and threat simulations), and a Common TECNET Interface containing a hierarchical keyword search for access to the various collections. TIDES will contain threat data and models and simulations from EWIR, NERF, NID, Constant Webb, TEARS and INNET, and TECNET wants to add data from AJTSH, STARS, EPL and the DIA Handbook. It will reside under Oracle on a Sun SPARC 10.

Currently, TECNET I-CASE tools consist of IDEF0 and IDEF1X, and relational DBMSs (e.g., Oracle) accessed through SQL containing data or pointing to data in JTAD, TIDES, TEXIS, etc. They are thinking of using an Object-Oriented DBMS to manage complex data including M&S, visuals, and raw data. Also TECNET uses the internet (gopher, WAIS, WWW) for handling/accessing textual data such as reports and abstracts. In the future they are anticipating a subject matter knowledge base supported by "drones" who would search tightly coupled relational databases, complex data and textual data.

The TECNET vision for MLS is to systematically migrate existing TECNET resources to create a standards compliant, multi-level secure communications and processing capability which links DoD test and evaluation entities to a shared but controlled user community information resource. They are working with NSA to accomplish this. They will be performing TECNET secure experiments with a 1996 objective of supporting email, file transfer, news, bulletin board and databases over multi-level systems through DSNET.

Included in the appendix is a short paper titled "TECNET: Evolution, Capability and Research and Development Initiatives" and a copy of the TECNET newsletter "TecNet Inform" that describes the new TECNET menu system.

3.5 DATA ADMIN, STANDARDIZATION, AND MODELING ACTIVITIES

Mr. Phil Cykana: Update on DoD Strategic Data Model
The DoD strategic data model represents the view of senior officials within the DoD about what is important to the DoD. Its purpose is to provide a standard framework, single data model, single starting point, single data architecture, for identifying improvement opportunities; anticipating impact of management, process, and technology; and to provide initial set of prime words to use in data standardization. It was released for comment 22 March 1993. As of September 1993, there were many responses (157) mainly to add entities, change relationships and change definitions. They held working sessions with C2, DMA, Acquisition, and CALS. An outcome was to develop the C2 core model from the battlefield generic hub model developed for NATO and integrate it with the DoD strategic data model. The DoD strategic data model is relatively stable and is a mechanism supporting Enterprise, mission and functional area integration. The DoD Data Model will be a collection of integrated functional area and component data models developed in accord with the DoD 8320.1 series.

At their integration/reconciliation sessions they made observations about the differences in "information about" vs "content of" and the differences in strategic data model vs functional area data model vs model for data element standardization. Cykana showed a picture of the original model before changes and then the proposed update which included changing "land" to "real estate" and adding "action" from the C2 core model. The model will be extended to include enumerated domains. He showed several examples of using the DoD Strategic Data Model to show a functional area view. In discussing the functional view of a document he discussed distinguishing document content from the information about a document and information about the structured content of a document.

Cykana said that when we see Duane Hufford's models, they will be at the entity level and not the instance level. He is interested in recommendations and comments about entities vs instance data, and meta data vs data. This addresses the concept that one person's entities may be another person's instances. For example at high resolution, an entity may be a specific type of tank (e.g., M1A1) with instances being individual tanks while at lower resolution the entity may be a generic tank and the instances specific types of tanks.

Question: as to how the I/DB members can get hold of the latest DoD Strategic Data Model documents. Answer: through DTIC, phone 1–800–225–3842. Ask for the DoD Enterprise Model (which is updated every six months).

Mr. Jeff Wolfe: Defense Information Repository System (DIRS)
Key concepts for the DIRS project is (1) single logical repository, (2) common meta model (core data model for Information Management(IM) and standard data elements for IM community); (3) information assets are related, managed and controlled; and (4) addresses migration strategy. Purpose of the DIRS project is to develop the requirements for a DoD information repository to serve four major activities: Functional Process Improvement (FPI), Data Administration (DA), Software Reuse (SR), and Software Engineering (SE) all of which require policies, procedures, repository, and standards and need program interoperability and data sharing as well as support for process improvement.

Many organizations are participating in the DIRS Project including the four CIM activities, DISA, DoD Components and NIST and there are many areas of expertise that have contributed including M&S with its complex data requirement. They did a number of as-is studies including the Interim IDEF repository, DDRS, Automated Resource Management System, DSRS, and others and even reverse engineered existing repositories to get data items. The DIRS requirements analysis consists of an as-is analysis producing process and data models, a to-be analysis to define the repository meta model and a requirements definition to get a repository functional description

The to-be analysis has produced a fully attributed meta model that supports a data administration view of logical, internal and external data models. Wolfe showed us a viewgraph of the to-be data model containing example categories of the information assets (e.g., functional-activity-model, conceptual-data-model, data-entity) and a model of the management information assets (e.g., security-classification, authoritative-document, functional-area).

Wolfe said that naming should fall out of the model without needing to specify any of the conventions put forth by CIM (note: I/DB may want to explore this further). He estimates that there are close to 200 entities they will want to control and manage, of which about 22–23 are information assets. For each asset they will want to maintain a history, life cycle, facets (taxonomy, search key), etc. They will be entering their data model into the CIM data approval process. In the technical analysis phase, they did a COTS study of repository tools (I/DB would like to get a copy of this report). They also did a technical assessment of implementation alternatives for the repository such as distributed vs centralized vs client-server and costed these out.

Question as to when the repository will be available. They are in the requirements phase, are doing a functional description and meta model and are comparing performance requirements to FIPS 156 for flexibility, extensibility and vendor independence. They want NIST to review their requirements analysis in light of the standards community.

Question about others reviewing their metamodel: they will try to get a copy to Chien Huo and he will make it available to the I/DB community. One can also get training material from Stan Plummer.

Mr. Stan Plummer: JIEO Update on C2 Data Modeling
The C2 Functional Data Administrator's mission is to achieve a fully interoperable C2 environment through an effective data standards program, develop data standards and data models for C2 projects, and to develop C2 FDAd policies and procedures, and planning, analysis, modeling, configuration management, storage, retrieval, validation and documentation of data. Under MCEB guidance: In July 1993 they published the C2 core data model and developed C2 Interim Data Elements; and in January 1994 established the Global Command and Control System (GCCS) as the conceptual migration system for theater level C2; and established data standards and common operating environment (COE) as key to integration. In support of GCCS they have produced IDEF1X data models for C2 Core, fire support, joint air operations, and SOCOM;

and JUDI data elements as common "interlingua" for Component systems. Products available to the C2 community are: C2 core data model and extensions and C2 portion of DoD data element standards "starter set". This consists of 1300 interim data elements that haven't been approved: 200 belong to JUDI, and the rest are previous data elements from JOPES and the Army. No later than March 1, they will submit C2 core data model entities/prime words and developmental and candidate DEs to result in standard data elements (SDEs). By Feb. 16 had submitted 109 entities and had 8 approved prime words, and submitted 297 data elements and had 5 approved and 8 as candidates. It is taking about 3 weeks from submitting the proposal to CIM until CIM enters these as candidate DEs and then a month longer to be approved as SDEs. There is no proposal package yet for the 1300 starter set. They are improving the way they prepare proposal packages for submission. The DISA guidance has been to submit the proposal package and then proceed with development keeping track of changes to the DEs as they are accepted/rejected by DISA. The proposal package for the fire support model will be submitted by April 1994, the SOCOM package by 3rd quarter FY94, and fully attributed model for joint air operations in FY94. In Dec 93 they loaded the joint air operations model into the Interim IDEF model repository, and in Jan 94 submitted the C2 core data model to the repository.

Peter Valentine: Report on IDEF Users' Group Meetings and Issues
The Last IDEF1X meeting was held in Salt Lake City November 1993. The IDEF FIPS were published December 21, 1993: FIPS PUB 183 – IDEF0 Process Modeling, and FIPS PUB 184 – IDEF1X Information Modeling. The draft IDL for IDEF0 was completed and the meta-model sub-group was closed.

A new IEEE IDEF1X Working Group 1320.2 was formed mainly with industry members committed to updating products. Some issues to be addressed include: meta-model; relationship of IDEF1X to Zachman Framework and other frameworks; extensions to IDEF1X language: object identity and object orientation, "fixes" to language peculiarities, expanding domains to abstract data typing, DBMS independent language for expressing complex rules and methods; and use of SML as Interchange Language. SML is being used by many vendor tools. Bruce Rosen suggested use of ASN.1 (abstract syntax notation. 1) but vendors felt they had an investment in SML and didn't want to change. The next IEEE IDEF1X WG 1320.2 will be held in Seattle March 3–5 and Pete will be attending. The items to be discussed include: change management, formalization, extensions, meta-model, and user manual. They will also be looking at a certification test for IDEF1X tools, deadline is September 1994.

Luci Haddad: CCTT Data Standardization and Reuse
They have taken the four DISA/CIM initiatives (Functional Process Improvement, Data Administration, Software Reuse, and Software Engineering) and tried to implement them at the Army Component level. Three of the CCTT systems use data from other sources that had different nomenclatures so they have used TRAC (Howard Haeker's) standard nomenclature. They have narrowed the scope of the data model to the M1A1 tank and will just provide the developers' data requirements using the TRAC data model. When they develop data models and standards, they first search for occurrence in an authoritative source (e.g, DDRS, ADDS).

Luci commented on their previous approach to data standardization which was based on Army Regulation 25–9. It consisted of researching data, modeling and developing data elements, submitting data elements to the PM-CATT data administrator, submitting PM-CATT approved data elements via batch to the ADD, and tracking data elements through final approval. The problem is the directive to use DoDD 8320.1-M-1 rather than AR 25–9. There are differences between them in data element naming conventions and in the metadata used to describe the data elements. In July 1993, Erwin Atzinger's memo to use ADD standards was modified to say that the Army was migrating to DoDD 8320.1-M-1, and on 4 Jan 94, DoDD 5000.59, DoD M&S Management required that data and data administration for DoD M&S applications conform to policies and procedures specified in DoDD 8320.1. CCTT intends to follow DoDD 8320.1.

In the research world they have found an effort called the domain analysis study of software systems and have been talking to UNISYS about their STARS initiative for reuse in a domain specific area. They would use IDEF0 to model the software process. They are researching this approach now and are looking at domain analysis tools. One reuse problem with M&S data is that often when you acquire outside source data for M&S, there is a need to convert it in some way using algorithms. These algorithms really need to be stored and reused with the data.

Ms. Iris Kameny: Report on TADS Weapon Performance Data Modeling
Objectives of the pilot study: (1) to produce a data model of five weapon performance areas: target acquisition, direct fire, artillery, mines, and weather; (2) produce a naming scheme for entities and data elements to be integrable with the CIM Enterprise and C2 Core data models; (3) develop 8320.1-M-1 descriptions of the data elements; and (4) report to I/DB task group on lessons learned. Only tasks 1 and 4 were carried out by the pilot study; TRAC did (2) and (3) itself except that the data element standards were submitted to the AMSMO for submission into the ADDs process, and then to be submitted to the DoD process.

The briefing included reasons for selection of TADS for the pilot study, approach to the study, equipment used, procedures, some statistics for the five areas (i.e., 13 independent entities, 29 associative entities and 6 categories) and lessons learned. TADS related lessons learned included: benefited from TADS experience with RDBMS; started anew with naming; needed experts at all sessions; estimated data modeling took 50% of total effort; TADS not impressed with use of IDEF1X to help them better understand their data or affect future data structures; suggest being careful to distinguish between "data model" and "model" during process; and foresee big PR problem in selling data modeling.

DoD related lessons learned: need for standard data models in infrastructure areas; problems using associative entities for modeling complexly derived data; lack of DoD taxonomy of meaningful entities/prime words; issues with naming of data elements (names can become very long and not meaningful and entity names are overloaded by using them both as unique identifiers and for providing taxonomy); overloading use of IDEF1X (logical modeling/ user understandability and also for generating normalized models); overloading associative entities; need for DoD guideline for naming of associative entities using names of participating entities; and need better way of identifying special types of relationships like part-whole and recursion. Lessons learned with relation to IDEF1X and ERwin/ERX tool: use of the tool made time in sessions more effective and enforced language rules but the tool lacks the ability to represent cardinality ranges and was restrictive in not allowing the naming of foreign keys by concatenating the originating entity name to help explain key migration. The group suggested projection of the tool to a large screen would be better than using the tool on a workstation with the group developing the data model on an automated white board.

Mr. Mike Rybacki and Mr. Jim Glymph: Army Modeling and Simulation Management Office Discussion on Data Standards

The advantage of the way the Army maintains standards is that it looks across functional areas. The Army has Information Classes (IC) and each is headed by an Information Class Proponent (I[illegible]). An Army project/system submits data elements for standardization to its I[illegible] which is responsible for building its ICP functional data model and submitting it to the Army Information Systems Command which integrates all Army functional models into the Army data model. The Army data model will be integrated into the DoD Enterprise Data model when the Army data modelers transition to JIEO/CIM in the near future. There are data standardization concerns with three incompatible standards: Army AR 25–9, DoD 8320.1-M-1, and IEEE 1278 for DIS PDUs.

The key technical challenges are: data model abstraction and partitioning, reconciliation of divergent data sharing strategies, and complex, complicated, derived data. In summary: data standardization is essential for information system interoperability; data standardization can save money through reuse of data models and data elements; the Army Data Model could serve as a core for a detailed enterprise data model with DoD-wide applicability; and we must meet several technical challenges to keep the program viable in the future.

Jim Glymph: differences between DoD and Army standards are small, class words are different, there is a difference in qualifiers in naming (e.g., Army would include weight units), and the differences in metadata elements seems greater than it is since some of the Army metadata elements are not used based on current priorities, etc. There are already 1500 entries in the Army Data Dictionary as compared to two or three in the DDRS. The ADD team has a backlog of fifty Army functional area data models waiting to be integrated into the Army data model. The Army has four years experience in doing data modeling. Soon ISC will transition its data modeling staff of 38 to DISA to work on the DoD data model.

3.6 PROGRESS ON DIRECTORIES

Mr. Roy Scrudder: Data Model for M&S Directory

This effort started as an update of SSDC's Analytical Tool Box with DMSO support to develop a DoD standard data model for an M&S directory. The Joint Data Base Elements (JDBE) Project provided training, review and consulting and IDA will provide prototype implementation. The M&S directory information sources included: the Army MOSAIC system, J8 Catalog of Wargaming and Military Simulation Models, Navy SMART Program, SSDC Analytical Tool Box, and CNA Survey for DMSO I/DB. Activities included: a draft data model developed by COLSA; model review by DMSO, SSDC, AMSMO, DIA/MISIC, SMART and JDBE; and model update by JDBE to reflect review comments. The M&S

taxonomy was to be supported by SSDC and DMSO but was not, and so it includes only the rudimentary facets of: purpose, application area, level modeled, domain, scope of conflict. The follow-on objectives are to: integrate the M&S Directory and Data Base Directory Data Models; complete the M&S Directory taxonomy and domain information; add DISA/CIM-compliant naming; submit integrated data model as an extension to the DoD data model; submit candidate standard data elements; and develop prototype M&S Directory and Data Base Directory.

Roy went over the entity-relationship model and several people expressed interest in using the model and attending the next session to review the model (hopefully the final time around).

Question: Is this an adequate data model to describe object-oriented models that are federated? **Answer**: You can state in the M&S Directory that the M&S input is objects.

Question: Do we need a history of the derivation of the model? **Answer**: Change in name should be captured as separate model entry

Question: Respect to taxonomy? **Answer**: Decide facets and then levels

Dr. John Griffiths: Intelligence Community M&S Catalog
I.C. M&S Catalog terms of reference: gather data on M&S accomplishments, activities, and centers of interest in the IC; store and access information to share technology, methodology and data regarding IC M&S; and make M&S available to Government Agencies and sponsored support, consistent with security constraints. Existing M&S catalogs include the following that are on-line at DMSO via Internet: JCS J-8 Catalog, Army M&S Catalog, Navy M&S Catalog, Rome Labs M&S Catalog; and DMSO M&S system. There will be two components to the IC M&S Catalog: unclassified and classified. The unclassified component: will parallel J-8 and Service Catalogs; will exist at DMSO and on classified component machine; will be available via internet to qualified users via DMSO; will have excluded entries of sensitive but unclassified programs and data (excluded by Intel agencies); and in such cases the unclassified catalog entry will contain only a POC. The classified component will: exist on a dedicated stand-alone PC in CIA spaces; make data available to qualified cleared users via hardcopy and softcopy; will rely on agencies to determine qualification and clearance level of individuals to have access to listed programs and data; furnish POCs only for specially compartmented M&S programs; and have on the classified database machine unclassified DMSO catalogs for use of personnel and agencies without internet access.

Status: 386/33 machine, 170 Mb removable storage, Oracle, dBase IV, Alpha Four, M&S access. The DMSO M&S catalogs will reside on the machine for IC members without internet access. The IC data call will be issued as soon as the new M&S catalog standard can be translated into a data call. The classified component of the catalog will contain additional fields.

Dr. Mike Frame: Discussion of Next Steps for Database Directory and Model and Simulation Directory Implementation

Status: logical design for Database Directory exists, a preliminary logical design for M&S Directory exists with one more review to be scheduled, and a plan has been developed for creating and populating the database and providing user access. There are six implementation steps: (1) integrate data models of M&S and Database Directories, (2) do initial physical database design and implementation, (3) do final physical database design and implementation, (4) develop support for populating database (5) develop support for database query and browsing, and (6) install production version.

Implementation of the initial physical databases is expected to be completed by March 1994 on IDA prototype system. Information will be collected about major sources of data and the creation of the final physical database designs using Oracle will be completed by June 1994 on the IDA prototype system. There is a plan for developing support for populating the database through bulk-load, low volume load, user interface for data entry, and to design for database maintenance. There is a plan to develop support for database query and browsing by determining a standard set of queries and browsing paths, implementing scripts, and designing and implementing a user interface that uses standard queries and browsing paths as well as a help facility for unusual queries. The systems will be tested and finally installed at the DTIC production site. Requirements for data population and browsing tasks will be defined in early summer 1994 with goal of having production system running in early 1995.

Suggestions:
(1) Look at X.500 directory standards
(2) Look to Army AMSMO for experience with MOSAIC
(3) Write baseline concept of operations on how the directory systems should work
(4) Look to Services to coordinate data entry and provide review rather than DMSO doing so
(5) Allow people to put in information about future databases
(6) Do a tradeoff of timely data in Directory vs time it takes to review and hold up availability of timely data
(7) Look at data elements such as: data submitted by and date, reviewed by and date, approved by and date
(8) Look at ARMS querying interfaces (Navy project)
(9) Look at use of natural language interface
(10) Look at CONOPS for Directory client-server model

3.7 PROJECT REPORTS

Capt Bill Cashman: J-MASS
J-MASS addresses the problem that current M&S were designed for specific, narrowly-defined purposes without built in interoperability and reuse. Lack of a common M&S system results in inconsistent/non credible results; too much effort to upgrade or modify existing models; new models always need to start afresh; the M&S infrastructure is continually reinvented and VV&A always has to start from "square one". J-MASS is designed to provide standards (to promote reusable, modifiable, maintainable, interoperable, and more easily validated M&S), tools that make the standards transparent to users, and a common system for developing, using and reusing M&S. The toolset lets users create models, pull in

existing models and modify them, set up simulation runs, execute simulations, and analyze simulation results. J-MASS provides toolset, experts provide models. Design goals: both realtime and non realtime (currently non realtime); support for varying levels of model fidelity (not well thought out now); scalable; portable; distributed (now single processor); ability to play in DIS exercises (not yet); license free; ability to customize; ability to connect to legacy models; support for Ada and C++ models; and visual programming to generate/modify models. J-MASS provides a common architecture the experts can use to build models for the DoD community. J-MASS today (release 2.0): provides first real functionality to build models, run simulations and analyze results, built on Sun workstation and soon Silicon Graphics, has graphical model development tool, simple plotting and animation tools, initial modeling library, and demonstration of J-MASS/DIS interface using old 1.0 PDUs. Release 3.0 in Dec 94 will have: initial realtime simulation capability, ability to split simulations across multiple processors, ability to use both Ada and C++ models, backward compatibility with release 2.0, and a "how to" manual.

In response to audience: there are currently no J-MASS guidelines for the person building a model but they expect these to evolve in time. Part of J-MASS specifications includes interface specs. They expect domain specific standards to be developing soon. The J-MASS toolset is just leaving the prototype phase.

Question: Change to COTS? **Answer**: There will be an architecture concepts run-off addressing software backplane standards on how to plug in COTS

Question: Ability of realtime for release 3.0? **Answer**: will not be able to do cockpit simulation with release 3.0

Mr. Mike Sarkovitz: Update on Universal Threat System for Simulators
UTS is the joint service repository for DIA approved threat data and validated real-time simulation software used as standardized input to DoD training simulation programs. UTSS participants: Navy is lead service with support of other services and DIA. Current status is: a requirements analysis has been completed and is being analyzed to determine user needs in the DoD aviation communities. It was based on information collected from 70 sites. A technology evaluation has been completed and is being reviewed by UTSS working groups and the EXCOM. The User Needs Analysis has been drafted and is in review by UTSS working groups. The current findings are that the technical evaluation and user needs analysis have produced 87 aircrew requirements. The original collection was of Navy Air but during FY94 they will look at Army ground and Navy undersea and surface forces. Future of how UTSS will work: training simulator sites, contractors, and designers and developers will request UTSS standards for new simulators, initial UTSS software, new and updated databases, and catalog of M&S with VV&A information. The current plans call for building the system with government resources at a purple site though it is not certain yet whether it will be a central repository or up to three satellite repositories. The UTSS man-machine interface can be used to help the requestor draw a picture of the kind of simulator/simulation he/she is interested in and this would be used as a filter. DoD instruction/directive will state that threat database and realtime simulator will fit into a training device and any threat update can be easily made in the training device by replacing a module. The concept is that the contractor

builds the trainer leaving room and interfaces for the threat database and realtime simulator module. VV&A of the simulator is done after the threat is placed in the simulator. UTSS is working with CATT and BFTT to determine their threat needs and is DIS compliant. Networking and mission rehearsal is not required currently across Navy and Air Force platforms. JDBE personnel will be part of UTSS WGs and will be helping with IDEF1X data modeling and IDEF0 process modeling.

LCDR John Letaw: Update on Naval Warfare Tactical Data Base
The NWTDB is a management process, a common database architecture that is more than a metadata repository, and a path to common sensor-to-shooter connectivity. In 1986 NAVINTCOM produced a prototype Naval Intelligence Database (NID). In 1990 NWTDB was formally established by adding environmental, cryptologic, forces and facilities. In 1992, the NWTDB Management Plan was published. In 1993 the first edition of the NWTDB Standards Manual was published, and in 1994 the NWTDB Implementation Panel was formed to consider and resolve issues relating to data migration of existing systems. NWTDB process is: determine information requirements and user validation, develop data standards and structures definition and validation, start reference database production, implement the system, do operational database management, and feedback to information requirements. The database architecture uses a common interface "language" and includes standardized data elements (including MTFs and TADILS), normalized logical structure, and designated authoritative sources. This will evolve to an open systems architecture with a Systems Information Directory (SID) of standard data elements, standards, and structures manuals. Users will be served by use of standard user profiles, data produced to NWTDB standards and structures, and distributed in agreed multimedia formats. Future directions: focus on high quality, timely data fill, add tactical system data structures into NWTDB, revise Standards Manual every 6 months, prepare configuration management plan, integrate NWTDB standards into the DoD C2 data model and envision goal of evolving existing data elements to Joint standards by 1997.

Questions: Who is SPAWAR POC? What are the functional areas? **Questions**: MTFs and TADILS: Looking at issue of standardizing these. JIEO has worked on loading them into the DDRS, but is TADILS worth standardizing?

They are receiving DMSO project support through ARMS and NWTDB.

Contact John Letaw at 703–697–3033 for standards documents.

Jack Teller: DoD Project on Spatial Data Element Standardization
The DMA mission is to provide worldwide coverage data about the real world that has military significance. They have the job of modeling the planet earth restricted to surface, below surface, ocean bottom and some coastal areas. CIM came knocking on their door last year with respect to developing a data model for MC&G data. They started with the international standard of around 300 features. CIM provided training and funding for the effort. It took about six people 4 1/2 months (August to November 1993 with one week training) to develop a fully attributed data model for MC&G data in 4th normal form. They have identified 75 potential standard data elements that include management data used to control,

maintain and provide features. An initial package of ten elements that deal with the basic ingredients of FEATURE have been submitted to CIM and there is work in progress on geometry and topology packages.

In doing the data modeling they discovered that many other players were modeling spatial aspects of MC&G data even though DMA is the recognized DoD authority for MC&G data. They ran into conflicts over basic concepts and the use of words. For example: feature, location, point, area, volume, attribute, coordinate—words with specific meanings in the MC&G area, were already being used and defined differently or had been reserved as CLASS words in the DoDD 8320.1 data standardization process.

An important lesson that they learned was that DMA can't achieve data standardization for MC&G data alone. Standardizing commonly used data elements requires a joint DoD approach. It is not enough to get experts in their functional area together, but they also need to involve the users of the data from other functional areas that consider themselves "experts" in the use of MC&G data in their areas.

Their current approach is to assemble a team of players from DoD, USGS, intelligence agencies, and other federal agencies with guidance or leadership and funding from DISA and participation and joint orchestration from DMA. The project objective will be to integrate all the different existing activity and data models that involve use of MC&G data with the DoD Enterprise model. The project will be well scoped to (1) develop a fully attributed data model; (2) produce a submission package to CIM containing at least 10% of the Feature Attribute Coding Catalog objects and their associated data elements, and (3) a schedule for producing the rest of the data elements.

The benefits of this approach are that: duplication of effort is eliminated; data elements are produced that everyone can use; it will enhance the DoD Enterprise Model with models from joint team efforts; coordinating the development of data standards will more rapidly achieve FDAd approved data element candidate status; and it will bring DoD and other federal agencies closer together in concurring on Spatial Data Standards. The disadvantages are: it requires commitment from all participants and they must be from the right functional areas, be experienced people and be empowered to speak and make decisions for their organizations.

Mr. Stephen Boyd: Air Force Studies and Analysis Power Projection Database Project

AFSAA products are: long term studies, support to COEAs, responses to Air Staff questions and participation in the Program Acquisition cycle. They do analyses of weapon systems and deliver the results in different formats. Their analyses are supported by computer models ranging from engineering level models, to functional level models, to engagement level models, to campaign level models. The study manager is responsible for all aspects of the data. They see a need to do something about their data because they find it is difficult to create consistent scenarios for models with different levels of abstraction, difficult to capture knowledge of the data process from study managers, there is an increasing need for detail in abstract models, and their analysis staff is shrinking. The solution is to manage the data by: centralizing the database collection, use data management tools and study management tools to help the study manager, use cartographic and geographic display to show analysis starting conditions and results, and develop tools to capture a history of the study and display results. They are using an incremental approach that includes creating data management standards and combines existing data management functions into a single set of processes. They are also avoiding having to make changes to models in order to implement the data management processes. Their need is for a database, a tool set for database development, and a tool set for analysts that supports their use of data and models.

They need GUIs for managing the data, for study management and for cartographic display. They have a visual programming environment (VPE) to make it easy for modelers to develop applications that can pull out the data needed by a model and convert it into formats appropriate for models. (The VPE license is $5,000 and runtime version is $1,000 and they will furnish AFSAA code to those interested.) They have developed a filter script language in formatted ascii that is user friendly and provides access to SQL queries. They are also providing archival tools for data and analyses.

There are overhead costs for implementation and use of this system. Splitting the data management functions between the study manager and the data manager may cause slower reaction time in setting up the study. Essentially, there is a central database with central management, and each study manager maintains his copy of that portion of the database that is necessary for his study. The data manager for the study manager can change the data to meet study requirements, and is responsible for verifying and authenticating the data for the study at hand. If the data he gets from the central database is flawed, better data may be requested.

The briefing ended with tasks to define requirements for the data management, study management and cartographic GUIs, establish timelines and establish integration/model tests.

Mr. Steve Matsuura: Joint Data Base Elements Project
The JDBE effort has been briefed at many I/DB meetings. JDBE is (1) developing candidate standard data elements and data models for M&S; (2) provides the M&S community with a reverse-engineering data modeling methodology; (3) provides a methodology for the creation of integrated schemas to share data between databases; and (4) has created a Military Handbook with a living electronic index. The JDBE approach is reverse engineering: bottom up data modeling using existing databases following the JDBE methodology, creating integrated data models from project data models by subject area, and using these to interface with the top-down CIM Enterprise Data Model. JDBE currently has a subject area information model for electromagnetic equipment characteristics, data dictionary/directory tools, and is the current temporary repository for M&S data models and definitions. JDBE future efforts include: extension of JDBE methodology to support 8320 data standards development and complex data types; refinement of the data dictionary tool; gathering metrics; and assisting M&S community projects in data modeling and the use of IDEF1X methodology through the ERwin tool. JDBE either is now or may in the future be supporting UTSS, MICOM, CENTCOM, and CCTT projects in data modeling efforts.

Mr. Rob Wright: Equipment Characteristics Data Base (ECDB)
The functional requirements for the CCTT Equipment Characteristics Data Base (Version 2.0) are: (1) transition to a windows environment; (2) create a dynamic database architecture capable of handling a wide array of equipment identified in the CCTT specification Table A-1, handling equipment data down to the piece level and developing a common verified parts master file, and imported LSAR, provisioning and IGES data files; (3) test the functionality of a dynamic database; (4) encourage users to submit ideas and data to increase productivity of the database; (5) create data management and editing tools; (5) analyze and build the A-1 parts information in the ECDB as the core data stream; (6) get confirmation of Table A-1 parts information from Equipment Program Managers and Subject Matter Experts; (7) after confirmation, build and expand characteristics data files and IGES library; and (8) apply this to other simulation programs (i.e., AVCATT, WARSIM 2000, DIS).

The database will need to contain equipment data for approximately 150 weapon systems. The database is managed by FOXPRO 2.5. This database links to other databases through the weapon system name (common nomenclature). Two areas that need further development are: expanding the data and doing data quality engineering. Appendix A includes the briefing charts which stepped through a very good demonstration of the windows interface to the database and a draft chapter titled "An ECDB Overview".

Mr. Mike Hopkins: Update on CENTCOM Conventional Force Database (CFDB) Project
The mission of the USCENTCOM Combat Analysis Group in creating the CFDB is to research DoD and service databases; collect and validate data; and provide wargamers/analysts with data, scenario generation tools, and model interfaces.

The objective of the Conventional Force Data Base (CFDB) task is to develop a database with units, personnel, and equipment data to provide the modeling community with a single source of required model data; reduce model database preparation time, and to check data accuracy. The units include data for all services, reserve and national guard, deployable units and supporting units, and units at the lowest level reporting personnel and equipment. Personnel data includes personnel assigned to a unit and broken down by grade and occupation. Equipment data is restricted to equipment appropriate for modeling.

The CFDB/Master Simulation Data System (MSDS) work in the following way. The CFDB loads dynamic force data from DoD and Services; performs quality assurance of data; builds force structures and displays unit data; and postprocesses the data. The MSDS loads CFDB and DIA dynamic force data, builds a scenario database, translates force data to model formats, and will process static characteristics data. The CFDB/MSDS has been in production since 1989; has interfaces to CBS, JTLS, TACWAR, and JCM models; is operational in UNIX and VMS environments; and provides data and/or software on a quarterly basis to 23 sites.

Semi-automated data quality engineering is done now making use of a data element dictionary, rules, tracking of data trouble reports, and human review.

Data quality can be improved by: standardizing data, providing a problem reporting process, improving database VV&C checks, enhancing data administration, and tracking data element sources and models. There are plans to provide an architecture to standardize data descriptions and data elements and an automated process to check data through automated comparisons, rules, math computations, acceptable ranges, and statistical tests.

Dr. Jed Marti: Experiences in Using Project 2851 Data
RAND is working on an Army project that needed to use Project 2851 data for Ft. Hunter Liggett in JANUS 4.0 and BDS-D (as well as other higher resolution data such as DMA ITD and PEGASYS PVDB). The RAND Cartographic and Geographic Information System (CAGIS) already does a large number of data format transformations from data sources (such as DMA DTED, DTAD, and ITD, PVDB, SIF, Landsat and Spot images, Arc/Info, and digitized data) into output formats (such as Arc/Info, ASCII, JANUS-A, JANUS-3, JANUS-4). The transformations they are currently planning to implement are for S1000 and ARTBASS inputs and SIF and S1000 outputs. The JANUS 4.0 terrain requirements include the need for polygonal terrain features, lineal features, elevation posts, and buildings. In converting Product 2851 SIF data to internal CAGIS format they ran into problems with polygons with holes, lack of buildings, passing multiple attributes with features, and that digitized roads and the culture map data they received were projected with the wrong spheroid (however PRC Corporation provided an easy-to-perform correction of the source data).

Conclusions about Project 2851 SIF database for this limited task were: most of the format was easy to decode and create; the manual is excellent; the Application Programming Interface (API) tools are incomplete; geolocation was incorrect in the one sample used due to misuse of spheroids in the UTM conversion; and two 3D formats must be dealt with.

Mr. Mike DaBose: Automated Repository for Models and Simulations (ARMS)
The ARMS way is to correct the problem of multiple data gathering efforts by providing a system based on distribution technology that acts as a single data gathering/aggregation and single data distribution effort. ARMS provides a common frame of reference and is developing a technology not a methodology.

A common frame of reference means that all data (reports, charts, numbers, etc.) can be reduced to various "classes" of representation (shapes, numbers, etc.). In turn, such data can be mediated from its native form to a consistent method and format of display/transmission to the user/system within a given context. As a result, data exchange/sharing between unlike systems becomes efficient and cost effective.

Using the definition for a repository from the Information Resource Dictionary System (IRDS) Reference Model Technical Report X3H4.1/92–002R3, September 24,1992 (draft),

> "A specialized set of information management services and facilities that manage information resources. A repository system accommodates the information management requirements of an organization, including the areas of information systems engineering and operation."

ARMS is a repository and distribution technology not another database. ARMS reduces redundant data collection, maintains continual data update, provides traceable, authoritative data (source tagged) and enhances current systems capabilities through seamless data availability. What is currently available in ARMS is its portable core and meta-dictionary, the rest is still planned or in development. ARMs uses object oriented technology, re-usable code, cross platform development and ANSI standards/vendor independence. The major parts of the ARMS architecture that have not been implemented are: data collection toolset and ARMS database mediator and network accessor; the ARMS model/sim mediators (DIS protocol), ARMS distribution network and graphical user interface.

The ARMS system objectives are: JMA data in common frame of reference; provide Joint M&S data for NWTDB; distribute NWTDB standards to the community; provide a roadmap for goal/objective architectures; centralized configuration control and repository management; distributed data gathering; repository of "lessons learned"; and joint doctrine statements. (**Aside**: it is unclear who the community is that is being served and that configuration control and repository management are being performed for.)

The ARMS programmatic objectives are: vendor independence; provide current and future platforms data for future assessment process; incorporate Enterprise Model functions, processes, and data models; incorporate an object oriented DBMS (COTS); establish a data "clearing house" for electronic distribution to models, simulations, and users; and provide standardized data elements as determined by responsible authority to support Joint interoperability. The benefit of ARMS will be to provide analysts with a single authoritative source of common format data for platform and systems information (red/white/blue) and other data (including simulations, wargames, architecture drawings, network and communication structures, documentation, characteristics of performance, effectiveness data, probability of kill).

4. DATA VV&C TASK FORCE MEETING NOTES

4.1 AGENDA

Monday, February 14, 1994

PRESENTATIONS

0830-0900	Discussion of Objectives for Data VV&C Group and Summary of Data VV&C Working Group Results from MORS SIMDAT: *Ms. Iris Kameny*
0900-0930	Interaction and Interdependencies of Analysis, Models, and Data: *Ms. Simone Youngblood*
0930-1000	CENTCOM Experience with Source Data Problems: *Mr. Mike Hopkins*
1000-1030	Discussion of Data quality Concepts: *Mr. Jeff Rothenberg*
1030-1100	*Break*
1100-1200	*Discussion*
1200-1300	*Lunch*
1300-1700	*Discussion:* — Send potential discussion topics to Iris Kameny kameny@rand.org, phone:310/393-0411, x7174 fax: 310/393-4818 — Topics will also be collected during morning briefings and prioritized for discussion

4.2 LIST OF ATTENDEES

DATA VV&C TASK FORCE MEETING
February 14, 1994

NAME	ORG	FAX #	PHONE #	E-MAIL ADDR
Jim Augins	ADS, Inc.	(619) 553-6083	(619) 553-9523	augins@nosc.mil
Michael Barton	JIEO	(410) 278-6242	(410) 278-4918	mbarton@brl.mil
Joe Brock	JIEO	(602) 538-2380	(602) 538-5029	brockj@cc.ims.disa.mil
William Burch	ISA, Inc.	(703) 379-8077	(703) 578-2587 or 578-2568	
Carl Carden	ISA, Inc.	(619) 574-8111	(619) 574-8100	ccarden@nosc.mil
David Danko	HQ DMA	(703) 285-9397	(703) 285-9238	
William Dunn	ARMY M&S	(703) 607-3381	(703) 607-3384	
John Freeman	DMSO	(407) 380-4829	(410) 380-4029	jfreeman@dmso.dtic.dla.mil or: freemanj@nisc.navy.mil
John Griffiths	I.C. M&S	(703) 820-2841	(703) 820-2841	jgriffit@dmso.dtic.dla.mil
R. Hartling	CNO	(703) 695-9760	(703) 695-3797	
Mike Hopkins	USCENTCOM	(813) 830-4919	(813) 828-6430	
Chien Huo	JIEO/DMSO	(703) 487-3256	(703) 487-3538	huoc@dmso.dtic.dla.mil
Iris Kameny	RAND	(310) 393-4818	(310) 393-0411	Kameny@rand.org
Chris Landauer	Aerospace	(703) 318-5409	(703) 318-1666	cal@aero.org
Paul Parker	VDS	(703) 683-8973	(703) 683-7287	
Mark Ralston	AMSAA	(410) 278-4694	(410) 278-5344	ralston@arl.mil
J.Rothenberg	RAND	(310) 393-4818	(310) 393-0411	Jeff_Rothenberg@rand.org
Pat Sanders	OSD/PA&E	(703) 693-5707	(703) 697-3521	pas@dmso.dtic.dla.mil
Jim Santangelo	GPS	(703) 381-2386	(410) 381-7240	
E. Schroeder	NAVOCEANO	(601) 688-4639	(601) 688-5501	eleanor@dmso.dtic.dla.mil
Walt Swindel	TRADOC	(913) 684-3866	(913) 684-3030	swindelw@tracer.army.mil
Ron Tyler	HQ Marines	(703) 696-1296	(703) 696-0897	
S. Youngblood	J H U	(301) 953-5910	(301) 953-5000	simone@aplcomm.jhuapl.edu

4.3 DATA VV&C ISSUE DISCUSSION

Ms. Iris Kameny: Suggested Objectives for Data VV&C and Summary of Results from MORS SIMDAT Data VV&C WG
Iris Kameny opened the session by presenting her suggested objectives for Data VV&C. As she proceeded through the first chart, there was much discussion and additional subjects were added as discussed in the following paragraphs.

Under "develop guidelines for Data VV&C," the TF wanted to make sure that this included cost models and cost information.

Under "address authoritative data sources and their responsibilities," it was noted that this should include the authority to certify another organization's data. An example offered by the AMSAA people was that they certify most of the data produced by the TRAC TADS data center to feed Army models. They certify the data derived from the data they furnish to TADS. This generated some discussion, since many of the TF members seemed to believe that data centers adding value to data would have the responsibility of certifying what they had done. This will need more exploration and perhaps a broader perspective to include several options as long as the certification authority and process is made clear.

No changes to: "Address the role of M&S data centers between data sources and simulation applications"

Question: should we address/distinguish between metadata and data? (Iris recently joined a metadata working group —at least over email— and will share some of their ideas with the Data VV&C group in the near future. An IEEE metadata WG is just starting up also.)

Iris' briefing went on to discuss the guidelines for Data VV&C as including definitions, description of tools and methods for V&V, definition and development of a certification profile of metadata that would describe the quality of a database, and developing policies and procedures for performing data VV&C and relating it to M&S VV&A. There was a suggestion to add: "management of the VV&C process" to the list of activities under developing guidelines for VV&C. There was a question as to whether separate VV&C guidelines are needed for near-term and long-term? (for example with respect to data standards).

She suggested that in considering the roles of M&S centers we include considering them as authoritative sources, in their sharing and reuse of data, and also the need for some organization keeping track of the centers, their missions, and encouraging communications between them.

Iris then went over the results from the MORS SIMDAT Data VV&C working group especially the definitions of VV&C which the TF decided would be addressed in the afternoon discussion session.

Mike Barton (AMSAA) offered that AMSAA has guidelines for certification since they have a red team look at data. The TF would like more information about this.

A point was made that the DODD 5000.59 levies the responsibility for data VV&C on the Services.

Mr. Mike Hopkins: CENTCOM Experience with Source Data Problems
Mike went over in detail, the kinds of source data problems they have run into (using the same viewgraphs from the I/DB main meeting). He noted that they will be sharing their data with NRaD in the future. The current CFDB database contains over 13 million records and 12,000 fields. The Marine HQ data quality engineering (DQE) effort addresses source data problems. The method is to check source data against the data element dictionary using rules defined by the Data Base Administrator. This begins to automate some of the process they were doing by having the human read through instance data. When they find errors in the source data, they need to go back to the source with a report since the source has to change or confirm the changes to the data. They plan to produce better data by: developing data standards, automating the problem reporting process, improving the database VV&C checks, enhancing the role of data administrator and tracking data sources.

Mike stressed that VV&C procedures need to address missing data, subject area experts developing rules, and domain constraints expressed as part of the data element standard descriptions. CENTCOM responded to the DMSO focus call with a "Database System Upgrade" project. DQE was the biggest piece of that effort. Their definition of quality includes completeness of the dataset as a characteristic since they often discover data is missing.

Ms. Simone Youngblood: Interaction and Interdependencies of Analysis, Models, and Data
(Simone Youngblood gave the same briefing that she and Dale Pace gave at the Data VV&C WG at the MORS SIMDAT Symposium and I have included my writeup from those proceedings as well as their brief on VV&C costs.)

Good analysis can produce insights and meaningful results in spite of model and data limitations. They suggested acceptance of SIMVAL/DoD M&S Directive Definitions for model, simulation, VV&A, and certification. Issues included license of the analyst to manipulate input data and M&S parameters for analytic purposes, and the credibility of analysis when drawing conclusions from use of inadequate data and/or tools. Observations were that: quality and capabilities of M&S tools have increased significantly; availability of data has increased and "live" data may be mixed with simulation data; the appropriateness of the analytic process, M&S tools, and associated data has received some recent attention; and value of analysis can be limited by the model and/or the data. The conclusions are that the interaction of analysis-model-data must be appreciated but current VV&A/C efforts do not do so adequately and that end use requirements focus can lead to economies in data/model resources (e.g., fidelity level driven by analysis plan).

Verification, Validation, Accreditation and Certification Costs: Ongoing V&V costs are in the development and implementation of V&V plans and in the performance of V&V at all levels of M&S development. Problems with cost include: limited historical cost data, lack of management appreciation of

VV&A/C value, lack of V&V foundation upon which to build, and legacy models are less supportive of the VV&A processes. Costs are dependent on size and type of M&S, data availability, level of confidence required, time/resources available, and application. V&V costs may be reduced by detecting errors early in the M&S development phase, using modern software engineering practices, and use of automation tools (e.g., data modeling and visualization tools). Software IV&V is typically 2% - 18% of total development and levels of M&S accreditation can vary from a few man weeks to man years dependent on the need and funding. There are many consequences in not performing VV&A/C adequately but not enough cost data has been collected to quantify V&V cost benefits. They suggested that projects involved in VV&A/C begin to accumulate and publish cost information; that projects begin the V&V process as early as possible to reduce M&S costs; and that VV&A/C become institutionalized as a normal part of M&S development

Discussion:
The Navy ARMS product looked at the data requirements for M&S and found that some of the data is input to M&S and other is embedded in models. This poses a problem for data VV&C

There is also an issue with how to verify live data.
Someone noted that DoDD 5000.59 says there must be guidelines for data as part of the VV&A process.

There was a good suggestion that we send out a formal request through the M&S offices of the Services and DoD agencies for cost benefit information regarding data VV&C.

John Griffiths voiced a need to turn a model into a deterministic model at the limits. When doing model VV&A, there is a need to perform sensitivity tests of the model when the data parameters are set to the limits.

Mr. Jeff Rothenberg: Discussion of Data Quality Concepts:
Data is the result of data modeling of the real world which produces some particular (abstract) view among many possible views of reality. Concretely, data in a database is a representation of a data view of the real world in some format. Many alternative representations are possible corresponding to different data models/formats. Every representation is a model of the abstract data. Data "quality" is really referring to the suitability of data for a particular purpose or range of purposes. It may be useful to think of this as its suitability for a particular "customer" or analysis/M&S purpose. We can promote data quality by recording sufficient metadata about data, by performing explicit VV&C on data (testing and evaluating and recording results) and by controlling and improving the processes that affect the data in such a way as to improve the data quality.

Quality is represented by metadata at three levels: the database level, the data-element level (data dictionary) and the data-value level. Jeff noted that one may need data-element and data-value level meta-metadata (data about the metadata) and that inheritance/defaulting of metadata may reduce redundancy and the size of a metadata database. The database level metadata can be categorized into general, characterization metadata, quality measures, process control information and VV&C audit trail. The data-element level metadata can be categorized into: meaning of the data element; source and generation-cycle information; completeness, constraints and relationships to other data/databases; domain/datatype and units-of-measure; resolution, precision, intended/expected accuracy; and VV&C audit trail. The data value level metadata can be categorized into quality, annotation, source information, next-source information, transformation audit trail, and VV&C audit trail. A certification profile can be composed from the VV&C audit trail metadata from all levels.

Jeff suggested the following first steps toward data quality: identify a candidate database for a "pilot" data quality project and outline the data quality procedures for the chosen database. An interesting question is whether we can afford to improve data quality, how much does VV&C cost? Or, can we afford NOT to improve data quality?

Discussion:
ARMS project and NWTDB will be doing a survey of M&S data needs and it was suggested that the survey information could be captured in entries into the M&S Directory. Navy and ARMS is trying to consolidate support for M&S data instead of having independent projects collecting the data.

It was pointed out that there was a need for a directory of authoritative data sources.

An issue was identified about updates to derived data and how to show this in quality characteristics. Is it shown as delta changes? Some data may not be updated until it is used. Also investigate whether different metadata is needed to describe historical databases then current databases.

There was discussion of a pilot study. The FY93 CENTCOM project that involved DQE was a proof of concept for CENTCOM. Another suggestion was that an unclassified database be selected perhaps in the healthcare area. An idea was to use one or more databases that cut across the greatest number of users for the greatest impact.

Discussion of cost issues resulted in Walt Swindell showing us a few TADS viewgraphs that indicated that automation and DQE by TADS resulted in reducing the staff by 50% and accomplishing 10 times the amount of work. On the TADS system, the network server performs access control. TADS checks: preloaded systems for correctness, data for anomalies, and the derived data it creates for anomalies. The TADS loader edits the database, archives it, and checks for anomalies. The TF asked TADS and CENTCOM for any additional cost benefit information related to data V&V they could provide.

Dave Danko (DMA) gave Iris a copy of the draft "Content Standards for Spatial Metadata" which was produced by the FGDC Standards Working Group on January 27, 1994. A copy is included in this proceedings. This effort was done jointly by the Census Bureau, USGS, the Forestry Service and DMA. The group was formed because they needed a metadata outline to be able to see who is doing what. They had tried sharing information through the internet WAIS but used different names for the metadata concepts and it didn't work. DMA wants to give people the metadata descriptions along with procedures for using them.

Afternoon Discussion:
The TF decided on definitions for VV&C as shown below. A copy of these were given to Pat Sanders for the M&S WG.

DATA VERIFICATION: The use of techniques and procedures to ensure that data meets constraints defined by data standards and business rules derived from process and data modeling, and that data values for input to the intended M&S conceptual and logical design are transformed and formatted properly.

DATA VALIDATION: The review of data by subject area experts and its comparison to known or best-estimate values as appropriate for an intended M&S conceptual and logical design.

DATA CERTIFICATION: Determination that data have been verified and validated as appropriate for the intended usage.

4.4 SUBGROUP ORGANIZATION

The TF decided to form two subgroups: one to address Guidelines for Data VV&C and the other to address Authoritative Data Sources and Centers

Guidelines for Data VV&C: a major task will be to define a certification profile for a database that will describe its data quality characteristics including verification and validation methods used. The profile will be necessary for database certification.

Members:
Bob Hartling (Navy) co-chair
Mark Ralston (Army/AMSAA) co-chair
Joe Brock (DISA/JIEO)
Dave Danko (DMA)
John Freeman (STRICOM)
Mike Hopkins (CENTCOM)
(Iris Kameny (RAND))
Ray Miller (Air Force XOMT)
Jeff Rothenberg (RAND)
Eleanor Schroeder (Navy)
Simone Youngblood (JHU/APL)
TRAC (DIS representative) ?

Authoritative Data Sources and Data Centers: will identify Component authoritative M&S data sources, define their responsibilities to the M&S community, and identify and define the roles of M&S data centers that get data from authoritative sources and prepare data for input to models.

Members:
Bill Dunn (Army/AMSMO) co-chair
Mike Hopkins (CENTCOM) co-chair
Jim Augins (consultant/Navy ARMS)
Dave Danko (DMA)

LCDR Flax (Navy/ARMS)
John Freeman (STRICOM)
Bob Hartling (Navy)
Dan Hogg (J8) ?
(Iris Kameny (RAND))
Ray Miller (Air Force XOMT)
Eleanor Schroeder (Navy)
Walt Swindell (Army/TRAC/TADS)
JIEO/CIM ??
DIA ??
CCTT ??
UTSS ??

?? Question marks indicate a desire to get participation from these organizations

4.5 FUTURE MEETINGS
March 22, 1994 Data VV&C Guidance Subgroup Meeting (at IDA Room 119). Goals are: (1) finalized versions of the definitions for Data VV&C, (2) a proposal for conducting joint Data VV&C, and (3) a compilation of tools and techniques for ensuring/measuring data quality.

April 1, 1994 Authoritative Data Sources and Data Center Subgroup milestone: first cut to compile the Services and joint elements efforts to: (1) provide agency names and responsibilities of the authorized (or perceived as authorized) data sources as necessary according to mission functionality (e.g., terrain, weather), level of resolution (e.g., engagement, campaign, theater), and customer/applications. What criteria constitute an authoritative source?; (2) provide agency names and responsibilities of data centers along with the customers and functionality they serve, (3) address sharing and reusing of data between/among these data sources and centers, and (4) address responsibilities of data customers.

April 19, 1994 VV&C Task Force Meeting at IDA (0800 – 01700)

5. DATA STANDARDS TASK FORCE MEETING NOTES

5.1 AGENDA

FEBRUARY 17, 1994.

The Data Standards Task Force will spend the day discussing areas of focus for itself and attempt to identify a project that it can undertake to support data standards in the M&S community.

Participants are encouraged to propose ideas prior to the meeting to Twyla Courtot (courtot@mitre.org, or voice (703) 883–7343).

5.2 LIST OF ATTENDEES

DATA STANDARDS TASK FORCE MEETING
February 15, 1994

NAME	ORG	FAX #	PHONE #	E-MAIL ADDR
Jim Augins	ADS, Inc.	(619) 553-6083	(619) 553-9523	augins@nosc.mil
Don Blanton	AMSAA	(410) 278-6242	(410) 278-4918	blanton@brl.mil
Carl Carden	ISA, Inc.	(619) 574-8111	(619) 574-8100	ccarden@nosc.mil
David Danko	HQ DMA	(703) 285-9397	(703) 285-9238	
John Griffiths	I.C. M&S	(703) 820-2841	(703) 820-2841	jgriffit@dmso.dtic.dla.mil
Luci Haddad	RCI	(407) 282-1451	(407) 658-9549	haddadl@dmso.dtic.dla.mil
Howard Haeker	USA TRAC	(913) 684-3866	(913) 684-3030	haekerh@tracer.army.mil
Mike Hopkins	USCENTCOM	(813) 830-4919	(813) 828-6430	
Cuane Hufford	AMS	(703) 841-5507	(703) 841-6066	
Chien Huo	JIEO/DMSO	(703) 487-3256	(703) 487-3538	huoc@dmso.dtic.dla.mil
Iris Kameny	RAND	(310) 393-4818	(310) 393-0411 x7174	Kameny@rand.org
Scott Kinser	RCI	(407) 656-9549	(407) 282-1451	skinser@dmso.dtic.dla.mil
Kent Manley	VDS	(703) 683-8973	(703) 683-7287	kmanley@dmso.dtic.dla.mil
Steve Matsuura	USA EPG/JDBE	((602)538-4973	(602) 538-4967	matsuuras@huachuca-emh17.army.mil
Emily McCoy	MITRE/NASA		(703) 883-7692	emccoy@mitre.org
Ray Miller	AF/XOMT	(202) 504-5341	(202) 504-5352	miller@dmso.dtic.dla.mil
M. Rybacki	AMSMO	(203) 607-3381	(203) 607-3385	rybacki@pentagon-hqdadrs.army.mil
Jim Santangelo	GPS	(703) 381-2386	(410) 381-7240	
E. Schroeder	NAVOCEANO	(601) 688-4639	(601) 688-5501	eleanor@dmso.dtic.dla.mil or: eleanor@pops.navo.navy.mil
Roy Scrudder	CSC-JDBE	(602) 538-4933	(602) 538-4812	scrudder@huachuca-emh17.army.mil
Omar Spaulding	NASA	(202) 358-3098	(202) 358-0777	ospaulding@mtpe.hq.nasa.gov
Walt Swindel	TRADOC	(913) 684-3866	(913) 684-3030	swindelw@tracer.army.mil
P. Valentine	USAEPG/JDE	(602) 538-4973	(602) 538-4976	valentinep@huachuca-emh17.army.mil
Rob Wright	RCI	(407) 658-9541	(407) 282-1451	wright@dmso.dtic.dla.mil

5.3 DATA STANDARDS ISSUES DISCUSSION

What should this group be focused on? There is a preponderance of M&S data that comes from other functional areas or places. Most M&S data is derived.

Augins: There may be some standards we need that are not being addressed by other groups. ANSI X3L8 has put forth a family of data standards and guidelines. This can be used as a starting point. We need standard data definition attribute standards, meta metadata standards, and standards for exchange of metadata and diagrams.

Valentine: With respect to IDEF1X, they are developing/need a data interchange language.

IRDS has been replaced by PCTE. The CDIF standard is beginning to allow the interchange of diagrams.

Haeker: With respect to DIS standards. What is our scope:
(1) 8320, data elements and data modeling
(2) interoperability: M&S talking to each other through PDUs
(3) Capturing central data provider information
(4) Capturing M&S data users: what do models require and who finds them and gets them modernized
(5) library concepts: data in library, information analysis center, catalogs
(6) information sharing, demos, communicate to the world as to where we are going

Standard and authoritative data sources can alleviate data redundancy: about the worst example of duplication that Haeker has seen are the three shops doing weather: Air Force, Navy and Army.

Dr. Anita Jones wants DMSO to concentrate on standards for data about smoke, who games it and what do they need wrt smoke, terrain, weather

Valentine: There are three different kinds of standards
—8300 series data standards
—standard data models: Army, Enterprise
—standardized data

Huo: We need to support Anita Jones in authoritative sources of data

Haeker: The role of this task force should be facilitating: pulling Services together on weather, forcing CDIF standards to be what we want

Augins: We need to get requirements out there, we need to set our priorities.

Courtot: CDIF has a prototype for exchange, what about a small group forming to evaluate and test it? How does a TF get work done voluntarily? Courtot supports breaking the large TF into sub-groups.

Griffiths: Some models that are outside DoD use databases that are highly classified. We want standards for M&S, the DoD community is driving the rest of the world in data standards and M&S

Twyla asked each person to tell what their interests were in data standards and the current work they were doing related to data standards. While they were speaking Twyla made an outline on the white board.

Coordination of Standards Development

CDIF	OME/A3H7
SQL	across/within DoD
DIS	

Models
- generic vs specific (lessons learned, focus)
- underlying database (IDEF1X modifications, standards/guidelines)

Requirements
- data/sources tools

Repository
- conformance testing
- interchange mechanism
- contents/tools

Standard Libraries (sources)

Classification

Discussion:
Question: How will the results of the standards TF be brought to the M&S WG?
Answer: the M&S FDAd will present the TF agenda to the M&S WG

NASA is putting out grants to get ideas geared toward networking, and development of tools by giving organization funds (e.g., universities working within the community) to develop tools and get them into community and bring users in and create needs. They will be giving a second set of grants that will be joint ventures between government and private organizations to drive things to be developed. We could look at this for DMSO for FY95, identify those areas worthy of funding to support the infrastructure. Data standards may be one of these areas, look at this method.

Expressed need to keep up document references on the I/DB bulletin board so people will know what standards documents are the latest ones.

The Data Standards Task Force made specific assignments to several members and identified at least one subgroup:

- What's Available and Where: Peter Valentine (Army/JDBE)
- Coordination of Data Standards Across and Within DoD: Luci Haddad (Army CCTT)
- Data Model Interchange Standards: Jim Augins (consultant for Navy ARMOR)
- Generic/Specific Data Models and Lessons Learned: Roy Scrudder (Army/JDBE)

- Reuse Library Framework (RLF): Luci Haddad (Army CCTT)

A Repository subgroup was formed to look into DDRS issues and also examine the IRDS standard in light of government implementation. Data interchange will also be addressed. The Repository subgroup had a meeting Thursday, Feb 17, after the I/DB broke up to discuss Jeff Wolfe's DIRS project.

Members are:
Jim Augins (consultant to Navy ARMOR) co-chair
Peter Valentine (Army/JDBE) co-chair
Carl Carden
Dave Danko
Mike Frame
Luci Haddad
Scott Kinser
Dan Lewis
Kent Manley
Emily McCoy
Chris Olson
Jim Santangelo
Eleanor Schroeder
Omar Spaulding
Jim Watson
Jeff Wolfe
Rob Wright

Interest in a database security was expressed by John Griffiths, Mike Rybacki, and Twyla Courtot

5.4 FEBRUARY 17 MEETING

February 17, Meeting of Repository Subgroup: action item: get an account for a bulletin board so members can describe what they are doing related to repositories and describe their short term needs and suggestions as to solutions (do this within 2 weeks). Repositories include: IRDS FIPS 156 systems, places to keep IDEF0, and IDEF1X models, and data standards, etc.

April 20, Meeting of the Data Standards Task Force at IDA

6. COMPLEX DATA TASK FORCE MEETING NOTES

6.1 AGENDA

FRIDAY, FEBRUARY 18, 1994

REPORT ON ISSUES IDENTIFIED DURING LAST MEETING

0800-0830	Report on definition of complex data and the categories of complex data to include multi-valued attributes/repeating groups and derived data (should also include results from MORS SIMDAT Mini-Symposium): *Mr. Peter Valentine*
0830-0900	Interoperability and Data Exchange: *Dr. Miro Medek*
0900-0930	Defense Information Repository System (DIRS) Data Model: *Mr. Jeff Wolfe*
0930-1000	*Break*
1000-1030	Report on DoD Data Standardization and Data Reuse Guidance for Complex Data Elements (Draft): *Mr. Duane Hufford*
1030-1100	Hard-Wired Data Hierarchies: The Tyranny of End-Use Specific Representations: Jack *Sheehan, ARL, Univ. of Texas*
1100-1200	Spatial Data Standardization Data Model: *Dr. Jack Teller*
1200-1300	*Lunch*
1300-1330	Pilot Studies: e.g., CCTT, UTSS, CENTCOM, several of which are considering JDBE help: *Ms. Iris Kameny*
1330-1630	*Discussion:* — Send potential discussion topics to Iris Kameny kameny@rand.org, phone: 310/393-0411, x7174 fax: 310/393-4818 — Topics will also be collected during morning briefings and prioritized for discussion

6.2 LIST OF ATTENDEES

COMPLEX DATA WORKSHOP
February 18, 1994

NAME	ORG	FAX #	PHONE #	E-MAIL ADDR
Jim Augins	ADS, Inc.	(619) 553-6083	(619) 553-9523	augins@nosc.mil
Karen Barland	AFSAA/SAG	(703) 697-1226	(703) 697-5616	barland@afsaa.hq.af.mil
Don Blanton	AMSAA	(410) 278-6242	(410) 278-3368	blanton@brl.mil.disa.mil
James Braud	NAVOCEANO	(601) 688-5196	(601) 688-4654	
William Burch	ISA, Inc.	(703) 379-8077	(703) 578-2587 or 578-2568	
Carl Carden	ISA, Inc.	(619) 574-8111	(619) 574-8100	ccarden@nosc.mil
David Danko	HQ DMA	(703) 285-9397	(703) 285-9238	
William Dunn	ARMY M&S Mgmt. Ofc.	(703) 607-3381	(703) 607-3384	
Beth Driver	Hq DMA	(703) 285-9222	(703) 285-9396	
R. Esslinger	NAVSEA	(703) 602-9121	(703) 602-5302	esslinger@navsea.SYSCOM.hdq.navy.mil
George Flax	SPAWAR-31	(703) 602-4541	(703) 602-5891	
John Griffiths	I.C. M&S	(703) 820-2841	(703) 820-2841	jgriffit@dmso.dtic.dla.mil
Luci Haddad	RCI	(407) 282-1451	(407) 658-9549	haddadl@dmso.dtic.dla.mil
Howard Haeker	USA TRAC	(913) 684-3866	(913) 684-3030	haekerh@tracer.army.mil
James Hammond	ARL	(512) 835-3259	(512) 835-3259	hammond.spgmsmail@msmailgwl.arlut.utexas.edu
Dan Hogg	JCS/JI		(703) 697-8899	dhogg@mhl.js.mil
Jamie Holcombe	Synectics		(703) 683-7287 x170	holcombe@dmso.dtic.dla.mil
Duan Hufford	AMS	(703) 841-5507	(703) 841-6066	
Mike Hopkins	USCENTCOM	(813) 830-4919	(813) 828-6430	
Chien Huo	JIEO/DMSO	(703) 487-3256	(703) 487-3538	huoc@dmso.dtic.dla.mil
Iris Kameny	RAND	(310) 393-4818	(310) 393-0411 x7174	Kameny@rand.org

NAME	ORG	FAX #	PHONE #	E-MAIL ADDR
Scott Kinser	RCI	(407) 656-9549	(407) 282-1451	skinser@dmso.dtic.dla.mil
James Mailhot	HQ AFC4A	(618) 256-2874	(618) 256-9657	mailhot@afc4a.asfp.af.mil
Kent Manley	VDS		(703) 683-7287	kmanley@dmso.dtic.dla.mil
Steve Matsuura	USA EPG/JDBE	(602) 538-4973	(602) 538-4967	matsuuras@huachuca-em17.army.mil
Emily McCoy	MITRE/NASA		(703) 883-7692	emccoy@mitre.org
Ray Miller	AF/XOMT	(202) 504-5341	(202) 504-5352	miller@dmso.dtic.dla.mil
M. Rybacki	AMSMO	(203) 607-3381	(203) 607-3385	rybacki@pentagon-hqdadrs.army.mil
Jim Santangelo	GPS	(703) 381-2386	(410) 381-7240	
E. Schroeder	NAVOCEANO	(601) 688-4639	(601) 688-5501	eleanor@dmso.dtic.dla.mil or: eleanor@pops.navo.navy.mil
Roy Scrudder	CSC/JDBE	(602) 538-4933	(602) 538-4812	scrudder@huachuca-emh17.army.mil
Len Seligman	MITRE	(703) 883-6435	(703) 883-5975	seligman@mitre.org
Jack Sheehan	ARL, U./Texas	(512) 835-3259	(512) 835-3594	sheehan@msmailgwl.srlut.utexas.edu
Cheri Wallmark	NAVOCEANO	(601) 688-5701	(601) 688-4323	

6.3 COMPLEX DATA ISSUES DISCUSSION

Iris Kameny started off the meeting by reviewing the action items from the October 28th meeting and noted that two identified issues, audit trails and tagging instance data, are topics that will be covered by the new VV&C Task Force. She reiterated the Complex Data Task Force (CDTF) long term goals: of providing categorization of complex data types and developing a guideline to data modeling and standardization of complex data types for the M&S community. The near-term goals are to perform pilot studies in complex data models and standards and coordinate with CIM on issues, problems and suggested extensions to IDEF1X and 8320.1-M-1. She presented a series of viewgraphs showing different categorizations of complex data from: MORS SIMDAT, Duane Hufford's DoD draft document, JDBE, and RAND.

The briefs from Peter Valentine on definition of complex data and from Miro Medek on interoperability and data exchange were action items from the October 28th meeting. Jeff Wolf, Duane Hufford, and Jack Teller's briefs were invited reports on projects relevant to complex data. Jack Sheehan's brief was volunteered.

Mr. Peter Valentine: Complex Data Definition
Definition "Complex Data is that data which is not easily represented using existing data modeling methodologies." Current data models can be very complex, an example is that IDEF1X categories are complex compared to Chen E-R diagrams. Structures such as hierarchies or directed graphs are called complex even though they can be represented (though with difficulty). Non-standard data types (like graphics and sound are called complex).

IDEF1X represents the DoD selected methodology for data modeling as part of the DoD data standards program and is the methodology being addressed in this TF. We can represent complex data as falling into one of two types of basic shortfalls to IDEF1X: those that are addressable through the use of tricks of representation, and those that are unaddressable unless the IDEF1X language is extended or there is an external supplementation to the data model.

Complex data that can be handled by addressable shortfalls to IDEF1X include: recursive structures like lists and hierarchies, composite attributes (groups), complex data types (BLOBs, arrays, binary, etc.), repeating groups (multiple values), and multi-purpose (different meanings).

Peter showed how a chain, list, hierarchy, binary tree, and directed graph could be modeled in IDEF1X. He noted that complex attributes can be represented as "group" attributes supported by a state-of-practice feature available in some IDEF1X tools. This is an issue being addressed by the IEEE IDEF1X WG.

He suggested that complex data types (BLOBS, graphics, sound, compound documents) can be addressed by separately modeling the data type using IDEF1X or other techniques such as Jackson Diagrams; that these objects can be physically represented in existing RDBMSs as BLOB, IMAGE or MEMO fields;

and that one can also use state-of-practice user defined data types to define them. (He showed an example of image and pixel in a part-whole relationship.)

Repeating groups are not a valid IDEF1X construct but can be easily addressed by creating another entity to contain the repeating values.

For multi-purpose attributes (attributes whose meaning changes based on changes in the instance values) there are no IDEF1X language constructs because this violates data normalization rules. He notes that these occur in as-is models and can be documented in the Glossary description of IDEF1X.

Complex data unaddressable by IDEF1X includes: derived data (algorithms, aggregates/summaries), complex business rules, objects (with methods), data dependencies (model level and instance level), and physical representation of bits and bytes.

He noted that the IEEE IDEF1X WG is working toward a formal language for documenting complex business rules (those not already handled as business rules in IDEF1X) and maintaining them in the Glossary. They are also addressing objects particularly issues of object identity and persistence. The important question is whether different data modeling methods are needed to represent objects and complex business rules. Derived data and data dependencies require some way of relating/tracking data to the data participating in the derivation as well as the derivation processes.

An issue that Peter posed is where does data leave off, should/when does data need to include process? What is the scope of data?

Dr. Miro Medek: Interoperability and Data Exchange
Data sharing in the DMSO community must overcome heterogeneity in models, data, hardware, and software. For data exchange, data standardization should reduce the problem of translating shared data. Data translation involves: data semantics (Boolean to T,F), data representation (miles to meters), data types (complex to primitive). Data conversion involves data organization and structure, and data format. Miro showed a target architecture based on data standardization where the sources collect/generate standardized data, the models use standardized data and there is a data exchange standard that they all recognize and use. In his evolutionary migration view, modifications have been made to the model to enable it to use standard data and to the source that provides standard data. In addition, translation is required between a data source that provides nonstandard data and the data exchange standard and between the model that uses nonstandard data and the data exchange standard. Migration strategies must consider time, budget, resources, data ownership, and technology insertion.

The repository plays a role in data translation/conversion by containing information about location of data, format and representation of source data, algorithms for converting data, and translation algorithms for translating data to the required representation. The description of translation algorithms in the repository should contain definitions of input, translation output, algorithm, and source code (if available).

There is an issue in the M&S community with finding data that doesn't exist in the required form but needs to be derived from existing data and an algorithm. An issue is, under what conditions is this information put into the repository for reuse. How much reuse must one expect in order to make this cost beneficial. Attention also needs to be paid to being able to rapidly locate such descriptions/algorithms once they have been entered.

(It was noted that this brief did apply more to the newly formed Repository subgroup of the Data Standards Task Force than to the CDTF.)

Mr. Jeff Wolfe: Defense Information Repository System (DIRS)
An objective of the DIRS project is to produce standard data for managing data (sort of meta metadata). DIRS is a life cycle model for customers having a need to share data assets at the enterprise level across DoD. Now there are many different nonstandard repositories in the CIM community and in the functional areas and Components. The hope is that DIRS will replace all these piecemeal repository efforts.

IRDS takes a broad look at the whole information infrastructure by including: systems, standards, resources, etc. in its repository definition. DIRS does this by modeling information asset subtypes and the entities needed to manage them. The DIRS Conceptual Data Standardization Data Model View at the meta metadata level includes the entities/concepts of group-attribute and derived-data-attribute. Jeff would like our help in better defining/expanding these. He would like a validation session for review of the complex data part of this model. He would like to get our input incorporated into a proposal package that he wants to submit to CIM within the next two months.

My notes included a recommendation for associating data class with a base type where class would include BLOBS, icons, etc.

Jeff said there is a question about cost justification of a data standards program. The issue being the cost of IRDS data and the move to a central logical repository. He gave an example of a Motorola repository that tracks everything.

We will try to set up another meeting possibly in early April to go over the DIRS model. (I really need some help in better understanding it—I don't know about the rest of you.)

Duane Hufford: Report on DoD Data Standardization and Data Reuse Guidance for Complex Data Elements (draft)
Duane works for American Management Systems and has been doing this work for CIM through Phil Cykana. This writeup will contain his definitions. His paper is available through RAND on request and his briefing charts and executive summary are in Appendix C.

Definitions of complex data:

Embedded or inherited information contained within the data element

From "Complex Data and the DoD Data Administration Program": any structure which requires order, any data structure which may be of variable length, or any data structures which require a pointer.

Duane identifies four types of complex data:

Composite: data elements that embed intelligence about multiple concepts in their names, definition, and domains.

Derived: data elements representing concepts computed, aggregated, transformed, or inferred from the values of one or more other data elements.

Data steam: Ordered bits or characters formatted to represent information in a variety of forms.

Assembly: data entities comprising instances of data which relate to other instances of data within the same entity.
Duane then gave examples of each of these and a way to represent them in an IDEF1X model. He has asked for feedback from the CDTF as to what is not understandable or for comments and recommendations.

Jack Sheehan: Hard-Wired Data Hierarchies: The Tyranny of End-Use Specific Representations
Jack described three heresies: (1) the real world of combat is not 2-D, (2) hardwire hierarchy is reuse hard-kill, and (3) data complexity is not an intrinsic property of a "data element". RDBMS is composed of 2-D relational tables. The challenge is to capture multidimensional nature of problems and make the projection onto the engine of choice. One maps into 2-D for efficiency, elegance, and reuse. When one addresses his heresies 1 and 2, you get a solution to complexity for free. Representation of data as complex is the consequence of point of view. Complexity is not an intrinsic feature. He discussed discovering these ideas when he was collecting data on a sonar tow array system.

Jack Teller: DMA Data Modeling Project for MC&G Standardization
(A summary of the briefing Jack gave at the I/DB can be found in the I/DB section.)

The aims of the DMA pilot project in data modeling were to develop a cadre with modeling and data standardization skills and to develop models compatible with the Digital Geographic Information Exchange Standard (DIGEST) Feature Attribute Coding Catalog (FACC). They developed a data model identifying 75 potential standard data elements and submitted an initial package of 10 data elements. The modeling was done from the MC&G perspective and did not extend to individual features and attributes. Since other DoD organizations have uses for the same objects, they have proposed a project to expand the perspective from MC&G DMA expertise to include DoD-wide participation. There are lots of users of their data because users need DMA data to carry out their missions. However, it is hard to find real "owners" of MC&G data outside of DMA, most are just providers.

DIGEST is a four volume standard document that is the exchange standard for all data produced by DMA. There was a question about commercial vendors using

DMA standards: several have converted DMA data into their own formats. DMA and USGS are working together on a Federal Data Transfer Standard (FDTS).

We could work with DMA by furnishing M&S participation in the MC&G model development. This should be a high priority for the CDTF since DMSO has recognized a need for data standards for environmental data.

Discussion:
Metrics: we need to collect metrics about the cost and benefits of developing standards for complex data.

This list titled "metrics" was in my notes

- Number of change requests
- Use of data model
- How many affected
- What are the issues
- Data sharing objectives

Volunteers for additional pilot studies in complex data modeling are CENTCOM and UTSS. CENTCOM will be using JDBE help in doing data modeling.

6.4 SUBGROUP ORGANIZATION

The Complex Data Task Force identified three subgroups:

Categorization of Complex Data Subgroup will start with several recent categorization attempts including those offered in Duane Hufford's paper and the DMA data modeling effort and try to feed input back to Jeff Wolfe's DIRS project.

Members are
Len Seligman (MITRE) co-chair
Peter Valentine (Army/JDBE) co-chair
Jim Augins (consultant to ARMS)
Carl Carden (ISA)
Mike Frame (IDA)
Dan Hogg (J8)
Duane Hufford
Iris Kameny (RAND)
Roy Scrudder (Army/JDBE)
(Jeff Wolfe (DISA/CIM)

Pilot studies in Complex Data will be done by UTSS, CCTT, CENTCOM, DIS, and DMA data modeling. Chien Huo will coordinate and JDBE will support.

Taxonomy/Indexes Subgroup (a subject area that is needed by the Repository subgroup and the database and M&S directories as well): task is to develop indexes to be used for accessing information about models and simulations and databases in DMSO directories as well as in reuse libraries. Will try to build off any available Component indexes. This is an important subject for M&S projects such as CCTT and UTSS as well as non-M&S efforts.

Members are
Dan Hogg (J8) co-chair
Iris Kameny (RAND) co-chair
Mike Hopkins (CENTCOM)
Chien Huo (DISA/JIEO/CFS)
Peter Valentine (Army/JDBE)
Rep from University of Central Florida (DIS)?
DIA ??

?? Question marks indicate a desire to get participation from these organizations

6.5 FUTURE MEETINGS

April 6–7, Categorization Subgroup meeting at IDA to get initial consensus on complex data for input to Jeff Wolfe's DIRS data model.

Appendix

A. MAIN I/DB MEETING BRIEFING CHARTS

DMSO

presented at the

Seventh Information/Database Task Group

(I/DBTG)

Defense Modeling and Simulation Office (DMSO) Update

16 February 1994

LTC Jerry Wiedewitsch, USA
Dep Dir, DMSO

EXCIMS
Investment Guidance

DMSO

The explicit goal of this effort is to promote the efficient and effective use of models and simulations at the Joint and DoD Levels. To accomplish this goal the following objectives will guide investments:

- **Promulgate standards to *promote interoperability* of the components of the modeling and simulation environment;**
- **Support development of *databases, tools, and methodologies* for community-wide use;**
- **Promote development of a *communications infrastructure* to support integration of Joint modeling and simulation activities;**

and,

- **Facilitate community-wide *coordination and information sharing*.**

Investment Guidance Conformance

DMSO

Investment Guidance Element	Funding FY91/FY92 ($k)	FY93 ($k)	Total ($k)
Promote Interoperability	14,750	19,756	34,506
Databases, Tools and Methodologies	20,281	30,664	50,945
Communications Infrastructure	10,561	7,800	18,361
Coordination and Information Sharing	1,385	1,778	3,163
	46,977	59,998	106,975

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14 Feb 94

FY94 Focused Calls

DMSO

Focused Call Areas

M&S Components	M&S Common System Support	M&S Interoperability	M&S Community Awareness
• Environmental Representation • Behavioral Representation • Unit/System/ Mission Representation	• Databases • Tools • Scenarios	• Standards • Interoperability • Communication	• Education • Information Sharing

Proposals Received

M&S Components	M&S Common System Support	M&S Interoperability	M&S Community Awareness
56	47	25	2

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Infrastructure Definition

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Modeling and simulation infrastructure is the foundation which enables and facilitates M&S development and use in support of DoD objectives. This foundation is composed of four major categories defined as follows:

- **Policy and Management -- The guidance on which objectives for the M&S community are developed.**
- **Common Structural Definitions -- Specifications of how the various components of models and simulations are constructed and interface with one another.**
- **Common-Use Assets -- The various components that are widely used and shared across the community in the development and application of models and simulations.**
- **Community-Wide Services -- Those capabilities that promote information sharing and education across the modeling and simulation community.**

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Infrastructure Categories

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Policy & Management

- DoD Directive
- M&S Master Plan
- Investment Priorities
- Component Guidance
- National and International Agreements
- Industrial Relations

Common Structural Definitions

- Architecture
  - Constructive
  - Virtual
  - Live
- Standards
  - Interoperability/Interface
  - Communications
  - Security
  - Databases/Data
  - Algorithms
  - Model Description
  - Human System
- Interface
- VV&A Processes

Common-Use Assets

- Networks
- Representations
  - Systems *weapons, support, C4I/friend, foe, neutral*
  - Threats
  - Scenarios
  - Physical Environments
  - Physical Phenom. & Processes
  - Human Behavior
- Tools & Methodologies
  - M&S Develop., Op., & Analysis
  - VV&A
- Testbeds

Community-Wide Services

- Technical Center
  - User Support
  - Repositories Dir.
  - Info. Analysis Ctr.
  - M&S Info. System
- Demonstrations
- Conferences and Workshops
- Training and Education Sessions
- Working Groups
- Repositories

Investment Strategy Evolution

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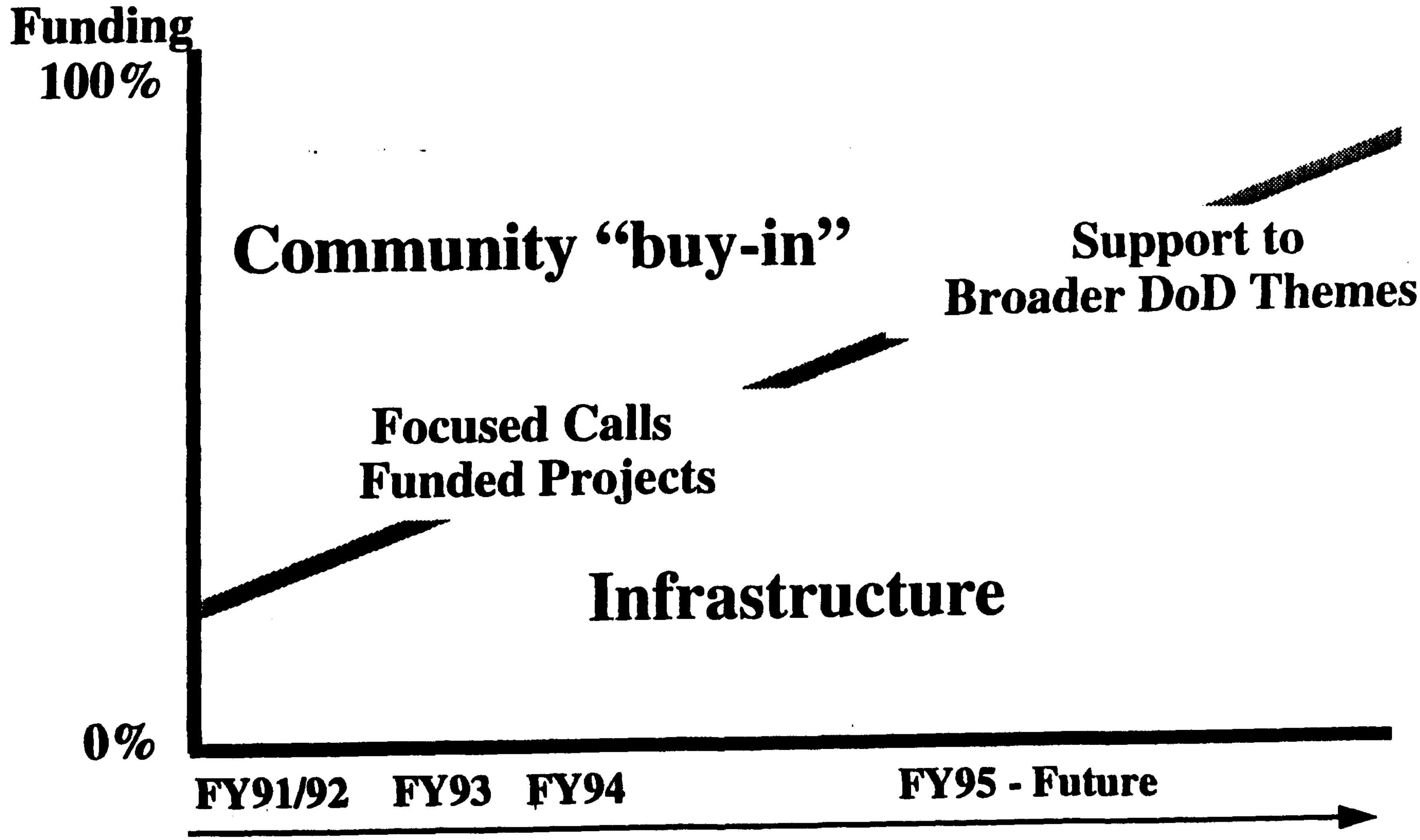

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14 Feb 94

FY94 Project Selection
(IPL Development)

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Based on EXCIMS approved strategy

Recommend consideration of proposals that emphasize and address the broader DoD concerns:

Readiness

Infrastructure

Quality /Value Added

Current DMSO supported Data Related Projects

DMSO

Project Title	Submitted by
Project 2851, Proposal 02, Pre-Population of the DoD Data Base Library	Air Force
Universal Threat System for Simulators *(UTSS)*	Navy
Project 2851, Proposal 01, Cartographic Imaging Modeling Program *(CIMP)*	Air Force
Integrated Radar & Infrared Analysis & Modeling *(IRIAM)*	Navy, Army, Air Force, Joint Staff
Joint Warfare Simulation Object Library	Navy
Joint Theater Missile Defense *(TMD)* Simulation Network *(JTMDN)*	Air Force
The Medical Modeling and Simulation Initiative	FM&P
Joint Data Base Element	Army

DMSO Integrated Priority List '94
Data Related Projects

DMSO

Project Title	Submitted by
Master Environmental Library *(MEL)*	Navy
**(Proposed Combination)* Joint Environment for Testing, Training, and Analysis *(JETTA)*/Joint Space Combat Environment Simulation *(J-SPACES)*/DIS Standards Testing Program *(DSTP)*	Navy, Army, Air Force, Marine Corps, BMDO, JITC
Advanced Amphibious Assault Vehicle *(AAAV)*: A Pilot Modeling and Simulation Program to Streamline Test and Evaluation within the Acquisition Process	Marine Corps
Mission Rehearsal *(MR)* Real Data/Syn. Environ. Testbed	Navy, Air Force, LANDSAT Prog Ofc
**(Proposed Combination)* Tri-Service Multi-Spectral Signature Prediction Env for Interactive Simulations/ FASTPROP: An Env Sim for LOS Calculations/ Multi-Svc Env for Auto Tgt Recog *(ATR)* Dev, Eval, and Optimization/IR/EO Sim of Mil Tgts and Backgrounds	Army, Navy, Air Force, Joint Staff, JDL/ATR
**(Proposed Combination)* Common Database, Real World Support Solutions for Modeling & Simulations/ Extension of ARMS Database to Support CJTF Models & Simulations	Army, Navy, Air Force, Joint Staff, DISA, DMA, BMDO

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Long Term Objectives

DMSO

- Seamlessly link live, constructive and virtual simulations on demand to support the operational readiness of forces
- Apply modeling and simulation both more broadly and with increased validity throughout DOD
- Provide authoritative representations, with appropriate scalability, fidelity and granularity
- Enable interoperability of M&S supporting technologies

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Objective #1

DMSO

Seamlessly link live, constructive and virtual simulations on demand to support the operational readiness of forces

- **Connect appropriate levels and classes of simulations for training, planning, and mission rehearsal**
- **Conduct/Support Demonstrations advancing M&S**

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Objective #2

DMSO

Apply modeling and simulation both more broadly and with increased validity throughout DOD

- Foster M&S application across all DoD enterprise areas
- Seize every opportunity to demonstrate the utility of M&S

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Objective #3

DMSO

Provide authoritative representations, with appropriate scalability, fidelity and granularity

- **Build representations of :**
  - **the physical environment**
  - **physics based processes and interactions**
  - **human behavior**
  - **threats**
- **Make representations accessible to user communities**

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Objective #3
Action Plan

DMSO

- Determine critical representations based on user requirements
- Prioritize development efforts
- Select first instantiations
  - Get customer involvement
    - Gain agreement on requirements
    - Committtment to use the product
    - Committment of resources for development
  - Leverage ongoing efforts
  - Require VV&A and VV&C
  - Field test of representation by multiple users
  - etcetera
- Select Executive Agents
- Set milestones
- Develop metrics
- Catalog representations and make them available

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continued

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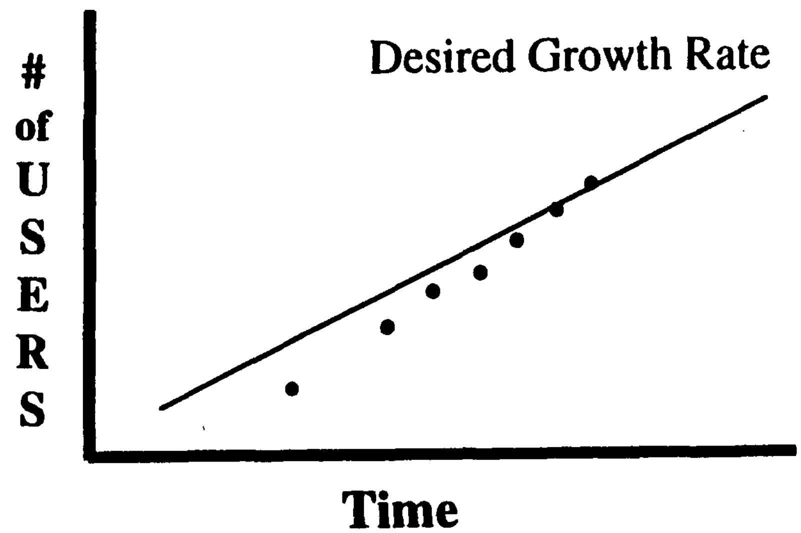
Objective #3
Action Plan

DMSO

continued

- **Candidate Metrics for a given terrain representation**
  - **Percentage of the earth modeled**
  - **Turn-around time for production of updated data for hot spots**
  - **Number of users**
- **Sample Metric graphically depicted**



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Objective #4

DMSO

Enable interoperability of M&S supporting technologies

- Establish common M&S architecture(s)
- Develop and promulgate DoD M&S standards

FY95 Investment Considerations

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[illegible] to orient on M&S Objectives

Verify Infrastructure elements

Use Infrastructure as the foundation

Focus on larger DoD concerns

Ensure compliance with DoDD 5000.59

Incorporate strategy in M&S Master Plan

Backups

2

DMSO

presented at the

Seventh Information/Database Task Group
(I/DBTG)

Modeling & Simulation Data Administration

16 - 17 February 1994

DMSO
1901 N. Beauregard Street, Suite 504
Alexandria, Virginia 22311
(703) 998-0660
(703) 998-0667 fax

Dr. Chien Huo
DMSO & JIEO/CFS

Data Administration
Objectives

DMSO

- **Promote the efficiency, validity, and interoperability of model and simulation development**
- **Key Issues**
  - **Data standardization**
  - **Sharing, reuse and access**
  - **Verification, validation, and certification *(VV&C)***
  - **Life cycle management**
  - **Security**

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Long Term Objectives

DMSO

- Seamlessly link live, constructive and virtual simulations on demand to support the operational readiness of forces

- Apply modeling and simulation both more broadly and with increased validity throughout DOD

- Provide authoritative representations, with appropriate scalability, fidelity and granularity

- Enable interoperability of M&S supporting technologies

M&S Functional Data Administrator (FDAd)

Responsibilities

DMSO

- Implement a M&S Data Administration *(DA)* infrastructure and to establish community consensus on policies, procedures and standards
- Address complex data standardization, database verification, validation and certification *(VV&C)*
- Establish an M&S repository and the development of taxonomy, Databases Directory and M&S Directory
- Identify and promulgate DA methodology and tools
- Facilitate interchange of information and lessons learned

Project Activities

DMSO

- **DIS (IEEE 1278)**
  Demo'd at I/ITSEC '92 & '93
- **DMSO designated as FDAd**

Workshops

- **Computer Gen Forces** *Mar 93*
- **DIS** *Mar, Sep 93*
- **I/DB** *Mar, July 93*
- **VV&A** *Oct 93*
- **MORS-SIMDATA** *Nov 93*

DISA/JIEO
Center for Standards

- Tech Coord M&S Data Administration/ Standards
- DISA Rep In-House at DMSO

DISA/JIEO
Center for Info Mgt

- Complex data modeling
- Tools & techniques
- Data Standards
- Repository

Building Blocks of Interoperability

Efforts

DMSO

- Designation DMSO as the M&S FDAd
- Established and continuously support the Information/Database Task Group *(I/DBTG)*
- Supported infrastructure efforts
  - Data administration
  - M&S data models, process models, and standards
  - Reverse engineering of existing databases
  - M&S taxonomy
  - Community Information Exchange
- Fostered joint projects
  - Complex data task force
  - Data VV&C task force
  - Common use tool development
- Supported projects developing new joint databases

DMSO supported
Data Related Projects

DMSO

Project Title	Submitted By
Project 2851, Proposal 02, Pre-Population of the DoD Data Base Library	Air Force
Universal Threat System for Simulators *(UTSS)*	Navy
Project 2851, Proposal 01, Cartographic Imaging Modeling Program *(CIMP)*	Air Force
Integrated Radar & Infrared Analysis & Modeling *(IRIAM)*	Navy, Army, Air Force, Joint Staff
Joint Warfare Simulation Object Library	Navy
Joint Theater Missile Defense *(TMD)* Simulation Network *(JTMDN)*	Air Force
The Medical Modeling and Simulation Initiative	FM&P
Joint Data Base Element	Army
Data Base System Upgrade	Joint Staff, CENTCOM, Marine Corps

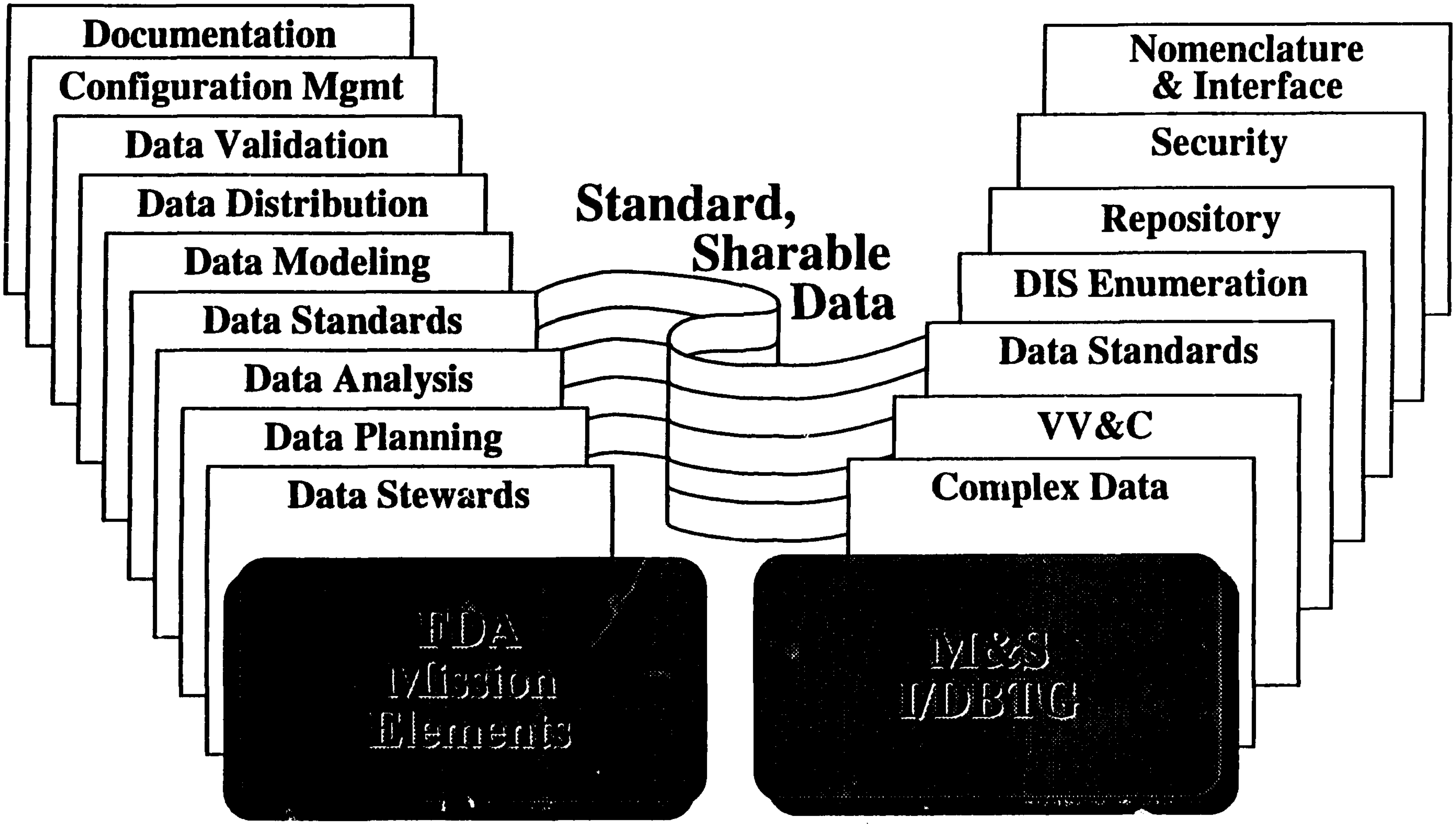
Community Needs

DMSO

- Complex data
- M&S Repository
- Directory: M&S and Databases
- Data VV&C
- M&S Taxonomy
- Community use tool development
- Data Security
- Nomenclature and Symbology Standards

Functional Data Administration

DMSO



Near Term Actions

DMSO

- Guidelines for data standardization policies and procedures including complex data and VV&C for M&S community
- Oversight of task groups addressing complex data, M&S data standards, and data VV&C and DMSO funded database projects
- An M&S repository to support DA standardization
- Populated M&S databases and simulation models directories and/or catalogues including subject area taxonomy to aid in browsing and searching
- Continuing institution of DMSO Information/Database *(I/DB)* forum

DMSO Integrated Priority List '94
Data Related Projects

DMSO

Project Title	Submitted by
Master Environmental Library *(MEL)*	Navy
*(*Proposed Combination*) Joint Environment for Testing, Training, and Analysis *(JETTA)*/Joint Space Combat Environment Simulation *(J-SPACES)*/DIS Standards Testing Program *(DSTP)*	Navy, Army, Air Force, Marine Corps, BMDO, JITC
Advanced Amphibious Assault Vehicle *(AAAV): A Pilot* Modeling and Simulation Program to Streamline Test and Evaluation within the Acquisition Process	Marine Corps
Mission Rehearsal *(MR)* Real Data/Syn. Environ. Testbed	Navy, Air Force, LANDSAT Prog Ofc
*(*Proposed Combination*) Tri-Service Multi-Spectral Signature Prediction Env for Interactive Simulations/ FASTPROP: An Env Sim for LOS Calculations/ Multi-Svc Env for Auto Tgt Recog *(ATR)* Dev, Eval, and Optimization/IR/EO Sim of Mil Tgts and Backgrounds	Army, Navy, Air Force, Joint Staff, JDL/ATR
*(*Proposed Combination*) Common Database, Real World Support Solutions for Modeling & Simulations/ Extension of ARMS Database to Support CJTF Models & Simulations	Army, Navy, Air Force, Joint Staff, DISA, DMA, BMDO

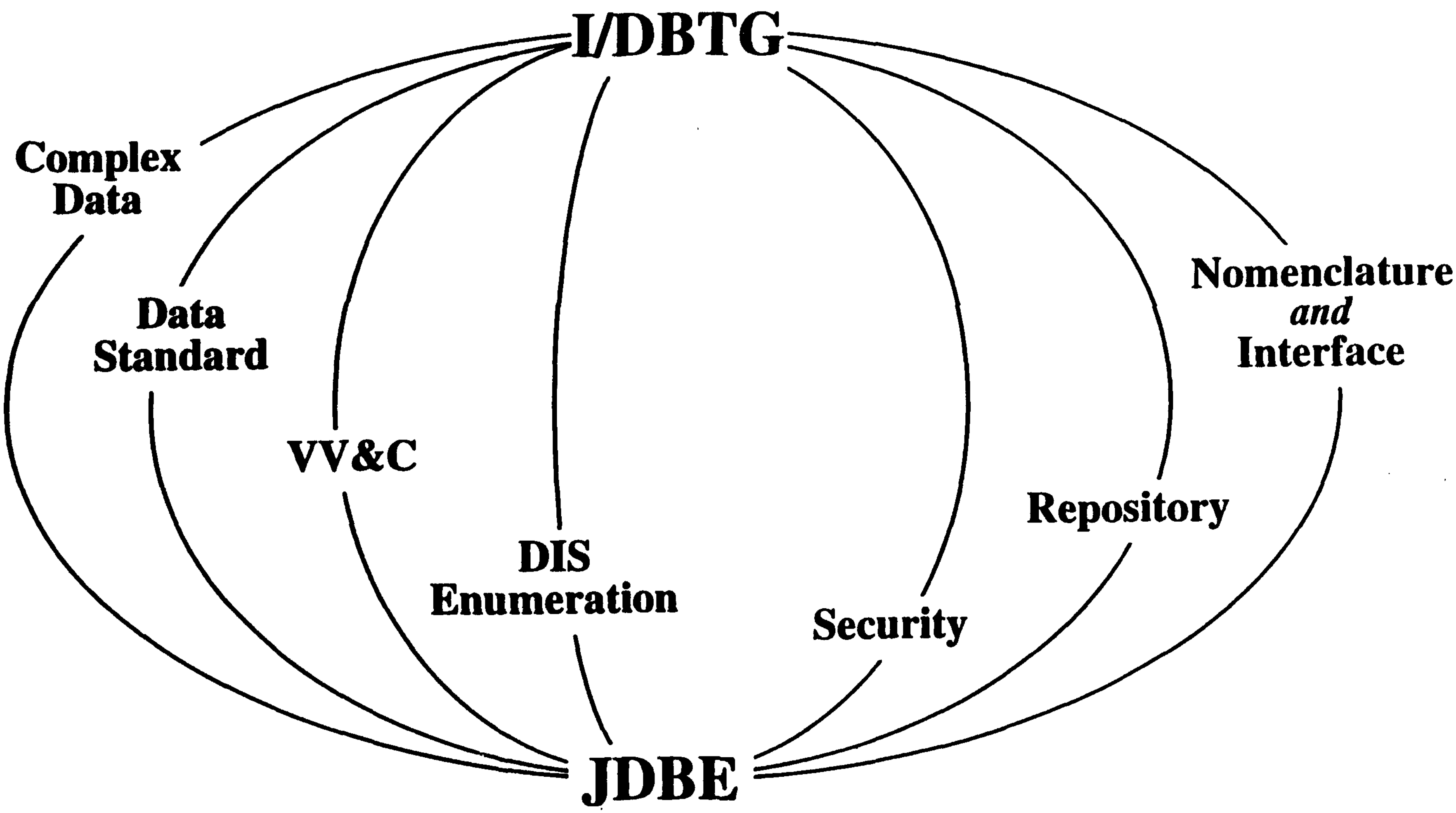
Summary

DMSO

- **Data Administration/Standardization Program**
  Developing Area. Your assistance welcome

- **Want to facilitate and/or assist M&S community in their data administration and standards**

Backups


I/DBTG
Complex Data
Data Standard
VV&C
DIS Enumeration
Security
Repository
Nomenclature *and* Interface
JDBE

Verification, Validation, and Certification *(VV&C)* of Data

DMSO

- Goals
  - Establish levels of data certification
  - Define relationship between M&S VV&A and the certification level of the data being used in M&S
  - Define instance data owner responsibilities for VV&C
  - Educate the M&S community as to how to use and interpret data at various levels of certification
- Approach
  - Define terms, discuss data ownership, policies, and issues, cost estimation of V&V, V&V methods and techniques, and experience with V&V tools
  - Convene Task Force to continue work to fulfil l objectives

Status of Directory and Repository Efforts

DMSO

Directory of databases used by and useful to M&S community
- Design completed on IDEF1X data model and database
- Implementation to be under Oracle DBMS
- Populated by end FY94

Directory of Models and Simulations
- Design effort completed on joint DMSO and BMDO data model and database by 1st Qtr FY94
- Implementation under Oracle DBMS
- Populated by end FY94

Repository development

Will organize joint interest group from I/DB to include JDBE, CCTT, UTSS, DMSO....CENTCOM?

DATA VERIFICATION, VALIDATION AND CERTIFICATION (VV&C) TASK FORCE MEETING

14 February 1994

Suggested Objectives for Data VV&C

and

Summary of Data VV&C Working Group Results from MORS SIMDAT Symposium

Iris Kameny

RAND

SUGGESTED OBJECTIVES FOR DATA VV&C

- Develop guidelines for Data VV&C
- Address authoritative data sources and their responsibilities
- Address the role of M&S data centers between data sources and simulation applications

DEVELOP GUIDELINES FOR DATA VV&C

- Develop definitions for data verification, validation and certification and other related concepts
- Describe tools and methods to be used in verification and validation
- Develop certification profile of metadata describing data quality of a database
- Develop policies and procedures for performing data VV&C and relate it to M&S VV&A

ADDRESS AUTHORITATIVE DATA SOURCES AND THEIR RESPONSIBILITIES

- Establish policy for determining the authoritative sources of M&S data and procedures for registering them
- Establish policies, procedures and enforcement of M&S data authoritative source responsibilities including:
  - Use of data standards
  - Carrying out of VV&C
  - Configuration management of data
  - Help to M&S users of data
  - Handling of data security issues such as data aggregation
  - Participation in M&S VV&A

ADDRESS THE ROLE OF M&S DATA CENTERS BETWEEN DATA SOURCES AND SIMULATION APPLICATIONS

- As authoritative sources
- In sharing and reusing data
- In keeping track of who they are, what their mission is, communcations among them

PRELIMINARY DEFINTIONS TAKEN FROM WORKING GROUP ON DATA VV&C AT MORS "MINI-SYMPOSIUM ON SIMULATION DATA AND ITS MANAGEMENT" (November 16-18, 1993)

- **Data Verification defined for a dataset from a generic data source (e.g., DMA, DIA):**
  - The use of techniques and procedures to ensure that data meets constraints defined by data standards and business rules derived from process and data modeling.

- **Data Verification defined for a dataset from a source furnishing data specific to a model/simulation (e.g., TRAC Automated Data Center (TADS) or CENTCOM's Conventional Forces Database):**
  - Review of input data values to ensure that they are converted and formatted properly for input into the M&S conceptual and logical design. Data reduction and transformation techniques should be addressed.

PRELIMINARY DEFINTIONS TAKEN FROM WORKING GROUP ON DATA VV&C AT MORS "MINI-SYMPOSIUM ON SIMULATION DATA AND ITS MANAGEMENT" (November 16-18, 1993)

- **Data Validation:**
  - The review of data by subject area experts and its comparison to know or best-estimate values
- **Data Certification:**
  - Determination that data have satisfied verification and validation criteria which may vary according to usage (i.e., general domain criteria or application-specific criteria).
- **Proposed alternative for Data Certification:**
  - Determination that the database/dataset has been accurately described in the attached certification profile and that all verification and validation tests described in the profile have been stringently carried out.

DATA CERTIFICATION PROFILE

- Furnished to dataset user by authoritative source to describe quality of dataset including verification and validation tests and procedures used
- Profile includes
  - Metadata concepts including: degree of completeness, degree of accuracy, confidence of belief, level of detail, precision, currency (spanning dates, effective dates, rate of update), geographic area (if applicable), etc.
  - Data describing authoritative data source, mission, purpose of dataset
- Certification profiles could have unique identifiers and could provide a complete audit trail for data from original source through value-added authoritaive sources up to use in the model.

SUMMARY OF WORKING GROUP ON DATA VV&C AT MORS "MINI-SYMPOSIUM ON SIMULATION DATA AND ITS MANAGEMENT"

- Over 40 participants
- Discussed long term goals of Data VV&C
  - Develop guidelines for Data VV&C
  - Establish procedures for identifying and registering authoritative data sources
  - Establish policies, procedures and enforcement of responsibilities of M&S authoritative data sources
- VV&C issues: definitions, V&V guidelines, multiple levels of VV&C, certification profile, role of data centers
- Ten papers were presented

FINDINGS

- Need VV&C group to address area
- Need policy, procedures, and guidelines for DB VV&C
- Need concise definition of terms
- VV&C for M&S needs to be addressed with strong interaction between analysis needs, model, and data
- Need to collect VV&C cost and cost benefit data
- There are automation tools to help with DB VV&C
- DB VV&C for M&S community needs to deal with two types of databases and data centers*: M&S supportive and generic*

1. FINDING AND RECOMMENDATION

Finding: An effort is needed to further define DB VV&C processes

Recommendation: DMSO pursue DB VV&C processes and ensure coordination of DB VV&C with M&S VV&A processes, and their associated costs and cost benefits

How (options):

(a) Expand VV&A Task Force to include DB VV&C (e.g. DB VV&C subgroup)

(b) Create new VV&C Task Force

2. FINDING AND RECOMMENDATION

Finding: Need policy, procedures and guidelines instructing data sources and data centers in carrying out DB VV&C

Recommendation: DOD develop policy, procedures and guidelines for DB VV&C management processes applied to data sources and data centers to enhance affordability, efficiency, and data consistency.

3. FINDING AND RECOMMENDATION

Finding: Need concise definitions of relevant VV&C concepts and terms

Recommendation: Enhance communications by defining DB VV&C terms that will be promulgated to the MORS community

- Follow DOD M&S definitions
- Use software engineering VV/DISA definitions as appropriate
- Consider data source, data center and M&S DB

DEFINITIONS REQUIRED

- Data
- Database
- Complex data
- Atomic data
- Data model
- Instance data
- Meta data
- Data verification
- Data validation
- Data certification
- Data center
- Data source
- Model Simulation
- VV&A (M&S)
- Database model
  - Logical
  - Physical

EXAMPLES OF DATABASE CHARACTERISTICS

- Description of subject areas and sources
- Audit trail
- Control
- Accessibility
- Currency
- Completeness
- Consistency
- Accuracy
- Precision
- Resolution
- Classification
- Credibility
- Reproducibility

Tuesday, 16 November 1993

1400—1430	VV&C Overview — *Long term goals including need J and procedures for data owners* — *Goals of this working group* — *VV&C definitions*	
1430—1500	Automation Tools for Data V&V	
1500—1530	Interaction and Interdependencies o Analysis, Models, and Data	
1530—1600	Verification, Validation, Accreditation and Certification Costs	Dale Pace, JHU/APL Simone Youngblood, JHU/APL
1600—1630	Discussion	

Wednesday, 17 November 1993

0800—0900	Joint Modeling and Simulation Verification,Validation and Data Accuracy	Mike Hopkins, CENTCOM LTC Wright, CENTCOM, Combat Analysis Group
0900—0930	Data Verification and Data Models	Chris Landauer, Aerospace
0930—1000	Extended Air Defense Simulation (EADSIM) Validation Methodology Using Comparisons with Field Test Data	Anil Joglekar, IDA
1000—1030	Break	
1030—1100	Contractor Data: Where does It Fit in Management?	Jim Kolding,Teledyne Brown Eng., Huntsville
1100—1130	TADS Visual Data Analysis	Howard Haeker, TRADOC Analysis Command-Study and Analysis Center
1130—1200	Oceanographic Data Base Management at the Naval Oceanographic Office	Martha Head, Naval Oceanographic Office
1200—1300	Lunch	
1300—1600	Group Discussion and Preparation of Report — *Goals:* — *Formation of VV&C Task Force* — *Definitions and Guidelines for VV&C* — *Policies for data ownership responsibility* — *Interoperability across source/derived data centers*	

List of Participants

LTC Robert C. Bailey, Jr.
Alexander B. Blair
David B. Blake
William H. Dunn (Co-Chair)
Dr. James Fox
Mary C. Fischer
Brian F. Goldiez
Kevin R. Hannon
Robert G. Hartling
Martha Head
David F. Hemingway
Iris M. Kameny (Chair)
James C. Kilding
Ralph G. Koontz
Dr. Christopher A. Landauer
Sylvia M. Lane
Pilar N. Montes
Tran N. Nguyen

Dr. Dale K. Pace (Co-Chair)
John D. Parsons
Dr. Francis M. Ponti
Robert T. Probus
John J. Rankin
Jean E. Razulis
Eleanor Schroeder
LTC Myron A. Spears, Jr.
Carol A. Subick
Brian W. Suma
Dr. Gokay Sursal
Gail S. Sweet
LtCol David S. Thomen
Charles A. Tunstall
James E. Weatherly
LtCol William G. Wright
Simone K. Youngblood
Sharon R. Nichols

REPORT FOR M&S DATA STANDARDS TASK GROUP

MR. HOWARD HAEKER

"Simulation Data and Its Management"

Overarching Issues

- Standards
  - Standards begin with a need, continued use and conformance, and value added
  - No strict enforcement of standards but use of standards incentivized
  - More information is needed
    - Whats being developed
    - What tools, products, methods
    - De facto, official standards
    - What's needed, priority of work

Recommendation

Form a standards group

DMSO I/DB TASK GROUP

February 16 — 17, 1994

Report from Complex Data Task Group

Iris Kameny

RAND

COMPLEX DATA ACTIVITIES

May 1993:	Meeting at AMSMO
August 1993:	Pilot study TRAC weapon performance data model
October 1993:	First meeting of Complex Data Task Force
November 1993:	MORS Working Group on Complex Data
February 1993:	Second meeting of Complex Data Task Force

DOCUMENTS

The RAND Metadata Management System (RMMS): A Metadata Storage Facility to Support Data Interoperability, Reuse, and Sharing, S. Cammarata, I. Kameny, J. Lender, and C. Replogle, RAND MR-163-OSD/A/AF, 1993.

Data Standardization and Data Reuse Guidance for Complex Data Elements, (Draft), DoD, 1994.

Complex Data Modeling Workshop for Modeling and Simulation (M&S), (Draft), Center for Standards, M&S Working Paper 1-2, 14 September, 1993

GOALS OF THE COMPLEX DATA TASK FORCE

Long Term

- Categorization of complex data types
- Guideline to data modeling and standardization of complex data types for M&S community

Near Term

- Data models and standards resulting from pilot studies from participating projects
- Coordination with CIM as to:
  - Issues and problems
  - Suggested extensions to data modeling (IDEF1X) and 8320.1-M-1 data standards

STRAWMAN APPROACH

(1) Interface with standards orgs and other groups with similar goals

(2) Organize pilot study teams for "volunteered" projects in small well-defined area

(3) Document pilot studies: issues, lessons learned, recommended approaches and share with CDTF and DISA/CIM

(4) Propose ways to model complex data types (e.g., extend IDEF1X)

(5) Propose ways to extend 8320.1-M-1 metadata for SDEs to represent complex data type data elements

(6) Develop categorization of complex data types

(7) Develop guidelines for M&S community

DEFINITION FROM MORS COMPLEX DATA WORKING GROUP

Complex data is data which contains inherent embedded Information

COMPLEX DATA CATEGORIZATION FROM MORS COMPLEX WORKING GROUPS

Examples:

- Non-first normal form
- Aggregation/disaggregation
- Multi-dimensional
- Networks
- Continuously variable systems
- Concepts and Ideas

COMPLEX DATA CATEGORIZATION FROM DOD DRAFT DOCUMENT ON COMPLEX DATA

- Composite data elements: data elements that embed intelligence about multiple concepts in their names, definitions, and domains
- Derivations: data elements representing concepts computed, aggregated, transformed, or inferred from the values of one or more other data elements
- Data streams: ordered bits or characters formatted to represent information in a variety of forms (e.g., graphic, voice, text document, and spreadsheet)
- Assemblies: data entities comprising instances of data which relate to other instances of data within the same entity (e.g., roads, buildings, equipment part assemblies, and organizations)

NEW DATA TYPES FROM JDBE

- Multi-media (graphics, sound, video, etc.)
- Compound documents (word processor and CAD files)
- Objects (OLE objects, Object Request Broker, etc.)
- Language/DBMS specific (complex numbers, structures, user-defined data types, object libraries, etc.)

MAJOR CATEGORIZATION FROM RAND

- Semantically complex data: complexly derived data such as Pk (to distinguish from "simply derived" such as age)
- Syntactically complex data: data with structural complexity such as road network, building, map, image, etc.

CATEGORIZATIONS FROM RAND METADATA MANAGEMENT SYSTEM

Composite data types

- Concatenated: two or more fields are concatenated into one data element
  - Concatenated fields representing different concepts: e.g., number and validity of civilian personnel strength
  - Concatenated fields where value of one field determines interpretation of other fields: e.g., basic type of aircraft where first character describes further subfamily groupings
  - Composite concept of two or more fields dependent on the value of another data element
  - Composite concept of two or more fields composing a list of values from the same domain: e.g., aircraft capabilities
- Multi-concept composite: e.g., count of F-16 aircraft
- Complex object composite: e.g., basic encyclopedia number (composed of world chart number and installation number)
- Complex object: database table, database view, image, matrix, list/sequence, etc.

CURRENT ISSUES TO BE PRESENTED/FURTHER DISCUSSED AT FRIDAY'S COMPLEX DATA TASK FORCE MEETING

- Definition of complex data and categories of complex data to include multi-valued attributes/repeating groups and derived data
- Audit trails (tracing the source of data): may be a Data VV&C issue
- Tagging instance data: addresses the kind of metadata needed to describe instance data (this is also a Data VV&C Task Force issue)
- Interoperability and data exchange
- M&S repository issues: requirements for a repository to manage complex data models and standards as well as atomic data models and standards

SECOND DMSO COMPLEX DATA TASK FORCE MEETING

Friday, 18 February 1994

Iris Kameny

Pilot Studies Involving Modeling of Complex Data

- Defense Mapping Agency
- Close Combat Tactical Trainer (CCTT): with JDBE help
- Universal Threat Simulator System (UTSS): with JDBE help
- CENTCOM Conventional Force Database: with JDBE help

SUGGESTED DISCUSSION TOPICS

From Beth Driver (DMA):

- What is the relationship between meta-data for "instance data" (as I think you are using the term—things like specific features or attributes) and that for "wholes" that represent a larger picture, not merely an aggregate of features. I have used the example of a map or digital data set that purports to be a picture of selected aspects of a geographic area. <u>One reason for concern: we draw conclusions about the absence of data and the relationships between features from the whole, not from the individual features</u>. For example, if I see no accesses to a limited access highway between two locations, I would conclude they don't exist. I would suggest that "completeness" measures, for example, (often considered a part of currency evaluations of MC&G data) need a well-defined footprint, as do any "truth in packaging" items that are based on sampling or statistical analysis.
- How can we verify the usefulness of metadata definitions; for example, how will applications software use the data provided in metadata fields? Perhaps generating sample values would help us understand and organize this.
- How much (at what level of granularity) metadata can M&S systems process? What are the priorities? Is there a need for selected attributes at high degrees of granularity (e.g., attribute level for some attributes) and other attributes only at a more generalized level, even though it would be possible to provide them at the instance level.

SUGGESTED DISCUSSION TOPICS

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DEFENSE STANDARDS INFRASTRUCTURE TASK FORCE TEAM (SIT)

BRIEFING TO

DMSO INFORMATION/DATABASE TASK GROUP

FEBRUARY 16, 1994

BY

WILLIAM F. FLANIGAN, JR., PH.D.

DEFENSE INFORMATION SYSTEMS AGENCY'S
CENTER FOR STANDARDS
AND
DEFENSE MODELING AND SIMULATION OFFICE

VOICE: (703) 487-8034
FAX: (703) 487-8038
DSN: 364
E-MAIL: FLANIGAB@CC.IMS.DISA.MIL

BRIEFING OVERVIEW

- BACKGROUND
- ITF MISSION
- SIT PURPOSE
- SIT VISION
- SIT MEMBERSHIP PROFILE
- REPRESENTATIVE ISSUES/SHORTFALLS
- SOME SIT RECOMMENDATIONS TO DMSO
- SOME CURRENT SIT EFFORTS
- SIT PRODUCTS

BACKGROUND

- TEN INFRASTRUCTURE TASK FORCE (ITF) TEAMS WERE CHARTERED BY THE DEFENSE MODELING AND SIMULATION OFFICE (DMSO) IN THE SPRING OF 1993:
  - ARCHITECTURE
  - BEHAVIORAL REPRESENTATION (AUTOMATED FORCES)
  - C3I - MODELING AND SIMULATION (M&S) INTERFACES
  - DISTRIBUTED INTERACTIVE SIMULATION (DIS) TESTBEDS
  - INFORMATION CLEARING HOUSE FOR M&S
  - INSTRUMENTATION
  - NETWORKS
  - SECURITY
  - STANDARDS
  - VERIFICATION, VALIDATION, AND ACCREDITATION (VV&A)

ITF MISSION

- IDENTIFY UNADDRESSED INFRASTRUCTURE NEEDS THAT CUT ACROSS M&S COMMUNITY ("CITY PLANNER'S" PERSPECTIVE).

- IDENTIFY SHORTFALLS/OPPORTUNITIES IN EACH INFRASTRUCTURE AREA.

- RECOMMEND PRODUCTS/PROCESSES/PROPOSALS TO MEET SHORTFALLS.

SIT PURPOSE

- o PROVIDE A KEY FOCAL POINT FOR GUIDANCE/LEADERSHIP IN M&S STANDARDS/ STANDARDS-RELATED MATTERS TO:
  - DMSO; AND
  - THE BROADER M&S COMMUNITY.
- o BUILD CONSENSUS AND PRO-ACTIVELY FOSTER COST REDUCTIONS THROUGH, FOR EXAMPLE:
  - DEFENSE CONVERSION AND DUAL USE;
  - MIGRATION TO A VENDOR-NEUTRAL, OPEN-SYSTEMS ENVIRONMENT (OSE)/OPEN-SYSTEMS INTERCONNECTION (OSI); AND

SIT PURPOSE (CONT'D)

- PROMOTING THE CULTURAL CHANGE TO INTERACTIVE, DISTRIBUTED SIMULATIONS AND SYNTHETIC ENVIRONMENTS.

o PUBLISH PERIODIC ASSESSMENTS AND STUDIES.

o EVOLVE A "NATIONAL PLANNER'S" POINT OF VIEW (POV) FROM A "CITY PLANNER'S" POV.

SIT VISION

"TO FACILITATE THE IDENTIFICATION, ESTABLISHMENT, ACCEPTANCE, AND IMPLEMENTATION OF STANDARDS, PROTOCOLS, AND OTHER APPROPRIATE MECHANISMS TO PROMOTE EFFICIENT AND EFFECTIVE INTEROPERABILITY, OPEN SYSTEMS, AND THE REUSABILITY OF HARDWARE, SOFTWARE, AND DATA FOR APPLICATIONS OF M&S. THESE STANDARDS, PROTOCOLS, AND OTHER MECHANISMS WILL BE CONSISTENT WITH AND BUILD UPON CURRENT NATIONAL, FEDERAL, DoD-WIDE, AND, WHERE PRACTICAL, INTERNATIONAL STANDARDS."

SIT MEMBERSHIP PROFILE

- o ACADEMIA
- o DEFENSE AGENCIES:
  - CENTRAL IMAGERY OFFICE
  - DEFENSE EVALUATION SUPPORT ACTIVITY
  - DEFENSE INFORMATION SYSTEMS AGENCY
  - DEFENSE MAPPING AGENCY
  - DEFENSE MODELING AND SIMULATION OFFICE
- o DEPARTMENT OF COMMERCE*
- o DEPARTMENT OF DEFENSE
- o DEPARTMENT OF ENERGY
- o DEPARTMENT OF TRANSPORTATION*
- o FEDERAL EMERGENCY MANAGEMENT ADMINISTRATION*
- o FEDERALLY-FUNDED R&D CENTERS
- o INTELLIGENCE AGENCIES*
- o JOINT STAFF*
- o MANUFACTURING ASSOCIATIONS*
- o MEDICAL COMMUNITY*
- o NATIONAL AERONAUTICS AND SPACE ADMINISTRATION*
- o PROFESSIONAL ASSOCIATIONS*
- o SERVICES
- o U.S. AIR FORCE PROJECT 2851

* IN PROGRESS OR UNDER CONSIDERATION.

REPRESENTATIVE ISSUES/ SHORTFALLS*

- o AVAILABILITY OF STANDARD PROCESSES AND MODELS FOR "COMPLEX" DATA AND "OBJECTS".
- o LACK OF SOFTWARE REUSE AND REPOSITORY ACCESS.
- o UNCOORDINATED STANDARDS DEVELOPMENT/USE WITHIN AND BETWEEN DOD AND FEDERAL COMPONENTS.

* SEE SIT REPORT 01-94 FOR COMPLETE LISTING/DETAILS.

REPRESENTATIVE ISSUES/SHORTFALLS (CONT'D)

- MOST M&S DOCUMENTATION NONSTANDARD/ INFORMAL/NON-EXISTENT.
- EXISTING/EMERGING STANDARDIZATION LAGS BEHIND TIME-LINE NEEDS OF M&S COMMUNITY.
- PROLIFERATION OF NONSTANDARD/NON-INTER-OPERABLE M&S INFORMATION SYSTEMS (ISs) ACROSS DOD AND FEDERAL COMPONENTS.

SOME SIT RECOMMENDATIONS TO DMSO*

- o M&S STANDARDS COORDINATION:

  - INVESTIGATE LOWER-COST ALTERNATIVES TO STANDARDIZE M&S DATA TYPES/MODELS WITH POTENTIAL FOR SHORT-TERM CONSENSUS AND PAYOFF;

  - IDENTIFY/REDUCE/ELIMINATE NON-STANDARD, REDUNDANT, AND UNRECOGNIZED DATA/OBJECT ACTIVITIES;

  - FORMALLY ADOPT A STANDARDS FRAMEWORK (E.G., THE TAFIM); AND

* SEE SIT REPORT 01-94 FOR COMPLETE LISTING/DETAILS.

SOME SIT RECOMMENDATIONS TO DMSO (CONT'D)

- ENSURE THAT DOD INTERESTS ARE ADEQUATELY REPRESENTED IN ALL APPROPRIATE NONGOVERNMENT STANDARDS BODIES.

o M&S STANDARDS COMMUNICATIONS:

- PROVIDE AN AUTOMATED, EXPERT SYSTEM TO GENERATE HARDWARE AND SOFTWARE STANDARDS/STANDARDIZATION PROFILES FOR PROGRAM MANAGERS; AND

- COUNTER HETEROGENEOUS IS PROLIFERATION BY AGGRESSIVELY PROMOTING SEAMLESS INTEROPERABILITY ("ONE CALL REACHES ALL").

SOME CURRENT SIT EFFORTS

- o CROSS MEMBERSHIP WITH OTHER ACTIVE ITF TEAMS.

- o A VISIONARY, HIGH-LEVEL ROAD MAP FOR M&S STANDARDS/STANDARDIZATION.

- o REVIEW OF STANDARDS/STANDARDIZATION ACTIVITIES/ISSUES INVOLVING DMSO PROJECTS FUNDED IN FY 1994.

- o DRAFT STANDARDS/STANDARDIZATION LANGUAGE FOR DMSO'S FY 1994/1995 INFRASTRUCTURE RFPs.

SOME CURRENT SIT EFFORTS (CONT'D)

- FUNCTIONS/FORM OF THE SIT INTERACTIVE BULLETIN BOARD:

  - OBJECTIVES:

    1. SUPPORT SIT ACTIVITIES/PROCESSES/PRODUCTS;

    2. PROVIDE M&S COMMUNITY SERVICES SUCH AS:

       A. CONTINUALLY-UPDATED INFORMATION/GUIDANCE;

       B. Q&A ACCESS TO THE COLLECTIVE EXPERTISE OF SIT MEMBERS; AND

       C. AN INFORMAL M&S STANDARDS FORUM.

  - CURRENTLY RESIDES IN THE DMSO IS.

SIT PRODUCTS

- SIT CHARTER*
- SIT REPORT 01-94*
- SIT MEETING MINUTES*
- DRAFT ROAD MAP FOR M&S STANDARDS/STANDARDIZATION

* ACCESSIBLE THROUGH THE DMSO IS.

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"Simulation Data and Its Management"
MORS Mini-Symposium

7

Mr. Howard P. Haeker

TRADOC ANALYSIS CENTER

Data Development Directorate

TRADOC Analysis Center

Training and Doctrine Command

"Simulation Data and Its Management"

Chair

Michael Bauman
TRAC

General Sessions

Walter Hollis, DUSA(OR)
Bekkis Leong-Hong, CIM, DISA
LTC Jerry L. Wiedewitsch, DMSO
Ed Fitzsimmons, Office Science & Technology

Working Groups

VV & C
Tools & Techniques
Complex Data
Standards
Research
Data Suppliers

Synthesis Group

Statistics
178 Attendees
-109 Gov't
-69 Industry/ Academia

MORS Mini-Symposium

16-18 November 1993

TRADOC ANALYSIS

"Simulation Data and Its Management"

Overarching Issues

- Standards
  - Standards begin with a need, continued use and conformance, and value added
  - No strict enforcement of standards but use of standards incentivized
  - More information is needed
    - Whats being developed
    - What tools, products, methods
    - De facto, official standards
    - What's needed, priority of work

Recommendation

Form a standards group

"Simulation Data and Its Management"

Overarching Issues

- VV&C
  - No standard techniques for VV&C
  - Responsible agencies should be identified
  - No policy, procedures and guidelines for VV&C
  - More concise definition of concepts and terms

Recommendation

- Form a VV&C group

"Simulation Data and Its Management"

Overarching Issues

- Bothersome Concerns

Who pays for VV&C? Standards?

How soon do we pay again? What's the shelf life of a data base? When will changing hardware/software render our data irrelevant? How do we keep up with it all? How do we know what's available, what's going on? How do we or should we define data? How do we 'tag' data to indicate quality, meaning, source, etc.? How do we get "user friendliness"?

"Simulation Data and Its Management"

Other Recommendations

- Develop a data source catalog (Identify "subject matter experts")
- Develop a standard taxonomy for categorization of data
- Develop standard nomenclature for forces and equipment
- Increase awareness of need for accurate and accesible unclassified data
- Support a M&S bulletin board for information sharing.
- Prioritize standardization effort (Use importance/priority of individual models and simulations as a guide)

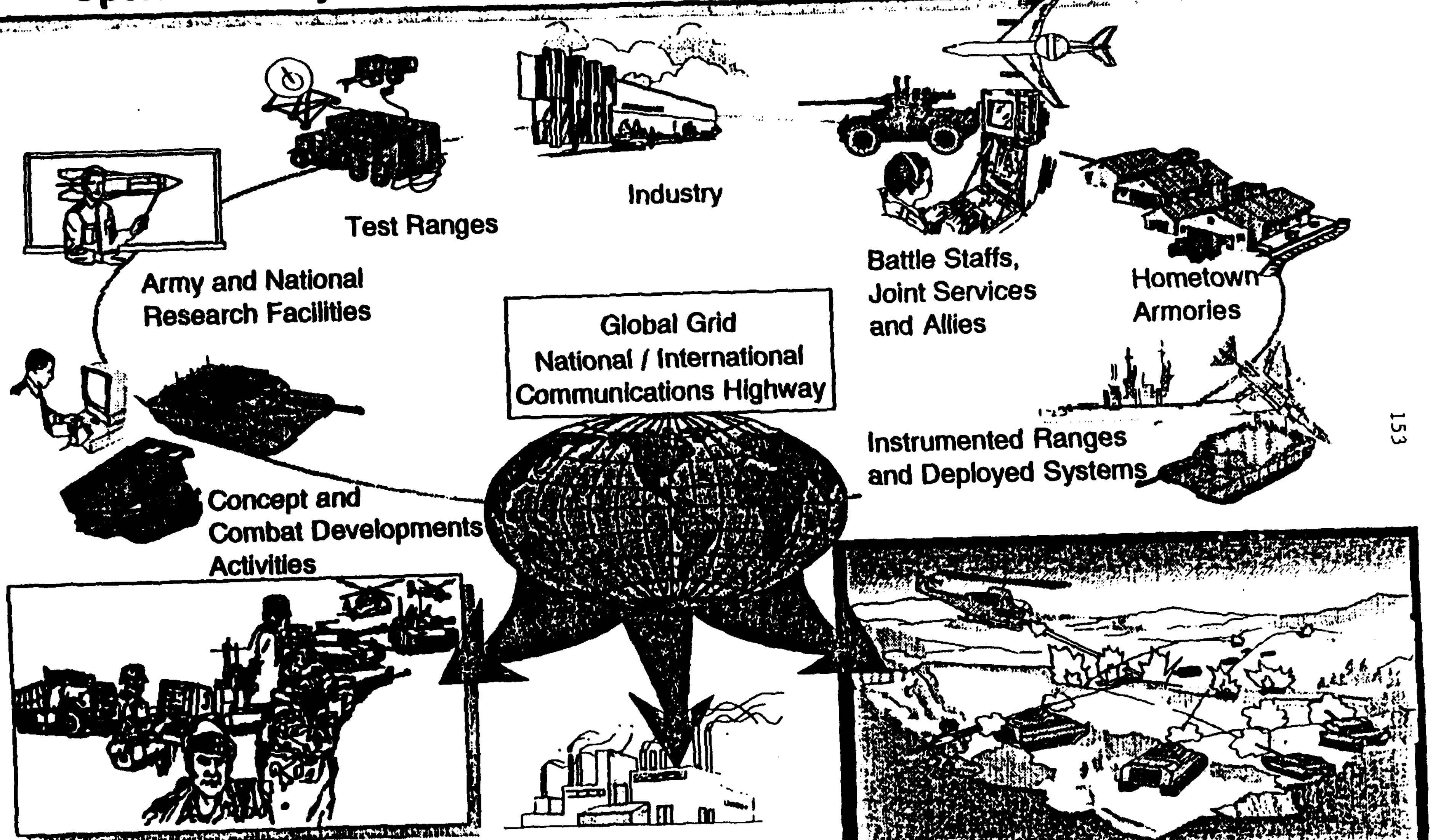
TRADOC ANALYSIS

Distributed Interactive Simulation (DIS)
"Data Standards"

Mr. Howard P. Haeker

Data Development Directorate
TRADOC Analysis Center
Training and Doctrine Command

The Vision . . . Synthetic Theaters of Operations Shared and Simultaneously Operated on by the Army, Sister Services, and the Defense Community

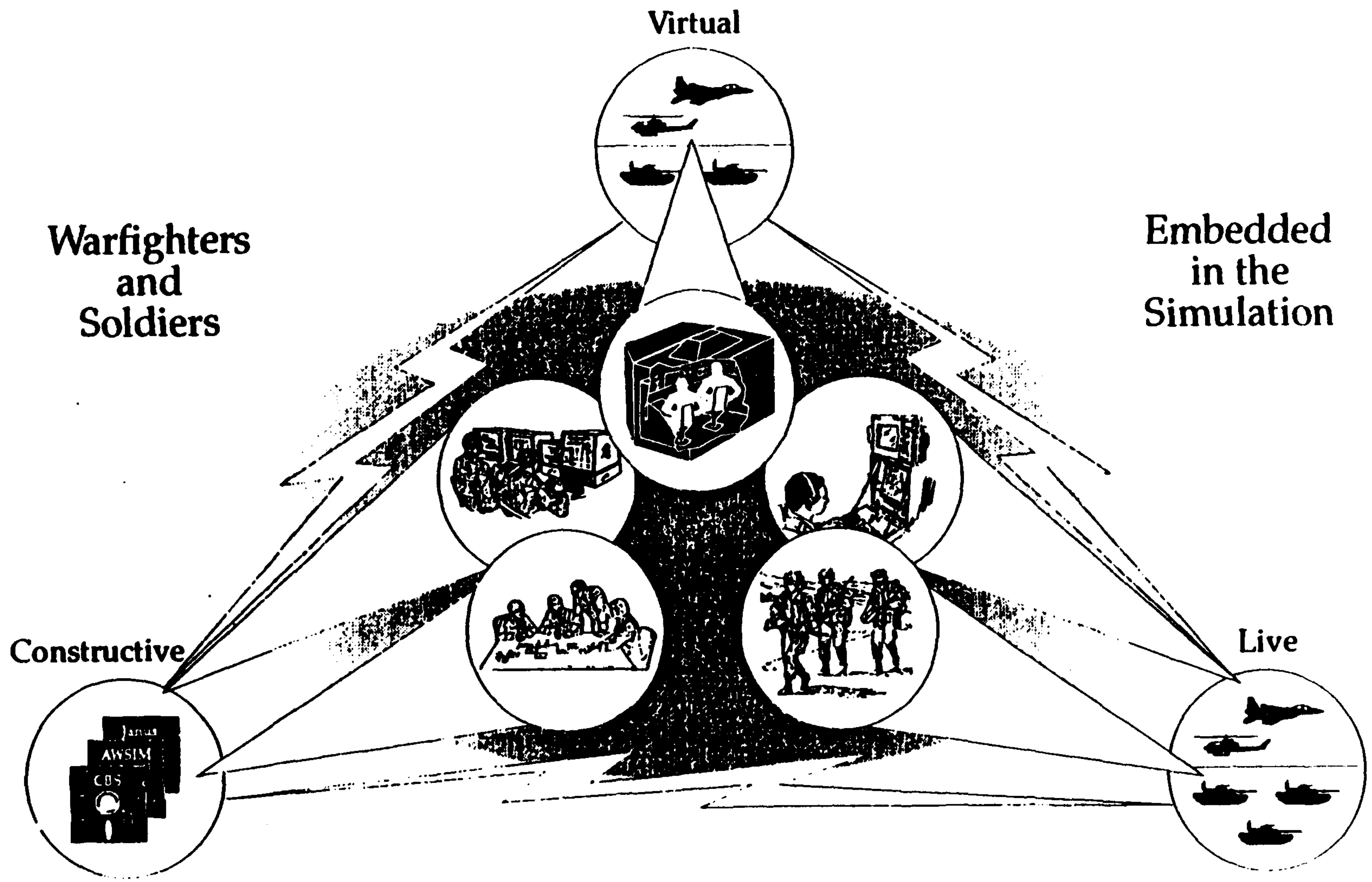


<u>Concept Exploration and Requirements Generation</u>
- Warfighting Concepts
- Operational Requirements
- Unit / Force Design
- Doctrine

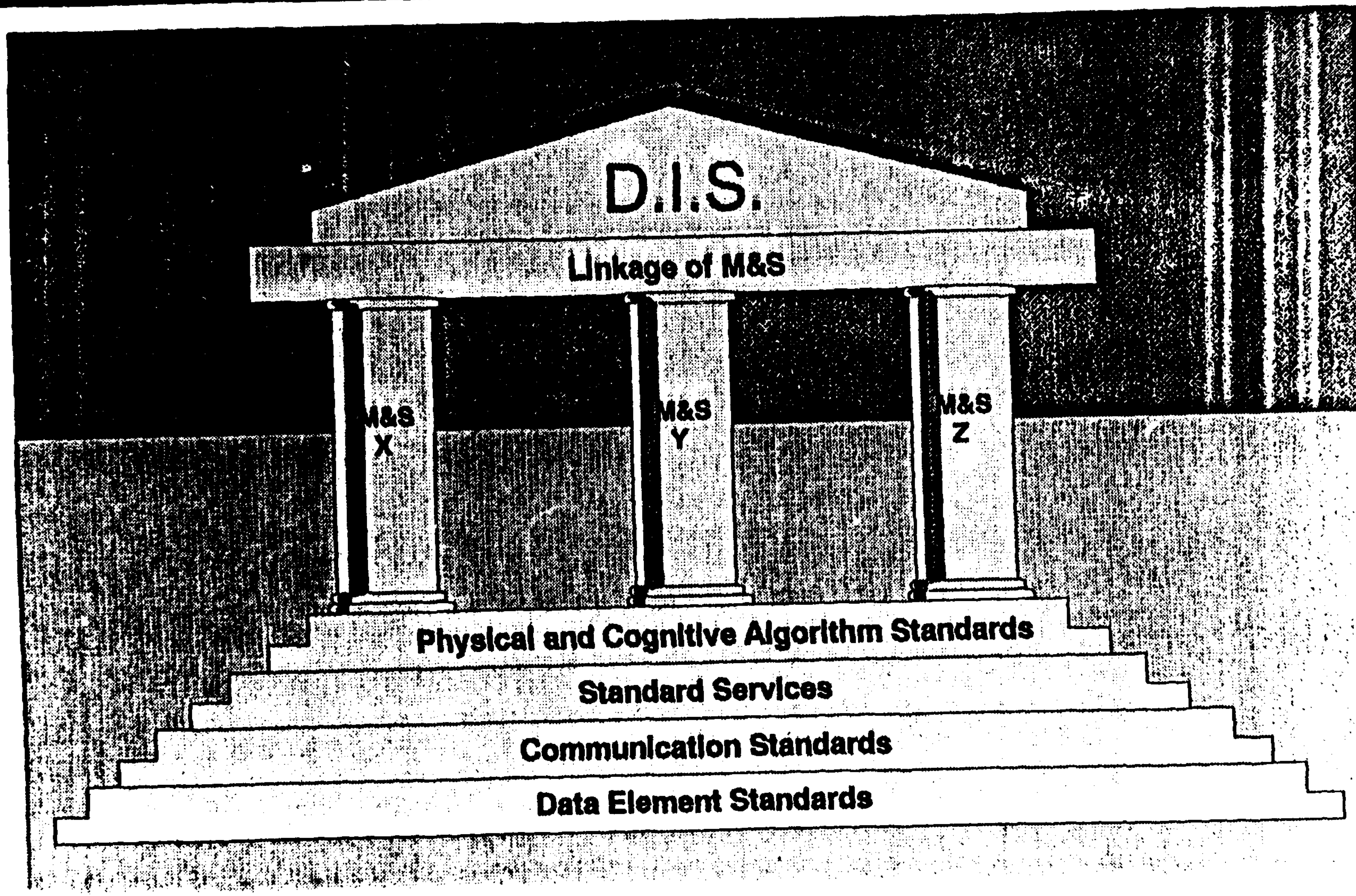
<u>Research and Materiel Development</u>
- Advanced Demonstrations
- Virtual Prototypes
- Baseline Designs
- Test and Evaluation

<u>Training, Exercises, Military Operations</u>
- Individuals and Crews
- Collective Training
- Battle Staffs / National Command
- Operations Plans

Interactive ...



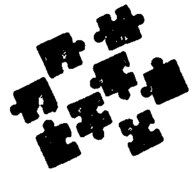
Standards: M & S Foundation

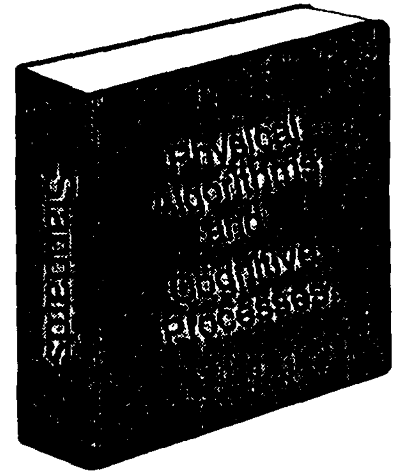


Common Software

Simulations built to standards will share software in common

Analytic Pieces





Estimate 3-5 year effort

Constructive Simulations

Battle Labs & Branch Proponents

TRAC responsible for V&V of DIS via standards

Technical Community

- MAR 93 HQDA
- OCT 93 AMSEC
- NOV 93 DIS GOSC
- DEC 93 HQDA

Payoff

- ☑ Consistency among simulations
- ☑ Software commonality
- ☑ Less complex linkages
- ☑ Lower software costs
- ☑ Credibility

VV&A

"DISTRIBUTED INTERACTIVE SIMULATION"

Data Standards

Why Standardization?

- Bring order and discipline to M&S
- Use for the same or similar functions
- Promote interoperability

Standards allow for:
- More Efficiently
- Stronger V&V

TRADOC

"DISTRIBUTED INTERACTIVE SIMULATION"

Data Standards

Concerns with Standardizaton

- Standards are based on past practices
- Will institutionalize out-dated processes
- Will stifle creativity for improved results

Standards have a life cycle

"Distributive Interactive Simulation"

M&S Standard Databases

Taxonomy

- Equipment Performance
- Unit Performance
- Equipment Characteristics
- Scenario
- Dynamic Terrain
- Geopolitical
- Tactics Doctrine & Operational
- Dynamic Environment
- Logistics

DIS Common Capabilities

Represent All Phases of Warfare

VV&A

Computer Generated Forces

Represent Terrain & Environmental Effects

Other Capabilities (i.e., [illegible]

[illegible]

Standards are the foundation for Common Capabilities & Interoperability!

Provide & Maintain Library of Standard Items:

Terrain	Approved Data
Nomenclatures	Algorithms
Icons	Subroutines

"DISTRIBUTED INTERACTIVE SIMULATION"

DATA STANDARDS OVERVIEW

- Dictionary/Directory Efforts
- Interoperability Standards
- Common Nomenclature Efforts
- Expanded DBMS for Data Providers
- Central Data Systems
- Information Systems
- Education

Data Standards

Current Efforts

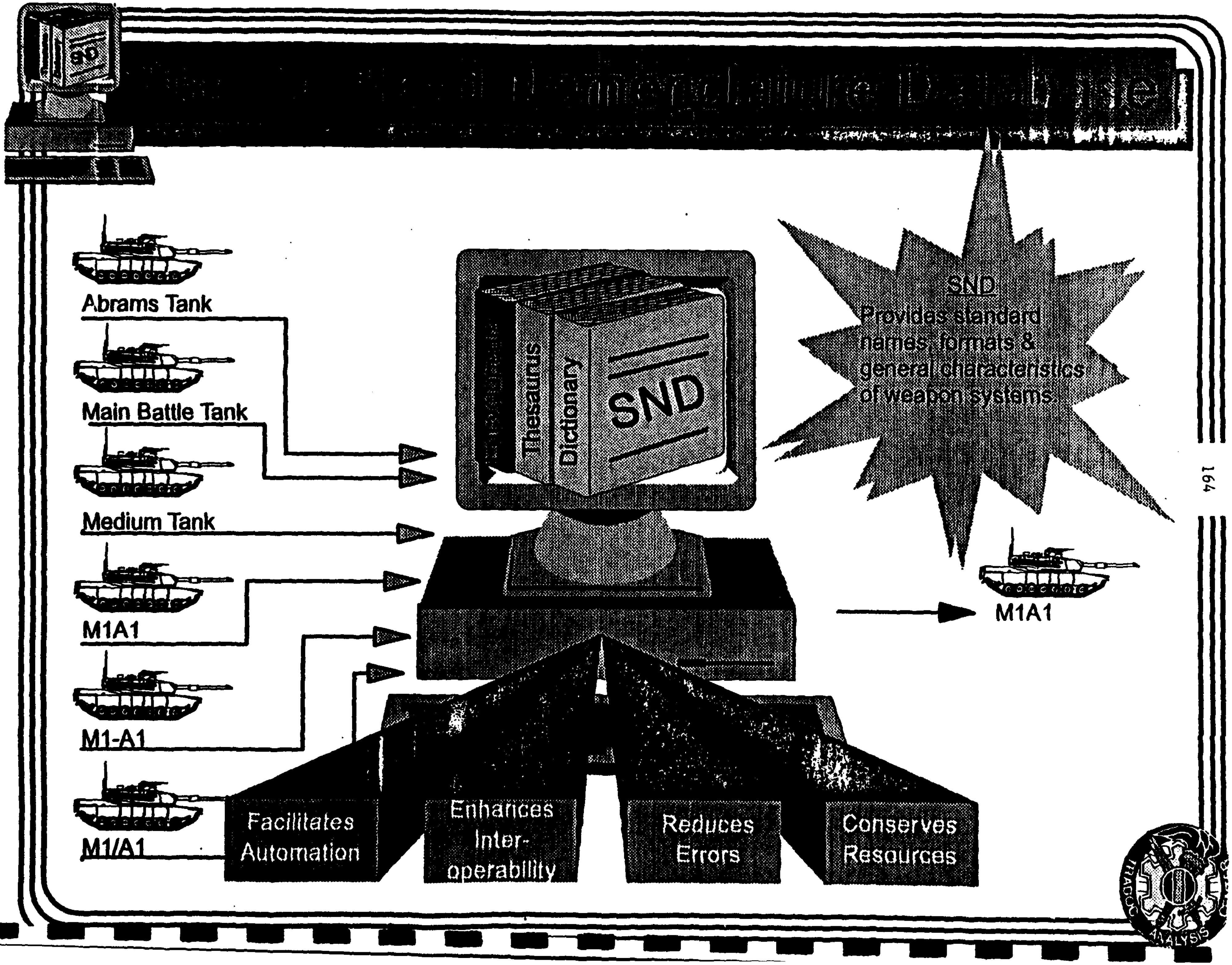
- Dictionary/Directory efforts
  - AR 25-9 - Army Data Dictionary (ADD)
  - DODD 8320 - Defense Data Repository System (DDRS)

"DISTRIBUTED INTERACTIVE SIMULATION"

Data Standards

Current Efforts

- Interoperability standards
  - IEEE 1278 - Protocol Data Units
  - NATO STANAG 4482


Abrams Tank
Main Battle Tank
Medium Tank
M1A1
M1-A1
M1/A1
Thesaurus
Dictionary
SND
SND
Provides standard names, formats & general characteristics of weapon systems.
M1A1
Facilitates Automation
Enhances Inter-operability
Reduces Errors
Conserves Resources
TRADOC
ANALYSIS

Data Standards

Current Efforts

- Common nomenclature efforts
  - Long Names
    - U.S.
    - DIA
  - Short Names
    - TRAC/AMSAA/STRICOM

"DISTRIBUTED INTERACTIVE SIMULATION"

Data Standards

Current Efforts

- Expanded DBMS for data providers
  - Atmosheric aerosols and optics data library (smoke library at BED)
  - Global electro-optical environmental matrix (weather library at BED)
  - AMSAA (TADS effort)

"DISTRIBUTED INTERACTIVE SIMULATION"

Data Standards

Current Efforts

- Central Data Systems
  - Operations Analysis and Simulation Interface System (OASIS)
  - Joint Modeling and Simulation System (J-MASS)
  - Universal Threat for Simulation System (UTSS)
  - Extended Air Defense Test Bed

"DISTRIBUTED INTERACTIVE SIMULATION"

Data Standards

Current Efforts

- Central Data Systems
  - Military Intelligence Integrated Data System (MIIDS)
  - Conventional Force Data Base (CFDB) and Master Simulation Data System (MSDS)
  - TRAC Automated Data System (TADS)
- Model-formatted Systems
  - MSDS
  - TADS

"DISTRIBUTED INTERACTIVE SIMULATION"

Data Standards

Current Efforts

- Information Sharing
  - Models and Simulations: Army Integrated Catalog (MOSAIC)
  - Close Combat Tactical Trainer (CCTT) Data Library
  - Tactical Warfare Simulation and Technology Information Analysis Center (TWSTIAC)
  - DMSO

TRADOC ANALYSIS

"DISTRIBUTED INTERACTIVE SIMULATION"

Data Standards

Current Efforts

- Education
  - DIS Education Program
  - Military Operations Research Society (MORS) Mini-symposium
  - Association of the United States Army (AUSA) Symposium
  - Information/Data Base Task Group

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8

TECNET HISTORY, STATUS AND R&D INITIATIVES

GEORGE F. HURLBURT - TECNET EXECUTIVE SECRETARIAT

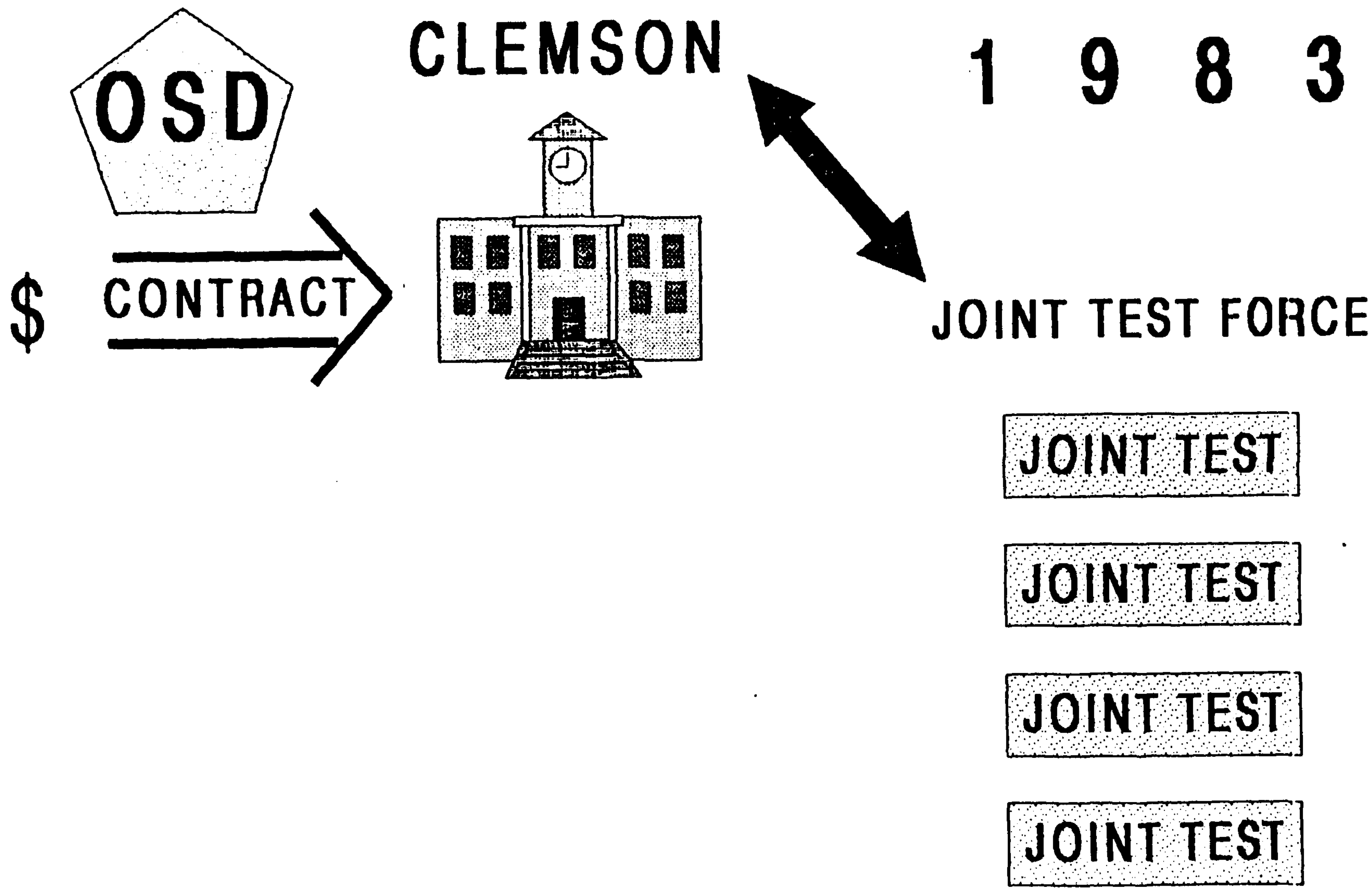
TEST AND EVALUATION COMMUNITY NETWORK HISTORY, STATUS AND R&D INITIATIVES

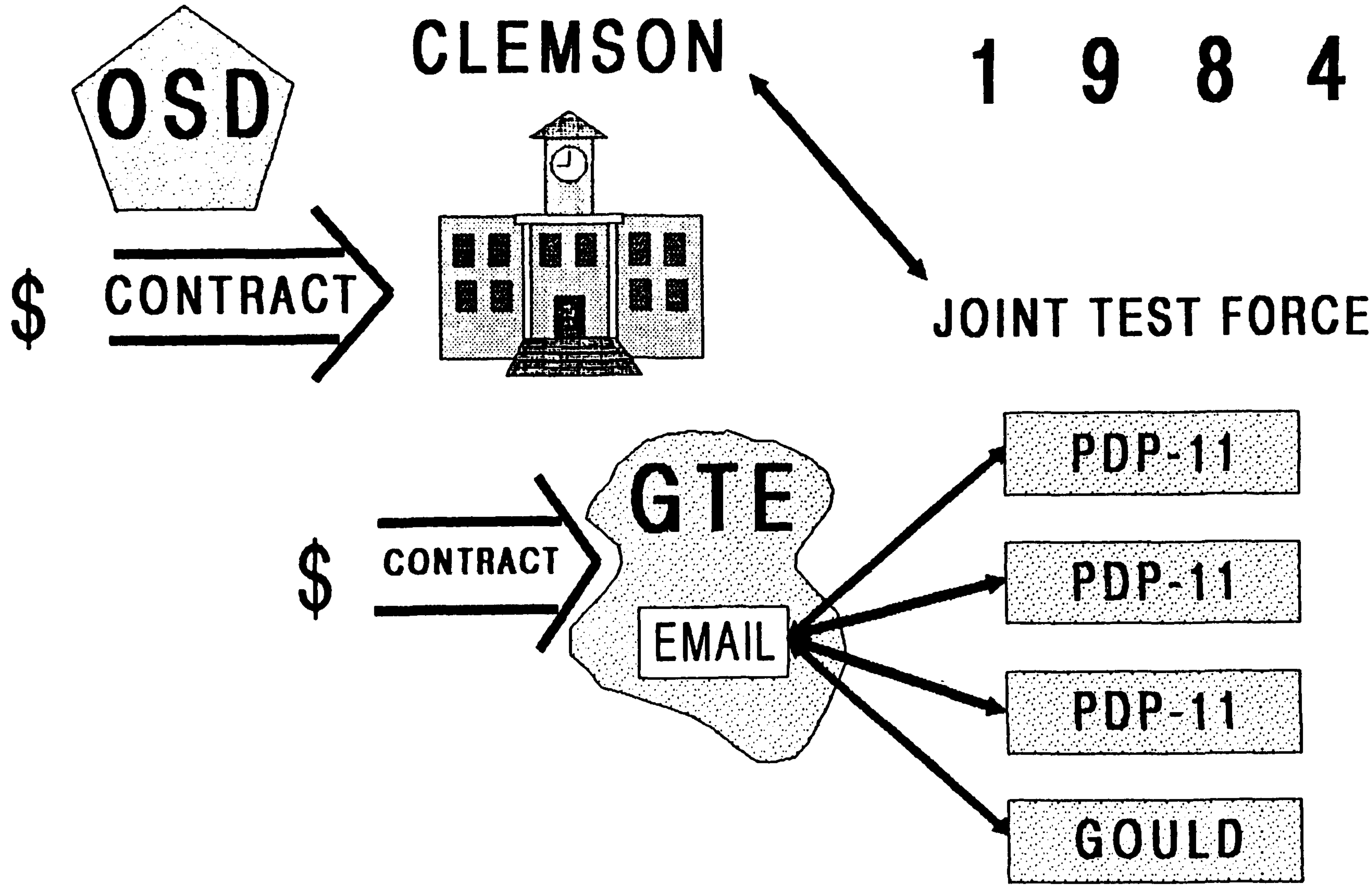
TECNET 10 YEAR EVOLUTION

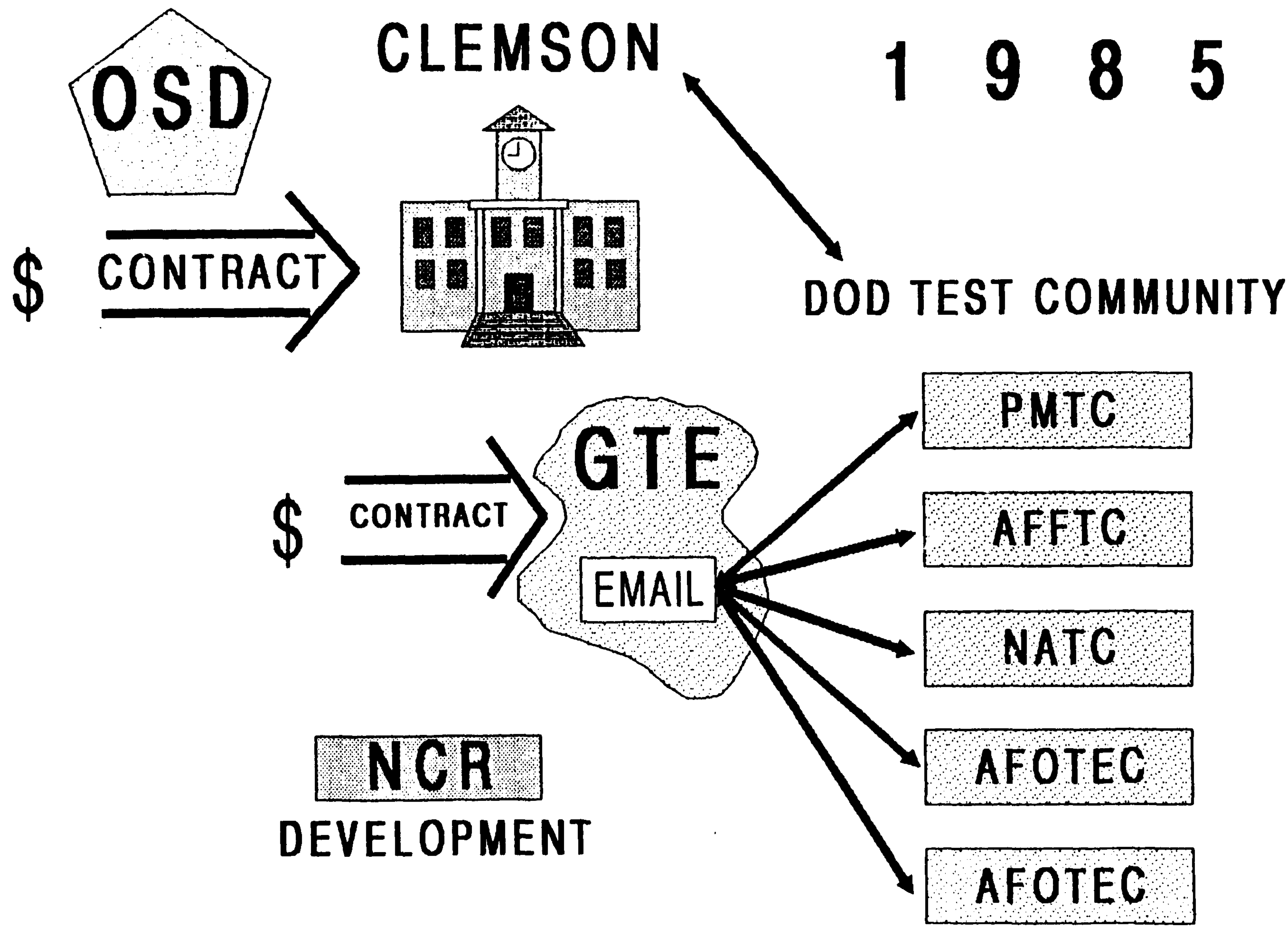
TECNET IN 1993

TECNET RESEARCH INITIATIVES

- DATA BASE EVOLUTION
- QUERY/SEARCH CAPABILITY
- MULTI-LEVEL SECURE


1 9 8 3
OSD
$
CONTRACT
CLEMSON
JOINT TEST FORCE
JOINT TEST
JOINT TEST
JOINT TEST
JOINT TEST


1 9 8 4
OSD
$
CONTRACT
CLEMSON
JOINT TEST FORCE
$
CONTRACT
GTE
EMAIL
PDP-11
PDP-11
PDP-11
GOULD


1 9 8 5
OSD
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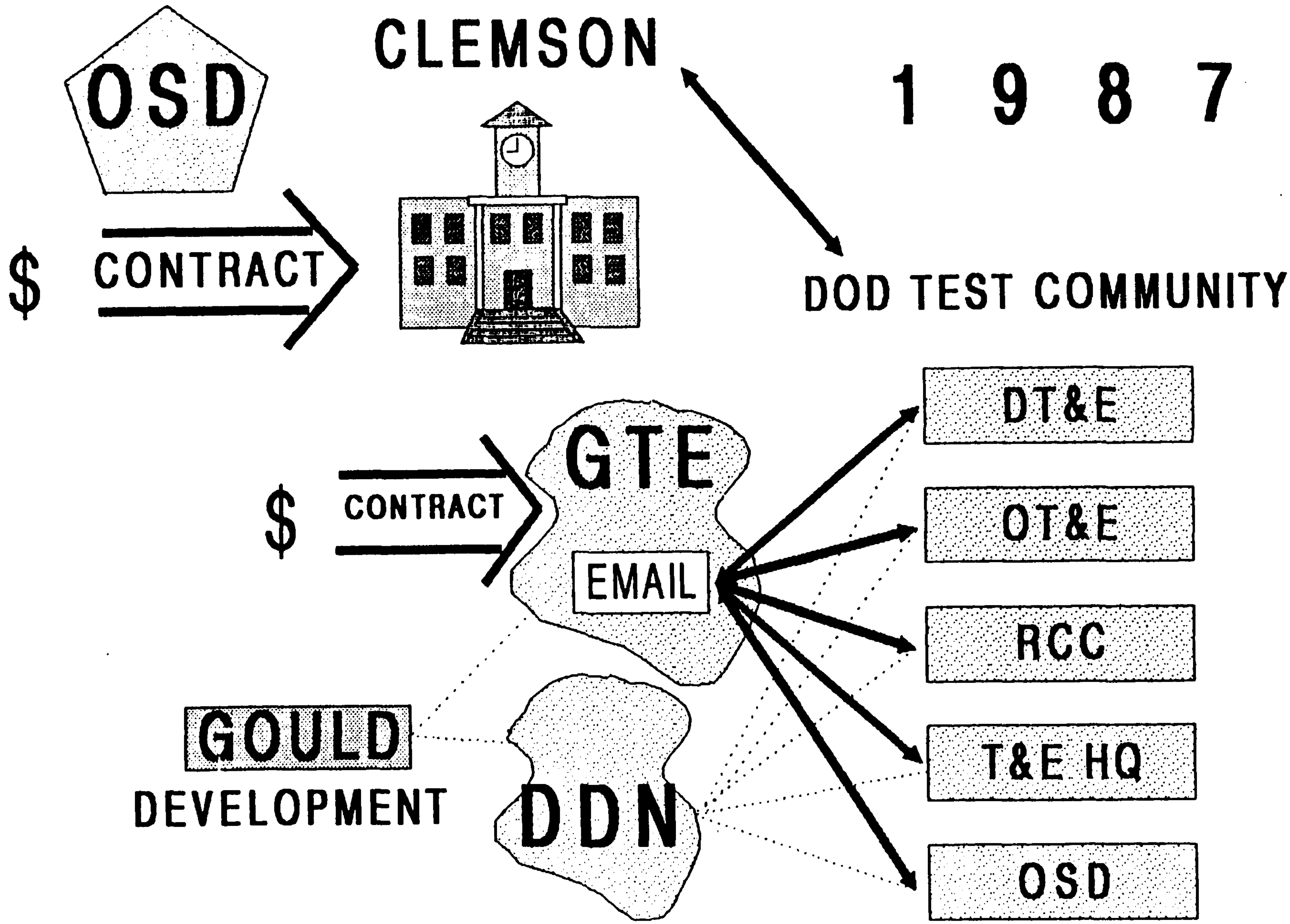
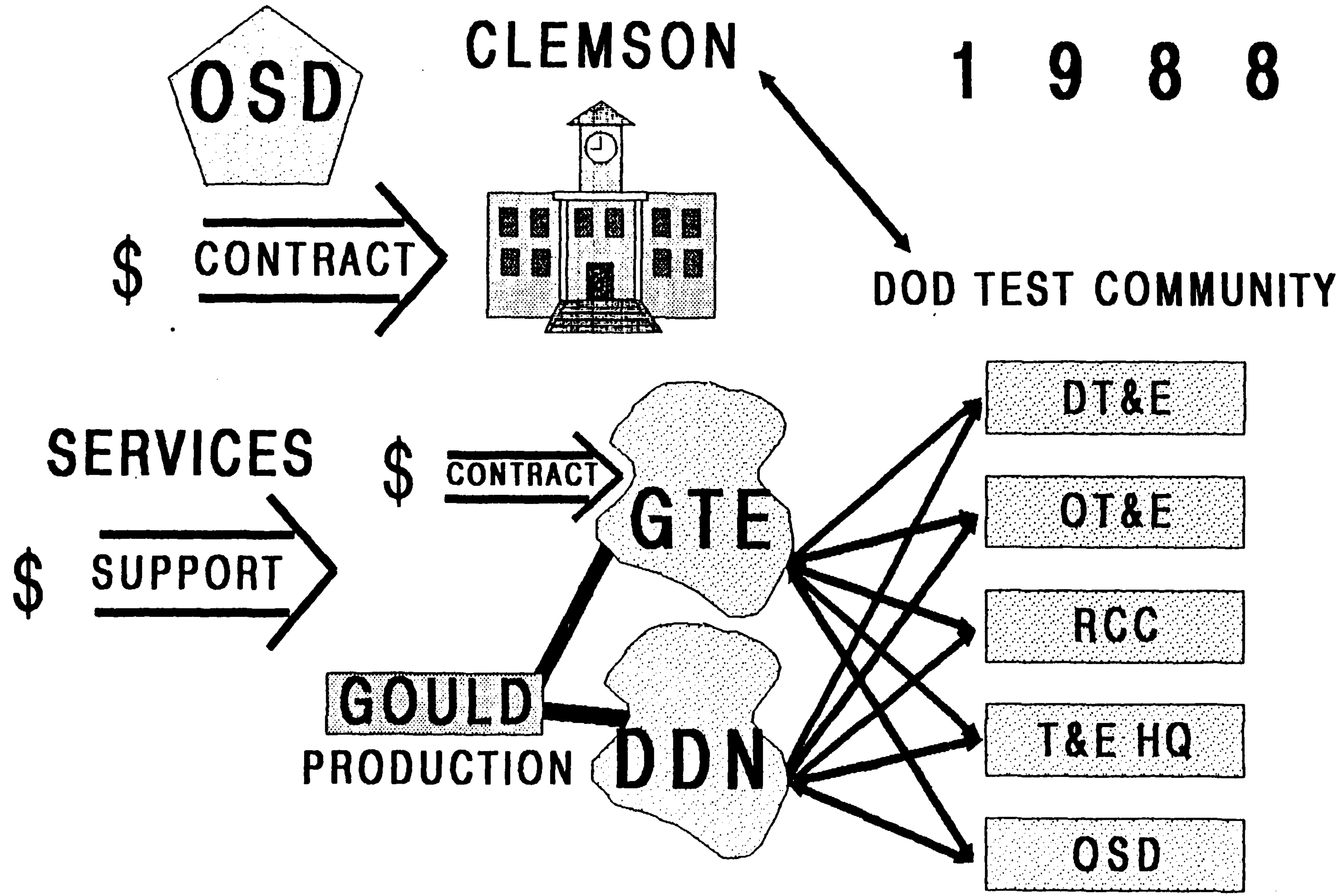
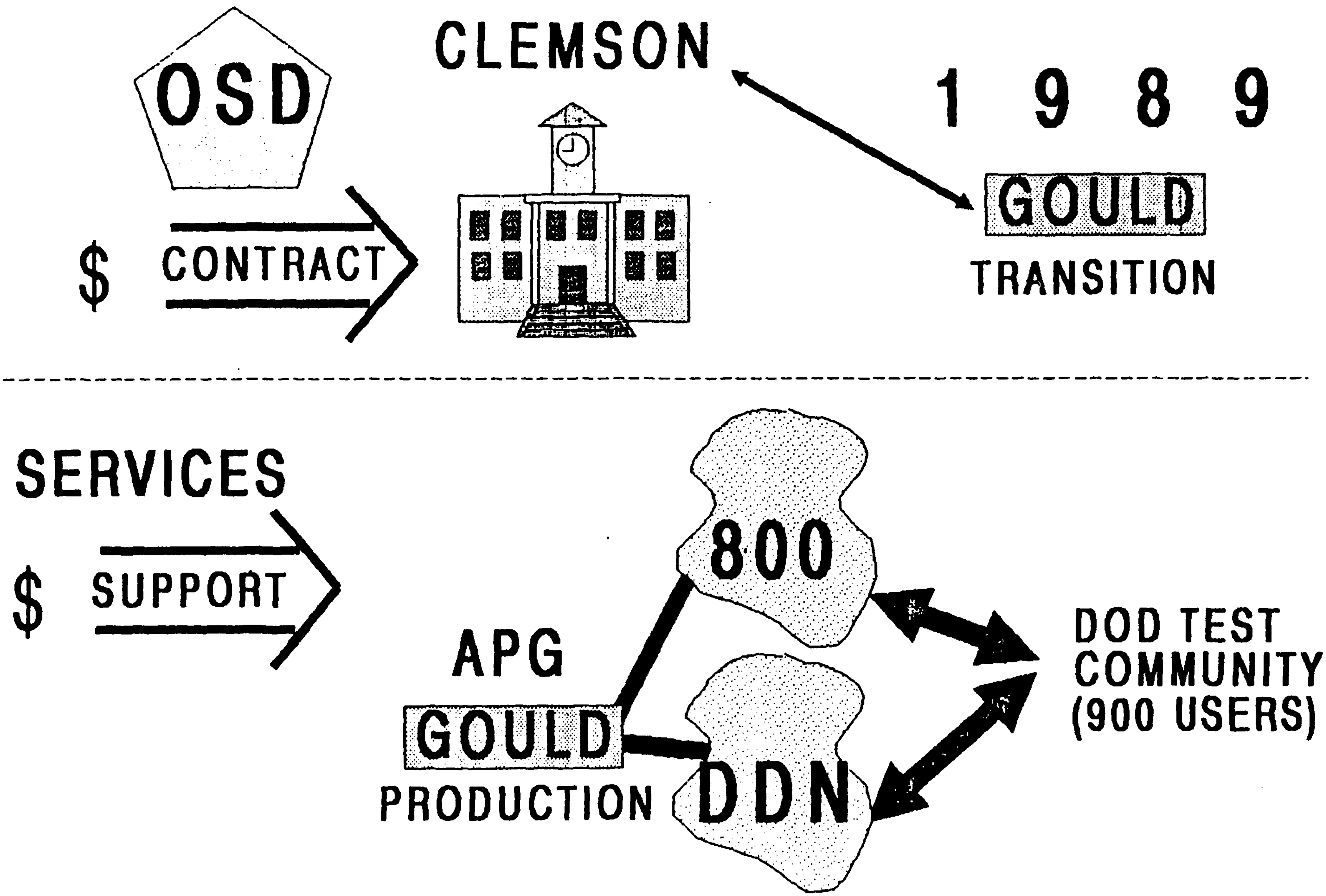
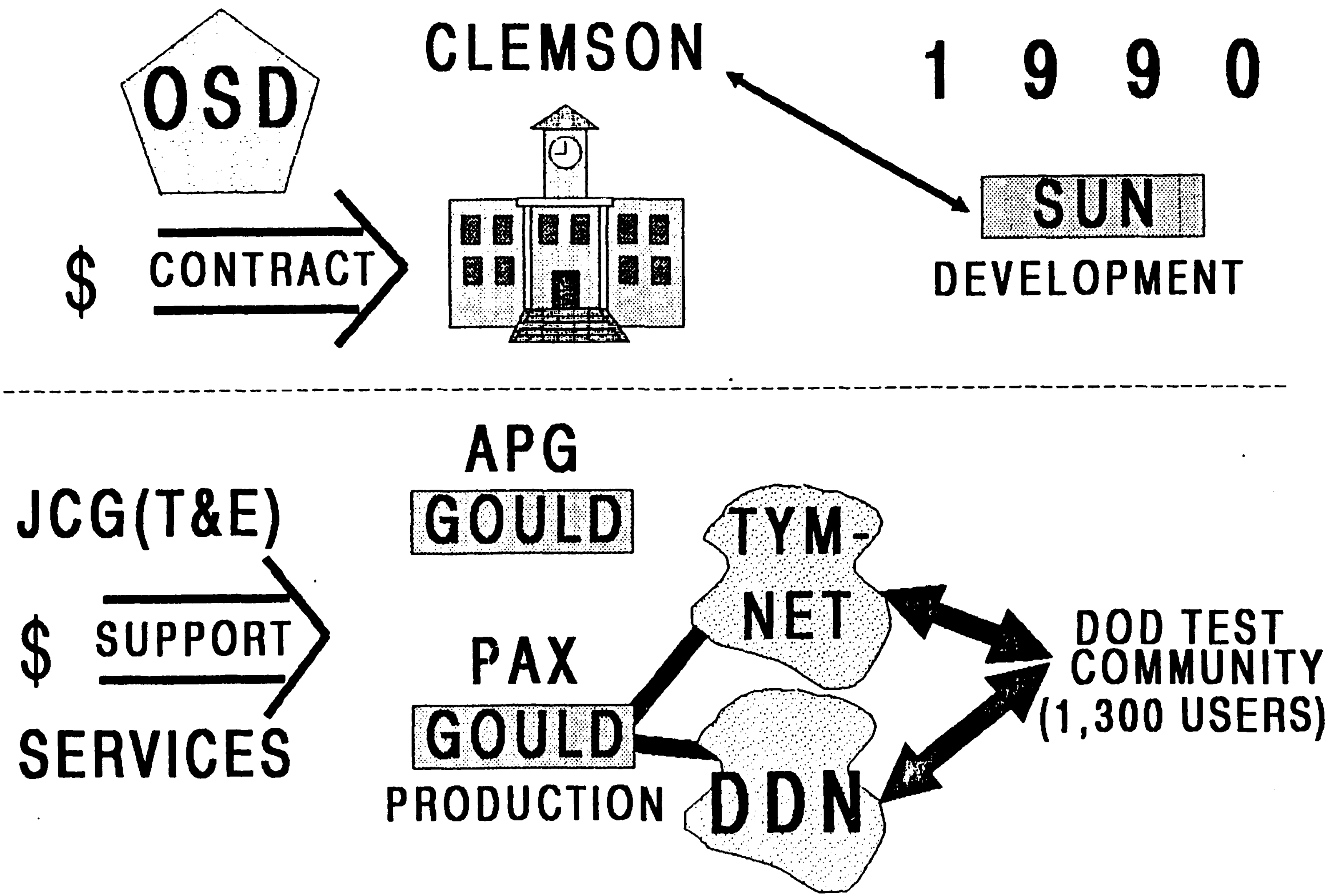
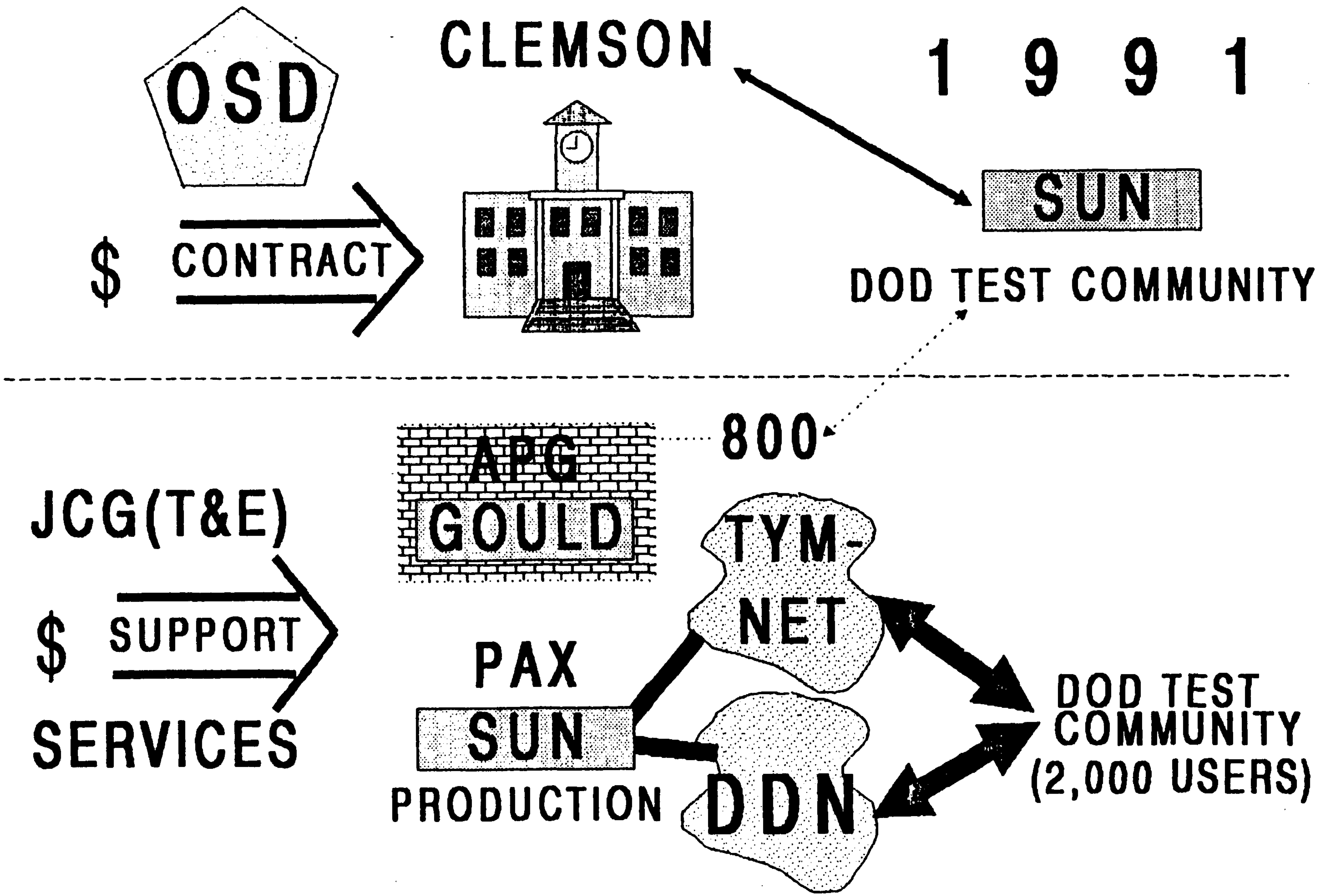
CONTRACT
CLEMSON
DOD TEST COMMUNITY
$
CONTRACT
GTE
EMAIL
PMTC
AFFTC
NATC
AFOTEC
AFOTEC
NCR
DEVELOPMENT

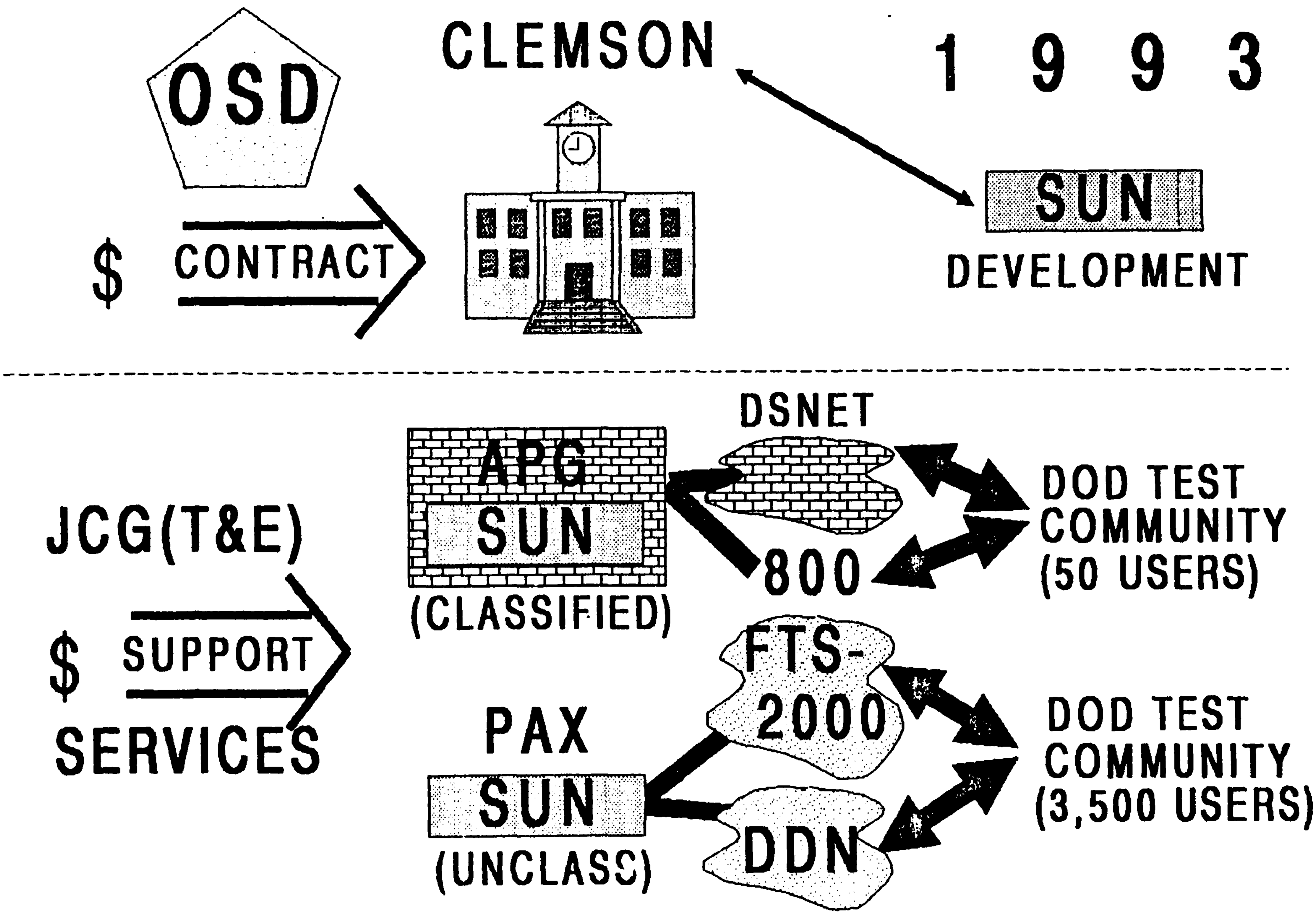

1 9 8 7
OSD
$
CONTRACT
CLEMSON
DOD TEST COMMUNITY
$
CONTRACT
GTE
EMAIL
GOULD
DEVELOPMENT
DDN
DT&E
OT&E
RCC
T&E HQ
OSD


1988
OSD
CLEMSON
$ CONTRACT
DOD TEST COMMUNITY
SERVICES
$ CONTRACT
$ SUPPORT
GTE
GOULD
PRODUCTION
DDN
DT&E
OT&E
RCC
T&E HQ
OSD


OSD
$ CONTRACT
CLEMSON
1 9 8 9
GOULD
TRANSITION
SERVICES
$ SUPPORT
APG
GOULD
PRODUCTION
800
DDN
DOD TEST
COMMUNITY
(900 USERS)


OSD
$ CONTRACT
CLEMSON
1 9 9 0
SUN
DEVELOPMENT
JCG(T&E)
$ SUPPORT
SERVICES
APG
GOULD
PAX
GOULD
PRODUCTION
TYM-
NET
DDN
DOD TEST
COMMUNITY
(1,300 USERS)


1 9 9 1
OSD
$ CONTRACT
CLEMSON
SUN
DOD TEST COMMUNITY
JCG(T&E)
$ SUPPORT
SERVICES
APG
GOULD
800
PAX
SUN
PRODUCTION
TYM-
NET
DDN
DOD TEST
COMMUNITY
(2,000 USERS)

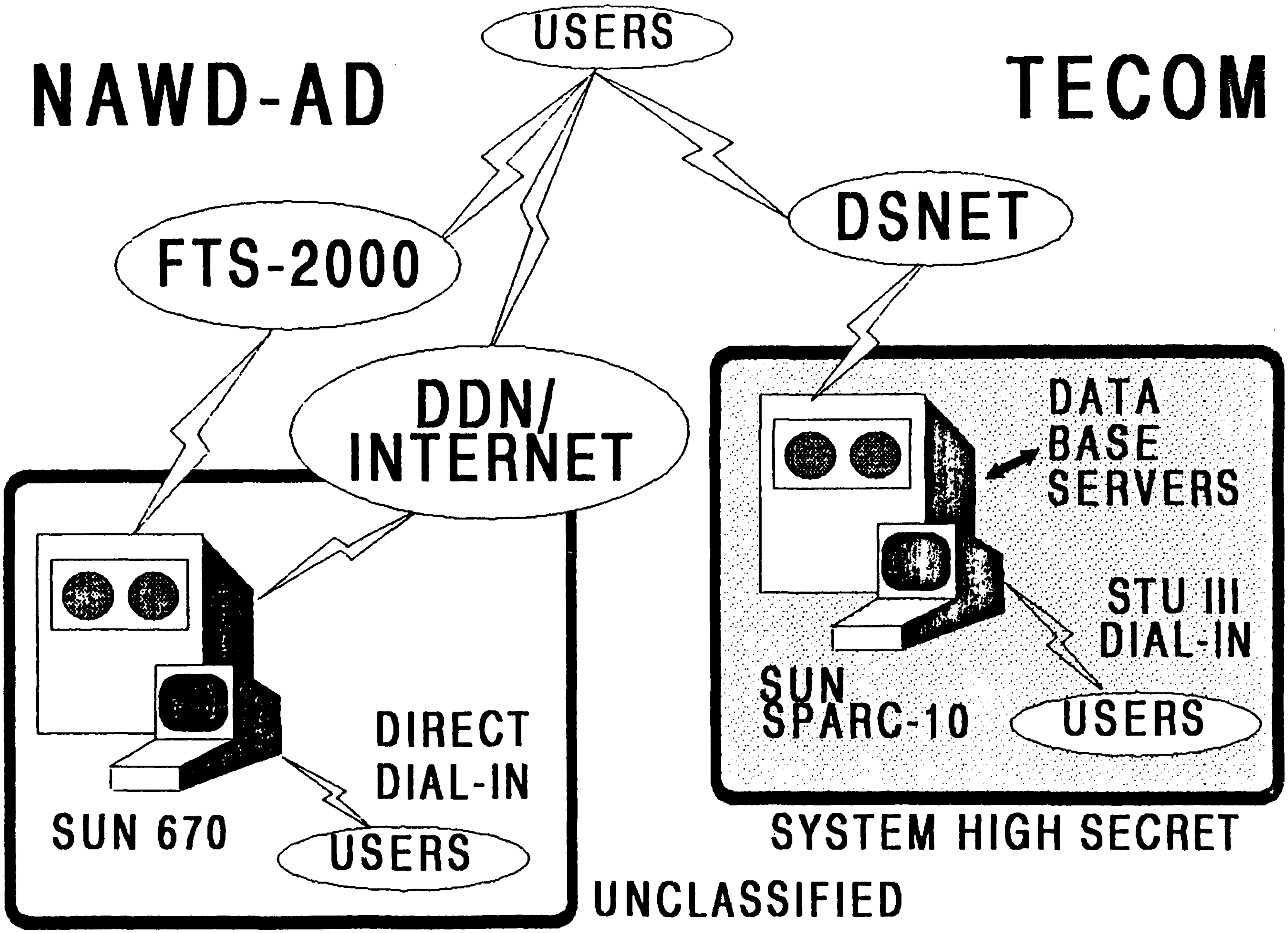


1 9 9 3
OSD
$ CONTRACT
CLEMSON
SUN
DEVELOPMENT
JCG(T&E)
$ SUPPORT
SERVICES
APG
SUN
(CLASSIFIED)
DSNET
800
DOD TEST
COMMUNITY
(50 USERS)
PAX
SUN
(UNCLASS)
FTS-
2000
DDN
DOD TEST
COMMUNITY
(3,500 USERS)

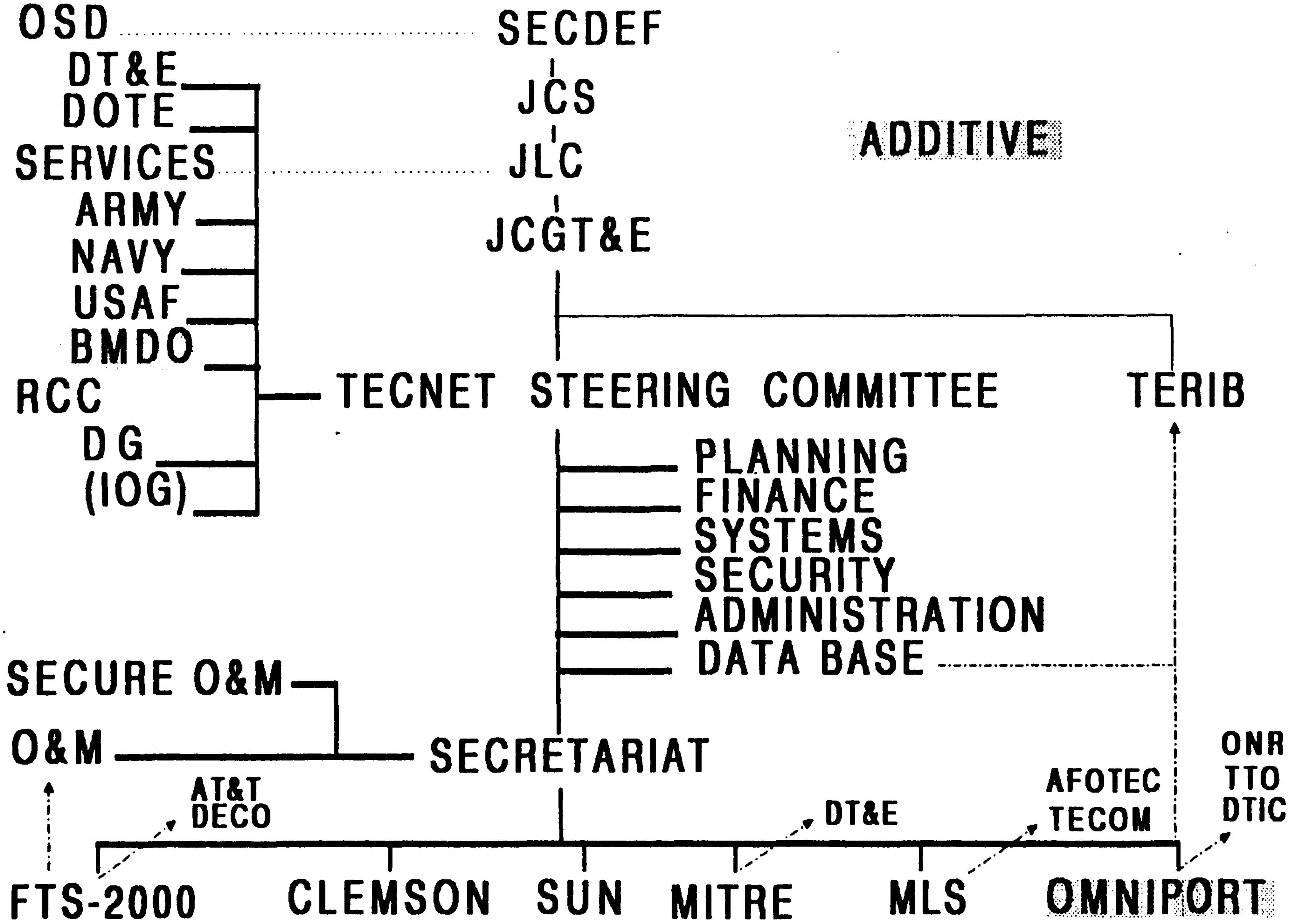
TEST AND EVALUATION COMMUNITY NETWORK HISTORY, STATUS AND R&D INITIATIVES

- TECNET 10 YEAR EVOLUTION
- ➡ TECNET IN 1993
- TECNET RESEARCH INITIATIVES
  - DATA BASE EVOLUTION
  - QUERY/SEARCH CAPABILITY
  - MULTI-LEVEL SECURE

TECNET CONFIGUARATION



TECNET MANAGEMENT STRUCTURE



THINGS TYPICALLY FOUND ON A DDN HOST

- ELECTRONIC MAIL
  - SEND
  - RECEIVE

- ADDRESSABILITY
  - WITHIN HOST
  - WITHIN DDN
  - WITHIN INTERNET

- PROTOCOLS
  - KERMIT TRANSFER
  - SIMPLE MAIL
  - TELNET ACCESS
  - FILE TRANSFER PROTOCOL

THINGS NOT ALWAYS FOUND ON A DDN HOST

- ELECTRONIC MAIL
  - RETURN RECEIPT
  - FULL SCREEN EDIT
  - BLIND COPY
  - OUT BOX
- USER INTERFACE
  - MULTIPLE MODES
  - CONTEXTUAL HELP
  - FLEXABLE SET-UP
- FILE REPOSITORIES
  - PERSONAL
  - PUBLIC
- ADDRESSABILITY
  - REMOTE AUTO CC
  - REMOTE AUTO FORWARD
  - AUTO POST FROM OUTSIDE
  - FACSIMILE
- PROTOCOLS
  - BATCH TRANSFER
  - X-Y-Z-MODEM
  - FILE COMPRESSION
  - PROTOCOL SET-UP
- FACSIMILE REPOSITORIES
  - PUBLIC
  - PROGRAMATIC
- UNLIMITED PERSONAL MAILBOX CAPABILIY
- RELIABILITY, SECURITY, MANAGEMENT

THINGS NOT FOUND ON A TYPICAL DDN HOST

- GPS DATA
- SERVICE SPECIFIC
  - ARMY
  - NAVY
  - USAF
- DIRECTIVES
  - 5000.1
  - 5000.2
  - 8120
  - SOFTWARE T&E
- SOFTWARE T&E
  - MILSPECS
  - DIDS
- INTEROPERABILITY
  - NETWORKING
  - DATA
- AEROSPACE DAILY
- USAF EC MANUAL
- DTEPI T&E COURSES
- BULLETIN BOARDS
  - NEWS SERVICES
  - DOD PROGRAMS
  - T&E SPECIAL INTEREST
  - RELIANCE/MSTIRC
  - GENERAL INTEREST
- DATABASES
  - T&E ASSETS
  - TECNET USERS
  - INSTRUMENTATION
    - UDS / RADCAL
- RELIANCE
  - MOAS
  - GUIDANCE
  - SUPPORT AIRCRAFT
- TEAL'S DIRECTORY
- COMMERCE BUSINESS DAILY
- ARPANET BOARDS
- DOD ACRONYMS

USER ENHANCEMENTS ADDED

- FEATURES
  - TECNET LIBRARY MENU SYSTEM
  - EDITOR ENHANCEMENTS
  - NOVICE MODE
- FILE TRANSFER
  - COMBINED FILE TRANSFER
  - ADDED PROTOCOLS
  - FILE REPOSITORY
  - GREATER DOWNLOAD FLEXABILITY
  - INTEGRATED FACSIMILE

TEST AND EVALUATION COMMUNITY NETWORK HISTORY, STATUS AND R&D INITIATIVES

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1993 TECNET DEVELOPMENT

- NEAR TERM
  - CURSOR DRIVEN DATA BASE ACCESS
  - COMBINED T&E RESOURCE DATA BASES
  - REVAMPED MENU STRUCTURE
  - IMPROVED REPOSITORY
  - ENHANCED FACSIMILE
- WORK IN PROGRESS
  - HYPERSEARCH
  - GOPHER/WAIS/WWW
  - WINDOWS INTERFACE
- LONGER TERM
  - GROUPWARE
  - PC BASED MAIL INTERFACE

TEST AND EVALUATION COMMUNITY NETWORK HISTORY, STATUS AND R&D INITIATIVES

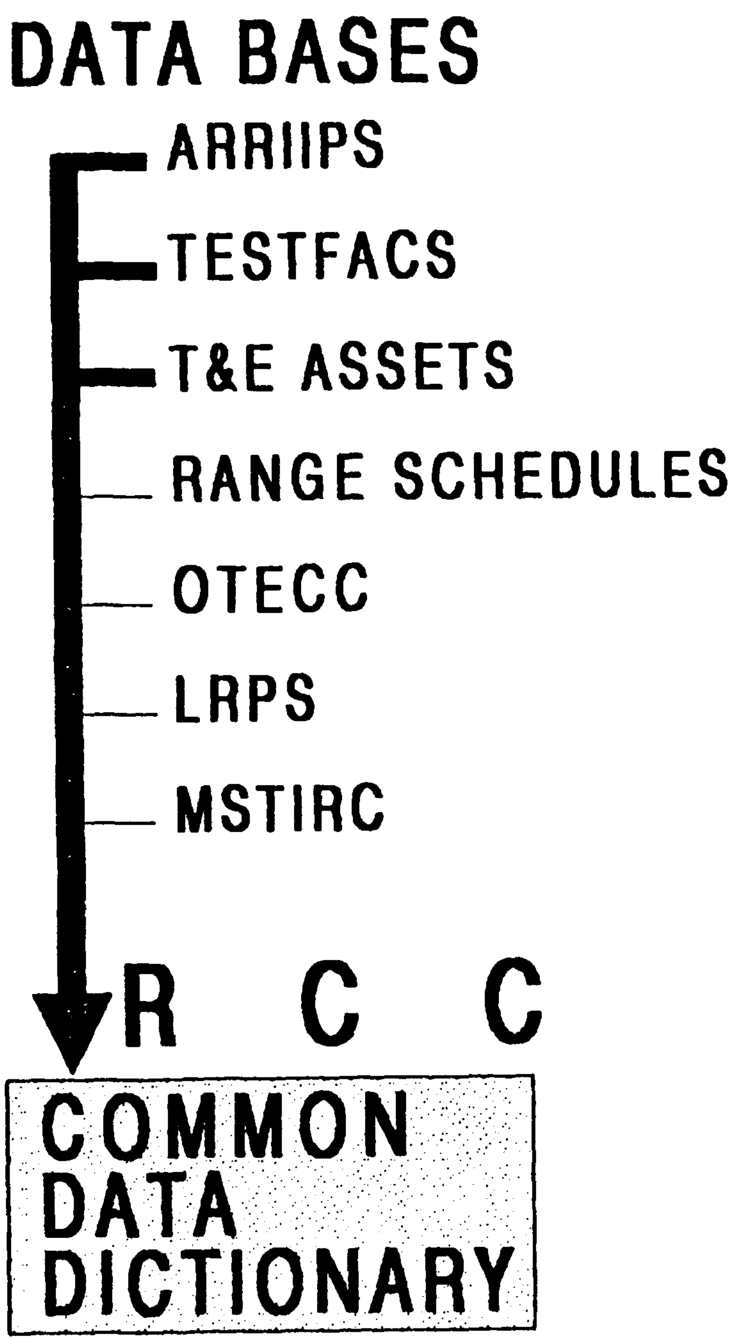
TECNET 10 YEAR EVOLUTION

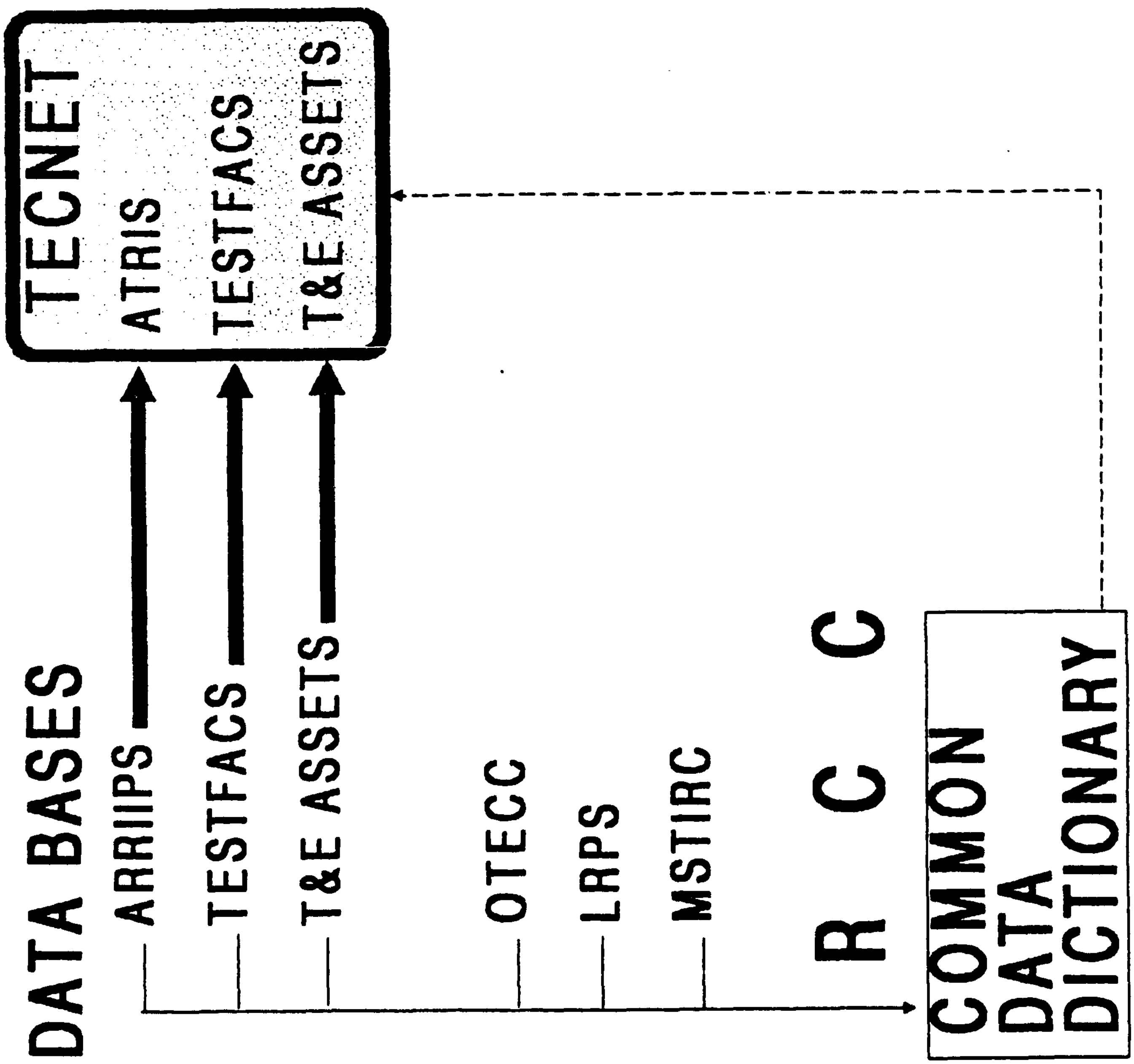
TECNET IN 1993

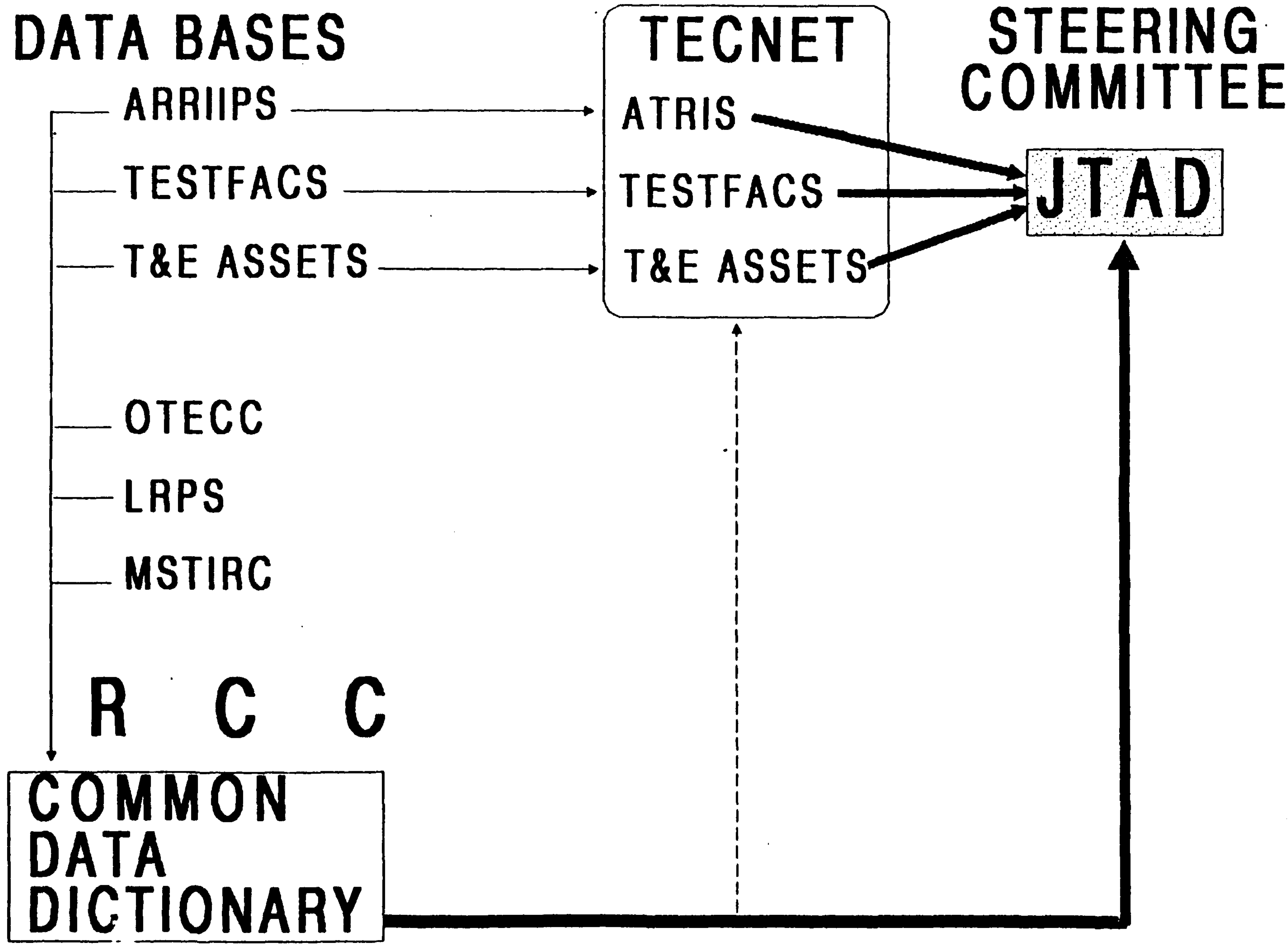
TECNET RESEARCH INITIATIVES

- DATA BASE EVOLUTION
- QUERY/SEARCH CAPABILITY
- MULTI-LEVEL SECURE

DATA BASES		SPONSORS
ARRIIPS	→	AFOTEC
TESTFACS	→	TECOM
T&E ASSETS	→	OSD
RANGE SCHEDULES	→	DSTC
OTECC	→	OTECC
LRPS	→	MSIC
MSTIRC	→	JCG(T&E)


DATA BASES
ARRIIPS
TESTFACS
T&E ASSETS
RANGE SCHEDULES
OTECC
LRPS
MSTIRC
R C C
COMMON
DATA
DICTIONARY


DATA BASES
ARRIIPS
TESTFACS
T&E ASSETS
OTECC
LRPS
MSTIRC
R C C
COMMON
DATA
DICTIONARY
TECNET
ATRIS
TESTFACS
T&E ASSETS


DATA BASES
ARRIIPS
TESTFACS
T&E ASSETS
OTECC
LRPS
MSTIRC
R C C
COMMON DATA DICTIONARY
TECNET
ATRIS
TESTFACS
T&E ASSETS
STEERING COMMITTEE
JTAD

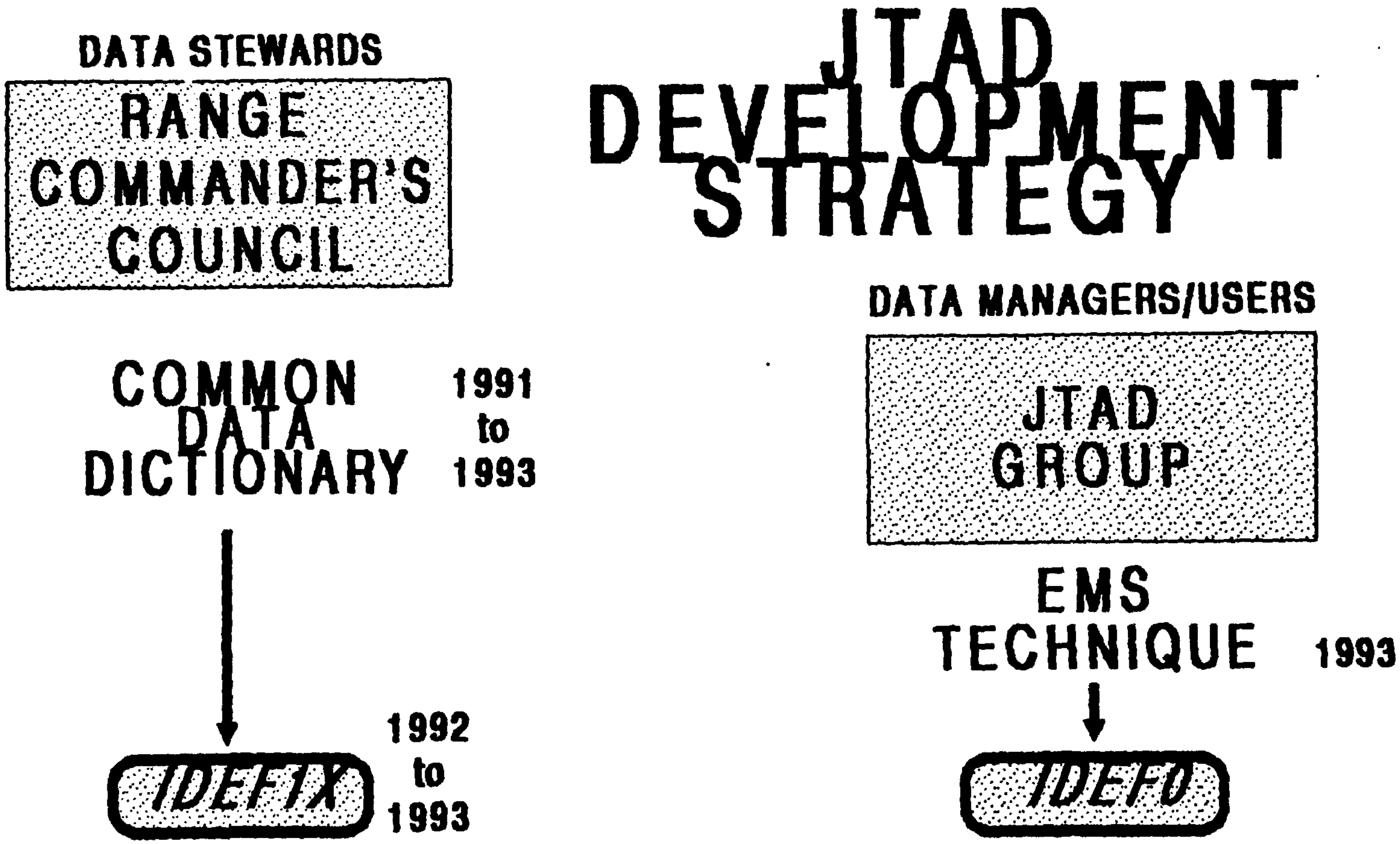
JTAD DEVELOPMENT STRATEGY

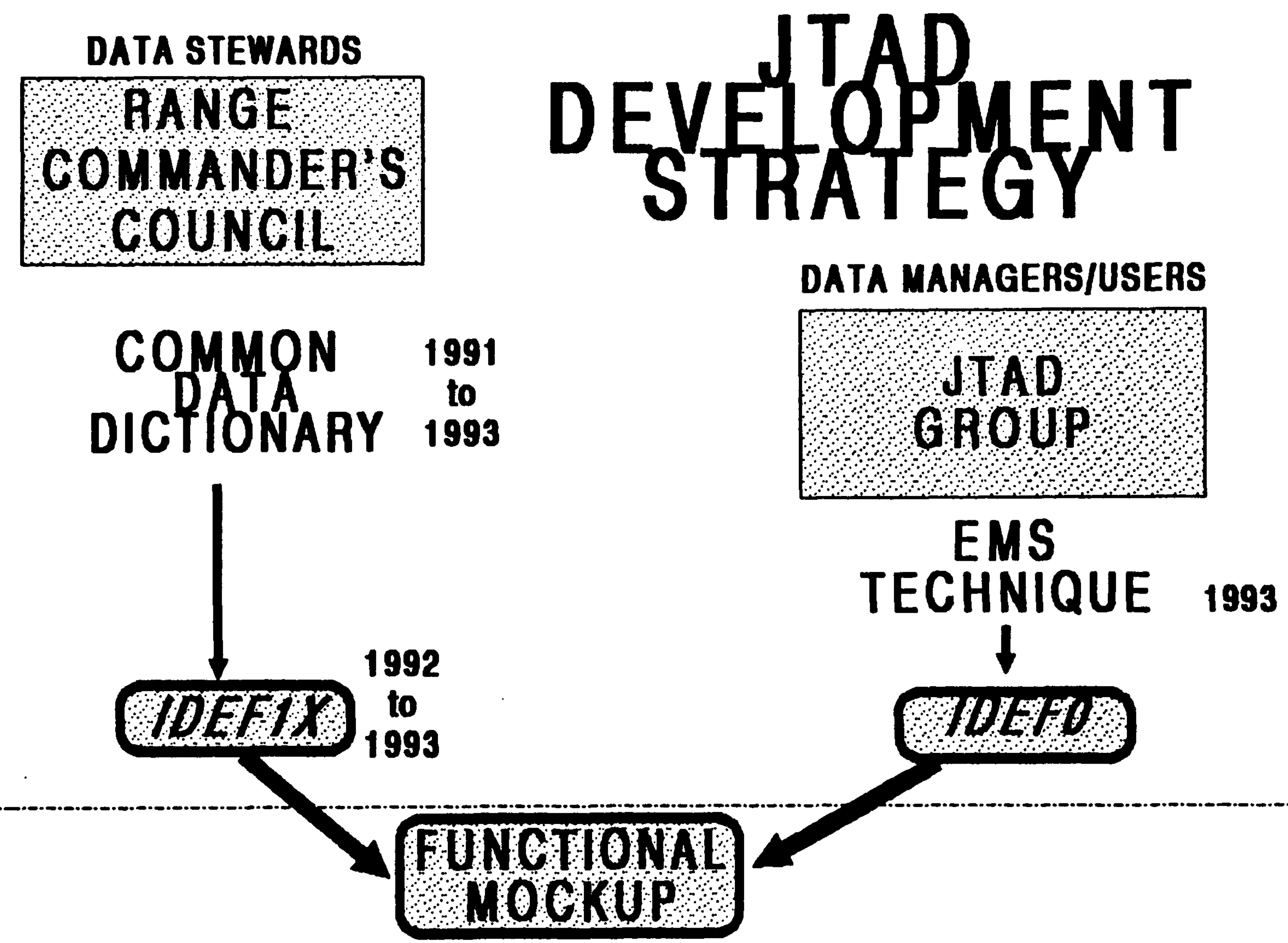
DATA STEWARDS

RANGE COMMANDER'S COUNCIL

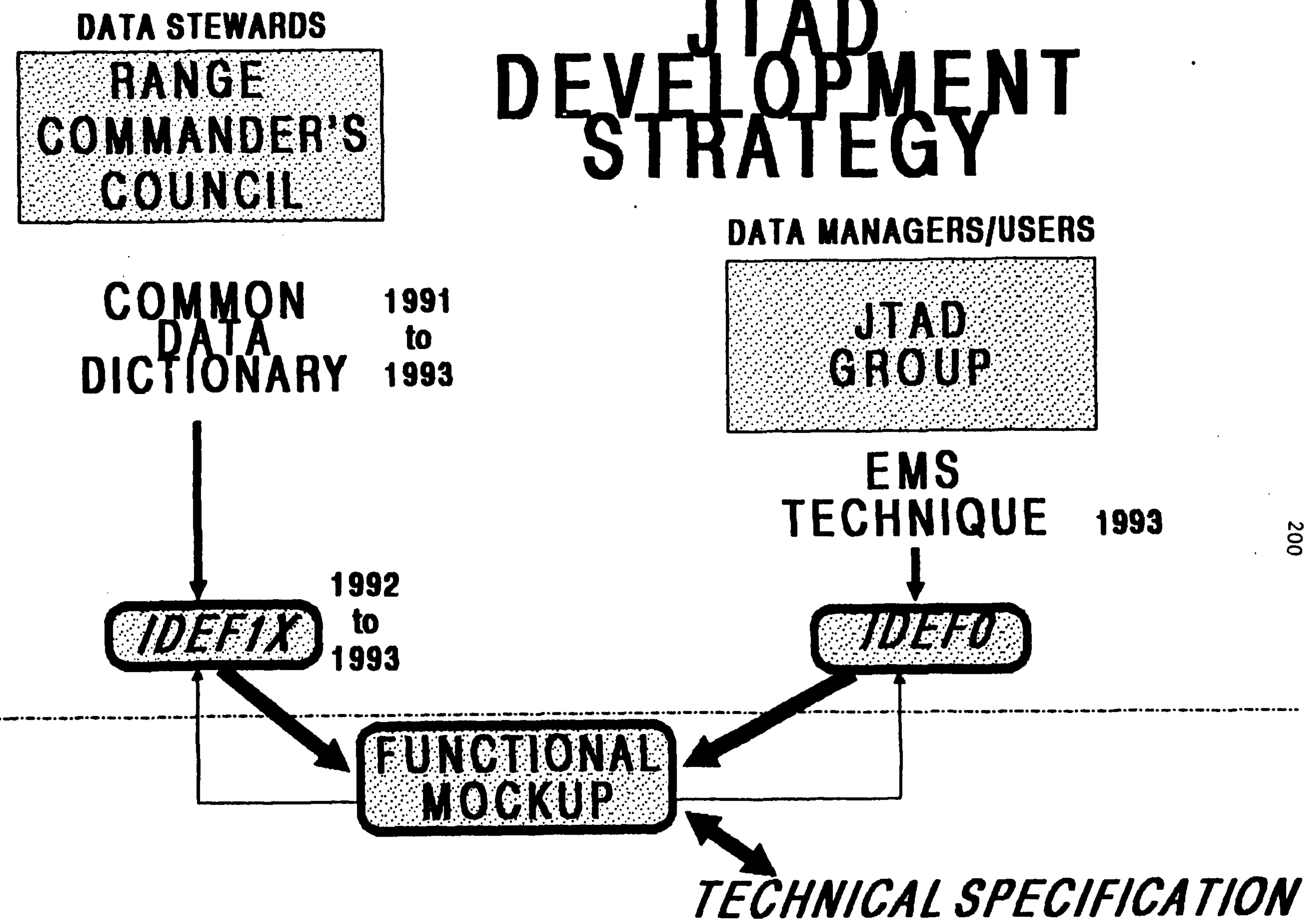
COMMON DATA DICTIONARY 1991 to 1993

IDEF1X 1992 to 1993

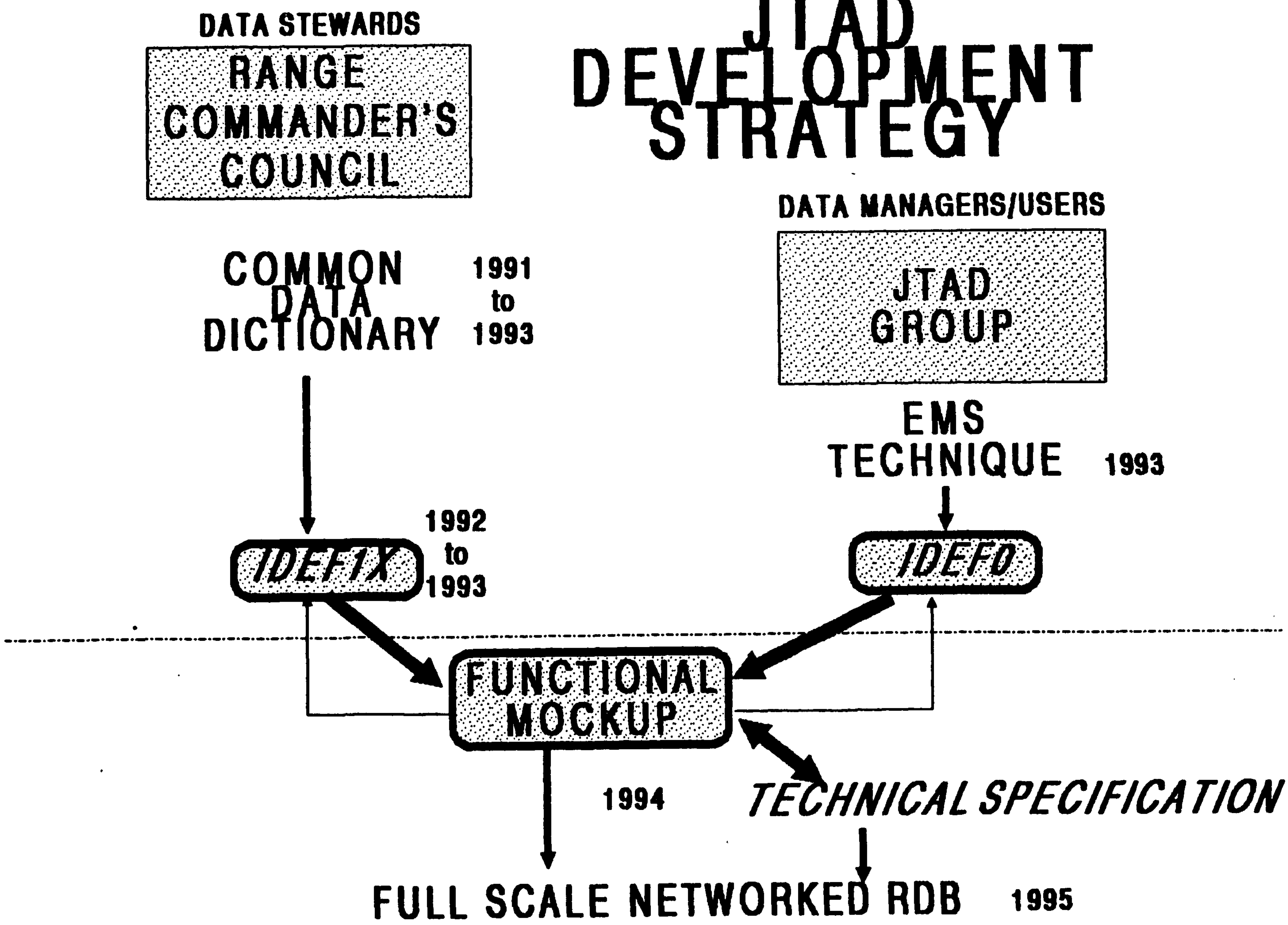

JTAD
DEVELOPMENT
STRATEGY
DATA STEWARDS
RANGE COMMANDER'S COUNCIL
COMMON DATA DICTIONARY
1991 to 1993
IDEF1X
1992 to 1993
DATA MANAGERS/USERS
JTAD GROUP
EMS TECHNIQUE
1993
IDEF0


JTAD
DEVELOPMENT
STRATEGY
DATA STEWARDS
RANGE COMMANDER'S COUNCIL
COMMON DATA DICTIONARY
1991 to 1993
IDEF1X
1992 to 1993
DATA MANAGERS/USERS
JTAD GROUP
EMS TECHNIQUE
1993
IDEF0
FUNCTIONAL MOCKUP

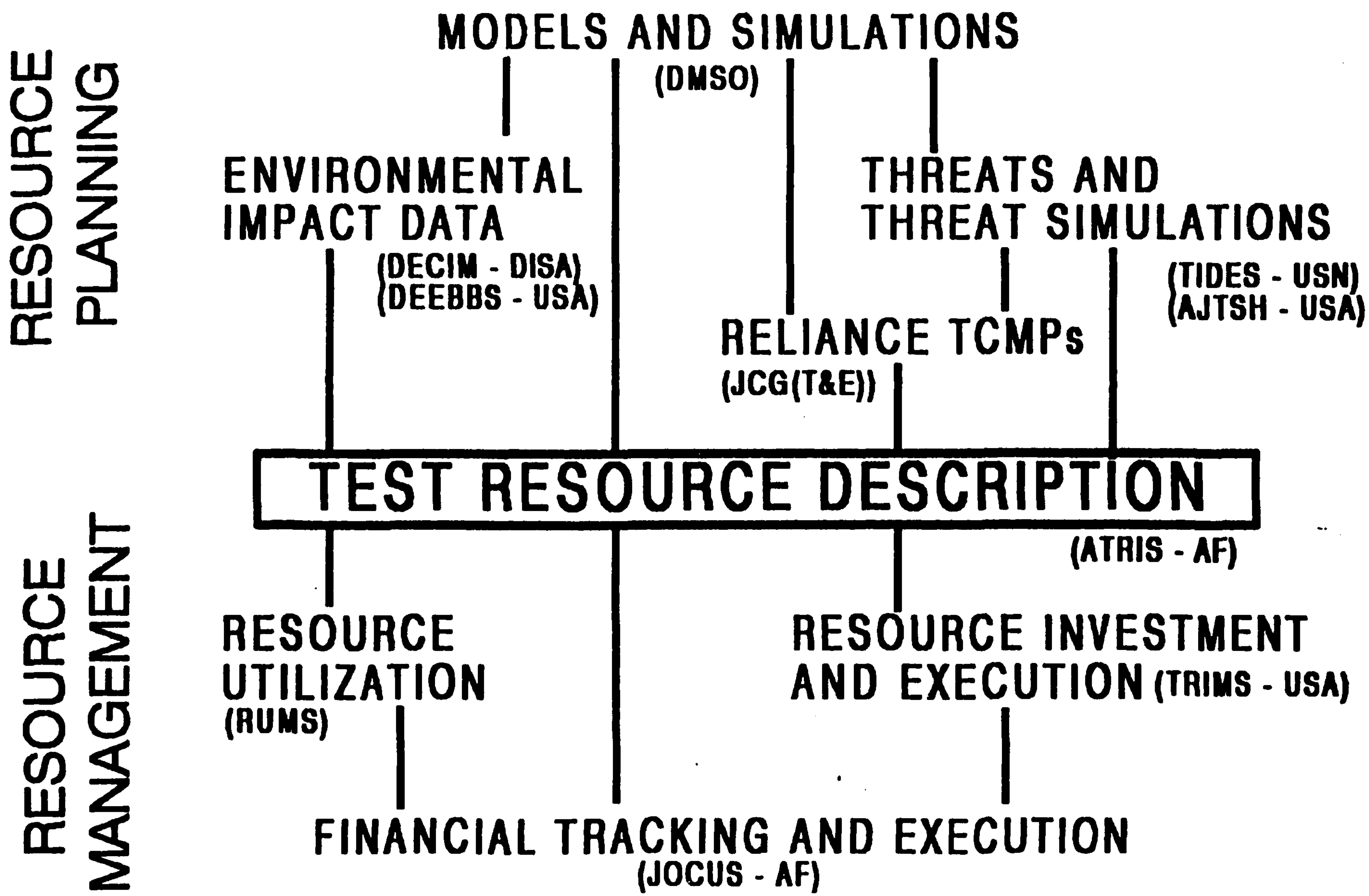
JTAD DEVELOPMENT STRATEGY

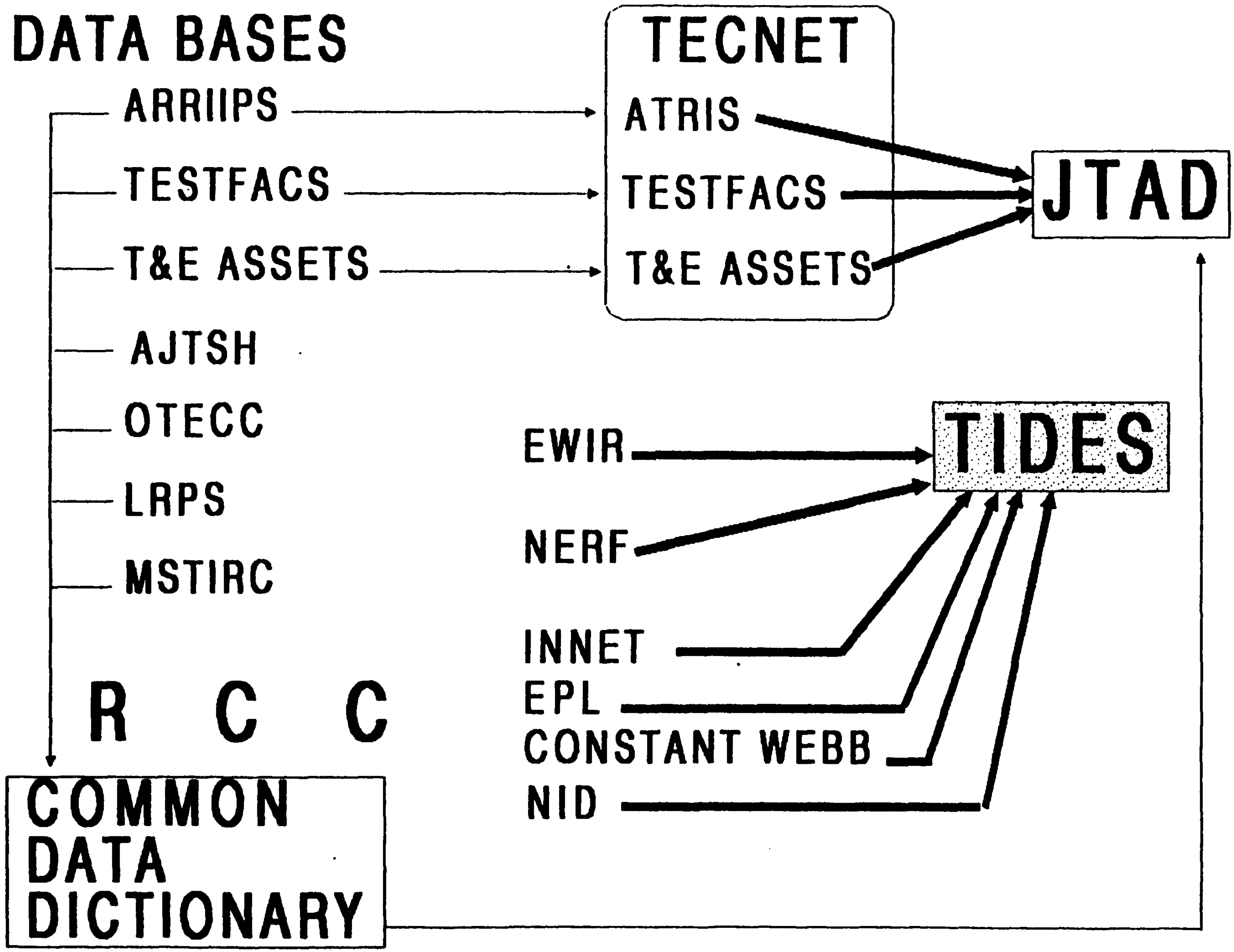


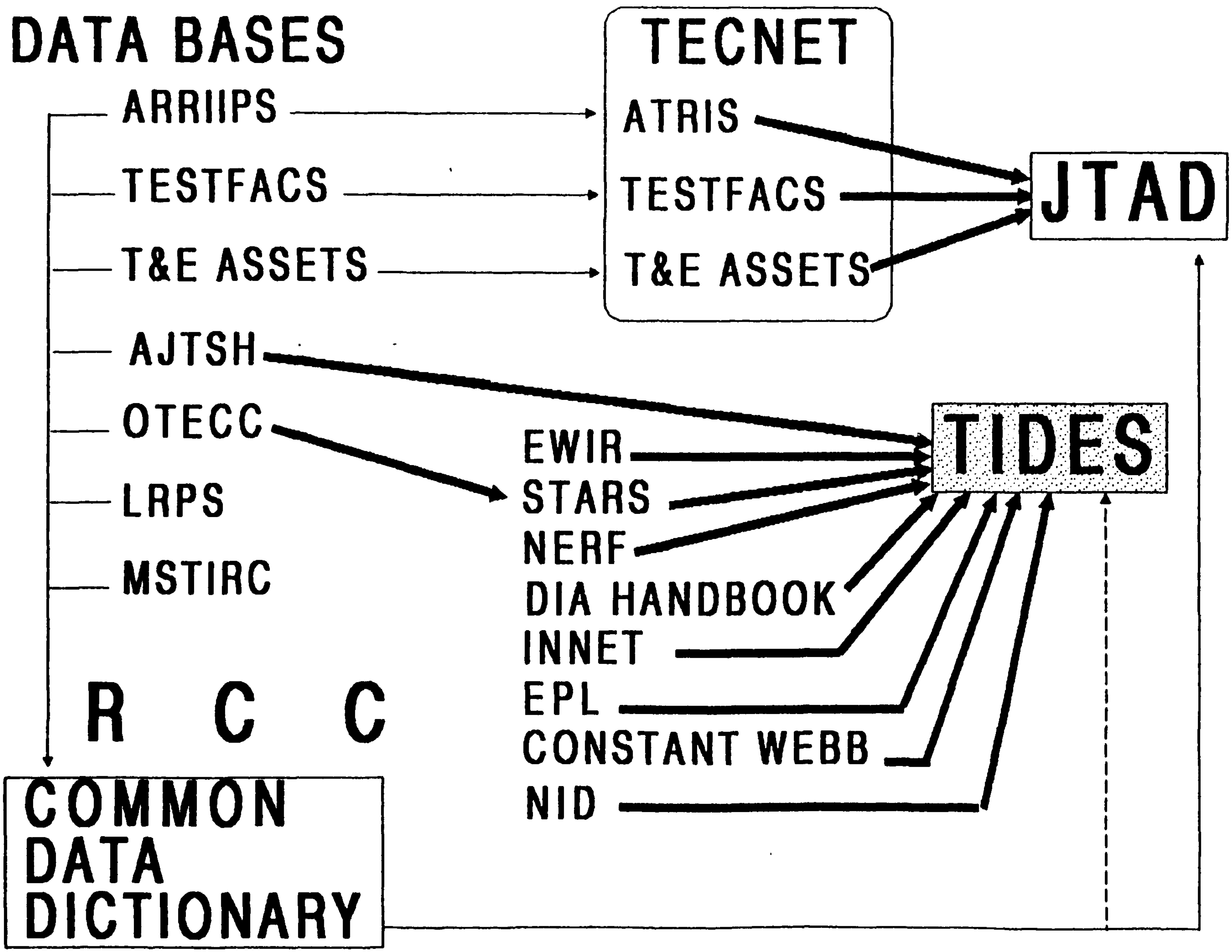
JTAD DEVELOPMENT STRATEGY

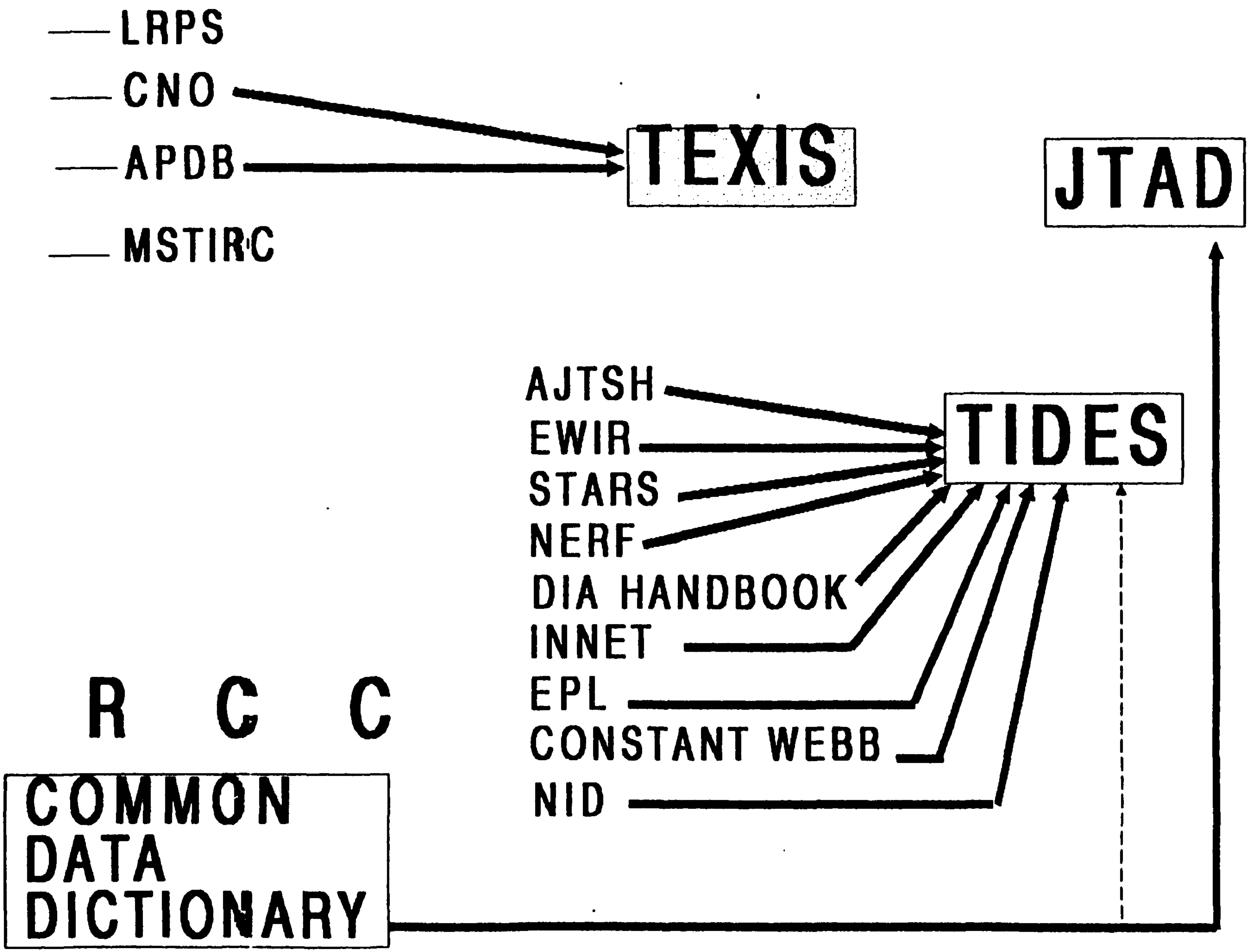


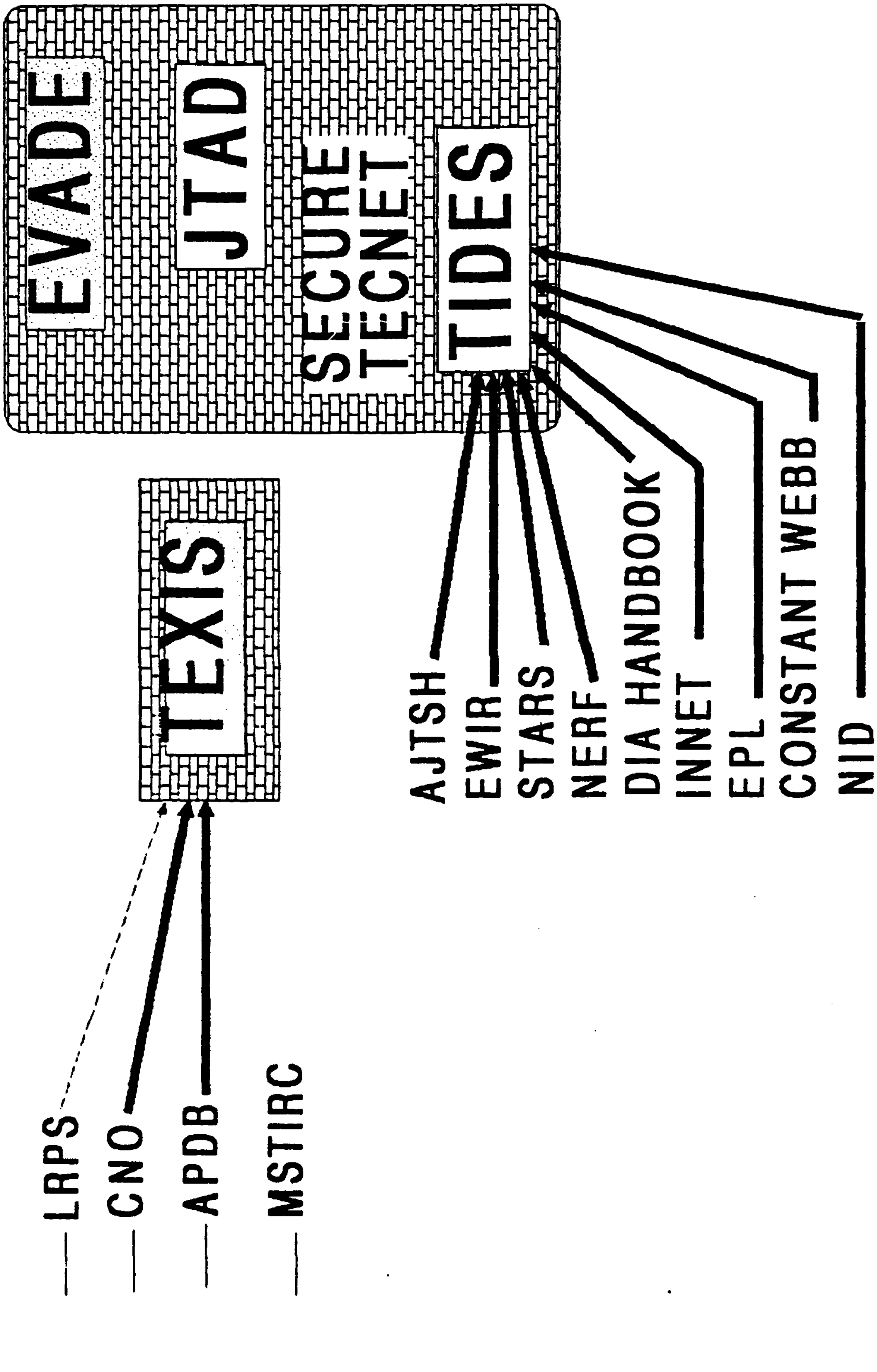
TEST RESOURCE RELATIONSHIPS

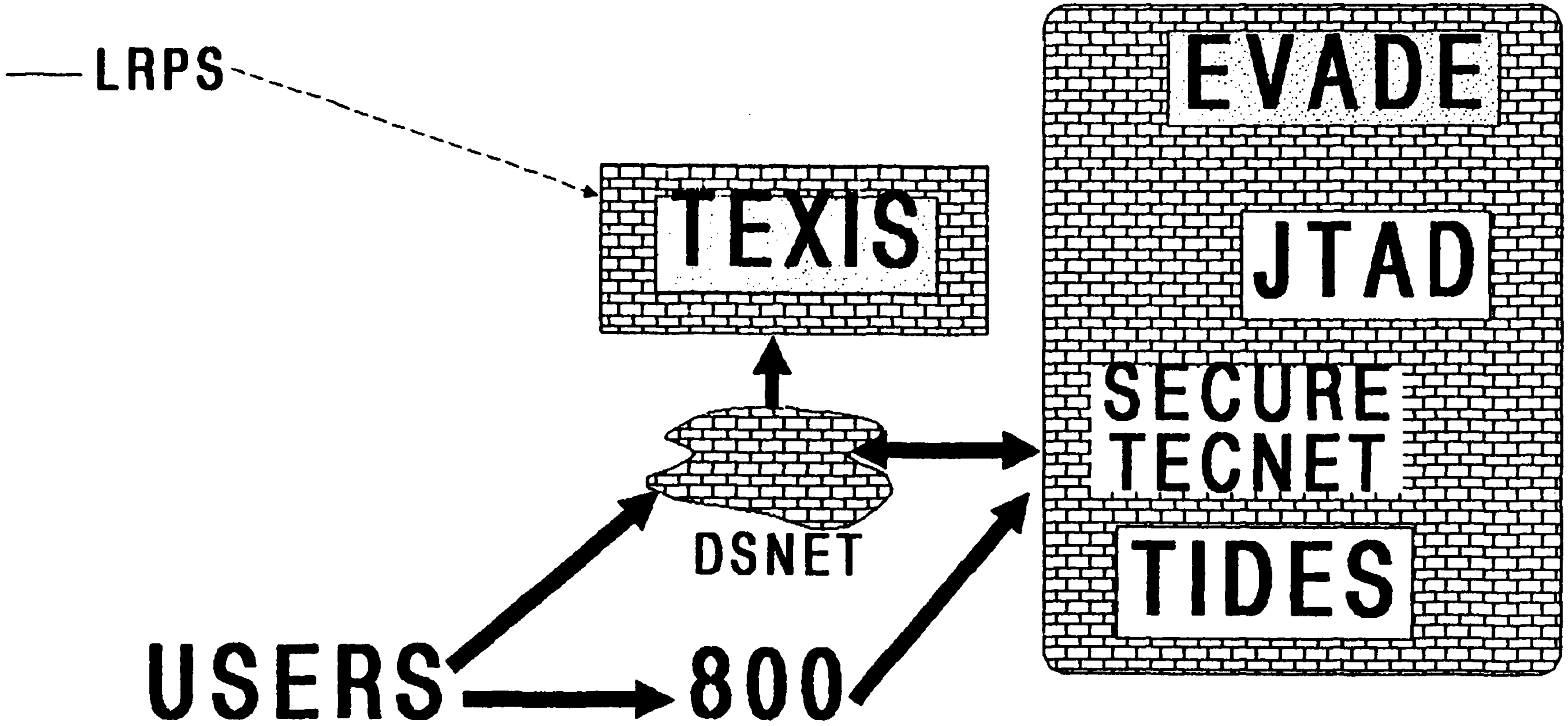


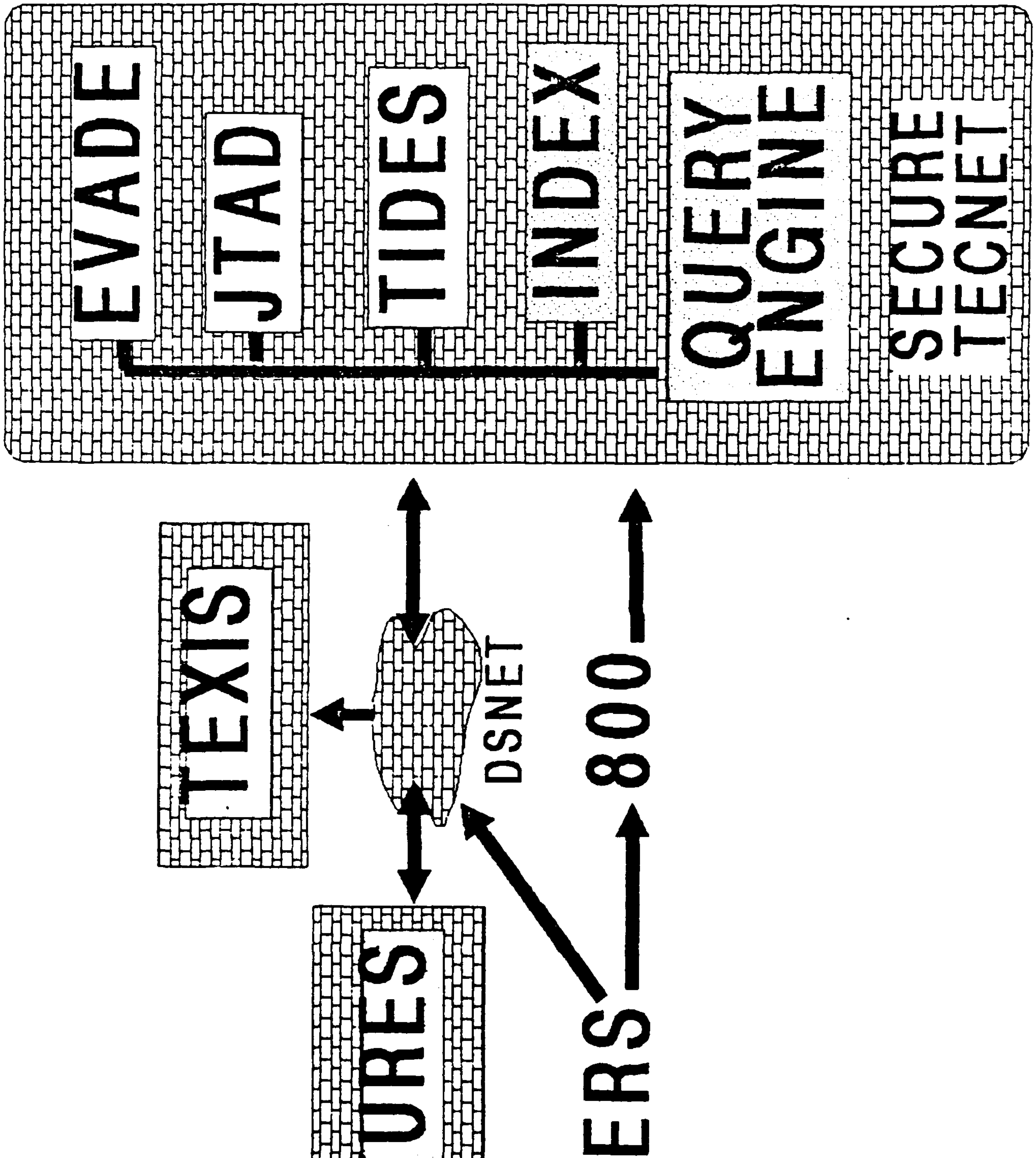

DATA BASES
ARRIIPS
TESTFACS
T&E ASSETS
AJTSH
OTECC
LRPS
MSTIRC
R C C
COMMON DATA DICTIONARY
TECNET
ATRIS
TESTFACS
T&E ASSETS
JTAD
TIDES
EWIR
NERF
INNET
EPL
CONSTANT WEBB
NID


DATA BASES
ARRIIPS
TESTFACS
T&E ASSETS
AJTSH
OTECC
LRPS
MSTIRC
TECNET
ATRIS
TESTFACS
T&E ASSETS
JTAD
TIDES
EWIR
STARS
NERF
DIA HANDBOOK
INNET
EPL
CONSTANT WEBB
NID
R C C
COMMON
DATA
DICTIONARY

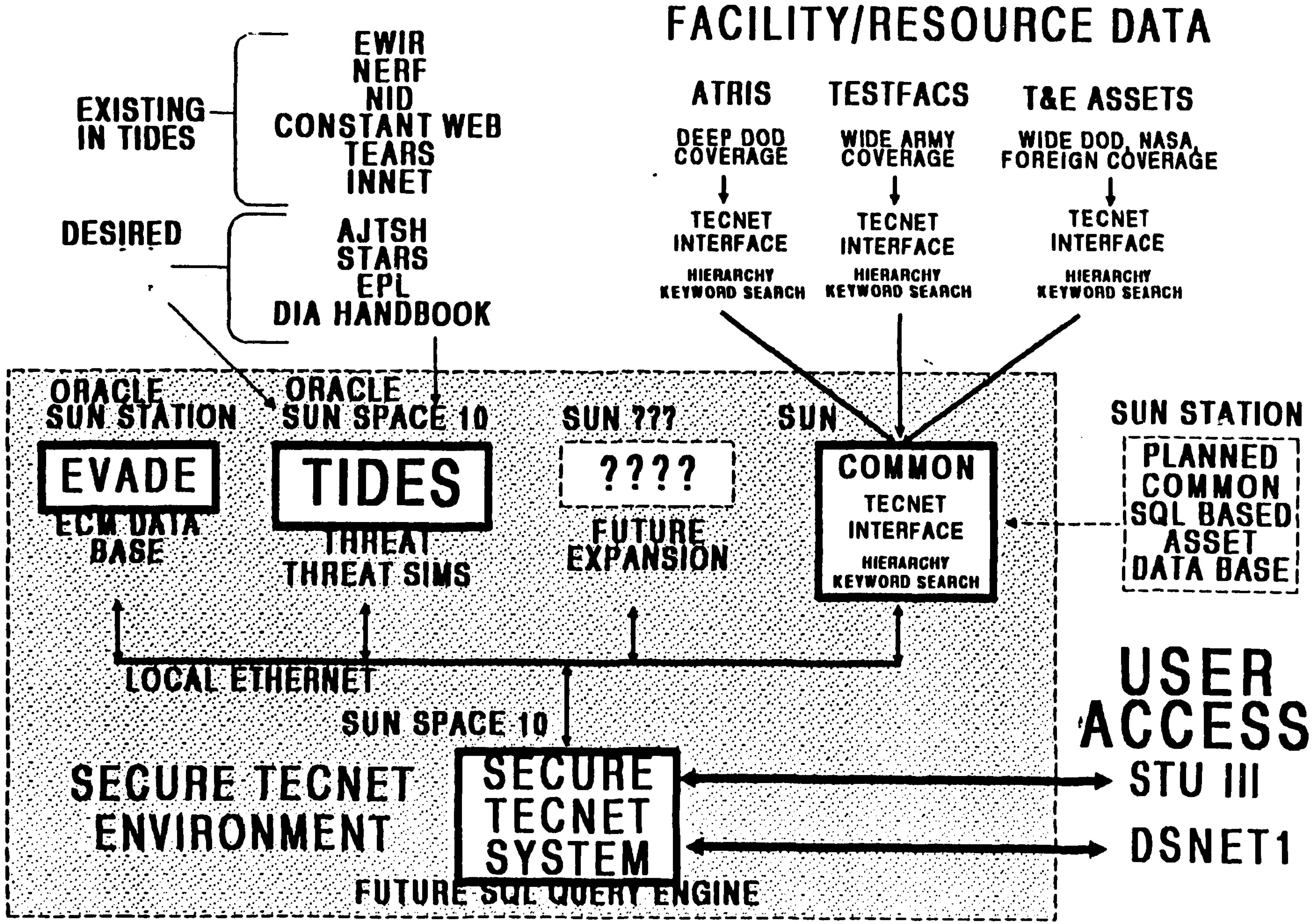

LRPS
CNO
APDB
MSTIRC
TEXIS
JTAD
AJTSH
EWIR
STARS
NERF
DIA HANDBOOK
INNET
EPL
CONSTANT WEBB
NID
TIDES
R C C
COMMON
DATA
DICTIONARY


EVADE
JTAD
SECURE
TECNET
TIDES
TEXIS
AJTSH
EWIR
STARS
NERF
DIA HANDBOOK
INNET
EPL
CONSTANT WEBB
NID
LRPS
CNO
APDB
MSTIRC


LRPS
TEXIS
DSNET
USERS
800
EVADE
JTAD
SECURE
TECNET
TIDES


EVADE
JTAD
TIDES
INDEX
QUERY ENGINE
SECURE TECNET
TEXIS
DSNET
800
SIGNITURES
USERS

PLANNED TECNET SECURE INFORMATION BASE



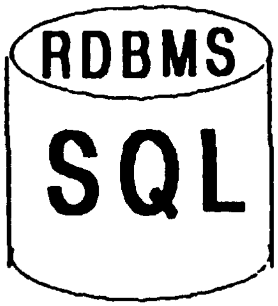
TEST AND EVALUATION COMMUNITY NETWORK HISTORY, STATUS AND R&D INITIATIVES

- TECNET 10 YEAR EVOLUTION
- TECNET IN 1993
- TECNET RESEARCH INITIATIVES
  - DATA BASE EVOLUTION
  - QUERY/SEARCH CAPABILITY
  - MULTI-LEVEL SECURE

DATA IN 1993

ICASE

IDEF0
IDEF1X

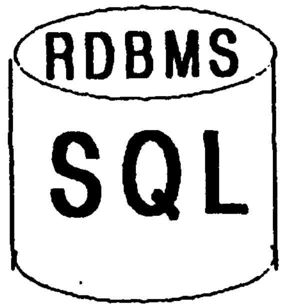


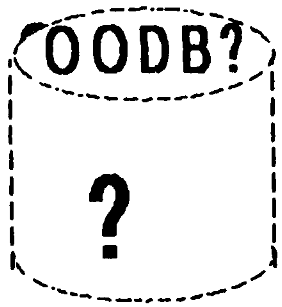
TIGHTLY COUPLED

JTAD
TIDES
TEXIS
ETC

DATA IN 1993

ICASE	
IDEF0	
IDEF1X	



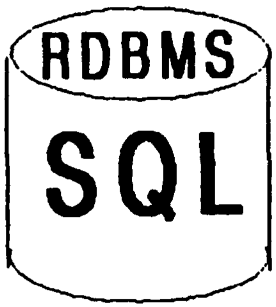


TIGHTLY COUPLED	COMPLEX DATA
JTAD	MODELS
TIDES	SIMULATIONS
TEXIS	VISUALS
ETC	RAW DATA

DATA IN 1993

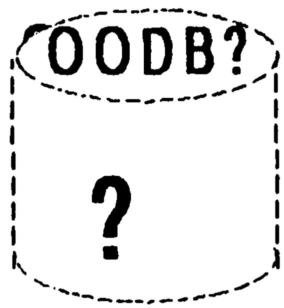
ICASE

IDEF0
IDEF1X



TIGHTLY COUPLED

JTAD
TIDES
TEXIS
ETC



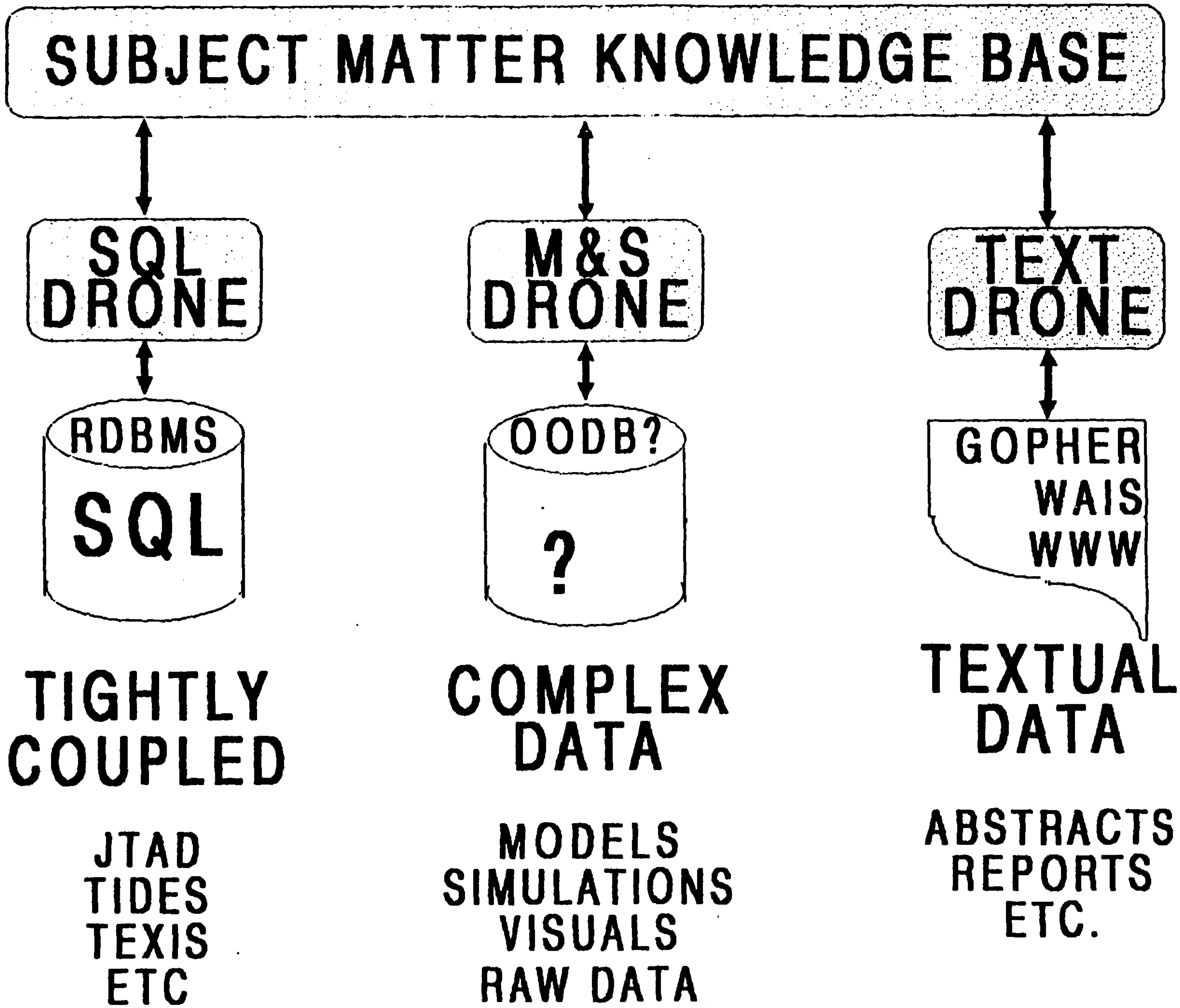
COMPLEX DATA

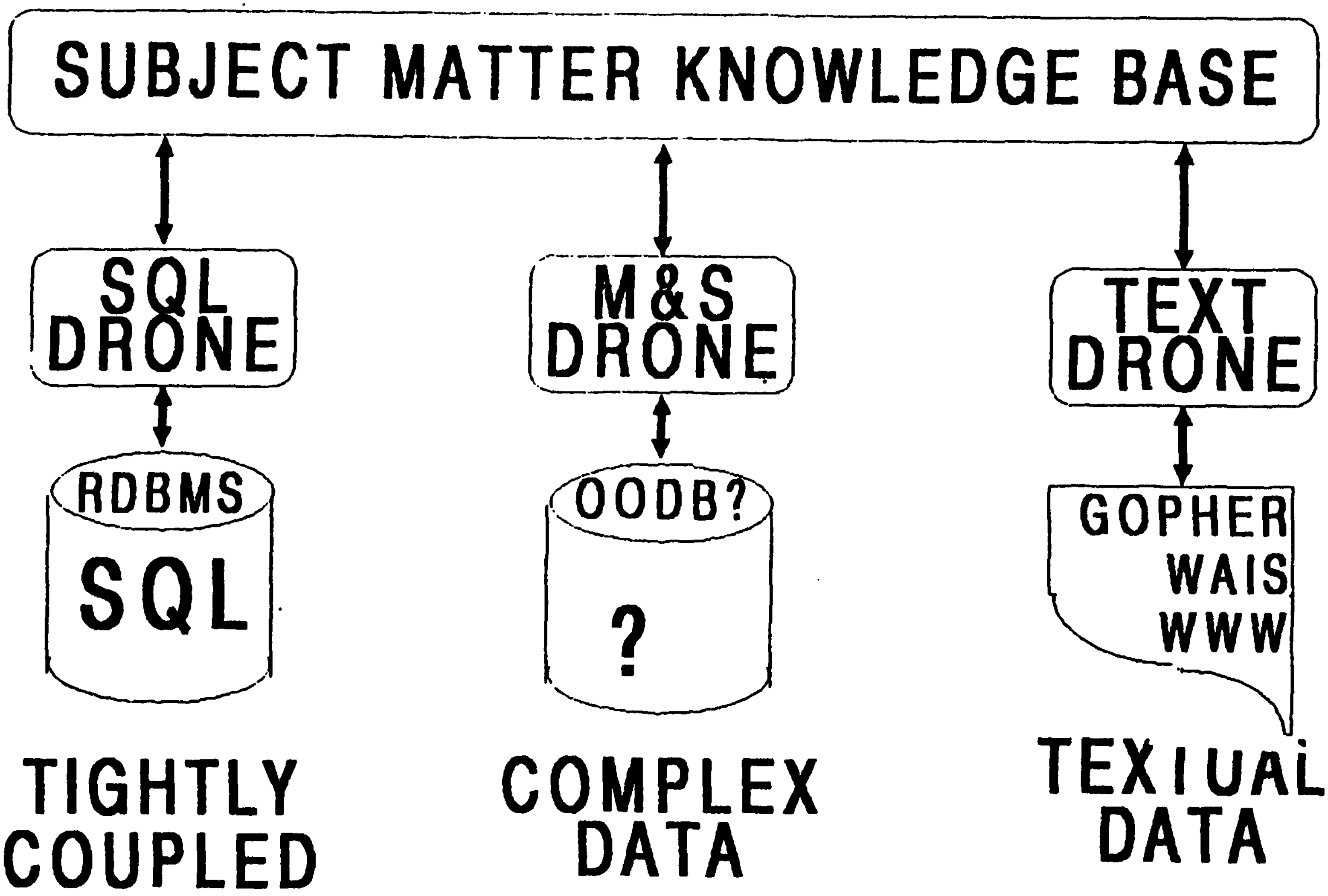
MODELS
SIMULATIONS
VISUALS
RAW DATA

INTERNET

TEXIUAL DATA

ABSTRACTS
REPORTS
ETC.


SUBJECT MATTER KNOWLEDGE BASE
SQL DRONE
M&S DRONE
TEXT DRONE
RDBMS
SQL
OODB?
?
GOPHER
WAIS
WWW
TIGHTLY COUPLED
COMPLEX DATA
TEXTUAL DATA
JTAD
TIDES
TEXIS
ETC
MODELS
SIMULATIONS
VISUALS
RAW DATA
ABSTRACTS
REPORTS
ETC.



BOTH CLASSIFIED AND UNCLASSIFIED

TEST AND EVALUATION COMMUNITY NETWORK HISTORY, STATUS AND R&D INITIATIVES

- TECNET 10 YEAR EVOLUTION
- TECNET IN 1993
- TECNET RESEARCH INITIATIVES
  - DATA BASE EVOLUTION
  - QUERY/SEARCH CAPABILITY
  - MULTI-LEVEL SECURE

TECNET VISION

SYSTEMATICALLY MIGRATE EXISTING TECNET RESOURCES TO CREATE A STANDARDS COMPLIANT, MULTI-LEVEL SECURE COMMUNICATIONS AND PROCESSING CAPABILITY WHICH LINKS DEPARTMENT OF DEFENSE TEST AND EVALUATION ENTITIES TO A SHARED, BUT CONTROLLED USER COMMUNITY INFORMATION RESOURCE

STANDARDS COMPLIANT

UNIX ------------------> POSIX

MILNET DDN *---------> GOSIP

C2 ---------------------> B2

FAX GP III ------------> ????

MILSPEC -------------> CALS

DBASE IV -------------> SQL

1200 BAUD -----------> T-1

CONVENTIONAL ------> RISC

*X.25, TCP\IP, SMTP, FTP, TELNET

MULTI-LEVEL SECURE

UNCLASSIFIED

CONFIDENTIAL

SECRET

MULTI-LEVEL SECURE

NSA/TECNET COOPERATION

SYSTEM ENGINEERING PROCESS

"BETA TEST" AGREEMENTS

LABOR ESTIMATIONS

OPEN ACCESS DRIVERS

- TECHNOLOGY TRANSITION
  - ACADEMIA
  - INDUSTRY
  - GOVERNMENT
- PUBLIC AFFAIRS
- PROGRAM MANAGEMENT
  - INDUSTRIAL PLAYERS
  - GOVERNMENT TEAM

SECURE ACCESS DRIVERS

HACKERS
ESPOINAGE AGENTS
SENSITIVE INFORMATION
- DEFENSE DATA
- PERSONNEL DATA
- TECHNOLOGY DATA
- RESOURCE DATA

DEFENSE MESSAGE SYSTEM

ALTERNATIVES

SYSTEM ADMINISTRATION
or
REGULATION

TECNET INITIATIVES

UNCLASSIFIED SYSTEM

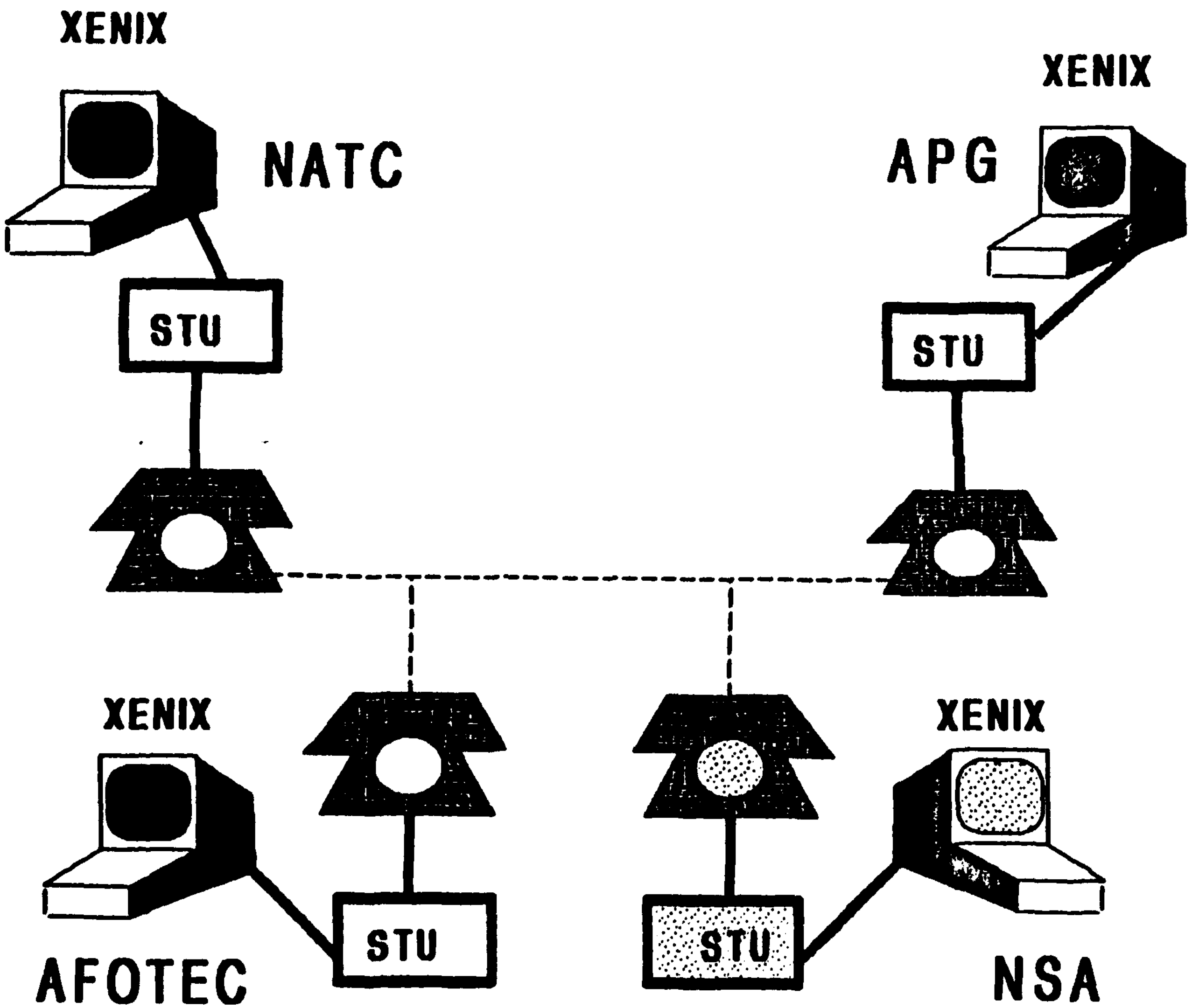
SYSTEM HIGH SYSTEM

MULTI-LEVEL SECURE

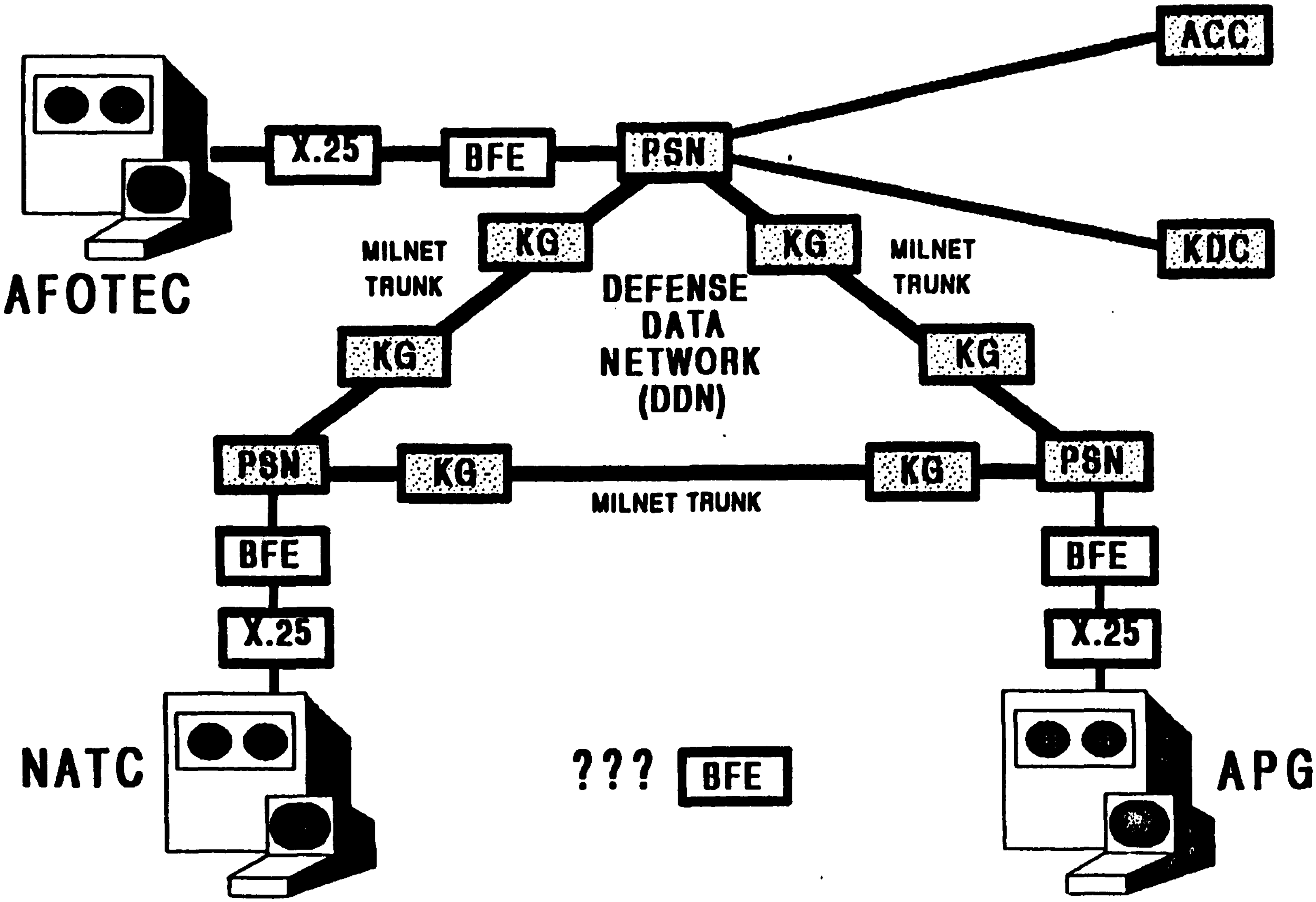
TECNET MLS CERTIFICATION

- NSA TESTBED FOR CERTIFICATION PROCESS
- COMPREHENSIVE NSA SUPPORT TEAM
  - ACCREDITATION
  - CERTIFICATION
  - THREAT
  - EVALUATION
  - OPSEC
  - POLICY
  - SYSTEMS ENGINEERING
- RDD TOOL FOR MODELING
- SYSTEMATIC APPROACH TO BUILDING A MEANINGFUL CERTIFICATION PACKAGE

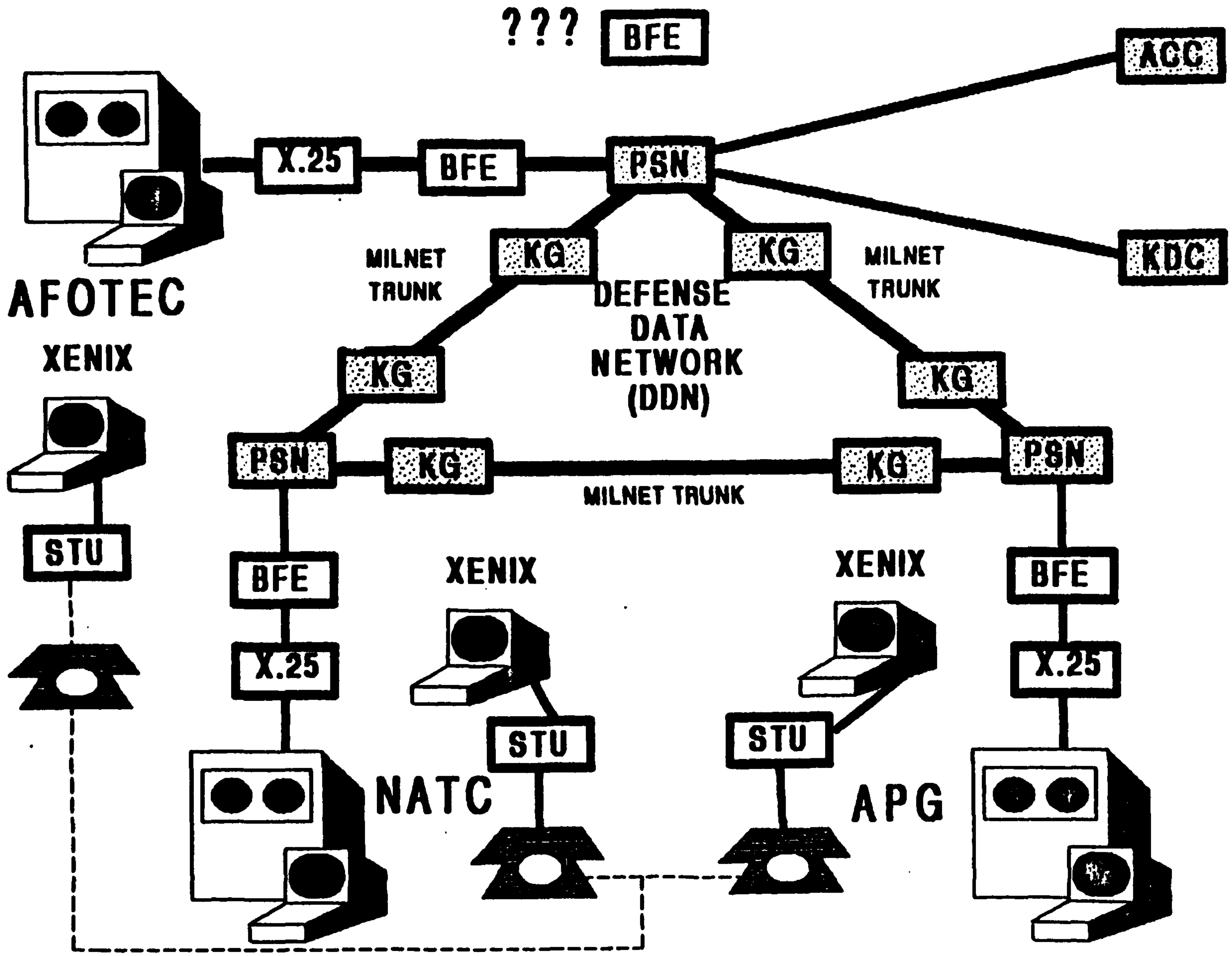
TECNET B2 SECURE PC EXPERIMENT



MILNET SECURE EXPERIMENT

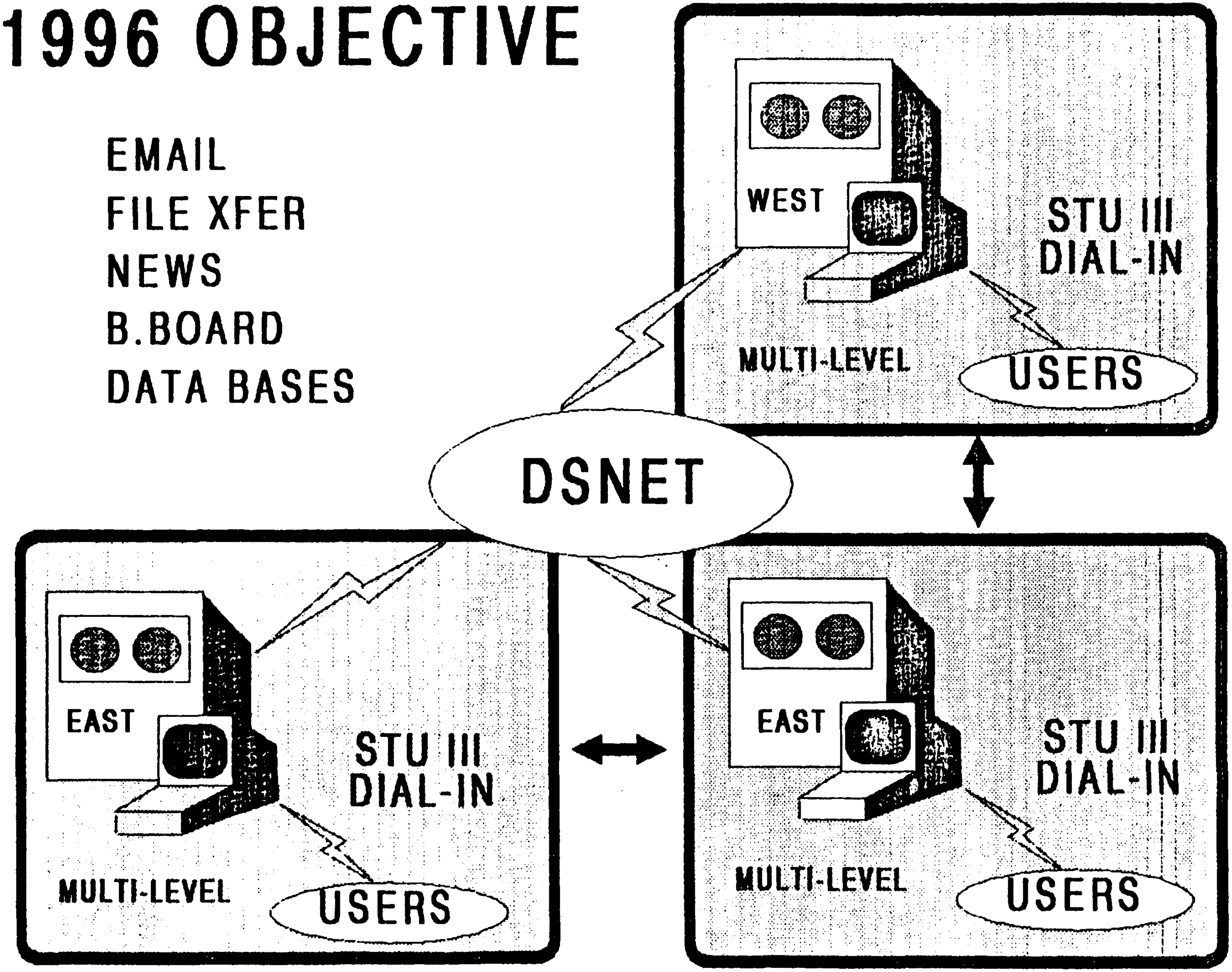


TECNET SECURE EXPERIMENTS



1996 OBJECTIVE

EMAIL
FILE XFER
NEWS
B.BOARD
DATA BASES



TECNET: EVOLUTION, CAPABILITY AND RESEARCH AND DEVELOPMENT INITIATIVES

George F. Hurlburt
Naval Air Warfare Center Aircraft Division
Patuxent River, Maryland 20670-5304

TEST TECHNOLOGY TRANSFER SYMPOSIUM
August 23-25, 1993
Burlington Marriott
Burlington, MA

TECNET: EVOLUTION, CAPABILITY, AND RESEARCH AND DEVELOPMENT INITIATIVES

George F. Hurlburt
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ABSTRACT

The Test and Evaluation Community Network (TECNET) stands on the leading edge of Defense weapons systems Test and Evaluation (T&E). It provides information of immediate value to those who plan, provision, support, conduct and evaluate the results of developmental and operational tests within the Department of Defense (DoD). Operating at both the unclassified and System High SECRET levels, TECNET supports information vital to the tester, those who support test facilities and those who commission tests. TECNET has evolved over the past 10 years to its present capability. It now supports over 3,500 users from within all the armed services. It contains significant data bases, information resources for the tester and a number of specialized electronic information services including electronic mail, bulletin boards, facsimile, and file transfer capabilities. A full partner in the Defense Data Network and the Internet, TECNET is also accessible via the Federal Telecommunications System for the Year 2000 (FTS-2000) dial-up service. TECNET is not static. Its development is user driven. Its focus on the future embraces concepts such as advanced user interfaces, groupware, technology transfer information support, and Multilevel Secure (MLS) capabilities. This paper traces the evolution of TECNET, defines TECNET as it exists today, and highlights where TECNET must go in the future.

The TECNET exists to support both developmental and operational T&E communities within DoD. Further, and importantly, TECNET also supports T&E customers in the larger DoD Acquisition community. TECNET has matured over the past 10 years to become a recognized T&E information resource for DoD. TECNET continues to evolve with modern information technology. This paper describes TECNET's evolution, describes its current capability, and defines its future direction to support its T&E information mission.

TECNET was initiated in 1983 under a DoD contract with Clemson University to determine how the several Joint Test Forces (JTF) could better cooperate with one another. The proposed solution brought the concept of electronic mail to the JTF. This recommendation took hold in an era when such a concept was still considered radical. Electronic mail was very much in the province of computer specialists. It awaited introduction of the communicating personal computer. Initial JTF support was provided by a subcontracted commercial electronic mail vendor. As the personal computer became an acceptable DoD tool, TECNET began to slowly extend beyond the JTF. Other test organizations began to see benefit in electronic information exchange. TECNET entered a dramatic expansion phase in 1986 as the armed services began to seriously embrace the electronic mail services of Clemson's commercial vendor. Unfortunately, the price of the commercial service skyrocketed as the business volume increased dramatically with use. In late 1986, the Office of the Secretary of Defense (OSD) called for a critical review of this and other costly initiatives to facilitate T&E by electronic means. The Naval Air Test Center (NAVAIRTESTCEN) at Patuxent River, Maryland. was selected and funded to conduct a critical study from the perspective of a field activity.

The NAVAIRTESTCEN study established a T&E framework that became a part of the Defense Systems Management College (DSMC) T&E curriculum. In a companion technical report, NAVAIRTESTCEN recommended that all existing OSD automation initiatives be reduced or scrapped. The report made one exception for the existing electronic mail capability for the entire DoD T&E community known as TECNET. The study recommended that this fledgling electronic mail capability be developed and moved in-house to one of the Major Range and Test Facility Base (MRTFB) activities to achieve both control and economy. It further stipulated that funding for Research and Development (R&D) should come from OSD only so long as the armed services were willing to provide funds for Operation and Maintenance (O&M). This idea predated the OSD Central Test and Evaluation Investment Program (CTEIP) which operates under a similar principle. In 1987, after appropriate coordination among the services, OSD sponsored the creation of a TECNET Steering Committee made up of formally designated service representatives. From that date, all TECNET O&M funding came from the services and all R&D support came from OSD under Steering Committee recommendation. The TECNET Steering Committee was subsequently chartered under the Joint Commander's Group (JCG) for T&E, which emerged in 1989 from the services in response to growing high level involvement in T&E investment matters.

In 1989, a Government owned version of TECNET software became operational at Clemson University. It ran on a computer acquired for the cost of its move from a terminated JTF program. The subcontract vendor was retained for communication access purposes only. The costly commercial electronic mail component of the commercial service had become unnecessary. To facilitate a smooth transition from Clemson University, TECNET temporarily operated from a backup sister computer acquired from the same JTF program. This support operation ran at the Aberdeen Proving Ground for the first quarter of Fiscal year 1990. The primary TECNET computer was moved to NAVAIRTESTCEN during this backup period. There, it became fully operational under full Government control in early 1990. The system was subsequently upgraded in 1991 and again in 1993 to take advantage of reduced system ownership costs and increased demand for added capability. Through a series of fully competitive contract solicitations, Clemson University has retained the primary R&D role for TECNET. The DoD mandated Defense Data Network (DDN) became TECNET's preferred method of access. After an intermediate competitive contract, the commercial access vendor was subsequently replaced by FTS-2000 under waiver to overcome known DDN limitations. In the meantime, TECNET worked with DDN to overcome certain of these service limitations. TECNET's 1990 point paper influenced DDN to increase nation-wide dial-up speeds for remote users.

Over the years, TECNET has evolved from a pure electronic mail capability to a mature repository for information of immediate value to the entire DoD T&E community. TECNET played a major role in support of the developmental named Unmanned Aerial Vehicle (UAV) program and the still evolving EA-6B program during operation Desert Storm in early 1992. TECNET was reportedly instrumental in saving lives during this brief war. TECNET also became an indispensable tool for the Multiservice Test Investment Review Committee (MSTIRC), the T&E Project Reliance, and the subsequent T&E Reliance Investment Board (TERIB). TECNET now supports over 3,500 users from over 450 T&E related organizations. TECNET use is strong among the Army, Navy, Air Force, Marine Corps and numerous Defense Agencies. Over 50 DoD acquisition programs are represented among the 220 plus TECNET Bulletin Boards. Other TECNET Bulletin Boards support current news and an array of timely subjects dealing with T&E matters. T&E related directives, instructions, guidelines, instructional course offerings, software T&E facts, environmental and service specific texts appear in the TECNET menus. Global Positioning System and Radar calibration Satellite operations are chronicled on TECNET. TECNET remains one of the few DDN computers to fully integrate facsimile capabilities with electronic mail. Most importantly, TECNET houses the DoD T&E Assets Data Base.

This data base defines Government and private T&E assets valued over one- million dollars. It contains over 4,000 plus records extending through DoD, other Government, industry and foreign T&E holdings. The existence of this data base established for the General Accounting Office that DoD had control over investments through knowledge of what was available within DoD. It supported the establishment of the CTEIP and became instrumental in supporting MSTIRC, T&E Reliance and the TERIB. It also gave rise to the second strong arm of TECNET, the classified version of TECNET.

In response to Operations Security concerns over the existence of the T&E Assets Data Base in early 1989, TECNET became deeply involved with the security and protection of the information it held. Initial extraordinary efforts were undertaken to enhance the security of the unclassified version of TECNET. These provisions have been regularly reenforced and further augmented with solid operating procedures. The TECNET unclassified system is certified at the C-2 level of trust and improvements continue. TECNET also accepted the long-term challenge to field a classified system. In 1991, an accredited System High SECRET version of TECNET became operational at the C-2 level of trust in an appropriately secured area of the Aberdeen Proving Ground. Using the same familiar TECNET software as augmented for required classified markings, the secure version of TECNET was formally accredited by the Army in 1991. Using the former JTF computer, last employed in the 1989 transition from Clemson, the secure version of TECNET became accessible only via STU-III or DoD's SECRET level Defense Secure Network Number One. As anticipated, use of the TECNET secure system has grown only slowly since it was fielded. In 1993, this system will be upgraded to a more flexible and less costly to maintain secure architecture. The new secure TECNET system will also soon contain substantive information of real value to the T&E community. Plans are now laid to field a compendium of data bases involving Electronic Countermeasures, Electronic Warfare threats, and DoD threat simulators. These substantive improvements will begin to show realistic payback in terms of secure TECNET utilization.

At the same time, the three leading DoD data bases that contain information concerning test assets and facilities, including the DoD T&E Assets Data Base, are also being effectively combined under the TECNET roof. Operating under a common cursor driven user capability, these data bases are to be housed on both the secure and unclassified versions of TECNET. Accessed individually or in combined fashion, they will contain appropriately classified information for the sites at which they reside. Thereafter, a common data base made up of all available T&E asset information will be developed as a single DoD standards compliant T&E resource data base designed to operate either on a stand alone PC data base or on TECNET. This combined data base capability was made possible by a TECNET sponsored effort through the Range Commander's Council (RCC) starting in 1990 to create a Common Data Dictionary involving T&E resources. The RCC Common Data Dictionary Group, chaired under the Naval Air Warfare Center Aircraft Division (formerly NAVAIRTESTCEN), has considered all known data bases involving T&E resource information. The data dictionary is currently modeled using a DoD compliant data modeling tool known as the ICAM Definition tool. The creation of the combined data base will be under agreements among the services independently engineered by TECNET. The designated Program Manager for this capability, however, will not be drawn from within TECNET. Rather, TECNET supports the concept of data base management under appropriately designated subject matter experts. TECNET shall only serve as the conduit to deliver the informational products so derived to appropriate consumers. When the resultant data base is folded into the secure TECNET system, the DoD T&E community will have truly arrived in the electronic age. For the first time, a current, classified electronic resource will exist which permits effective test and test investment planning throughout DoD. At that time, use of the secure TECNET computer is expected to skyrocket.

Figure 1, graphically defines the TECNET configuration for the near term as described above.

In the meantime, while like systems tended to seek increasing budgets in 1993, TECNET announced a 20% reduction over its initial 1994 budget. Through consolidation, rightsizing, and reexamination of work flows, TECNET can take advantage of the dramatic cost reductions made possible through the rapidly evolving computer industry and concerted internal controls. This move was taken only after development of a detailed TECNET economic and sensitivity analysis capability. This capability serves as the foundation of a complete TECNET business case. The analysis demonstrates that TECNET O&M realizes great savings as compared to alternative methods, delivers more than comparable Government systems, and costs less than a similar, but far less custom, commercial services. At the same time as reducing O&M expense, TECNET plans to greatly expand its services to keep pace with demand. The TECNET R&D program continues to pay cost effective dividends.

TECNET R&D centers on three critical areas: enhanced user capabilities, assisted access to heterogeneous data whether structured or not, and a MLS capability. This research is vital, ongoing, and presses the state of the art in network capability.

TECNET's users guide its development. User complaints, gripes, comments, and suggestions from a variety of sources are all carefully recorded and tracked. The resulting data base yields periodic Pareto charts that point toward statistically significant and user desired system characteristics. The Pareto chart, together with industry trend assessments, strongly influence the direction of TECNET development. All emergent capabilities in TECNET progress from Alpha testing to Beta testing and finally to production. Likewise, as new capabilities enter into production, logging and statistical process control techniques help track detailed system utilization trends. Thus, TECNET is a closely monitored laboratory where new capabilities are always candidates for further improvement. A number of new capabilities are coming to the forefront in 1993.

TECNET users have long desired an online conference capability. Such a moderated capability will migrate from a carefully controlled Alpha test environment to active Beta testing by summer's end in 1993.

The long established TECNET main menu has recently received criticism as being far too obtuse. Many feel it aims at computer function as opposed to true T&E support, thus hiding many important T&E features. In August 1993, TECNET plans to unveil a new menu system designed to permit direct navigation to valued T&E information. This new menu will also support direct entry of desired capabilities based on keyword selection. At the same time, a new user mode based on an interactive cursor driven activity will enter into Beta test. Critical user feedback will be sought on these proposed features in an August 1993 user's Forum. The earlier Beta test user mode, a version of a risk free menu called "novice mode," will be introduced into production prior to Beta test of these new features.

With the forthcoming cursor mode, TECNET will support five selectable user interfaces designed to suit individual tastes: a novice mode, a menu mode, a command mode, a cursor driven mode, and an unprompted expert mode. With the advent of X-windows and PC based point and click interfaces characterized by PC windows, Windows NT, and the Macintosh, TECNET faces yet another new interface challenge. While retaining the five character based modes, TECNET must now also operate in these advanced and highly standardized graphical environments. A major rewrite of the underlying TECNET software will make these capabilities available far before DDN and other DoD protocols will be able to support them with the requisite data rates. TECNET will respond by increasing dial-up rates to greater than the current 9600 baud capability.

The concept of "groupware" for decision documentation and support represents another advanced field with great potential. TECNET will soon introduce rudimentary tools for "different time, different place" moderated brainstorming among defined interest groups. A companion "rack and stack" type of tool will permit designated users to "vote" on an array of defined concepts. This voting capability serves as a means for remote users to rank options either selected during the brainstorming phase or as presented by a moderator. TECNET intends to field such geographically independent decision support tools to conduct its own Steering Committee business more effectively and economically. In so doing, the emergent capability will begin to take shape for general use. The planned return on the investment is reduced travel and, hopefully increased small group efficiency in cases where the group is distributed.

Where possible, TECNET plans to link to remote hosts supporting needed information. Rather than attempting to house this information locally, TECNET has chosen to take advantage of what already exists. In 1993, TECNET made such a vital linkage with the DoD Environmental community's electronic bulletin board capability. Similar cost effective linkages are planned in the coming months. Increasingly sophisticated access and data transfer techniques will emerge.

TECNET is also investing in future information handling technology aimed at access to heterogeneous information scattered throughout the world. Such investment may well prove significant for DoD. The shift from fully fielding mature technology to developing production ready weapons systems profoundly affects DoD acquisition methods. The related concepts of technology transition and insertion becomes far more meaningful. Access to relevant technology information, fueled by fast emerging scientific and technical information, becomes critical in an environment characterized by rapid scientific advancement and punctuated by latent production capability. As field warfighter requirements continue to appear electronically, the affect on modern warfighting capability will be dramatic. Acquisition based information systems must be sufficiently responsive to meet this rapidly evolving information mandate. In the interim, DoD continues to stress the importance of developing tightly coupled information systems under Integrated Computer Aided Software Engineering methodologies. While such data driven transaction oriented systems are essential to the orderly conduct of DoD's business, technology based information will become far more elusive. It lives and breathes in the Internet. Those who need to pursue such data must be provided the necessary tools. These tools extend far beyond tightly coupled data bases.

TECNET decided to first attack this issue head-on and right at home. TECNET now houses significant amounts of relevant T&E information in many forms and formats. Unfortunately, there is no search capability to seek all the information available on any given topic within the TECNET information base. Thus, TECNET proposes to introduce a

"Hypersearch" capability in 1993. The initial capability will provide a user with all relevant information pertaining to searches as specifically defined by user request. This capability will launch a new phase in TECNET's continuing evolution.

Hypersearch initiates a larger quest. The need to access relevant information in the broader context of the Internet becomes more crucial by the day. Existing tools such as the World Wide Webb, WAIS, and a number of enterprising "Gophers" support such initial search capabilities. TECNET is in the initial phases of experimentation with these tools. While promising, they can yield limited results and consume costly resources in their execution. Directed searches must be better focused. They must know how to target high payoff sources and perform searches against the resources therein. They must yield maximum results at lowest expense. Advanced search capabilities must be able to target highly structured data bases and free text with equal ease. They must be able to interpret complex data structures, such as models and reusable software. They must glean intelligence from pictorial material. They must be able to interpret user requests in a contextual framework. In short, they must be smart.

TECNET, together with a number of leading DoD agents for technology transition and information transfer, will soon participate in a series of planned experiments based on such an intelligent search capability. The TECNET component of the emerging capability will be nested in the TECNET T&E resource data bases. Directed intelligent search capabilities will be employed to better isolate relevant test capabilities based on rather "fuzzy" user requirement statements. The results will be based on weighted criteria. Likewise, TECNET will draw upon other identified and shared network based resources among the other experimental participants to fully support answers to technology based questions. While oriented to corporate learning, this series of experiments will give rise to new capabilities not yet imagined. Unfortunately, as these experiments proceed, the issue of security will become paramount. The technology data derived will undoubtedly become too sensitive to treat in an open and shared environment. Thus, security considerations, particularly the role of MLS, cannot be ignored.

The existing classified TECNET system serves as a precursor to the desired MLS TECNET capability. Such capability obviously depends on what hardware and software the National Security Agency (NSA) approves. The hardware and software components of MLS are important, but as parts of a system, they are not the total solution. A system also comprises policy, procedure, and labor. In the absence of overarching national MLS policy, procedure must be developed. Likewise, labor requirements to operate a true MLS system must be fully defined and documented if adequate network resourcing is to occur. These components must be wrapped into a tightly coupled, well regulated "system" before an intelligent accreditation decision can be rendered. TECNET has engaged in a funded 1993 experiment aimed at empirical documentation of the policy, procedure, and labor components involved in fielding a nationally networked MLS capability. Involving Air Force, Army, and Navy participants at designated service sites and working closely with NSA, TECNET is carefully documenting its findings. Documentation is taking shape in the form of NSA-based experimental templates for MLS systems. The 1993 MLS experimentation and documentation will give rise to 1994 work with emerging hardware and software systems rated at a level of trust to permit a true MLS capability on the scale envisioned for TECNET. While much remains to be accomplished, TECNET is making steady progress in defining methods by which information may be managed at varying levels of depth and corresponding classification. The plan is to migrate TECNET from the C-2 level of trust to the B-2 level of trust extending from unclassified through secret coresident on all TECNET machines and accessible by appropriately trusted users and hosts. Such management is essential if DoD is to preserve the national security in an increasingly insecure world where information has a measurable value.

Figure 2 graphically defines the TECNET configuration for the long-term as described above.

ABOUT THE AUTHOR

Mr. George Hurlburt serves as the Executive Secretariat for TECNET. He is responsible to the tri-service TECNET Steering Committee which, in turn, reports to the JCG for T&E. Mr. Hurlburt is a senior manager assigned to the Computer Sciences Directorate, Naval Air Warfare Center Aircraft Division, Patuxent River, Maryland. Prior to his full-time TECNET assignment, he ran NAVAIRTESTCEN's Information Resources Management (IRM) Office. In this capacity, he successfully launched a Business System Planning initiative which led to systematic adoption of corporate information engineering methodologies. Before this assignment, he served as a senior IRM systems analyst responsible for the design and implementation of lasting command wide information systems. Mr. Hurlburt managed NAVAIRTESTCEN's Technical Information Department, and spent 8 of his 16 years at NAVAIRTESTCEN as a special assistant on the staff of the Commander. Mr. Hurlburt is a former Naval Officer and possesses a bachelor of sciences degree from the University of Houston. He is a 1990 graduate of the Naval Air System Command's Senior Executive Management Development Program and served a 1 year developmental tour in the Office of the Secretary of Defense.

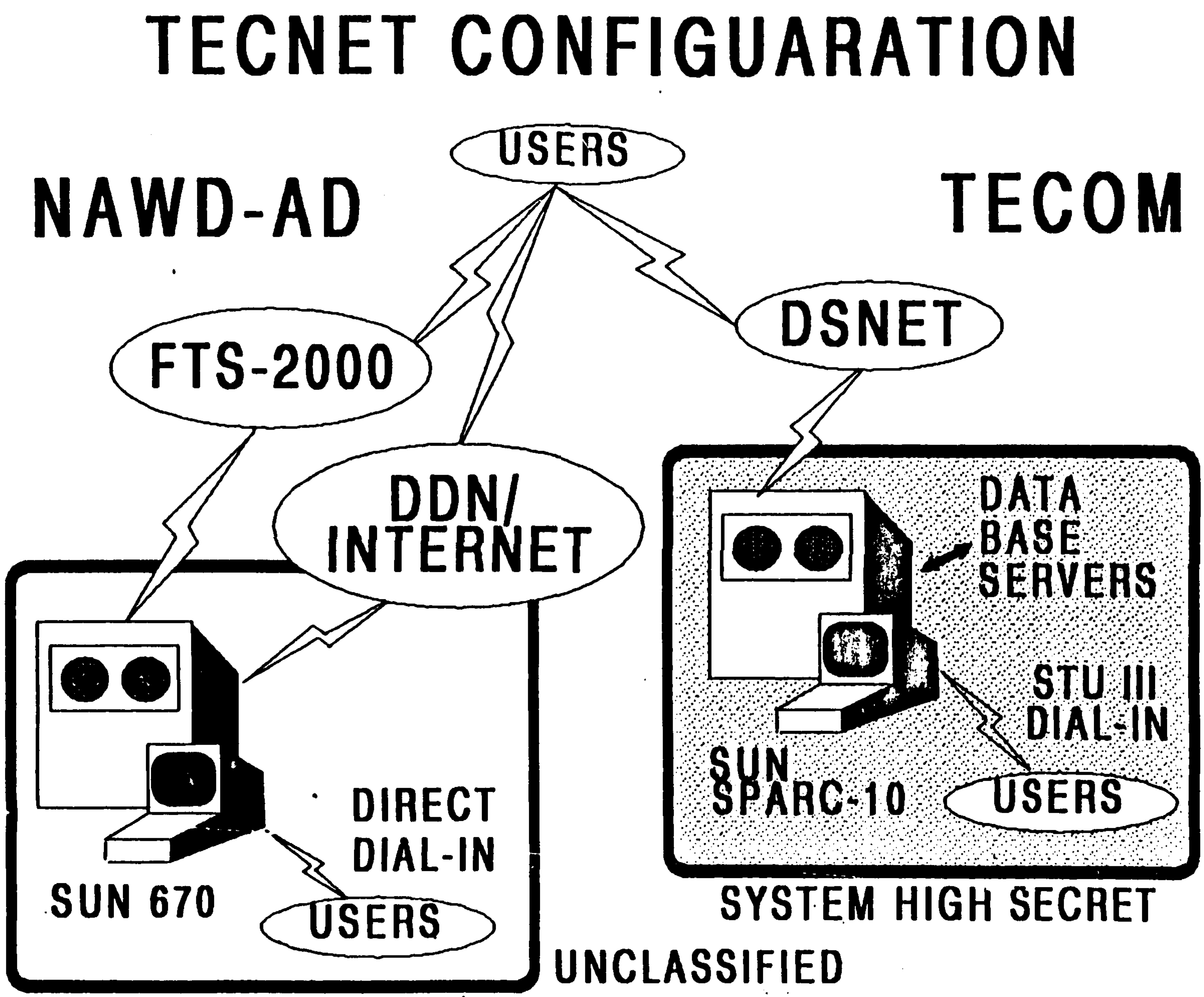


Figure 1
TECNET CONFIGURATION FOR NEAR TERM

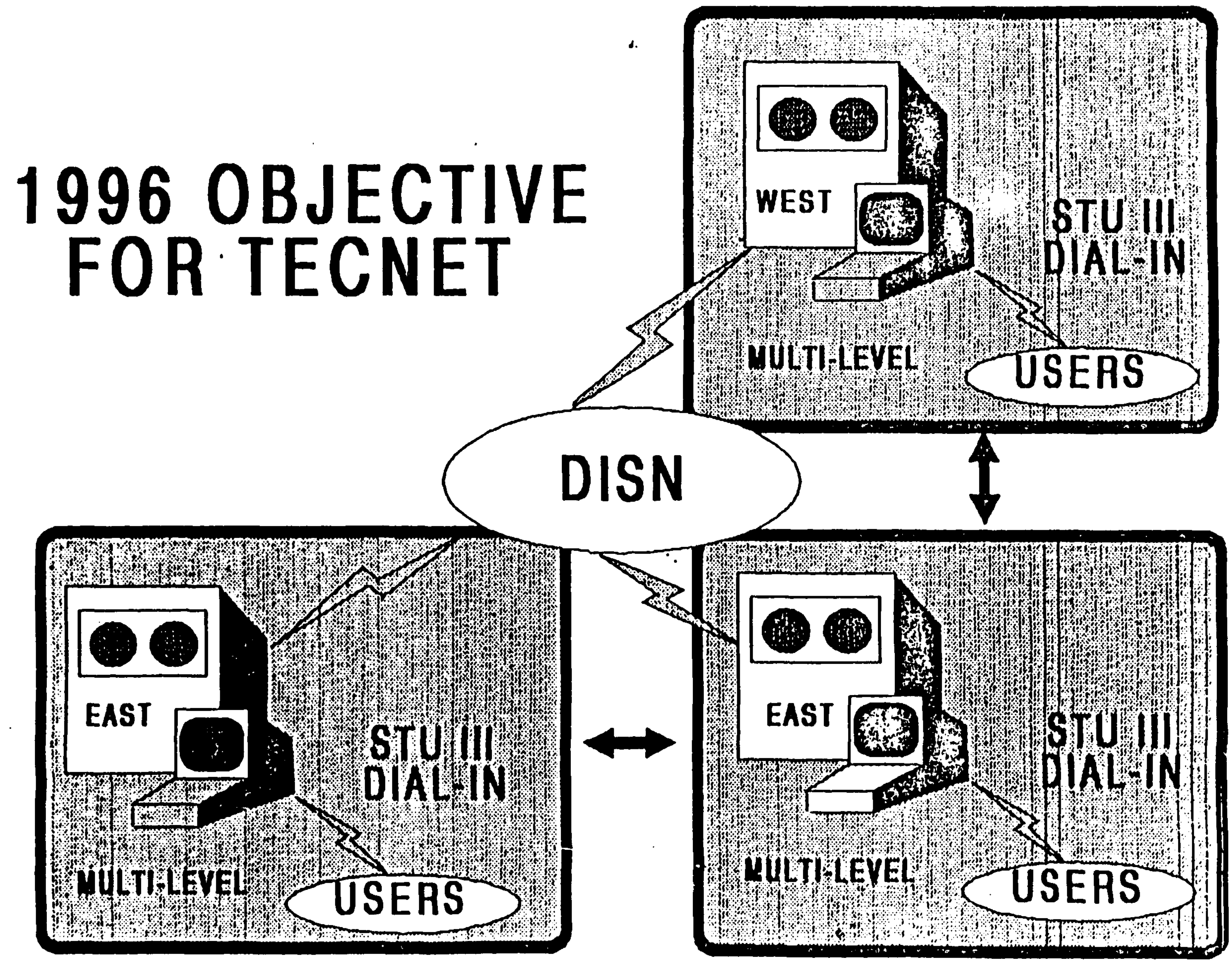


Figure 2
TECNET CONFIGURATION FOR LONG TERM

1994 holds many changes Read about them in this issue

TECNET staff changes, New talents on board; old friends move on

A forum for TECNET professional electronic-communications users

January 1994 *Vol. 4 No. 1*

TecNet Infoform

New TECNET menu system operational

The new TECNET Menu System was introduced in late December after several months of beta testing. This system takes advantage of several behind the scenes improvements which we made to the TECNET software over the summer.

These changes permit us to mix and match such things as bulletin boards, file repositories, FAX repositories, data bases and menus under a common TECNET menu selection. Now, rather than segregate like data by its structure as has been our practice, we can now link data by related subjects.

Thus, if a given subject area includes a data base, a bulletin board and a repository, all three of these selections can now appear under a common menu. Thus, to find information related to a given subject, it is no longer an adventure in menu searching.

We have tried to make the new TECNET Menu structure relate to the business of Defense Test and Evaluation. Of course, the new menu structure is different. Thus, it will require a bit of experimentation before you get used to it's layout. The exploded menu structure is revealed in a companion message found in the *tecnet Bulletin Board. You may wish to review this message.

New Production features

So that you have an idea of how much disk space your account occupies, an announcement of disk space occupied appears at each login. If you have a large amount of space in use, we encourage you to purge unused or out of date files. A temporary patch has also been moved which hastens access to the File repositories. We are working on even faster access to these repositories, but that may take a bit of time to implement.

Change In 'Bcc'

Due to a new version of the mail system that has been rolled to production, the Bcc field has been slightly modified. Individuals receiving a blind carbon copy will have "Blind Carbon Copy" displayed in the Bcc field as opposed to their user id which is how it worked before the new version was rolled. Likewise, the sender will not be able to verify who he has Bcc'd by referring to the message in his 'out' box. The message in the out box will simply display "Blind Carbon Copy" in the Bcc field.

More changes coming, stay tuned!

1993 gave us many new changes on TECNET. It's a safe bet that many more are going to come your way. Many new types of information too. Stay tuned!

New Facsimile (FAX) Capabilities

by C. Reid Harmon
TECNET Development Staff

TECNET is proud to present a major expansion of its FAX capabilities. The FAX problems recently associated with the production system of TECNET were related to preparations to introduce these new FAX capabilities. The FAX System is now once again fully operational. The enhancements include full compatibility between FAX and file repositories, the ability to automatically upload FAXes to a new personal FAX repository and greatly enhanced FAX addressing capabilities. The following outline details the specific enhancements:

I. The New File/FAX Repository System

Formerly the differences between the File Repository System and the FAX Repository System were significant, despite most operations of the two systems are really the same. To remove the differences, we have rewritten the file repository system. It now handles both files and FAXes. More importantly, both the repositories now have the same *look and feel.*

A. Repository location

The file repository is located under the "File Transfer/Repository Systems" option from the main TECNET menu.

The FAX repository is located on the 'FAX Repository Services' option under the 'FAX Services' option from the main TECNET menu.

B. Changes in the file repository system

There is one real change in the file repository system: It may now contain FAX, text and binary files. If you select a FAX on a File Repository menu, you will not be able to display its contents, but you are now able to FAX or forward it to a FAX or another repository.

By request, the Repository system menu is now a single-column menu, rather than a double-column menu, and includes the file size and file type.

C. Differences Between File and FAX Repositories

The behavior of file and FAX repositories is based on the nature of files and FAXes themselves. Therefore, it's important to understand what the differences are between each. The classification *file* refers to any item stored on the system. It may be one of three 'types':

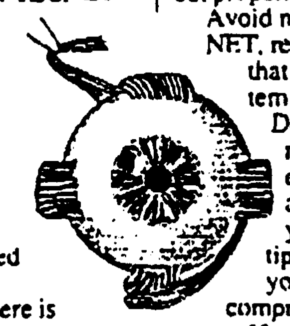
- Text: Text (or ASCII) files contain only letters, numbers, punctuation marks, and other symbols you can find on a keyboard. In short, text is readable material, typed in by hand.
- FAX: A FAX document is a graphics format; it describes where on pages there should be black spaces and printed spaces, which, as a whole, we perceive as symbols, drawings, and even writing. A FAX, then, is a type of file, at least when it is stored on TECNET. This distinction is important as we usually do not consider the paper itself someone

Continued next page
See FAX

DoubleVision – what's that?

One may ask if it's possible for two things to occupy the same space at the same time. On TECNET, it is not only possible, but happens more times than it should.

If you have to log off TECNET in a hurry, take extra second to enter the letter "E" to Exit at any point during your session. If you don't, TECNET keeps your account active and on-line for about 15 minutes. This time is actually tied to the timer that keeps track whether or not there is any activity on your account. If you don't touch your keyboard for that time, TECNET will log you off. What's worse, if you log back in within a 15-minute window after your first improper exit, TECNET will raise a red flag. The system now believes there are two people using your account at the same time.



Once DoubleVision is detected on your account, the system generates an attention message and sends it to your mailbox. Logging out properly will do three things: Avoid nasty notes from TECNET, reduce on-line charges for that period and reduce system congestion.

DoubleVision notes will make you aware of others who are using your account (with or without your permission). It also tips you off as to whether your password has been compromised.

If you are aware of another individual utilizing your account, we strongly urge you to register them for their own. If you are not we ask that you please contact TECADMIN and change your password.

FAX
Continued from previous page

has FAXed to/from be a computer file. In this case, the standard Group III FAX has been encoded as a computer file for it's life on TECNET.

- Binary: This is a catch-all category for every other type of file. Binary files can be compressed data, graphics, or DOS executable.

You now have your own personal FAX repository in which you may keep FAX documents, and forward them or FAX them out, just like you may with a public repository.

Each repository has an associated file type. File repositories contain every kind of file; FAX repositories contain only those files which can be FAXed. This includes FAXes, of course, but also text files which can be converted to FAX files.

There is one additional difference between the two repository types: uploads are restricted to file repositories.

E. Differences Between Action Menus

Once you select a file in a repository, the system determines its type, and then presents you with an Action Menu --- a list of options which you may perform on that file. Not all actions apply to all file types, so the menu is limited to only what you may do with that particular file. The following is a list of restrictions on the Action Menu selections:

- Download: Not available to FAXes, since as files they are stored with header information which PC FAX packages will not recognize.
- Display Contents: Available only to text files, since binary files can be of many formats, and FAXes can only be displayed on a graphics screen.
- FAX Out: Restricted to 'faxable' files, which are text files and FAXes.
- Forward to Another Repository: All types of files may be forwarded, but only 'faxable' files may be forwarded to a FAX Repository.

All other Action Menu options are available to all file types.

II. The Personal FAX Repository and automatic FAX uploads

You now have your own personal FAX repository in which you may keep FAX documents, and forward them or FAX them out, just like you may with a public repository.

The major difference is the ability to FAX a document directly into your own private FAX repository. The first step in FAXing yourself a document is to use a TECNET provided bar coded FAX cover sheet which identifies you personally.

To have a personalized bar coded cover sheet sent to you, or to another individual wishing to FAX you something via TECNET, select the Generate Fax Cover sheet option on the FAX Services menu, and fill out the necessary recipient information as requested.

Then use this cover sheet on top of the stack of document pages to be FAXed, and FAX the whole works to the number listed at the bottom of the coversheet.

Once TECNET receives your FAX, the automatic-routing system will scan the bar code at the top, determine that you are the intended recipient, place the FAX into your repository, and send you an electronic mail message that you have received a new FAX.

III. FAX Distribution Lists

A. FAX Addresses

On the new FAX Services menu, there is a 'Create and Maintain Fax Address Entries' option. With it, you may create FAX addresses (recipient name, office, organization, voice phone, and FAX phone information). FAX addresses are distinguished by other kinds of addresses with a preceding dollar sign ($).

B. Distribution Lists

Under the 'Create and Maintain Fax Address Entries' option is the 'Mail Distribution List Manipulation' option, which allows you to create and edit mail distribution lists. The new distribution lists, used by both the mail and FAX systems, allow you to specify recipients by either electronic mail (E-mail) addresses, or FAX addresses. For example, you may create a distribution list called 'help', which contains the following:

tecadmin,reid@tecnet5.cs.clemson.edu,$joe

FAX addresses are distinguished by other kinds of addresses with a preceding dollar sign ($)

The first two items are both E-mail addresses, but the last item, '$joe', is a FAX address, which is recognized as a FAX address by the dollar sign ($).

- **Mail System Treatment of Distribution Lists. If you mail a** message to #help, your private distribution list, recognized as a distribution list by the leading pound sign (#), the mail system will send an E-mail message to tecadmin and reid@tecnet5.cs.clemson.edu, but will FAX a message to the recipient specified by $joe. This is helpful for including people in your distribution lists who have FAX machines, but no E-mail address.
- FAX System Treatment of Distribution Lists. If you send a FAX to #help, the FAX system, being unable to send a FAX via E-mail, will ignore the E-mail addresses in your distribution list, and use only the FAX addresses.
- FAX Requests. Since distribution lists are now supported, there have been some changes to the interactive FAX Transmission Request system. At the 'To' prompt, there are now

Continued next page
See FAX

FAX
Continued from previous page

three choices with which you may specify recipient(s).

1. By Name and FAX Phone

This method has not been changed. You may enter information on each of the fields to specify a recipient. The default entry is shown in square brackets ([]). The 'To' field, and the two fields specifying the FAX phone number must be filled out.

2. By FAX Address

Instead of specifying each field, at the 'To' prompt you may instead specify a FAX address (e.g. $joe), and the field information from the FAX address will be used instead. This is a great time-saving advantage for when you have someone to whom you regularly send FAXes.

3. By Distribution List

In specifying a distribution list (e.g. #help), all of the FAX addresses are displayed, and each becomes a recipient. This is particularly helpful when you have a group of people to whom you send FAXes.

After you enter this information and specify one or more recipients, you will encounter a 'Add Send Quit? [Add]:' prompt. You may enter an 'S' to send the FAX to your list of recipients, a 'Q' to quit the request and not send the FAX, or an 'A' (by default), which will take you back to the 'To' prompt and allow you specify more recipient(s). In this way, you do not have to make a distribution list just to send a FAX to more than one person at a time. If you have a FAX that you wish to send to Joe and Mike, then you may enter '$joe' at the 'To' prompt, an 'A' to add another recipient, '$mike' at the next 'To' prompt (if you have created a FAX address called 'mike', that is), and then an 'S' to send the FAX.

This flexibility should greatly enhance the utility of the TECNET FAX system.

IV. Questions

TECADMIN, (301-826-7501) stands ready to assist with the use of These new TECNET features.

Please direct any questions or comments about the new Repository system and FAX Distribution List usage to the *comments or the *bugbox bulletin boards as appropriate

C. Reid Harmon Jr. - TECNET Development Staff reid@tecnet5.cs.clemson.edu.

December breaks new record

With its holidays, December is traditionally slow in terms of TECNET utilization. While many TECNET users focus on family and friends at month's end, TECNET statistics tend to show a corresponding decline.

Despite this annual trend, TECNET records were set in December for the number of unique users and the total number of registered users.

The total numbers of accesses and the overall connect time, while not record breaking, were still very respectable figures. These numbers placed December at the third highest spot and well above many previous months.

Despite expected slowdown at month's end, the system utilization was significant during the weeks before the holidays. Thus, the seasonal dip was not as pronounced as in past years.

TECNET had little in the way of internal problems in December, save for an indiscrete circuit board which decided to become unseated late on December 27th. This board was re-seated that evening with no further problem. Most of the problems we observed were external to our environment. In early December, we experienced some severe problems with our Defense Data Network (DDN) circuit which backed up our outgoing mail for a little over a day.

Our focus on this external problem helped lead to its timely conclusion. We also have indications that some DDN and Internet mail is not getting to us.

While we are tracing these reports, they tends to be elusive as they are rooted in the DDN or Internet network routing infrastructures. If you know of traffic not getting to us, it would be helpful to tell us the originating host computer from which the traffic was sent. We are also still tracking the very elusive FTS-2000 performance problems which are sporadically reported to us. Again, your reports are our lifeline to better serving you as you access TECNET.

NAWC SMTP Directory is now online

For those of you wishing to correspond with individuals in the Naval Air Warfare Center (NAWC) a new remote connection to the on line NAWC Simple Mail Transfer Protocol (SMTP) is available. This feature permits a search by name for individuals in the NAWC structure. The feature is available from the new Access Remote Internet Services Menu.

More news than ever before

In case you haven't noticed, the *newswire and *news bulletin boards should keep you abreast of just about anything that is happening in the world today.

The China, Russia, SouthEast Asia and Croatia news are only some of the new products available.

Now there is no reason being kept in the dark when things are happening all around the globe.

Next time you have a few moments, stop on by and see what's going on in the world.

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9

DoD Strategic Data Model

- Background
- DoD Strategic Data Model
- Using the DoD Strategic Data Model
- Summary

DoD Strategic Data Model: Background

- POINT OF VIEW
  - Secretary of Defense
  - Civilian - Military Leaders
- PURPOSE
  - Standard Framework for Identifying:
    - Improvement Opportunities
    - Anticipating Impact of Management, Process, & Technology
  - Provide Initial Set of Prime Words - Data Standardization
- RELEASE FOR COMMENT - 22 March 1993

DoD Strategic Data Model: Background

- Respondents as of 15 Sept 1993

- Army	8	- Navy	1
- Air Force	1	- Agencies	3
- Functional Areas	5	- CINCs	1
- Program Offices	1	- Contractors	7

- Recommendations, Comments, Questions - 157
  - Add Entities
  - Add Relationships
  - Change Definitions

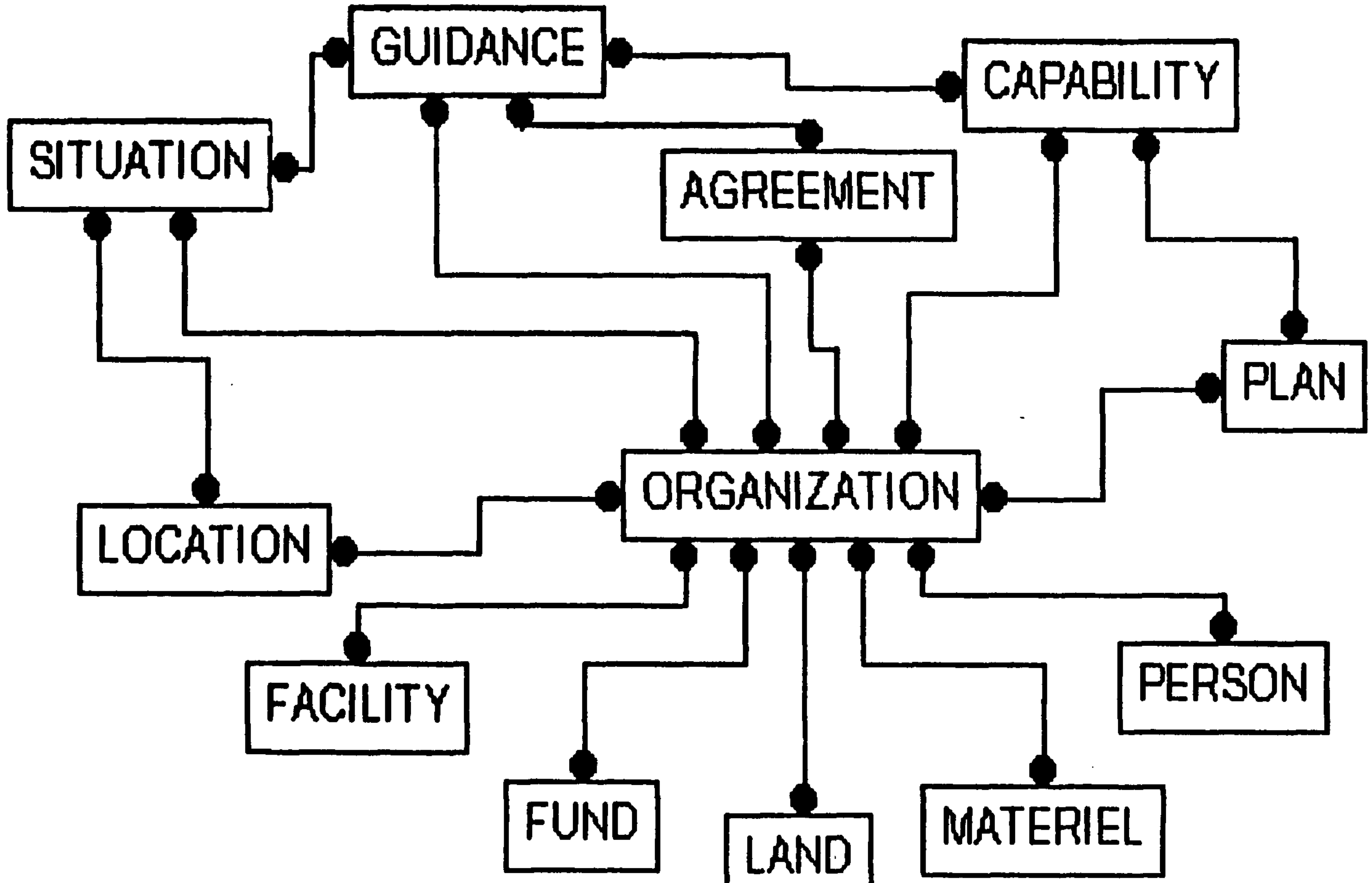
DoD Strategic Data Model: Background

- Integration/Reconciliation Working Sessions
  - Command & Control
  - Defense Mapping
  - Acquisition
  - CALS Community

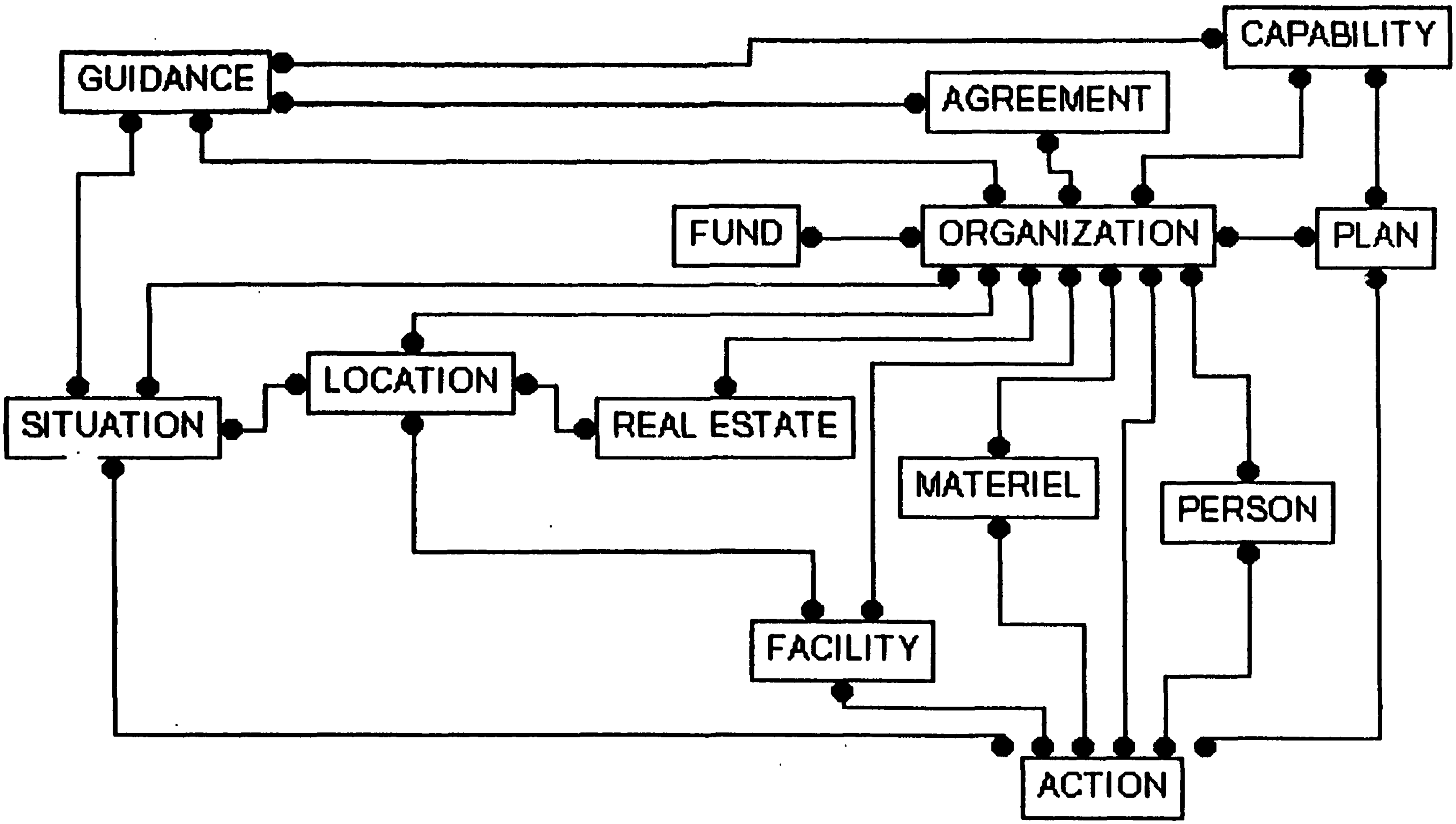
IDEF

- Observations
  - Information About... vs. Content of...
  - Strategic Data Model vs. Functional Area Data Model vs. Model for Data Element Standardization

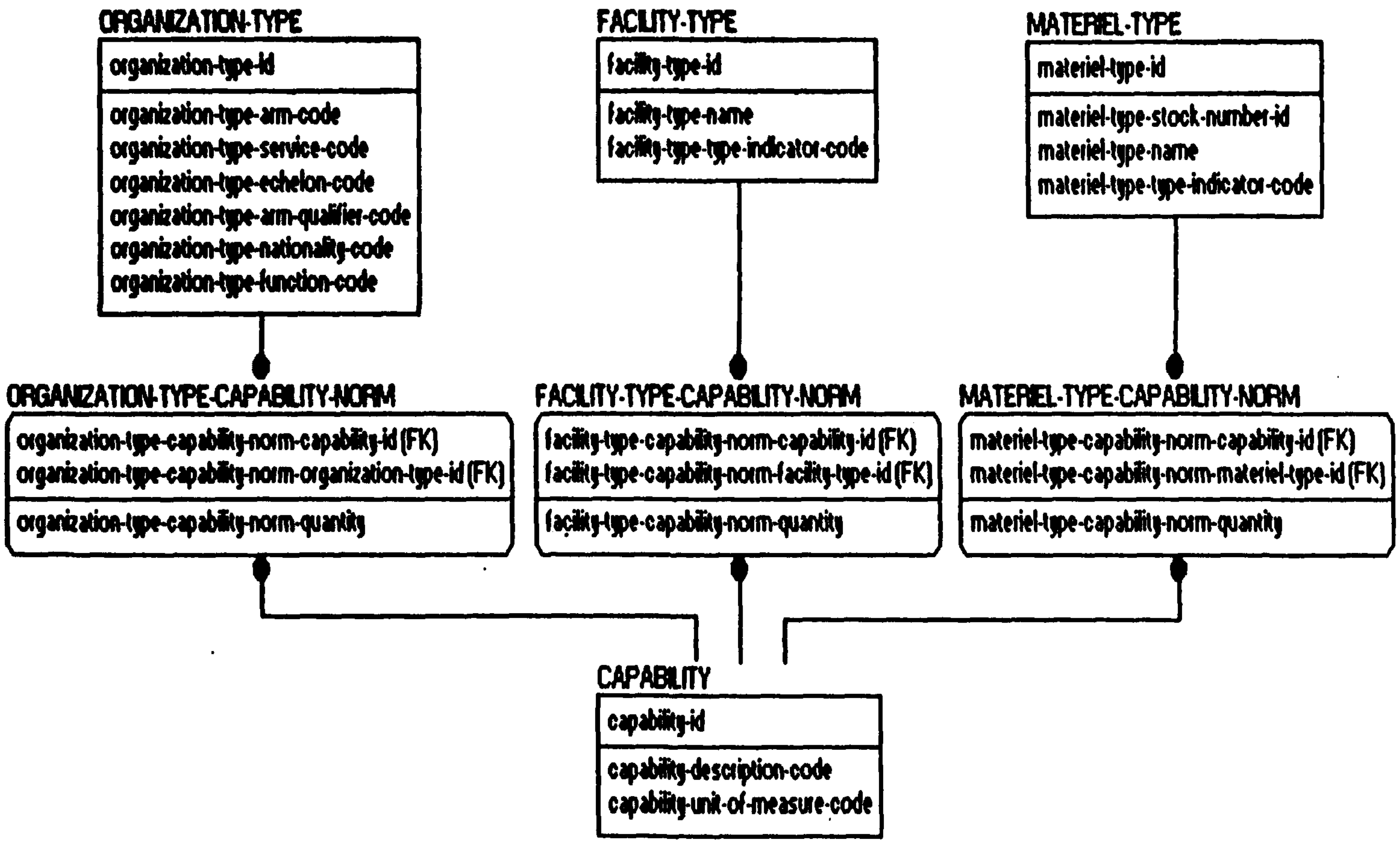
DoD Strategic Data Model: Before Picture



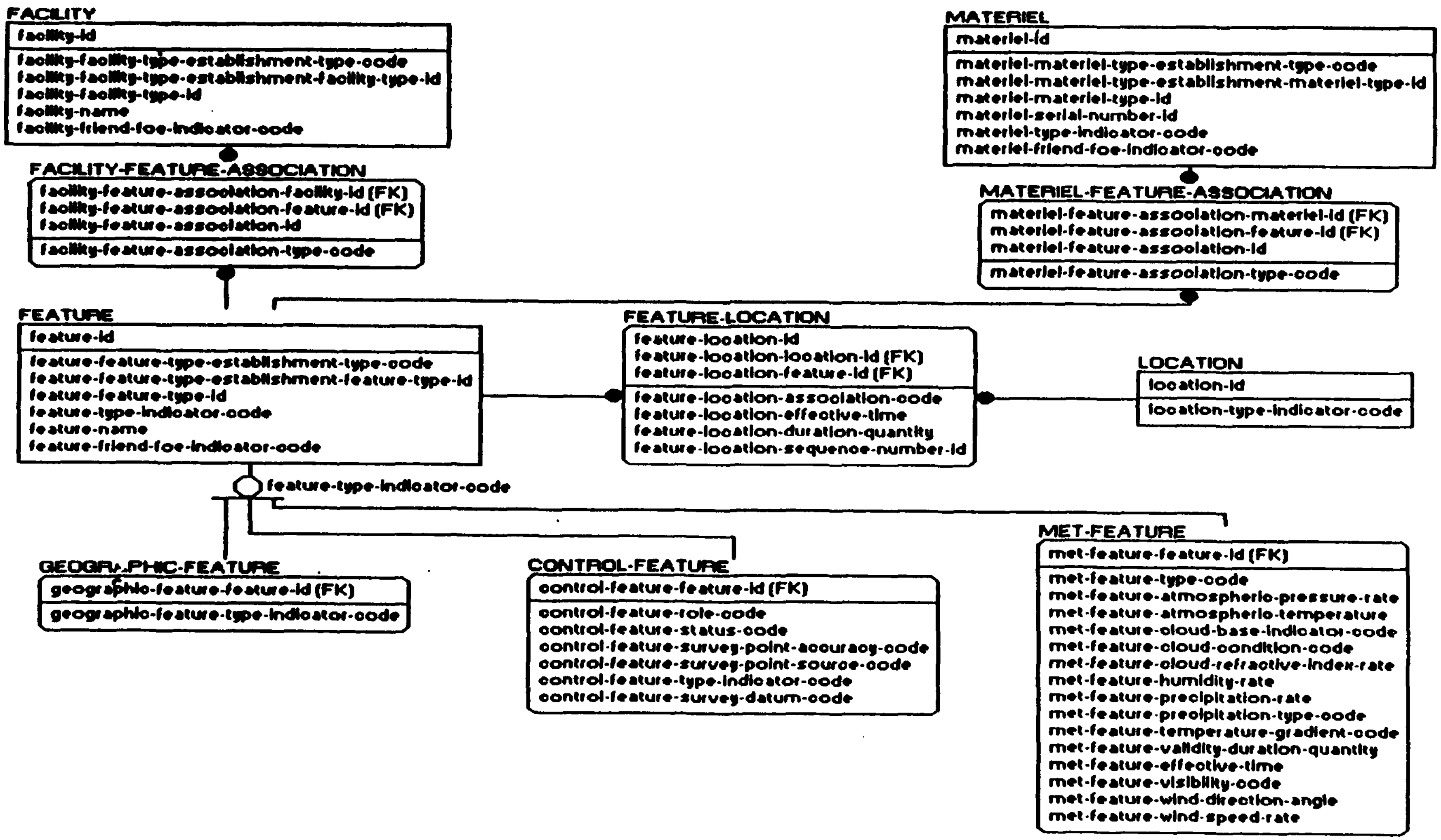
DoD Strategic Data Model: Proposed Update to White Paper



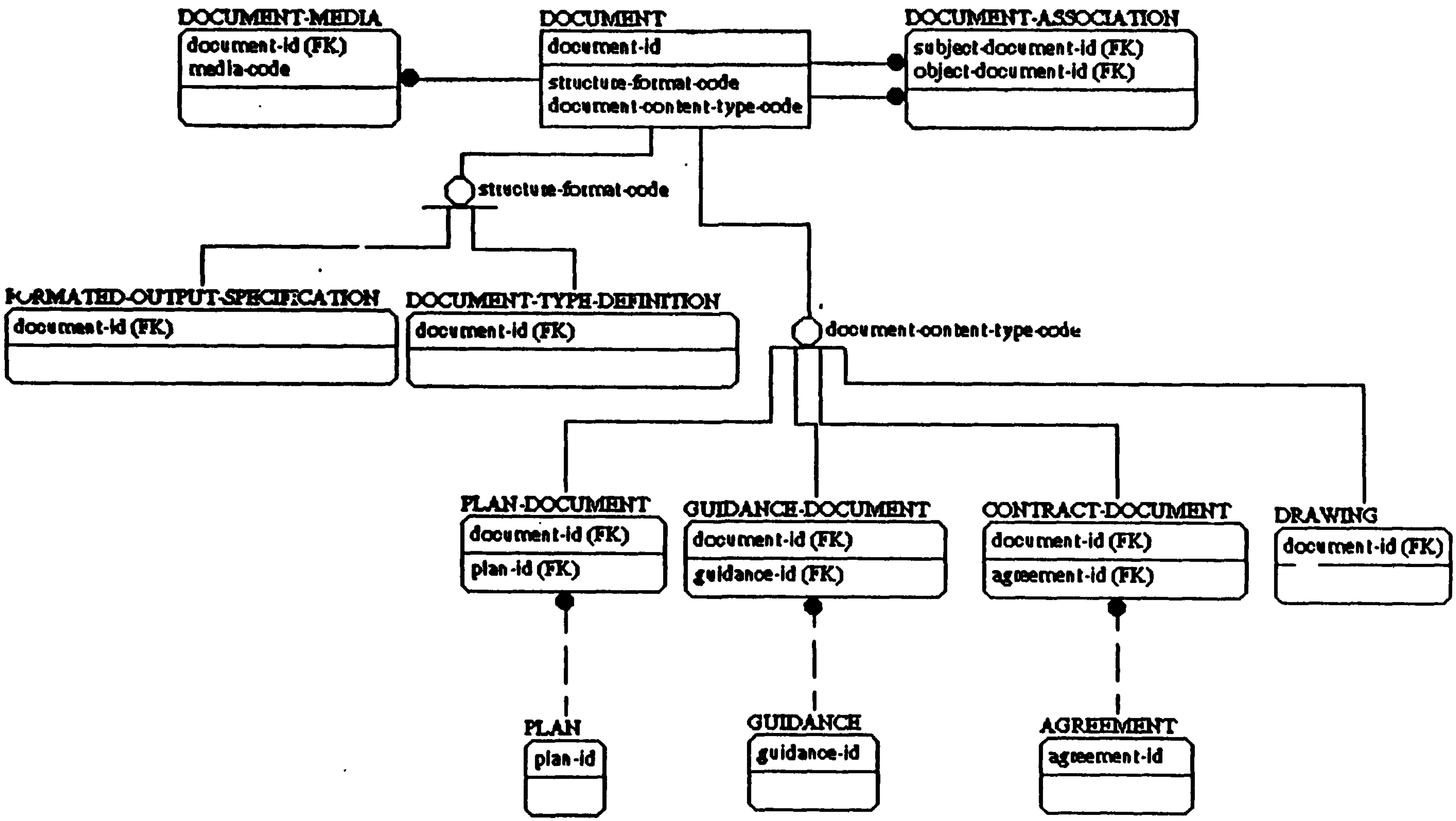
Using the DoD Strategic Data Model: EXAMPLE OF FUNCTIONAL AREA VIEW



Using the DoD Strategic Data Model: EXAMPLE OF FUNCTIONAL AREA VIEW



Using the DoD Strategic Data Model: EXAMPLE OF FUNCTIONAL AREA VIEW



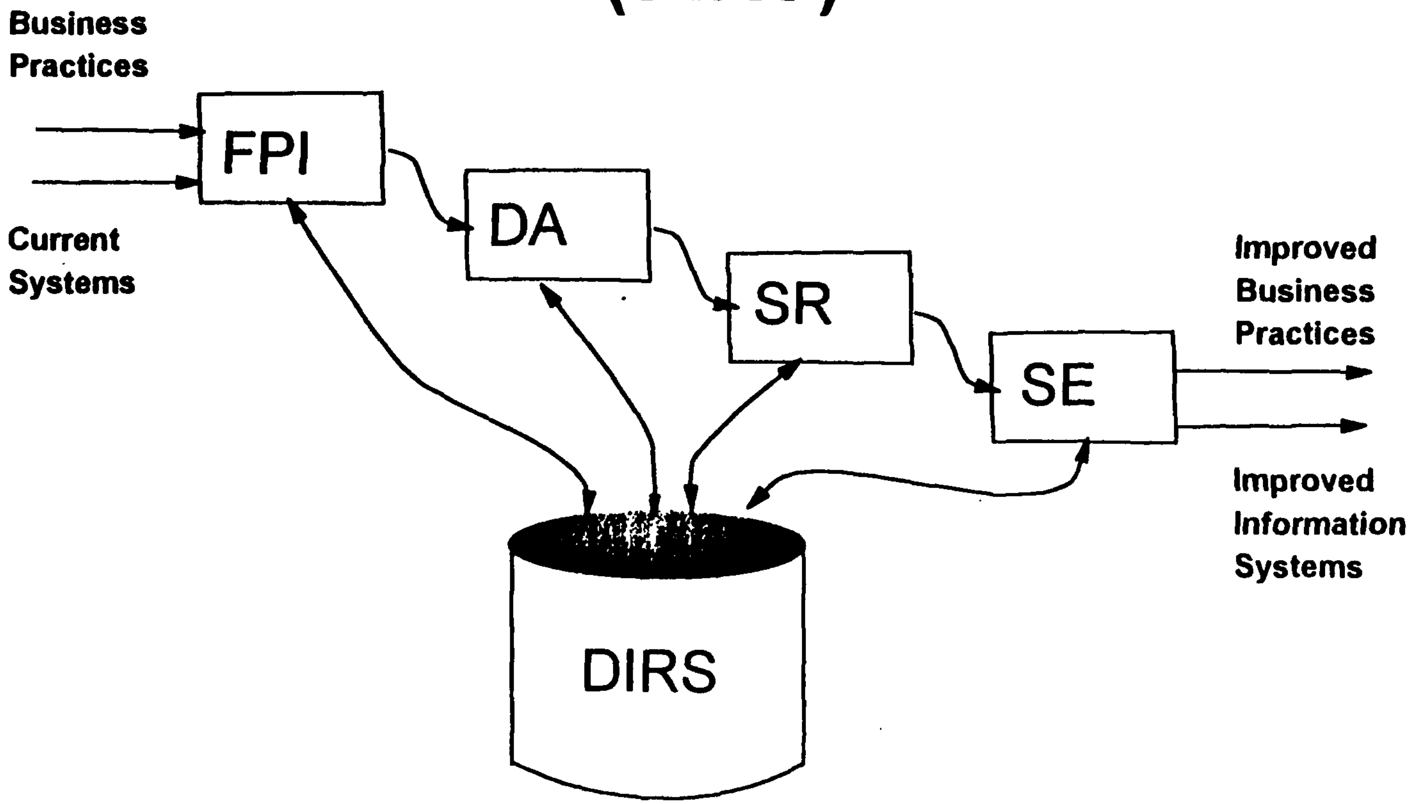
Summary

- DoD Strategic Data Model
  - Single Data Model - Single Starting Point - Single Data Architecture
  - Guidance to Functional Area/Component Data Modeling Efforts
    - View of Senior Officials within the Department
    - Concerning Information Critical to Management of Department
- Use of the DoD Strategic Data Model
  - Strategic Data Model - Relatively Stable
  - Mechanism Supporting Enterprise, Mission, and Functional Area Integration
- DoD Data Model
  - Collection of Integrated Functional Area and Component Data Models
  - DoD 8320.1 Series Guidance

1-800-225-3842 DTIC.

10

Defense Information Repository System (DIRS)



DIRS Project

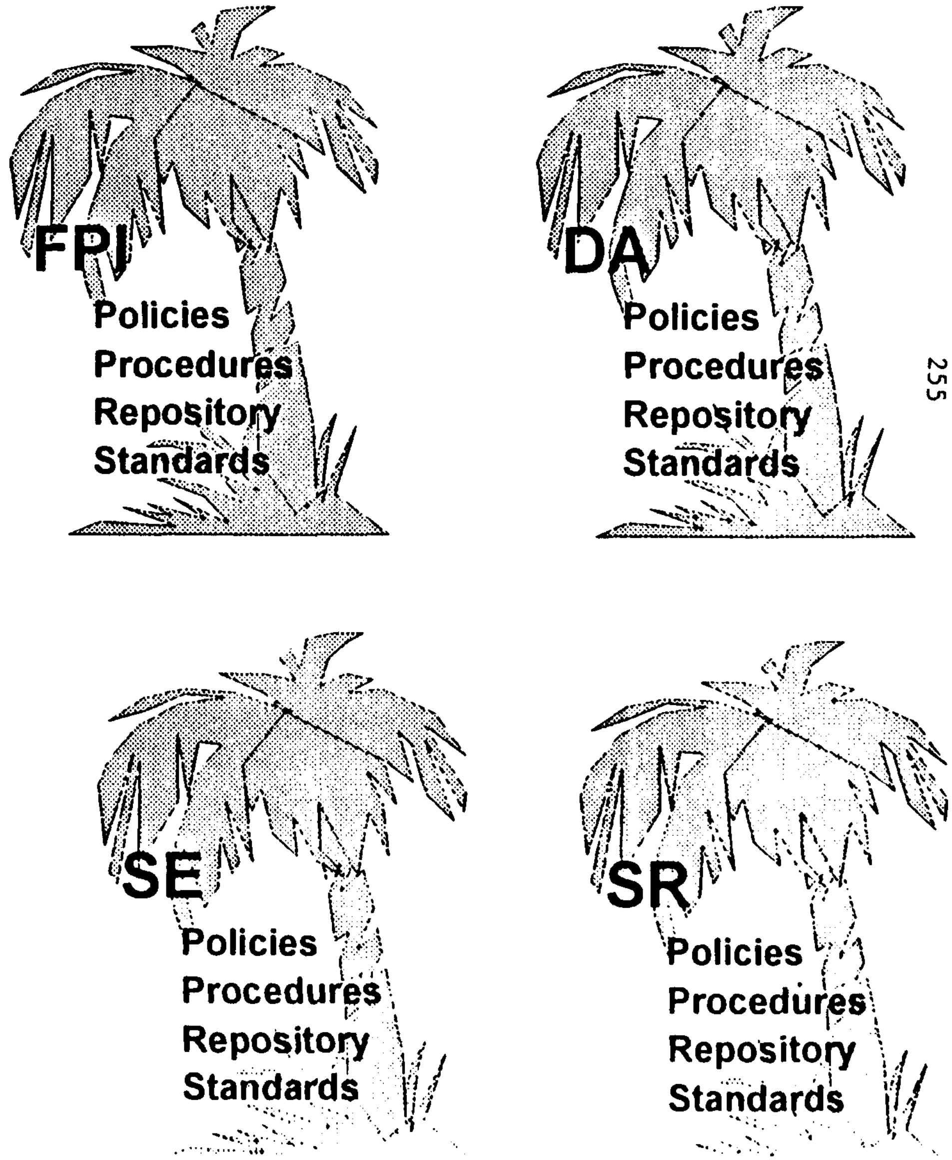
Description

- Analysis of key Defense IM Programs
- Major activities represented
  - Functional Process Improvement (FPI)
  - Data Administration (DA)
  - Software Reuse (SR)
  - Software Engineering (SE)
- Purpose
  - Develop requirements for a DoD information repository
    - Develop conceptual data model that can serve as common meta model for DoD information repositories
  - Vehicle for decision on DoD IM repository strategy
  - Provide analysis for improved program interoperability

DIRS Project Background

As-Is Environment

- **4 Active Programs**
- **Requirements for:**
  - Program Interoperability
  - Data Sharing
  - Process Improvement



DIRS Project

- Requirements Analysis
- Data Standardization
- Technical Analysis
- Implementation Decision
- Acquisition
- Implementation

DIRS Project

Organization Participation

- CIM
  - FPI
  - DA
  - SR
  - SE
- DISA
- DoD Components
  - Department & Agencies
  - Requirements & Development
- NIST

DIRS Project Participation

Areas of Expertise

- CASE Data Interchange Format (CDIF)
- Computer-Aided Acquisition and Logistics Support (CALS)
- Data Modeling
- Data Standards
- Modeling and Simulation
- Domain Modeling
- Domain Specific Software Architecture
- Software Reuse
- Object Oriented Technology
- Functional Process Improvement
- Software Development
- System Integration
- Technical Process for Information Management
- Software Reengineering Working Group

DIRS Project

Requirements Analysis

- As-Is Analysis
  - Data Model
  - Activity Model
- To-Be Analysis
  - Activity Model
  - Data Model
- Requirements Definition
  - Consolidated Studies
  - JAD sessions

Improvement Opportunities

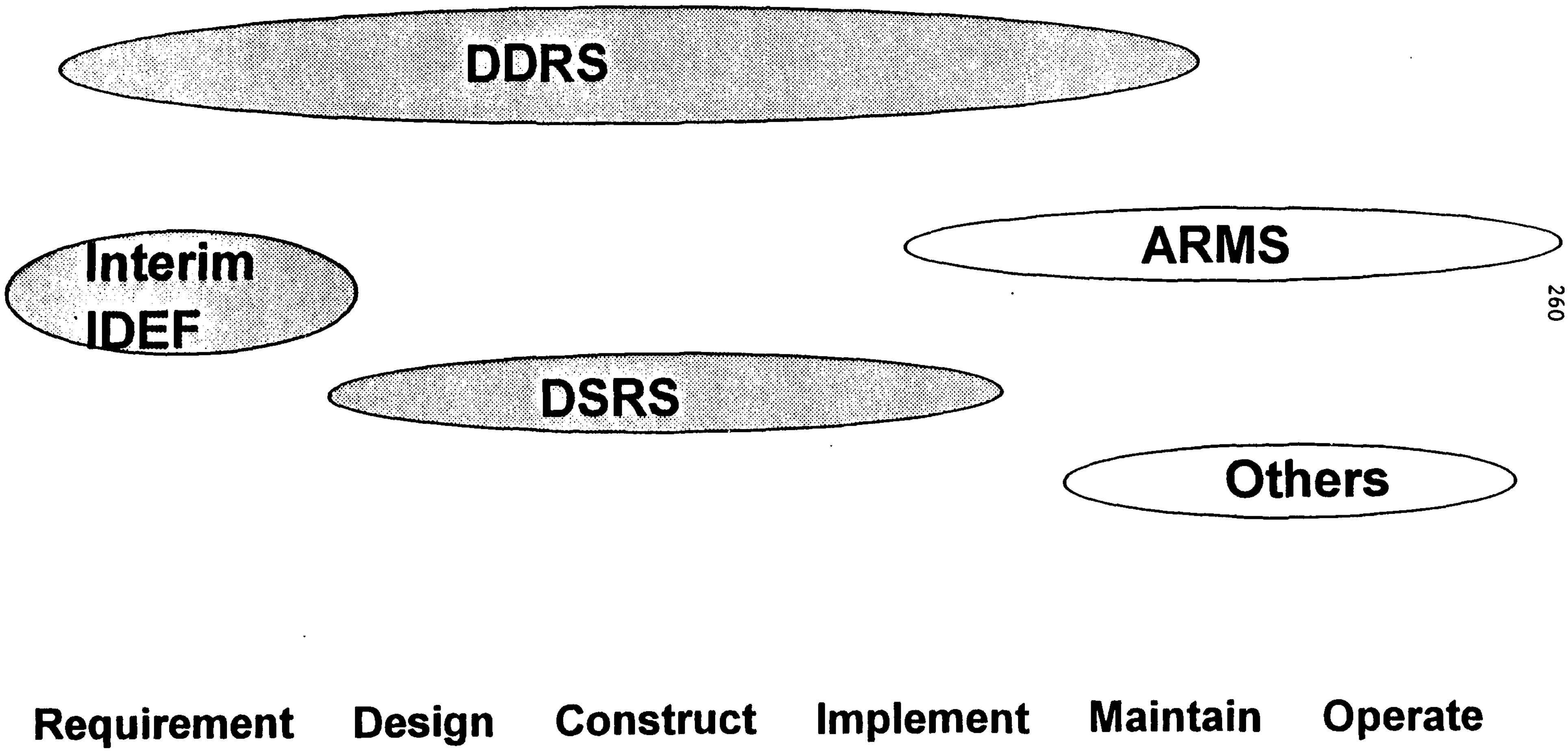
Repository Meta Model

Repository Functional Description

DIRS Project

As-Is Analysis

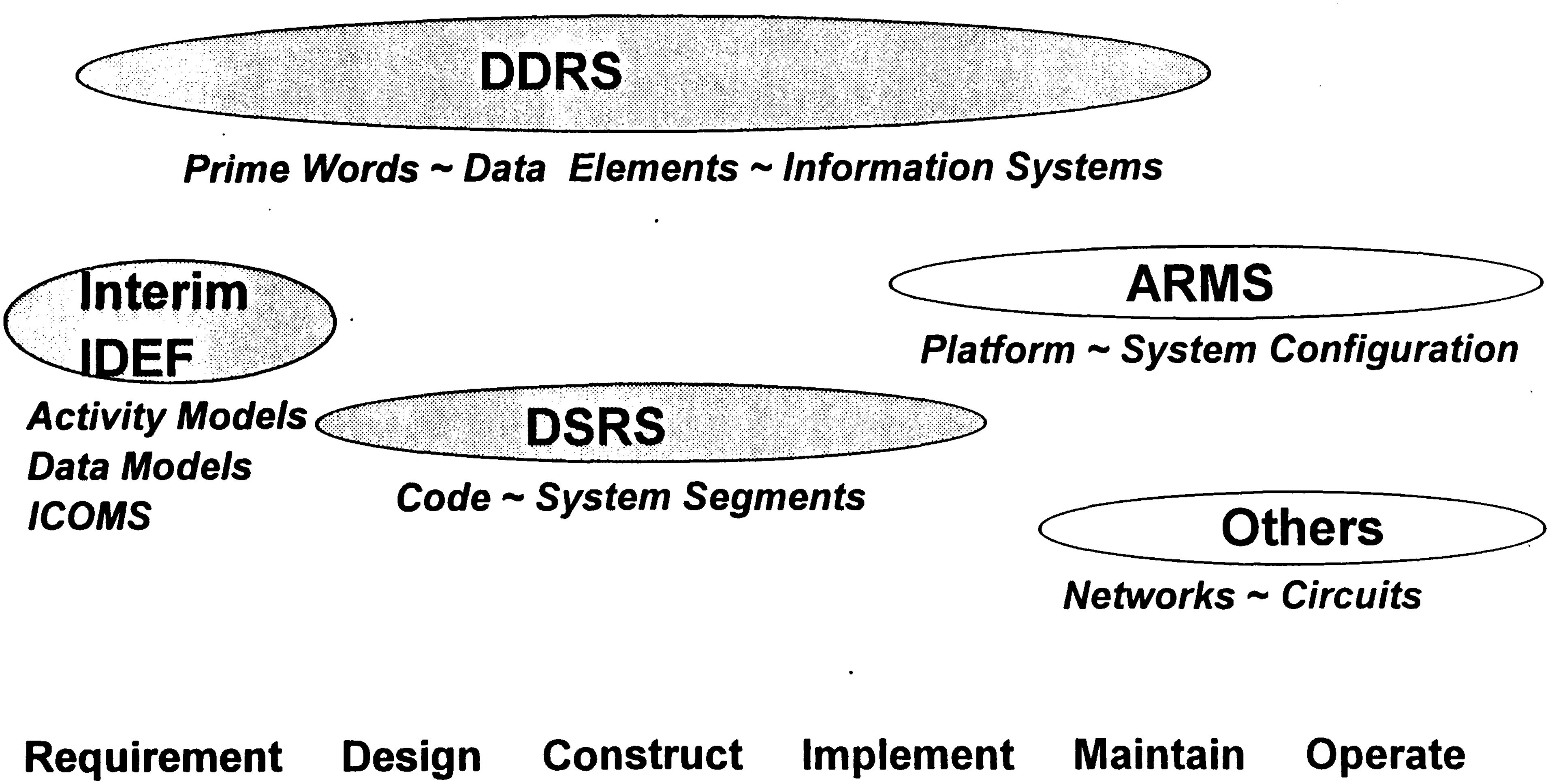
Overlapping Life Cycle / Customer Support



DIRS Project

As-Is Analysis

Redundant Non Standard Data



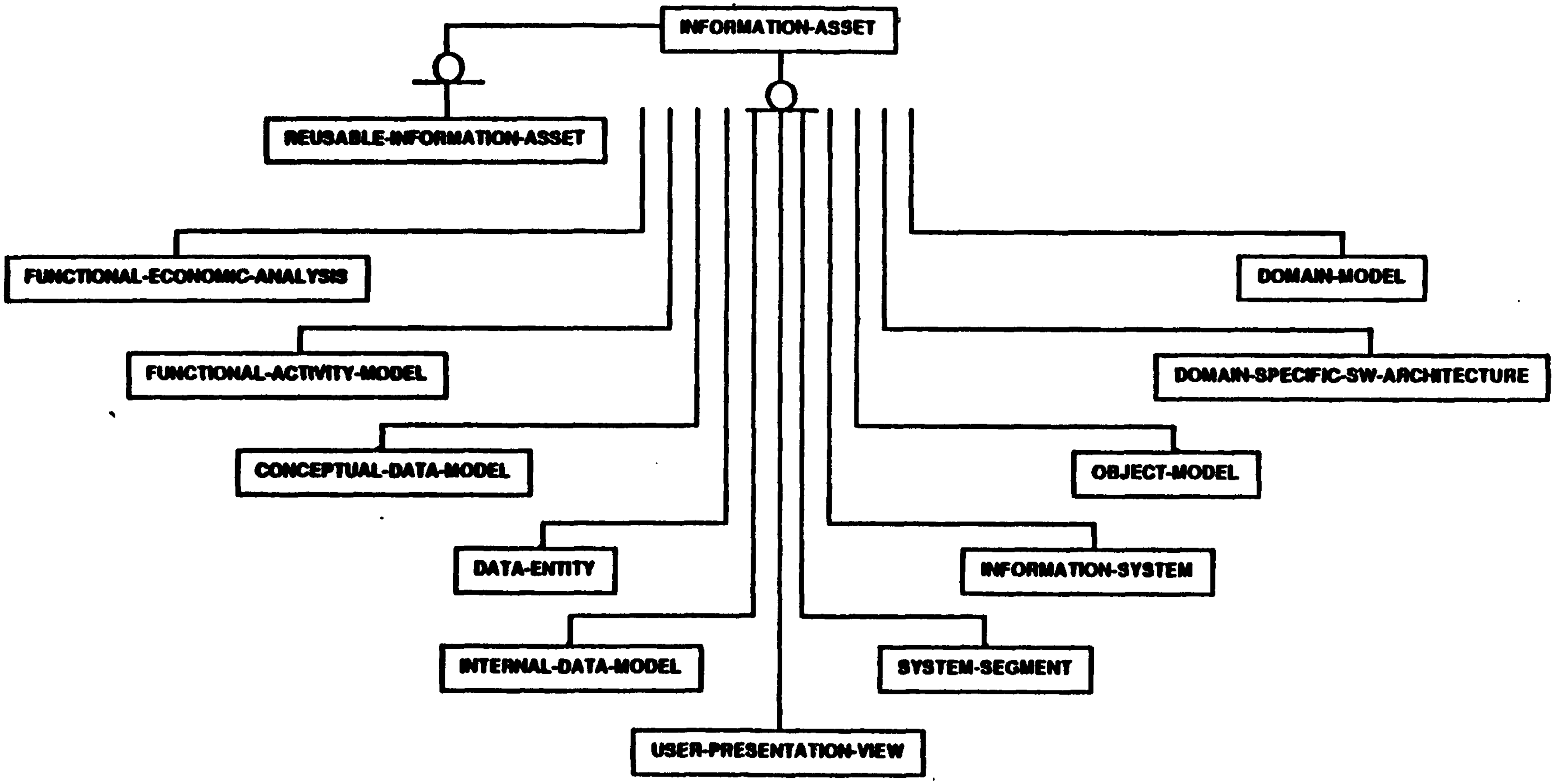
DIRS Project

To-Be Analysis

- Meta Model
  - Fully Attributed
- Data Administration View
  - Logical
    - Data Models, Data Entities, Data Attributes
  - Internal
  - External
- FPI View
  - Activty Models
  - FEA Process
- SE & SR View
  - Applications, Systems
  - Domain Models
  - OOT

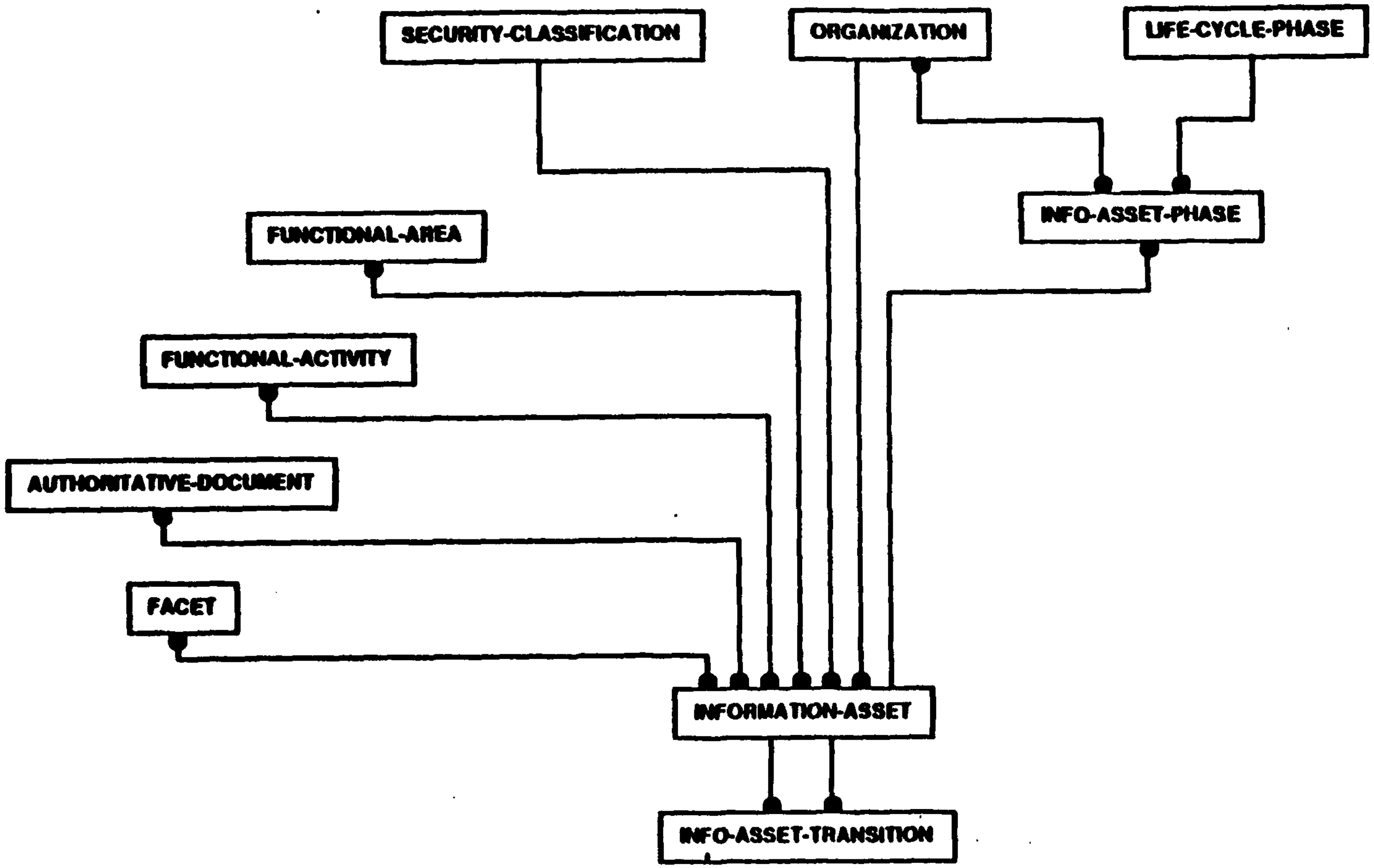
To-Be Data Model – Repository Metamodel

Information Assets: Categories (subset)



To-Be Data Model – Repository Metamodel

Information Assets: Management



DIRS Project

Data Standardization

- Meta Model
  - Core Data Model for IM
- Validation Process
- Documentation of Data Elements
- Phased submission of Proposal Packages
  - Align with phased system implementation

DIRS Project
Technical Analysis

- COTS Study
  - RFI
  - Market Survey
- Alternative Analysis
  - Technical Solutions
    - Costs
    - Benefits
    - Functionality
    - Implementation Strategy

Repository Tool Report

Technical Alternative Analysis

FEA/IDP

DIRS Project

Implementation Decision

- FEA/IDP
- Repository System Migration Selection
  - Technical Alternatives
  - Target Requirements

DIRS Project
Acquisition

- Acquisition Plan
- Implementation Decision
  - Migration Strategy
  - Technical Solution
  - Options
    - COTS Acquisition
    - GOTS Development

DIRS Project

Implementation

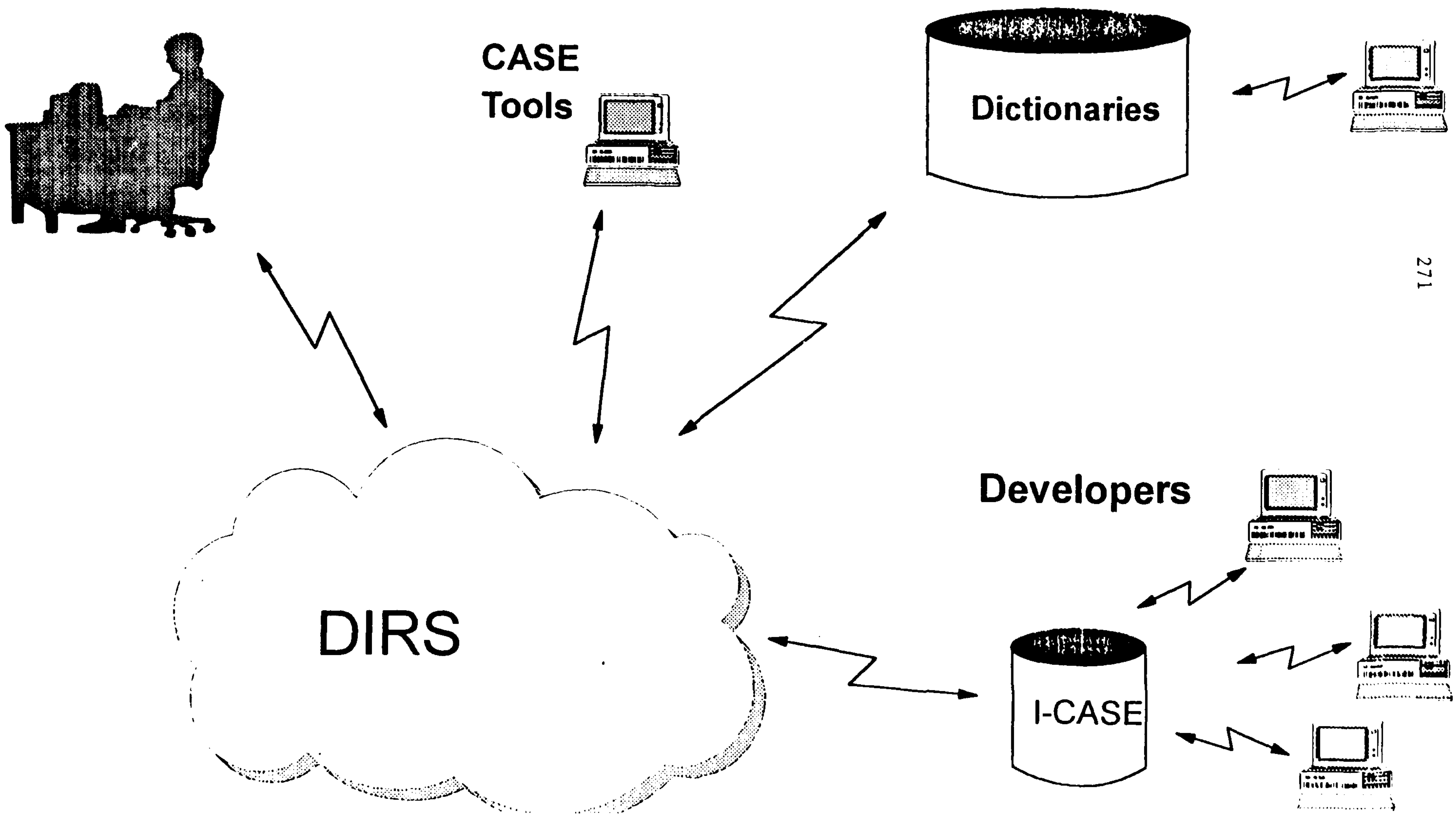
- Phased Implementation

- Dependent
  - Repository Integration
  - Information Asset
  - Customer
  - Tool Support

DIRS Project
Concepts

- Single Logical Repository
- Common Meta Model
  - Core Data Model for IM
  - Standard Data Elements for IM Community
- Information Assets
  - Related
  - Managed & Controlled
- Migration Strategy

DIRS Project
Single Logical Repository



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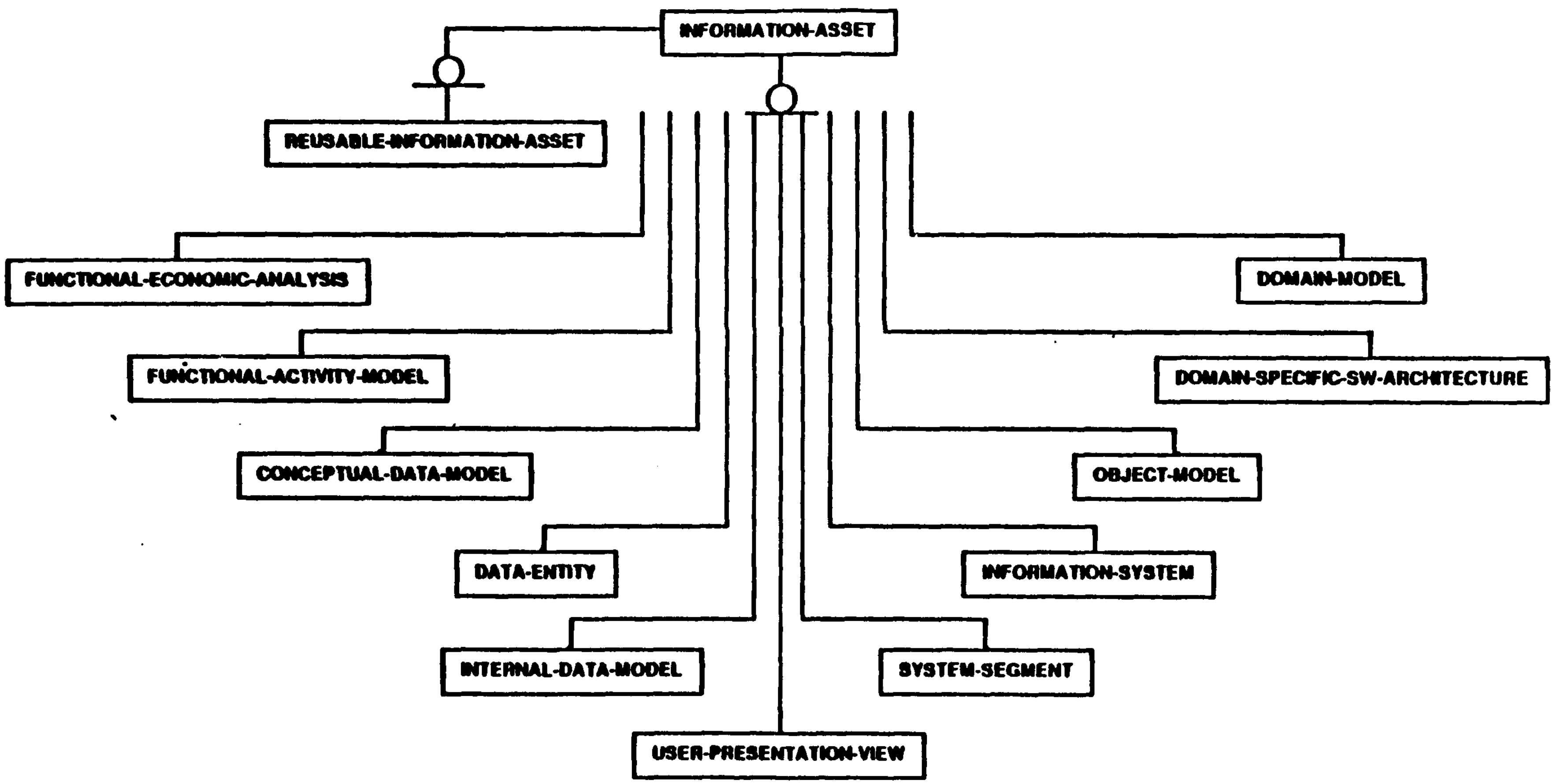
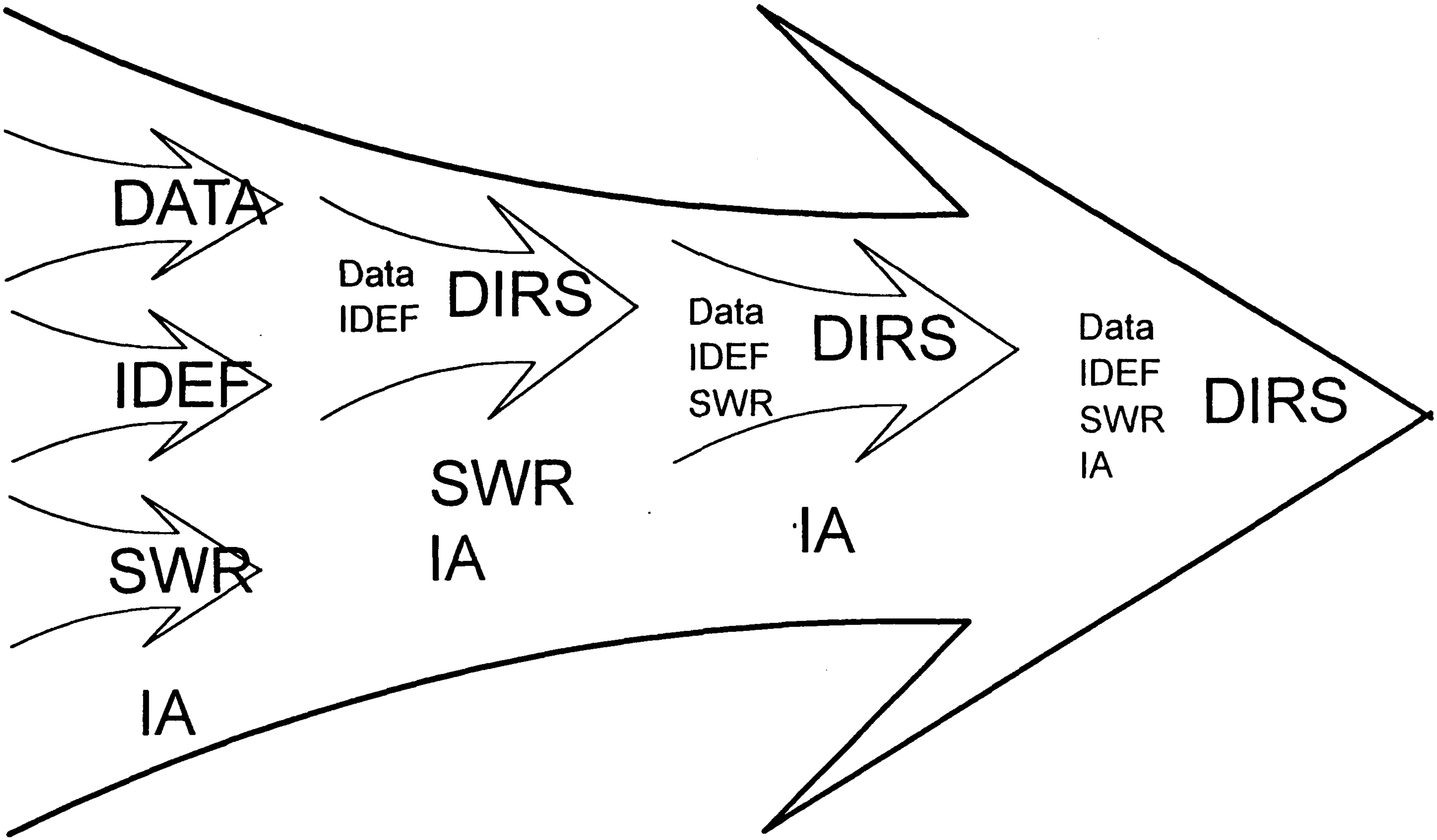
To-Be Data Model – Repository Metamodel

Information Assets: Categories (subset)



DIRS Project

Migration Strategy



Command and Control (C2) Data Modeling Update

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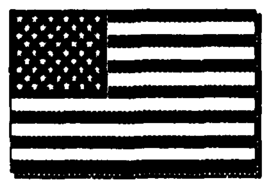


Stan Plummer
DISA/JIEO/CFS
487-8024

16 FEB 94

C2 FDAd Mission

- Achieve a fully interoperable C2 environment through:
  - Effective data standards, coordination, and program development.
  - Development of standards for data elements and data models for C2 projects, programs, and migration systems.
  - C2 Functional Data Administration policies and procedures.
  - Planning, analysis, modeling, configuration management, storage, retrieval, validation, and documentation of data.

MCEB Guidance

- JUL 93:
  - Publish C2 Core Data Model
  - Develop C2 Interim Data Elements
- JAN 94:
  - GCCS is the Primary C2 Migration System
  - Data Standards and a Common Operating Environment are Key to Integration

Support to GCCS

- 8320 Process, DoD Standard Data Elements for Blocks II and III
  - C2 Core Data Model
  - Fire Support Data Model
  - Joint Air Operations Data Model (FPI Proj)
  - SOCOM Data Model (FPI Proj)
- JUDI Data Elements
  - Universal Data Base
  - Common "interlingua" for component systems

Products for C2 Community

- Functional Area Data Model
  - C2 Core Data Model
  - Extensions
- Standard Data Elements (DoD 8320)
- C2 Portion of DoD "Starter Set"

C2 Core Data Model

- Published 1 SEP 93
- Proposal Package Submission NLT 1 Mar 94
  - DoD Data Model Entities/Prime Words
  - Developmental and Candidate Data Elements
- Result: DoD Standard Data Elements

C2 Core Data Model Progress

(16 FEB 94)

- Entities
  - 109 Submitted
  - 8 Approved Prime Words
- Attributes
  - 297 Submitted
  - 8 Candidate Data Elements
  - 5 Approved Data Elements

Fire Support Data Model

- Common Lineage with C2 Core Data Model
- Integration with C2 Core Data Model
- Integration with DoD Data Model
  - Proposal Packages
  - Into formal process NLT 1 APR 94

Special Operations Command (SOCOM) Data Model

- Integration with C2 Core Data Model
- Integration with DoD Data Model
  - Proposal Packages
  - Into formal process 3d Quarter FY 94

Joint Air Operations Data Model

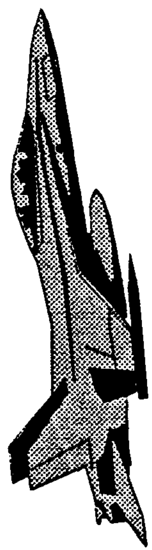
- Key Based
- From FPI project
- Integration with C2 Core Started DEC 93
- Draft Proposal Packages Developed
- Fully Attributed Model - FY94

Interim IDEF Model Repository

- Process (IDEF0) and Data (IDEF1X)
- Documentation/Files for download (proposed)
- Joint Air Operations Model Loaded DEC 93
- C2 Core Submitted JAN 94
- DoD Data Model -- Quarterly Update

C2 Data Modeling Review

- Supports GCCS
- C2 Core Data Model results in DoD Standard Data Elements (the real thing)
- Extensions to the Model
  - Fire Support
  - SOCOM
  - Joint Air Operations
- Models will reside in the IDEF Repository



IDEF Users Group Update

- Salt-Lake City Nov 1993
- Successful Publication of IDEF FIPS
  - FIPS PUB 183 - IDEF0 (Process Modeling)
  - FIPS PUB 184 - IDEF1X (Information Modeling)
  - Published Dec 21 1993
- Officially kicked off IEEE IDEF1X Working Group
- Draft IDL for IDEF0 completed
- Meta-Model Sub-Group closed

USAFPG

IEEE IDEF1X Working Group (1320.2)

- Developed Charter
- Developed prioritized Standard change list.
- Set Action Items
- Spun-off sub-groups to address specific issues
- Scheduled teleconferences & meetings

USAEPG

IEEE IDEF1X WG (1320.2) Issues

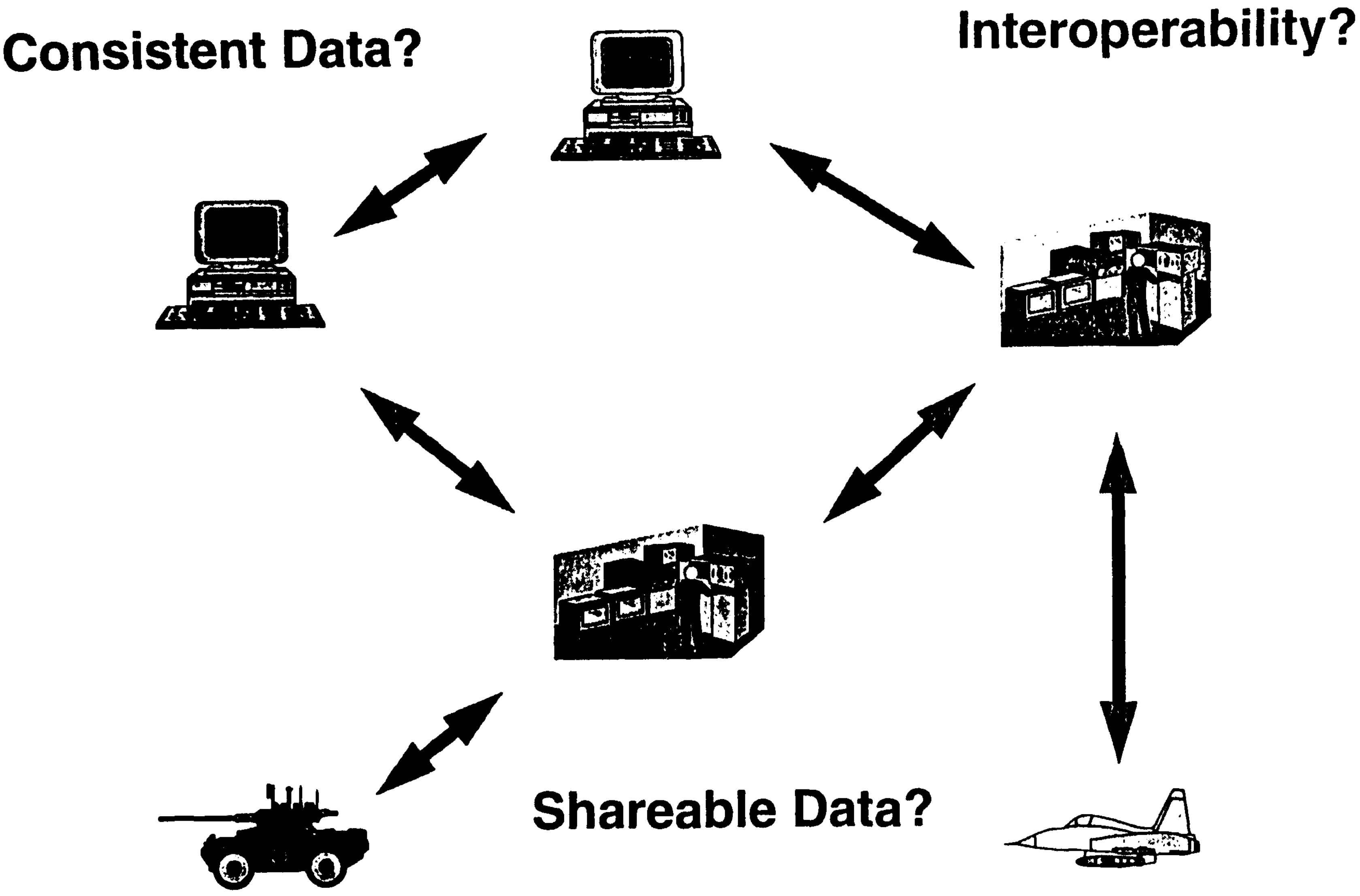
- Meta-Model
- Relationship to Zachman Framework & other Frameworks
- Developing Users Manual
- Addressing Extensions to IDEF1X Language:
  - Object Identity & Object Orientation
  - "Fixes" to language peculiarities
  - Expanding Domains to Abstract Data Typing
  - DBMS independent language for expressing complex rules & methods
- Use of SML as Interchange Language

USAEPG

IEEE IDEF1X WG (1320.2) Upcoming Meeting

- Mar 3, 4 & 5th at Boeing in Seattle WA
- Items to be discussed:
  - Change Management
  - Formalization
  - Extensions
  - Meta-Model
  - User Manual
- Tutorial on Formalization Logic - Bob Brown
- Confirm Direction and Standard Content

PROBLEM



OVERVIEW

- Previous Approach
- DoD vs. Army Conflicts
- Conflict Resolution
- Revised Approach
- Expected Results

PREVIOUS APPROACH

Based on Army Regulation 25-9,
Army Data Management and Standards Program

- Research/Model Data
- Document Results IAW AR 25-9
- Submit Candidate Elements to PM-CATT Data Administrator
- Submit PM-CATT Approved Elements via Batch to ADD
- Track Data Elements Through Final Approval

CONFLICTS: AR 25-9 vs. DoDD 8320.1-M-1

Differences between the AR 25-9 and the DoDD 8320.1-M-1 were identified and documented by Iris Kameny, RAND 22 NOV 93.

- Data Element Naming Conventions
- Data Dictionary Meta Data

DATA ELEMENT NAMING CONVENTIONS

- Army has imposed additional structure on modifiers and qualifiers
- Army has many more “class” words than DoD
- Additional effort required to rename data elements from ADD to DDRS
- Field lengths between ADD and DDRS differ

DATA DICTIONARY META DATA

- Total meta data field attributes:
  - DDRS 50
  - ADD 60 (not counting alias attributes)
- Unquestionable matches: 24 (48%)
- Questionable Matches: 8 (16%)
- DDRS without ADD match: 18 (36%)
- ADD without DDRS match: 28 (47%)

DOD/ARMY CONFLICT RESOLUTION

- 6 JUL 93 : Memo by Erwin M. Atzinger, Chief, Special Studies and Activities Office

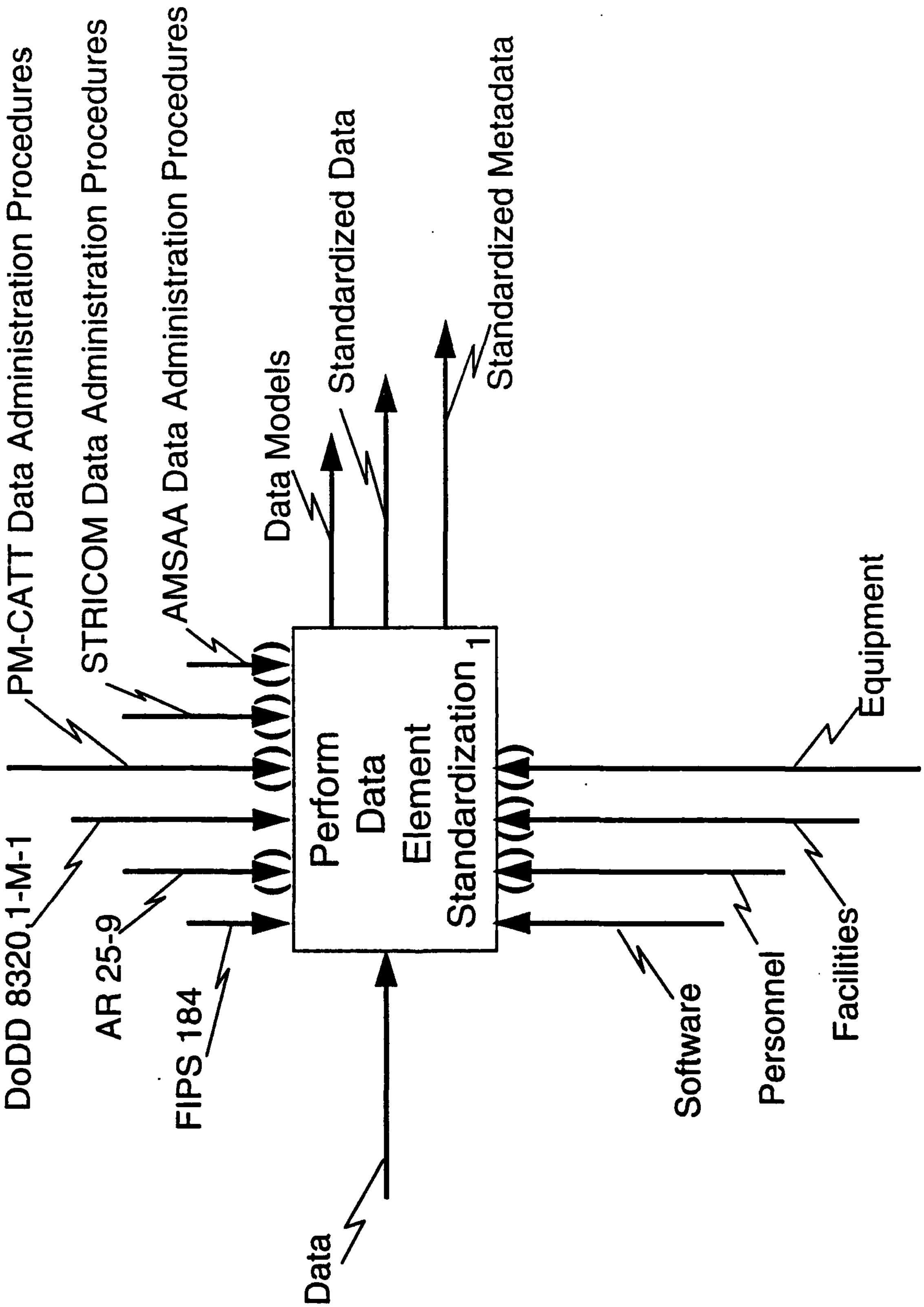
  Interim procedures as a guide for developing and submitting standard data elements for Army modeling and simulation into the ADD.

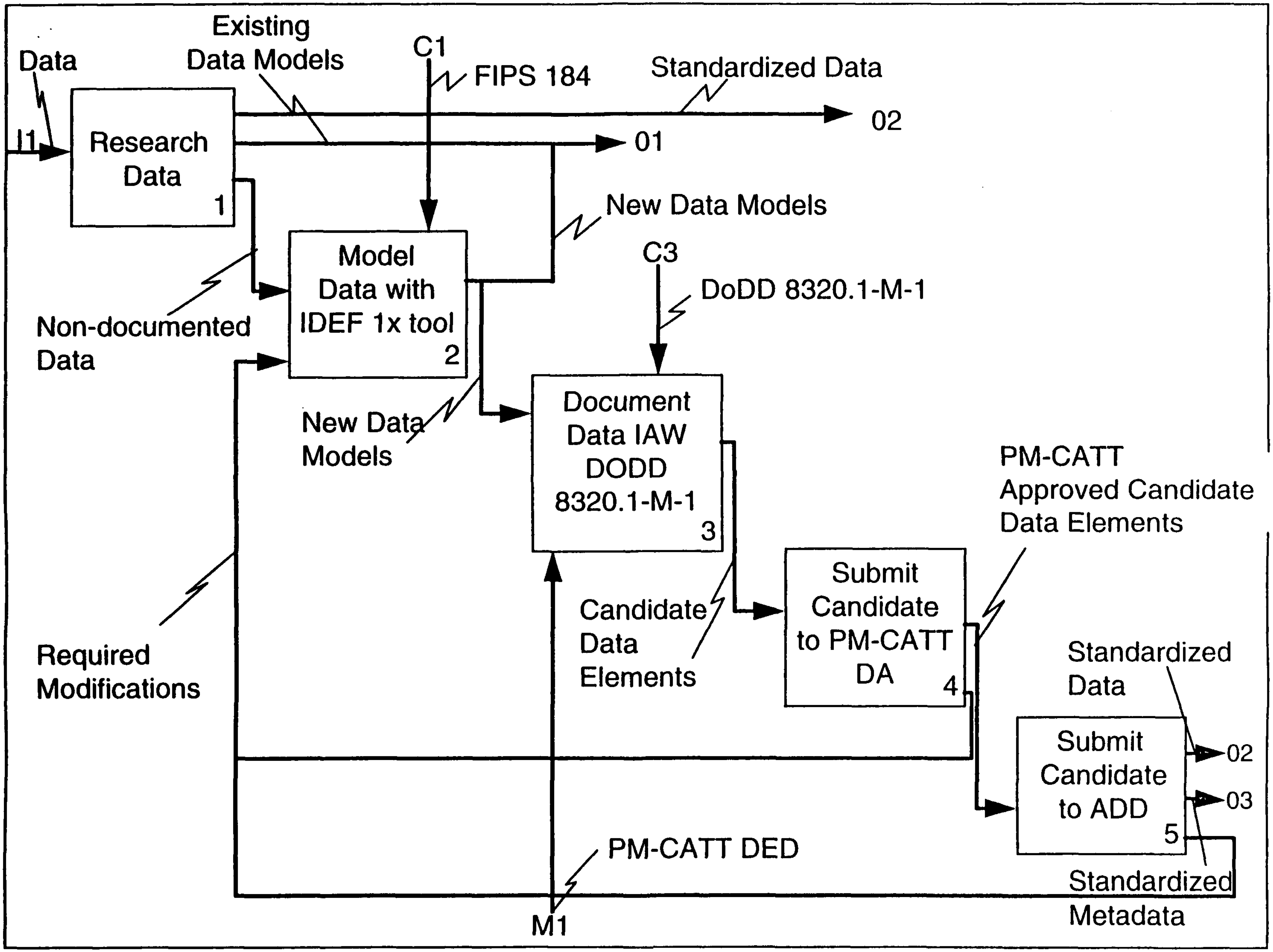
- 6 JUL 93 : Atzinger Memo, Modification

  The Army is migrating to the naming convention defined in DoDD 8320.1-M-1. In spite of the number of issues yet to be resolved, the element developer should proceed in compliance with 8320.1-M-1.

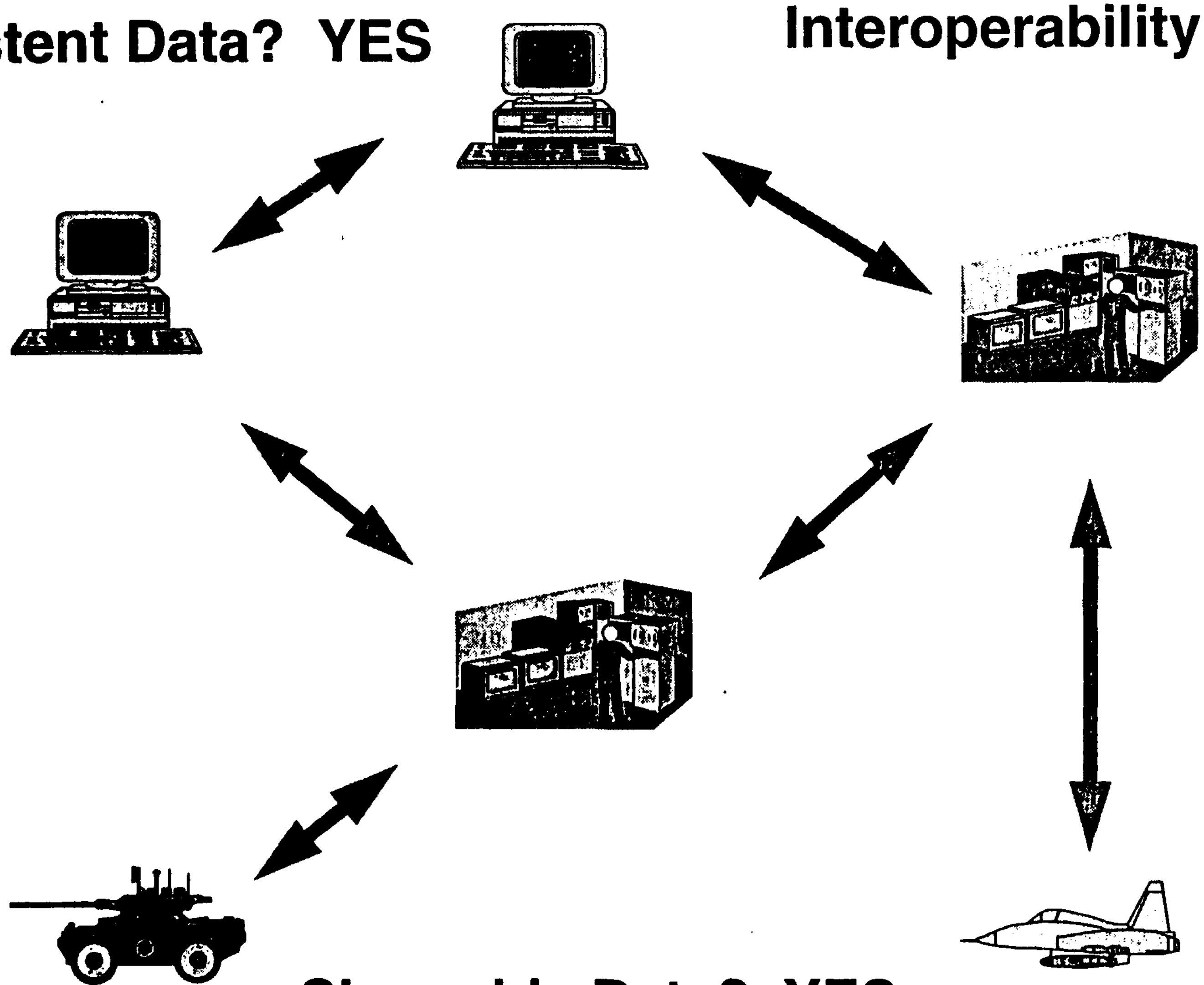
- 4 JAN 94 : DoDD 5000.59 DoD Modeling and Simulation (M&S) Management

  Requires that data and data administration for DoD M&S applications conform to the policies and procedures for data administration specified in DoDD 8320.1 (reference (E 11)).


Perform Data Element Standardization
1
DoDD 8320.1-M-1
AR 25-9
FIPS 184
PM-CATT Data Administration Procedures
STRICOM Data Administration Procedures
AMSAA Data Administration Procedures
Data
Data Models
Standardized Data
Standardized Metadata
Software
Personnel
Facilities
Equipment


Data
I1
Existing
Data Models
Research
Data
1
C1
FIPS 184
Standardized Data
02
01
Model
Data with
IDEF 1x tool
2
Non-documented
Data
New Data Models
New Data
Models
C3
DoDD 8320.1-M-1
Document
Data IAW
DODD
8320.1-M-1
3
Candidate
Data
Elements
Submit
Candidate
to PM-CATT
DA
4
PM-CATT
Approved Candidate
Data Elements
Standardized
Data
Submit
Candidate
to ADD
5
02
03
Standardized
Metadata
Required
Modifications
PM-CATT DED
M1

PROBLEM


Consistent Data? YES
Interoperability? YES
Shareable Data? YES

DMSO I/DB TASK GROUP MEETING

February 16 — 17, 1994

Report on TADS Weapon Performance Data Modeling Pilot Study

Iris Kameny

RAND

OBJECTIVES OF PILOT STUDY

(1) To produce a data model of five weapon performance areas: trget acquisition, direct fire, artillery, mines, and weather (and broad-brush of scenario)

*(2) Produce a naming scheme for entities and data elements to be integrable with the CIM Enterprise and C2 Core data models

*(3) Develop 8320.1-M-1 descriptions of the data elements

(4) Report to I/DB Task Group on lessons learned

*** Not performed by pilot study group***

REASONS FOR SELECTION OF TADS FOR PILOT STUDY

(1) There was a recognized problem in modeling the TADS weapon performance data which was complexly derived data

(2) The data is well documented and understood by Howard Haeker, the TADS Center Director and others on his staff

(3) TADS data is managed in an Ingres RDBMS and the staff has a good understanding of relational DBMS technology, e.g., the database was normalized

(4) The TADS database could be partitioned into manageable subsets

TADS MISSION

- To furnish quality data to specific Army simulation models to be used for specified analysis purposes
- TADS personnel
  - Understand user's analysis problem and the M&S tool they plan to use
  - Make electronic requests for necessary data from Army sources such as AMSAA, BRL and others
  - Collect source data and abstract, integrate, aggregate it into verified, validated, and certified weapon performance data to suit analyst's purpose
  - Electronically deliver data to simulation model
- As part of AMSMO business process modeling activity, TADS identified eleven categories of data they furnish to Army M&S users: equipment characteristics, equipment performance, test, human factors, unit performance, tactics-doctrine-operational, environment, force description, scenario, logistics, and geopolitical
- The TADS database contains approximately 7 billion data values

APPROACH TO PILOT STUDY

- Convene team of subject matter experts to develop TADS IDEF1X data model from existing weapon performance databases
- Develop data model at Ft. Leavenworth to have access to experts and classified database
- Perform data modeling in week long session
- Conduct additional meetings as needed to develop names and standards
- Document lessons learned
- Publish results
- Encourage discussion and, if successful, promote use of approach

IN ACCORD WITH TOM BRUCE'S RECOMMENDATIONS ON IDEF1X DATA MODELING THE SIX TEAM MEMBERS AND THEIR ROLES

NAME	AFFILIATION	ROLES
Howard Haeker	TADS	Manager (Army TADS/business community) and Subject Matter Expert
Stan Hopkins	MITRE	Information Modeler and Assistant Data Analyst
Chien Huo	JIEO/CFS	Observer
Iris Kameny	RAND	Manager (support of DMSO community), Facilitator, Limited Subject Matter Expert
Roy Scrudder	ARC/JDBE	Data Analyst and Assistant Information Modeler
Walt Swindell	TADS	Assistant Facilitator and Subject Matter Expert

EQUIPMENT USED

- Electronic white board used by the Facilitator in the collaborative development of the data model
- Overhead projector and screen for projecting IDEF1X models for review
- PC and printer: PC to run ERwin/ERX software and printer to print ERwin/ERX outputs
- ERwin/ERX software by Logic Works Inc.: Tool that implements IDEF1X methodology and provides capabilities described in Thomas Bruce's book on "Designing Quality Databases with IDEF1X Information Models"
- Photocopier

PROCEDURE

- Half day introduction to IDEF1X and overview of TADS database
- Approximately 3 days spent developing data models for: artillery, mine, acquisition, direct fire, weather, (and scenario)
- Developed key-based models with primary non-key attributes
- Modeled entities, relationships between entities, relationship names and cardinality
- Did not model secondary non-key attributes, develop standard names,definitions and attribute domains
- Discussion of lessons learned

PROCEDURE
(continued)

(1) A subject area session began by determining main entities

(2) Questions were asked about important and representative data elements and relationships between entities

(3) Questions were asked about entity keys and their dependent (non-key) attributes

- data values could be examined to check for total key dependencies
- discussions ensued about entity categories and use of associative entities

(4) Information was captured on electronic white board and also captured using ERwin/ERX

(5) At each initial model session end: information modeler and data analyst made final adjustments and printed model for review

(6) Model was reviewed using overhead projector, errors corrected on transparency

(7) Entity relationships and cardinalities were labeled

(8) ERwin/ERX version was updated and hard copies printed for review and correction

INTEGRATION ACROSS SUBJECT AREAS

- When entitites in one subject area appeared similar to entities in other subject areas:
  - Explored similarities and if same then addressed conflicts and naming
  - Some changes were made to earlier subject area models to reflect later modeling (e.g., the scenario model became better diferentiated after the last subject area model for weather was done)

SOME STATISTICS FOR THE FIVE AREAS MODELED

13 Independent entities: Activator-Type, Equipment, Fuze-Type, Geographic-Area, Mine-Type, Platform-Type, Scenario, Sensor-Type, Terrain-Code, Type-of-Force, Weapon-Type, Weather-Reporting-Site

29 Associative entities

6 Categories

SOME PRELIMINARY LESSONS LEARNED FROM TADS PILOT STUDY TADS RELATED

- Benefit from TADS experience in RDBMS and legacy system in RDBMS
- Started anew with naming
- Need experts present at sessions
- Estimated that data modeling took 50% of total time
- TADS reaction to session:
  - Helped them meet Army request
  - Little help in better understanding data or affect on future data structure
  - IDEF1X model lacking in user understandability but may still be a help to their data suppliers and users
- Be careful to use "data model" rather than "model"
- PR problem in selling data modeling
- TADs completing data standardization themselves

SOME PRELIMINARY LESSONS LEARNED FROM TADS PILOT STUDY DOD RELATED

- Lack of standard data models for infrastructure areas
- Problems with use of associative entities for modeling complexly derived data
- Lack of DoD taxonomy of meaningful entities (e.g., primary words)
- Issues with naming of data elements
  - Generating names from all participating entities (and associative entities) could create very long names
  - Overloading entity names: for unique identification, for providing understandable names to users, and for providing a taxonomy/index into the data dictionary

SOME PRELIMINARY LESSONS LEARNED FROM TADS PILOT STUDY DOD RELATED *(continued)*

ISSUES IN NAMING AND MODELING RELATIONSHIPS AMONG MORE THAN TWO ENTITIES

- Overloading use of IDEF1X: logical modeling and user understandibility, and to generate normalized models
- Overloading associative entity: one-to-many relationship with attributes, many-to-many relationship between two entities, relationship involving more than two entities
- Need DoD guidelines for naming of associative entities using names of participating entities (e.g., alphabetical order)
- Better way of handling special types of relationships like part-whole, and recursion

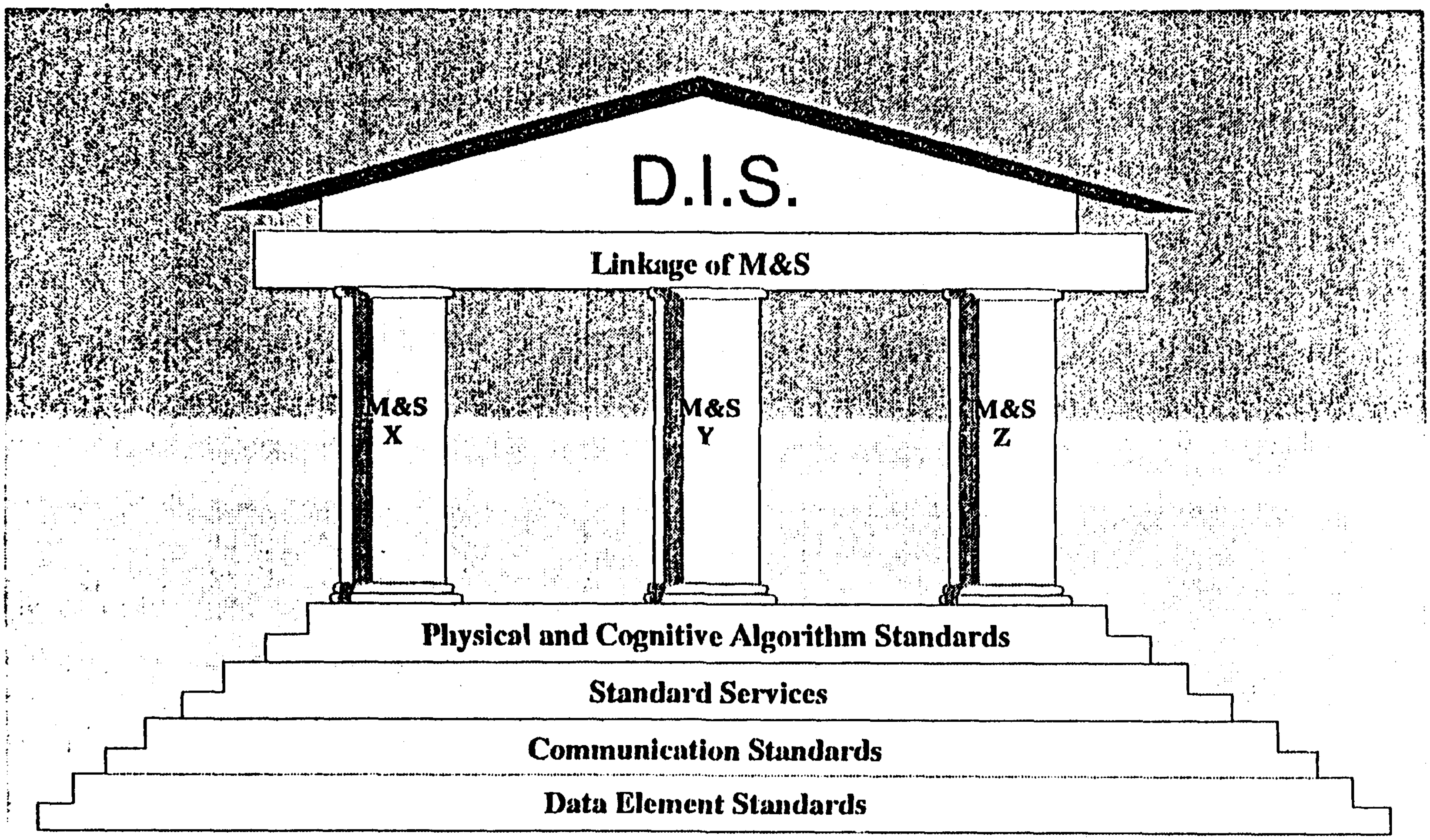
SOME PRELIMINARY LESSONS LEARNED FROM TADS PILOT STUDY
IDEF1X and ERwin/ERX Related

- Use of IDEF1X modeling tool:
  - Made time spent in sessions more effective
  - Enforced language rules such as proper key migration
- Lack in ERwin/ERX:
  - Cardinality ranges
  - Foreign keys: use of entity-name.attribute-name to explain key migration rather than rolename.basename
- Capability to project software tool screen on large screen instead of writing on white board was a suggested improvement

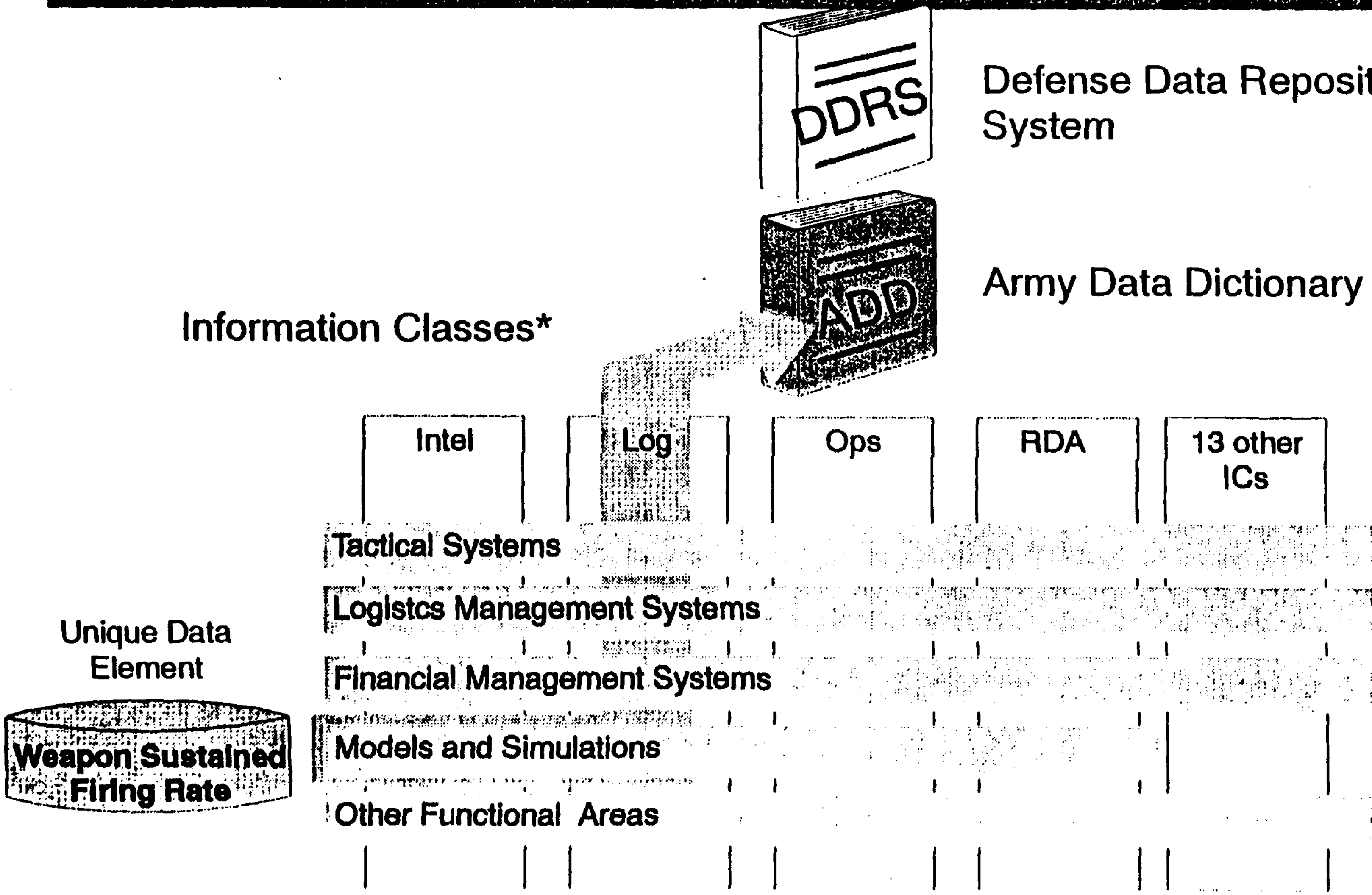
TRAC AUTOMATED DATA SYSTEM (TADS)
DISCUSSION OF COST BENEFIT

MAJOR WALT SWINDELL

Standards: M & S Foundation



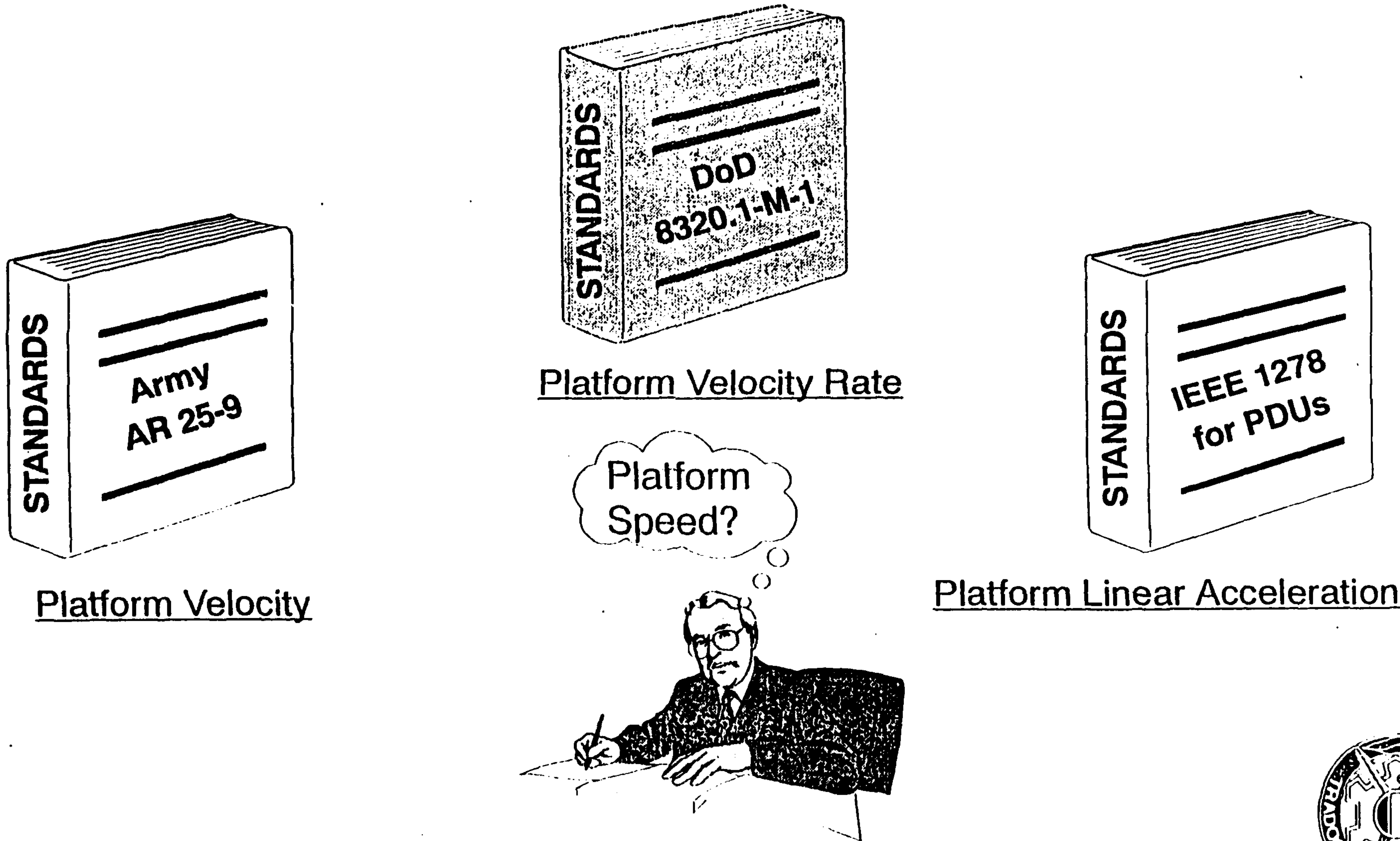
Standardization Hierarchy



*Each Information Class is headed by an Information Class Proponent (ICP)

Data Standardization Concerns

Three Incompatible Standards



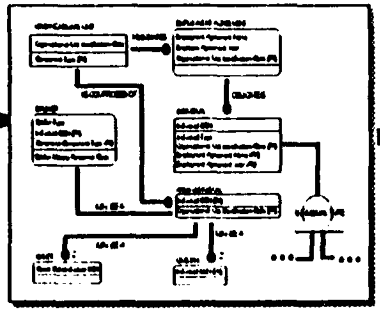
The Data Standardization Process
Functional Data Modeling

Information Class Proponent (ICP) builds functional data model

ICP retains responsibility for his portion of the Model

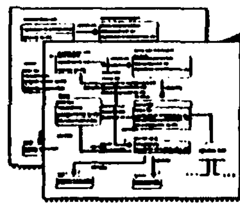
- •Policies
- •Processes
- •Doctrine
- •Information

Requirements define the way a functional does business

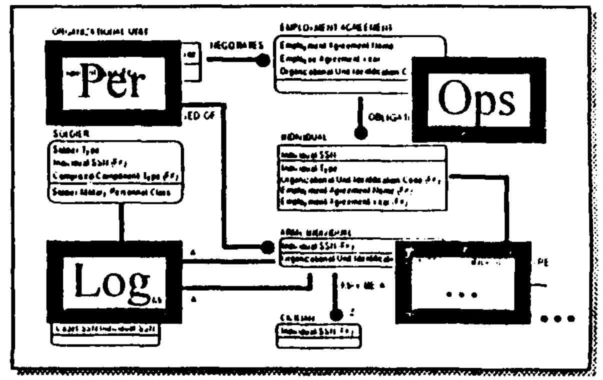


Functional Data Model

A structured view of functional data requirements



Army ISC integrates all functional models



Army Data Model

A structured, unified view of Army data requirements

The ICP Extends and Improves the Functional Model as His Business Changes
ISC Integrates New or Changed Functional Models into the Army Data Model

Data Element Reuse Saves Money.

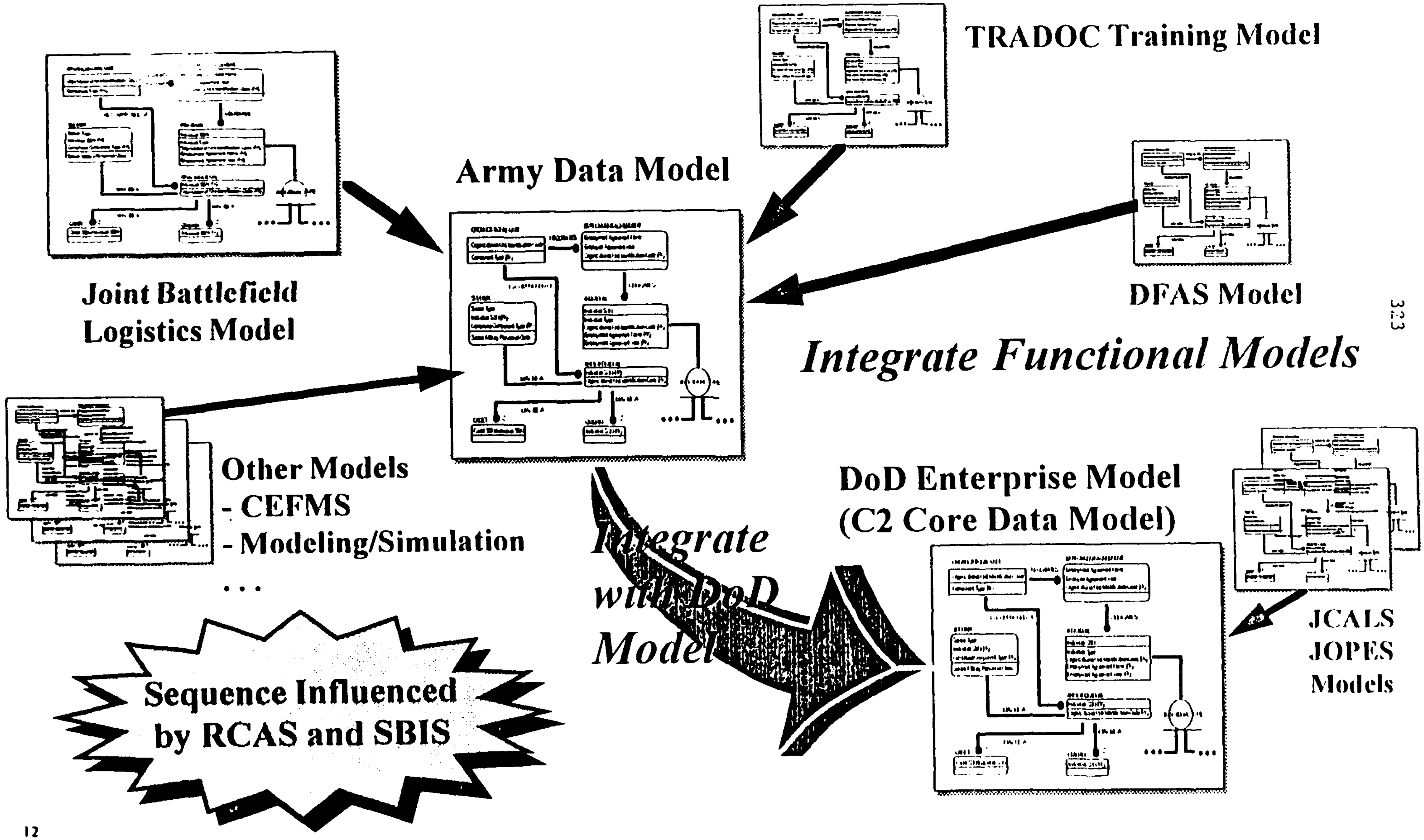
As much as 40% of the data entities in SBIS modules are reused from the Army Data Model

Data Element Approval Process

Materiel Developer proposes a new data element based on functional requirements found in the Army Data Model	Proposed Data Element
	⇩
Materiel Developer submits data element for standardization	Candidate Data Element
	⇩
ISC reviews for technical adequacy and completeness	Technical Review
	⇩
ICP reviews for consistency with Army Data Model and functional requirements	Functional Review
	⇩
Data Element is Army Standard	Standard Data Element

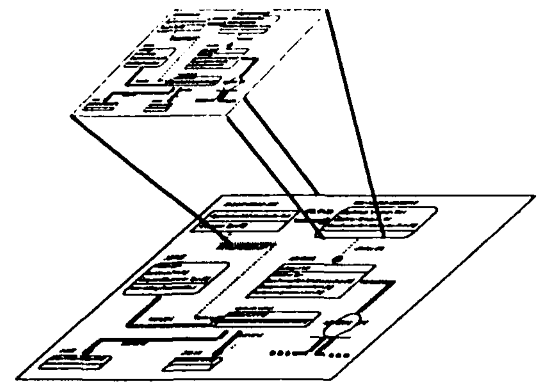
Technical or functional disapproval: returns data element to materiel developer for correction.

Army Data Model Integration

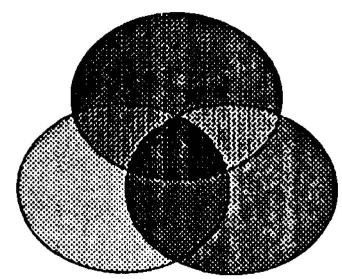


Key Technical Challenges

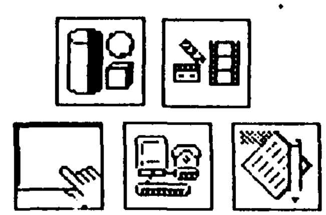
- **Data Model abstraction & partitioning**
  - *To better understand and manage large data models*
  - *To provide different views of business data, both horizontal and vertical*
  - *To maintain traceability among model components*



- **Reconciliation of divergent data sharing strategies**
  - *Protocol Data Units, ECI, PCTE, Open Document Architecture, Object Linking & Embedding, Common Object Request Broker Architecture*
  - *Other data definition standards (SGML, CGM, etc.)*



- **Complex, Complicated, Derived Data**
  - *Examples: Images, multimedia, assemblies & aggregations, performance characteristics, software, documents, behavior, algorithms, data streams*
  - *Becoming important to all information systems*



Summary

- **Data Standardization is essential for information system interoperability**
  - *Common data elements enable data sharing*
  - *Data modeling identifies the relationships among elements of data which information systems must enforce*
- **Data Standardization can save money**
  - *Through the reuse of data models and data elements*
- **The Army Data Model could serve as a core for a detailed enterprise data model with Defense Department—wide applicability**
  - *Integration of several DoD and Army models with the Army Data Model during this fiscal year is proceeding*
- **We must meet several technical challenges to keep the program viable in the future**

Data Model for Modeling and Simulation Directory

presented by
Roy Scrudder, JDBE Project

Background

- Initial project started as an update of SSDC's Analytical Tool Box
- DMSO sponsored project to develop DoD standard data model for M&S Directory
- JDBE provided review and consulting
- IDA to provide implementation

Information Sources

- MOSAIC - Army Master Model and Simulation Catalog
- J8 Catalog of Wargaming and Military Simulation Models
- Navy Model and Simulation Catalog
- Navy SMART Program
- SSDC Analytical Tool Box
- Center for Naval Analysis Survey

Activities

- Draft data model developed by COLSA
  - Entities and attributes identified and defined
  - Partial specification of domain information
  - Preliminary assignment of data types
  - Preliminary design of user interface
- Model reviewed by DMSO, SSDC, AMSMO, DIA/MISIC, SMART, and JDBE
- Model updated to reflect review comments

M&S Taxonomy

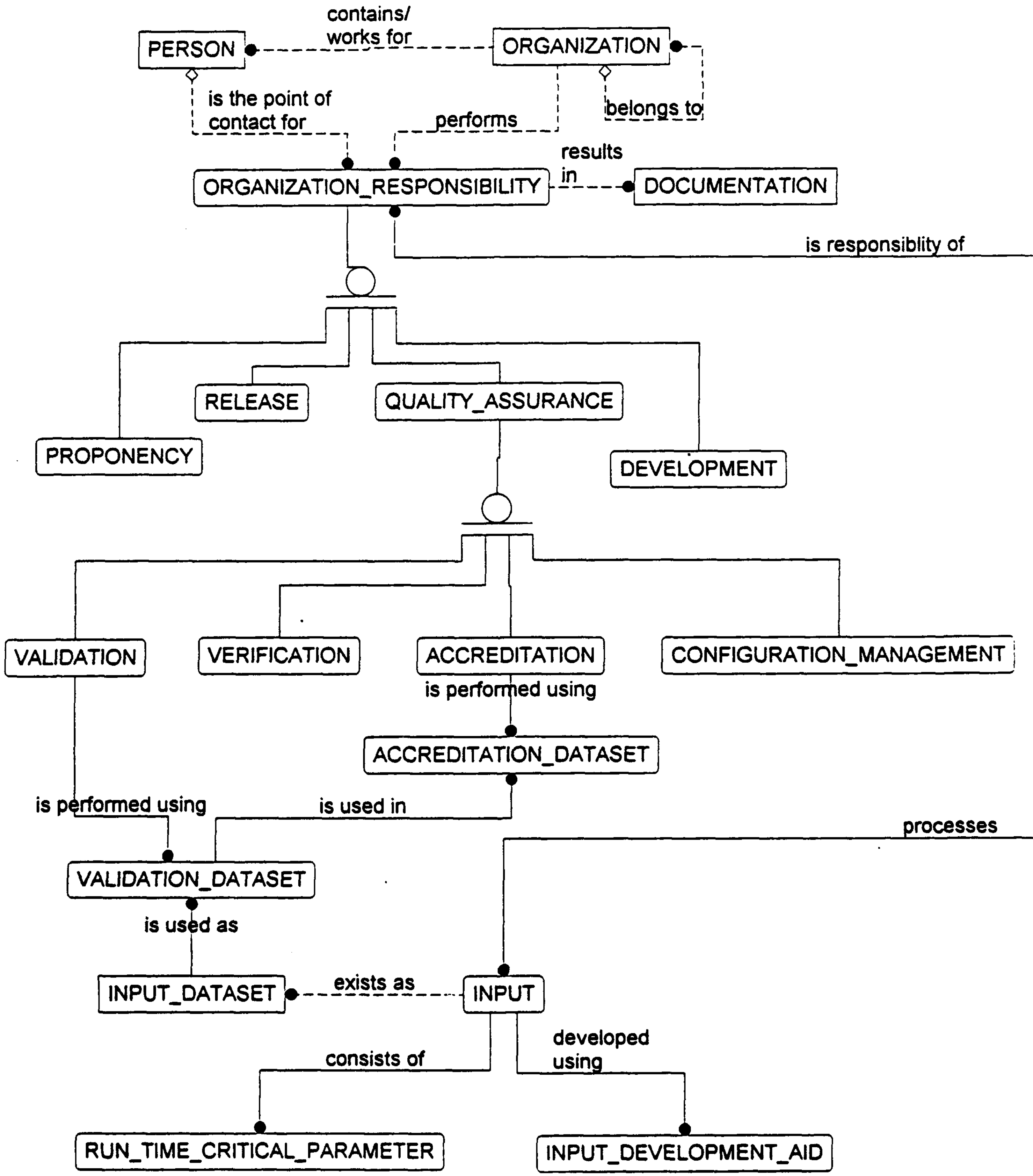
Purpose	Application Area	Level Modeled	Domain	Scope of Conflict
Analyze	Architecture	Weapon	Air	Global
Train	Environment	Fire Unit	Space	National
Test	Weather	BN and Below	Ocean	Theater
Evaluate	Nuclear	Corps and Div	Surface	Tactical
Design	Chemical	Above Corps	Subsurface	Individual
Support	⋮	Joint	Bottom	⋮
Construct	Operations	⋮	Ground	
Drive	⋮		⋮	
⋮				

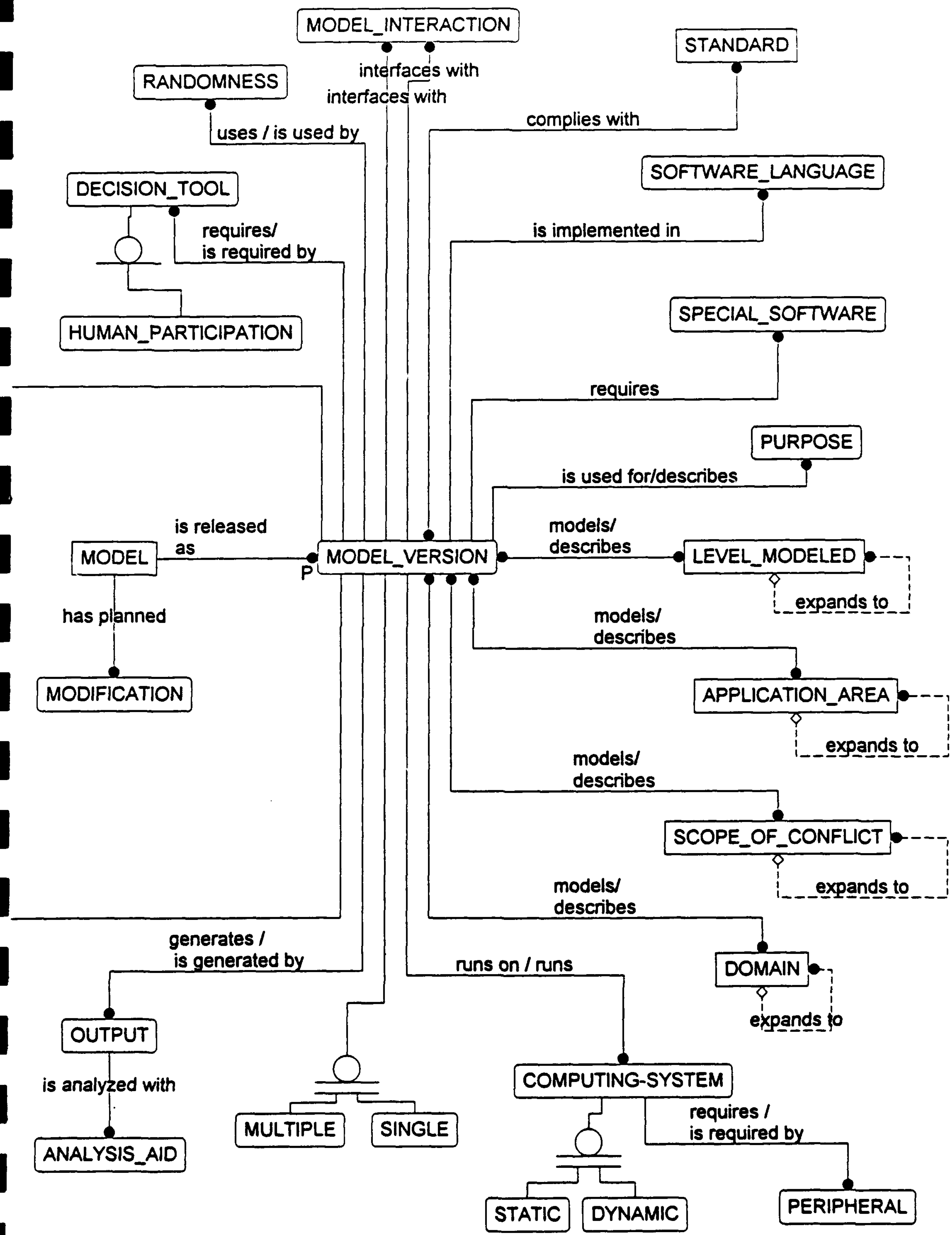
Follow-on Objectives

- Integrate the M&S Directory and Data Base Directory Data Models
- Complete taxonomy and domain information
- Add DISA/CIM-compliant naming
- Submit M&S Directory Data Model as an extension to DoD Data Model
- Submit candidate standard data elements
- Develop a directory of M&S and data bases.

DMSO Model & Simulation Directory
Entity-level Logical Data Model

Developed by COLSA Corporation: 10 Jan 94
Modified by JDBE: 10 Feb 94

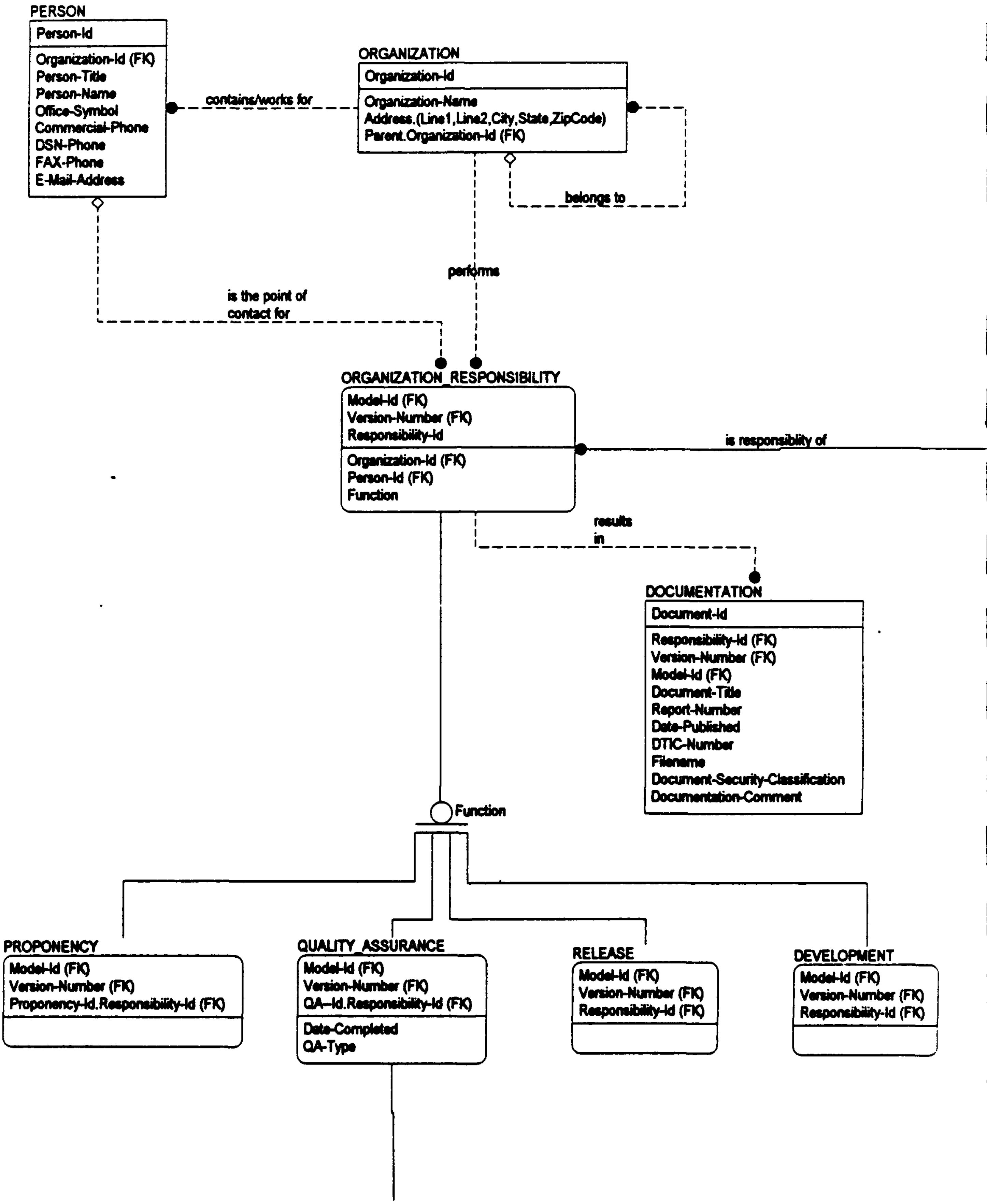


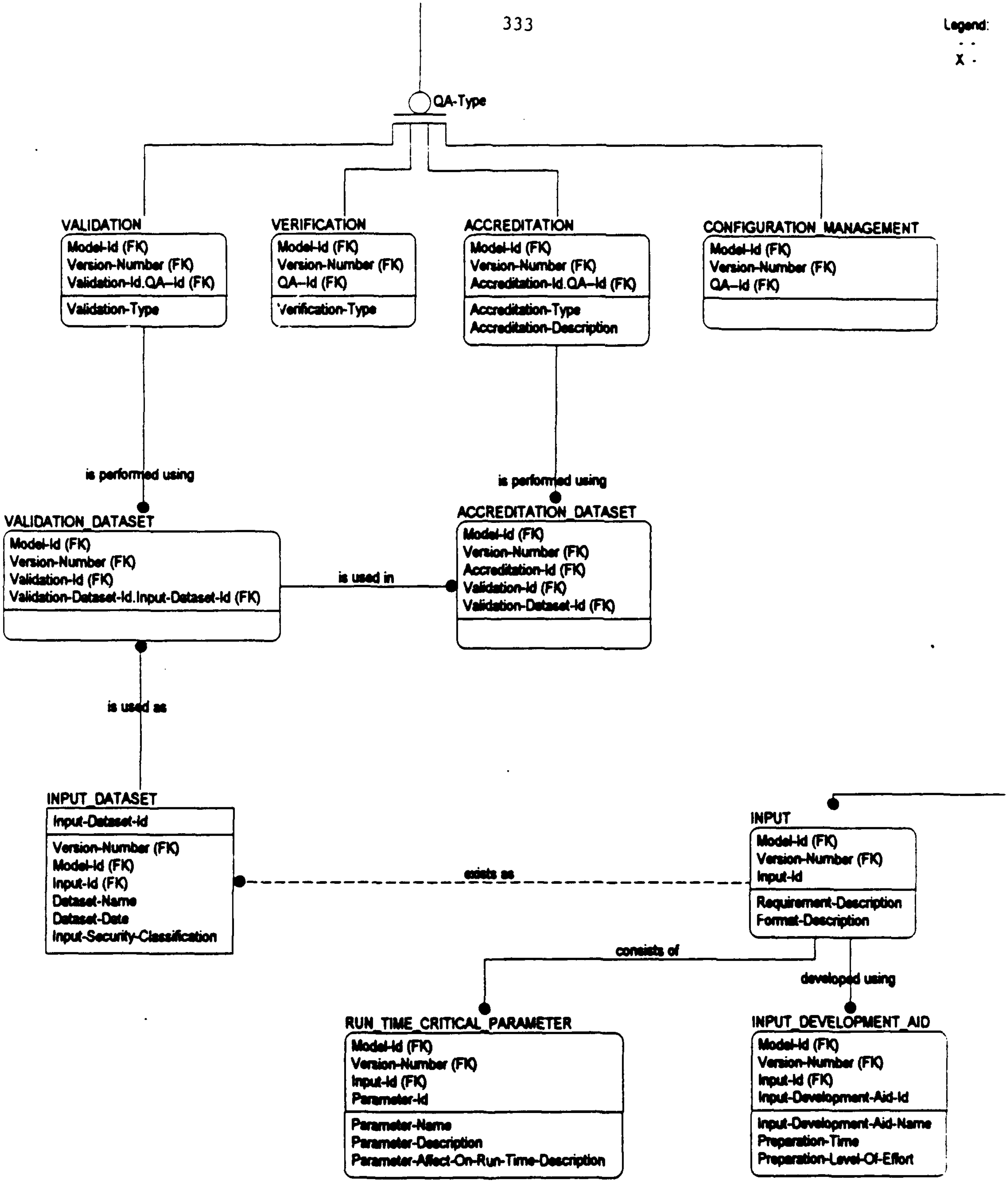

MODEL_INTERACTION
interfaces with
interfaces with
STANDARD
RANDOMNESS
uses / is used by
complies with
SOFTWARE_LANGUAGE
DECISION_TOOL
requires/
is required by
is implemented in
HUMAN_PARTICIPATION
SPECIAL_SOFTWARE
requires
PURPOSE
is used for/describes
is released
as
models/
describes
MODEL
P
MODEL_VERSION
LEVEL_MODELED
expands to
has planned
models/
describes
MODIFICATION
APPLICATION_AREA
expands to
models/
describes
SCOPE_OF_CONFLICT
expands to
models/
describes
generates /
is generated by
runs on / runs
DOMAIN
expands to
OUTPUT
COMPUTING-SYSTEM
is analyzed with
requires /
is required by
MULTIPLE
SINGLE
ANALYSIS_AID
STATIC
DYNAMIC
PERIPHERAL

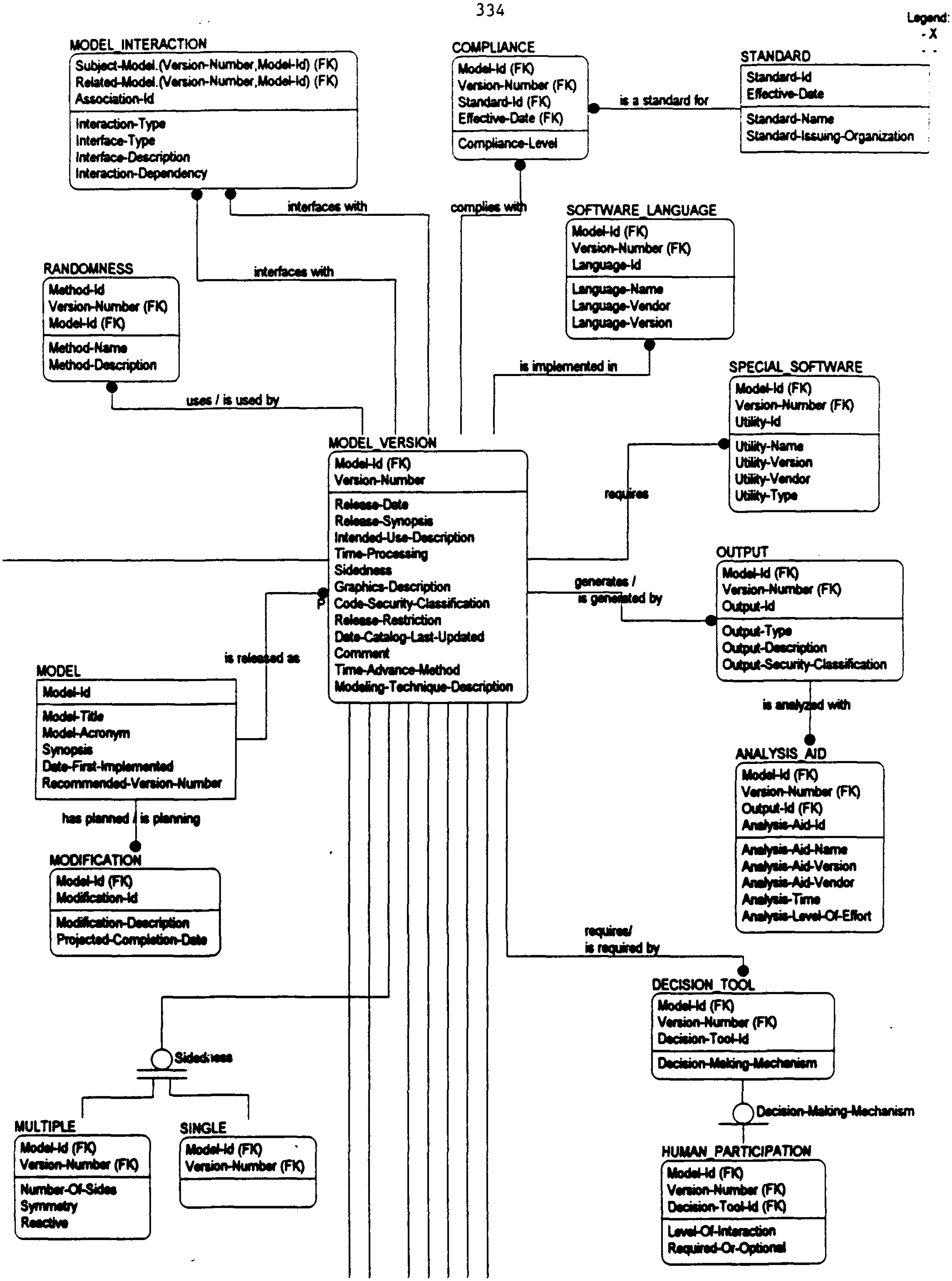
DMSO Model & Simulation Directory
Fully Attributed Logical Data Model

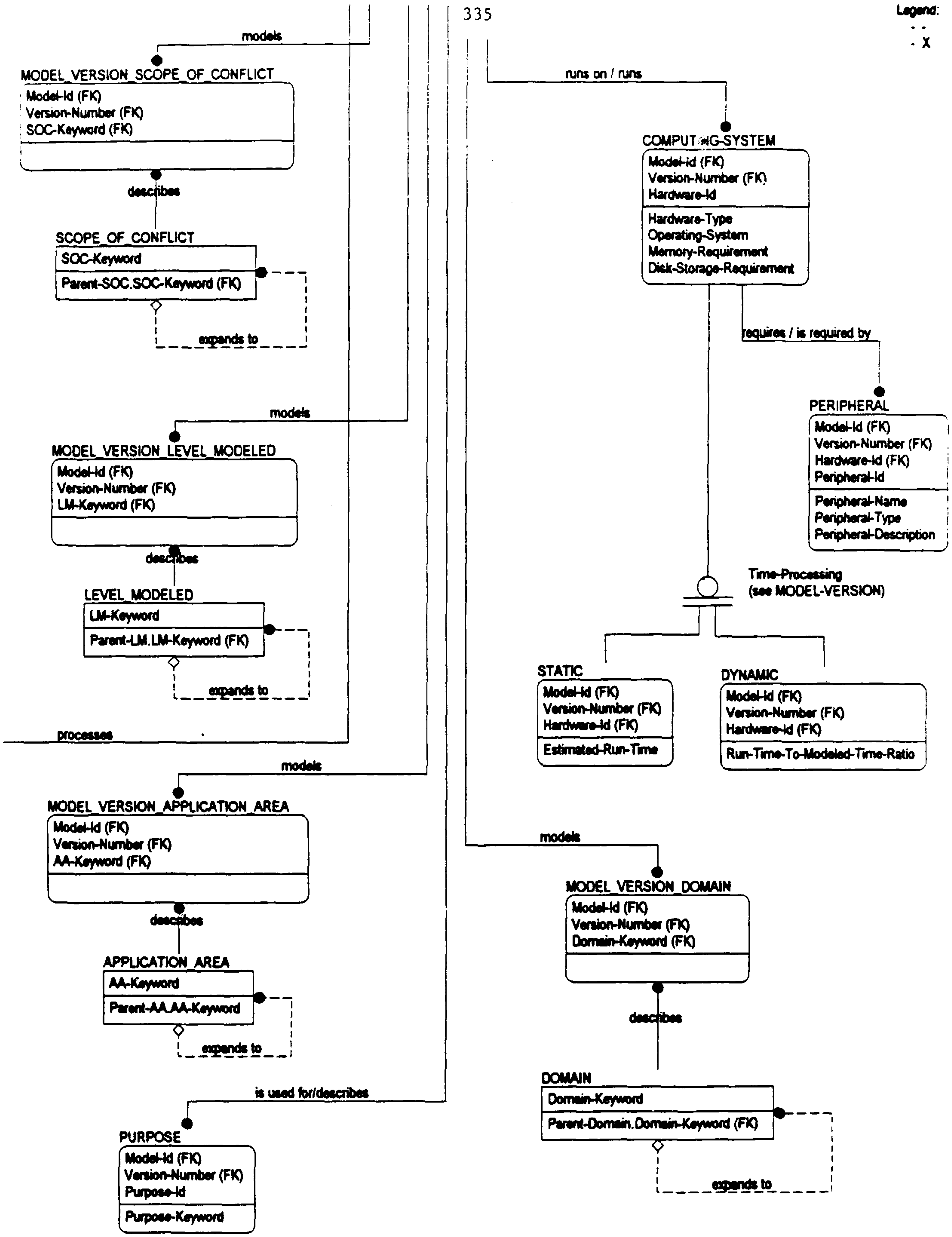
Legend:
X -
- -

Developed by COLSA Corporation: 10 Jan 94
Modified by JDBE: 10 Feb 94




Legend:
QA-Type
VALIDATION
Model-Id (FK)
Version-Number (FK)
Validation-Id.QA--Id (FK)
Validation-Type
VERIFICATION
Model-Id (FK)
Version-Number (FK)
QA--Id (FK)
Verification-Type
ACCREDITATION
Model-Id (FK)
Version-Number (FK)
Accreditation-Id.QA--Id (FK)
Accreditation-Type
Accreditation-Description
CONFIGURATION_MANAGEMENT
Model-Id (FK)
Version-Number (FK)
QA--Id (FK)
is performed using
is performed using
VALIDATION_DATASET
Model-Id (FK)
Version-Number (FK)
Validation-Id (FK)
Validation-Dataset-Id.Input-Dataset-Id (FK)
is used in
ACCREDITATION_DATASET
Model-Id (FK)
Version-Number (FK)
Accreditation-Id (FK)
Validation-Id (FK)
Validation-Dataset-Id (FK)
is used as
INPUT_DATASET
Input-Dataset-Id
Version-Number (FK)
Model-Id (FK)
Input-Id (FK)
Dataset-Name
Dataset-Date
Input-Security-Classification
exists as
INPUT
Model-Id (FK)
Version-Number (FK)
Input-Id
Requirement-Description
Format-Description
consists of
developed using
RUN_TIME_CRITICAL_PARAMETER
Model-Id (FK)
Version-Number (FK)
Input-Id (FK)
Parameter-Id
Parameter-Name
Parameter-Description
Parameter-Affect-On-Run-Time-Description
INPUT_DEVELOPMENT_AID
Model-Id (FK)
Version-Number (FK)
Input-Id (FK)
Input-Development-Aid-Id
Input-Development-Aid-Name
Preparation-Time
Preparation-Level-Of-Effort


Legend:
- X
MODEL_INTERACTION
Subject-Model.(Version-Number,Model-Id) (FK)
Related-Model.(Version-Number,Model-Id) (FK)
Association-Id
Interaction-Type
Interface-Type
Interface-Description
Interaction-Dependency
COMPLIANCE
Model-Id (FK)
Version-Number (FK)
Standard-Id (FK)
Effective-Date (FK)
Compliance-Level
is a standard for
STANDARD
Standard-Id
Effective-Date
Standard-Name
Standard-Issuing-Organization
interfaces with
complies with
SOFTWARE_LANGUAGE
Model-Id (FK)
Version-Number (FK)
Language-Id
Language-Name
Language-Vendor
Language-Version
RANDOMNESS
Method-Id
Version-Number (FK)
Model-Id (FK)
Method-Name
Method-Description
interfaces with
is implemented in
uses / is used by
SPECIAL_SOFTWARE
Model-Id (FK)
Version-Number (FK)
Utility-Id
Utility-Name
Utility-Version
Utility-Vendor
Utility-Type
MODEL_VERSION
Model-Id (FK)
Version-Number
Release-Date
Release-Synopsis
Intended-Use-Description
Time-Processing
Sidedness
Graphics-Description
Code-Security-Classification
Release-Restriction
Date-Catalog-Last-Updated
Comment
Time-Advance-Method
Modeling-Technique-Description
requires
P
generates /
is generated by
OUTPUT
Model-Id (FK)
Version-Number (FK)
Output-Id
Output-Type
Output-Description
Output-Security-Classification
is released as
MODEL
Model-Id
Model-Title
Model-Acronym
Synopsis
Date-First-Implemented
Recommended-Version-Number
is analyzed with
ANALYSIS_AID
Model-Id (FK)
Version-Number (FK)
Output-Id (FK)
Analysis-Aid-Id
Analysis-Aid-Name
Analysis-Aid-Version
Analysis-Aid-Vendor
Analysis-Time
Analysis-Level-Of-Effort
has planned / is planning
MODIFICATION
Model-Id (FK)
Modification-Id
Modification-Description
Projected-Completion-Date
requires/
is required by
DECISION_TOOL
Model-Id (FK)
Version-Number (FK)
Decision-Tool-Id
Decision-Making-Mechanism
Sidedness
Decision-Making-Mechanism
MULTIPLE
Model-Id (FK)
Version-Number (FK)
Number-Of-Sides
Symmetry
Reactive
SINGLE
Model-Id (FK)
Version-Number (FK)
HUMAN_PARTICIPATION
Model-Id (FK)
Version-Number (FK)
Decision-Tool-Id (FK)
Level-Of-Interaction
Required-Or-Optional


Legend:
models
MODEL_VERSION_SCOPE_OF_CONFLICT
Model-Id (FK)
Version-Number (FK)
SOC-Keyword (FK)
describes
SCOPE_OF_CONFLICT
SOC-Keyword
Parent-SOC.SOC-Keyword (FK)
expands to
models
MODEL_VERSION_LEVEL_MODELED
Model-Id (FK)
Version-Number (FK)
LM-Keyword (FK)
describes
LEVEL_MODELED
LM-Keyword
Parent-LM.LM-Keyword (FK)
expands to
processes
models
MODEL_VERSION_APPLICATION_AREA
Model-Id (FK)
Version-Number (FK)
AA-Keyword (FK)
describes
APPLICATION_AREA
AA-Keyword
Parent-AA.AA-Keyword
expands to
is used for/describes
PURPOSE
Model-Id (FK)
Version-Number (FK)
Purpose-Id
Purpose-Keyword
runs on / runs
COMPUTING-SYSTEM
Model-Id (FK)
Version-Number (FK)
Hardware-Id
Hardware-Type
Operating-System
Memory-Requirement
Disk-Storage-Requirement
requires / is required by
PERIPHERAL
Model-Id (FK)
Version-Number (FK)
Hardware-Id (FK)
Peripheral-Id
Peripheral-Name
Peripheral-Type
Peripheral-Description
Time-Processing
(see MODEL-VERSION)
STATIC
Model-Id (FK)
Version-Number (FK)
Hardware-Id (FK)
Estimated-Run-Time
DYNAMIC
Model-Id (FK)
Version-Number (FK)
Hardware-Id (FK)
Run-Time-To-Modeled-Time-Ratio
models
MODEL_VERSION_DOMAIN
Model-Id (FK)
Version-Number (FK)
Domain-Keyword (FK)
describes
DOMAIN
Domain-Keyword
Parent-Domain.Domain-Keyword (FK)
expands to

DMSO Model and Simulation Directory
Logical Data Model

Entity Name	Entity Definition
ACCREDITATION	Certification that a model is acceptable for use for a specific type of application.
ACCREDITATION_DATASET	The use of a validation data set for an accreditation function.
ANALYSIS_AID	An automated system employed to manage or analyze model output.
APPLICATION_AREA	A specific type of use for a model or simulation.
COMPLIANCE	The adherance of a model version to a standard.
COMPUTING-SYSTEM	The use of a model version on a specific hardware platform.
CONFIGURATION_MANAGEMENT	Applying technical and administrative oversight and control to identify and document the functional requirements and capabilities of a model, control changes to those capabilities, and document and report the changes.
DECISION_TOOL	One of the manual or automated decision tools used by the model version.
DEVELOPMENT	The design and production of the model or simulation from specifications.
DOCUMENTATION	Books, notes, design drawing, etc, electronic or hard copy that describe the model or simulation.
DOMAIN	The real-world system being modeled.
DYNAMIC	A computing environment where the model or simulation is time dependent on some mechanism.
HUMAN_PARTICIPATION	The human interaction used in the model or simulation
INPUT	The input data requirements and formats for the model or simulation.
INPUT_DATASET	A data set, data file and/or database used as input to the model..
INPUT_DEVELOPMENT_AID	A software system used to aid in development or management of the model input.
LEVEL_MODELED	A specific mission area represented by a model.
MODEL	A software representation of a a real-world object, system, activity or situation.
MODEL_INTERACTION	A relationship between a specific version of one model and a specific version of another model.
MODEL_VERSION	A particular version of a model or simulation.
MODEL_VERSION_APPLICATION_AREA	The association of a application area keyword with a model version.
MODEL_VERSION_DOMAIN	The association of a domain keyword with a model version.
MODEL_VERSION_LEVEL_MODELED	The association of a level modeled keyword with a model version.
MODEL_VERSION_SCOPE_OF_CONFLICT	The association of a scope of conflict keyword with a model version.
MODIFICATION	An enhancement and/or modification that will be made to the model/simulation.
MULTIPLE	A model or simulation that models the activities of more that one side.
ORGANIZATION	An administrative structure constituted to accomplish a goal, purpose, or mission.
ORGANIZATION_RESPONSIBILITY	A mission or goal assigned to an organization with respect to a model version.

DMSO Model and Simulation Directory
Logical Data Model

Entity Name	Entity Definition
OUTPUT	A data file, report or database produced by a model.
PERIPHERAL	A piece of add-on hardware required to use the model.
PERSON	A human being.
PROPONENCY	The sponsorship of the development and use of a model version.
PURPOSE	The general classification for the use of the model.
QUALITY_ASSURANCE	The activities undertaken by an organization to ensure that the quality control measures for the model or simulation have been followed.
RANDOMNESS	The methods of handling randomness used by the model.
RELEASE	The authorized distribution of a model or simulation by an organization.
RUN_TIME_CRITICAL_PARAMETER	An item from the model input which has an effect on run-time performance.
SCOPE_OF_CONFLICT	The models limitations in time, space, and scope.
SINGLE	A model or simulation that models the activities of only one side.
SOFTWARE_LANGUAGE	One of the possibly multiple software languages used to implement the model version.
SPECIAL_SOFTWARE	Special purpose utility software used by the model version.
STANDARD	A standard governing the specification, development, testing, use, or support of a model or simulation.
STATIC	A computing environment where the model or simulation is not time dependent on some mechanism.
VALIDATION	The process determining that a model is an accurate representation of the intended real-world object from the perspective of the intended use of the model.
VALIDATION_DATASET	The use of an input data set for a validation function.
VERIFICATION	The process of determining that a model accurately represents the developer's conceptual description and specifications.

DMSO Model and Simulation Directory
Logical Data Model

Entity Header	Attribute Name	Attribute Definition
ACCREDITATION		
	Accreditation-Type	The specific type of accreditation performed.
	Accreditation-Description	A description of the conditions and applications for the use of the model version under this accreditation.
ACCREDITATION_DATASET		
ANALYSIS_AID		
	Analysis-Aid-Id	A unique identifier used to distinguish between possible multiple output analysis aids used for the same output of a model version.
	Analysis-Aid-Name	The name of the analysis aid software used.
	Analysis-Aid-Version	A version number of the analysis aid.
	Analysis-Aid-Vendor	The company and/or POC to obtain the analysis aid.
	Analysis-Time	The estimated amount of time required to analyze the output of the model using this analysis aid.
	Analysis-Level-Of-Effort	The estimated level of effort required to analyze the output of the model using this analysis aid.
APPLICATION_AREA		
	AA-Keyword	A word or phrase that uniquely identifies an area of application for categorization of the model or simulation.
	Parent-AA.AA-Keyword	The application area keyword that this keyword is an expansion of.
COMPLIANCE		
	Compliance-Level	The level to which this model version complies with the standard.
COMPUTING-SYSTEM		
	Hardware-Id	A unique identifier of the host hardware that the model will run on used to distinguish between multiple possible computing environments.
	Hardware-Type	The name of the vendor of the host computer system.
	Operating-System	The operating system version that this computer system uses.
	Memory-Requirement	The amount of random access memory (RAM) required to run this model.

DMSO Model and Simulation Directory
Logical Data Model

Entity Header	Attribute Name	Attribute Definition
	Disk-Storage-Requirement	The amount of disk storage required to store and execute this model on this hardware platform.
CONFIGURATION_MANAGEMENT		
DECISION_TOOL		
	Decision-Tool-Id	A system generated unique identifier to distinguish between possible multiple decision tools used by a single model version.
	Decision-Making-Mechanism	A decision making mechanism used in the model.
DEVELOPMENT		
DOCUMENTATION		
	Document-Id	A unique identifier for a document.
	Document-Title	The title of the document.
	Report-Number	The identifying number of the report from the organization that generated the document.
	Date-Published	The publication date of the document.
	DTIC-Number	The Defense Technical Information Center number of the document.
	Filename	The filename of the document if available in electronic form.
	Document-Security-Classification	The security classification of the model document.
	Documentation-Comment	Textual comments related to the document.
DOMAIN		
	Domain-Keyword	A word or phrase that identifies a domain for categorization of the model or simulation.
DYNAMIC		
	Run-Time-To-Modeled-Time-Ratio	A ratio of the amount of computer time required to simulate the typical span of modeled time using this computing platform.
HUMAN_PARTICIPATION		
	Level-Of-Interaction	A description of the level of human interaction used by the model.
	Required-Or-Optional	An indicator of whether human interaction is required or optional.
INPUT		

DMSO Model and Simulation Directory
Logical Data Model

Entity Header	Attribute Name	Attribute Definition
	Input-Id	A unique identifier of an input used by the model used to distinguish between possible multiple inputs to the same model version.
	Requirement-Description	A description of this input data requirement for this model.
	Format-Description	A description of the format required for the input data.
INPUT_DATASET		
	Input-Dataset-Id	A unique identifier of a model input dataset.
	Dataset-Name	The name of the dataset.
	Dataset-Date	The revision date of the dataset.
	Input-Security-Classification	The security classification of the input data set.
INPUT_DEVELOPMENT_AID		
	Input-Development-Aid-Id	A system generated unique identifier to distinguish between multiple input development aids used to prepare a model input.
	Input-Development-Aid-Name	The name of the system used to develop or preprocess input.
	Preparation-Time	The estimated time required to prepare the model input using this input development aid.
	Preparation-Level-Of-Effort	The estimated level of effort required to prepare the model input using this input development aid.
LEVEL_MODELED		
	LM-Keyword	A word or phrase that identifies a level modeled for categorization of the model or simulation.
MODEL		
	Model-Id	A unique identification for a model.
	Model-Title	Complete name of the model.
	Model-Acronym	The acronym of the model.
	Synopsis	A brief description of the model.
	Date-First-Implemented	The date the model was first used.
	Recommended-Version-Number	The identifier number of the model version that has most recently been released.
MODEL_INTERACTION		
	Association-Id	A unique identifier used to differentiate between possible multiple interactions of the same two model versions.

DMSO Model and Simulation Directory
Logical Data Model

Entity Header	Attribute Name	Attribute Definition
	Interaction-Type	A description of the interaction relationship between two model versions.
	Interface-Type	An indicator of whether the interface is automated or manual.
	Interface-Description	A description of the interface between the associated models.
	Interaction-Dependency	An indicator of whether the interaction between model versions is required or optional.
MODEL_VERSION		
	Version-Number	A unique identification of a particular release of the model.
	Release-Date	The date that this version was or will be released for use.
	Release-Synopsis	A brief description of this version of the model.
	Intended-Use-Description	A description from the developer of the intended use of the model.
	Time-Processing	An indicator of whether the model is time dependent.
	Sidedness	Number of sides in competition in the model.
	Graphics-Description	A description of the graphic capabilities normally available for use during a normal run or for playback.
	Code-Security-Classification	The security classification of the model source code.
	Release-Restriction	A description of any restrictions on the release of the model.
	Date-Catalog-Last-Updated	The date the model catalog entry was last updated.
	Comment	Comments from the maintenance agency.
	Time-Advance-Method	Indicates the method the model uses to advance time.
	Modeling-Technique-Description	A description of any well-known algorithms or representation used in the model version.
MODEL_VERSION_APPLICATION_AREA		
MODEL_VERSION_DOMAIN		
MODEL_VERSION_LEVEL_MODELED		
MODEL_VERSION_SCOPE_OF_CONFLICT		
MODIFICATION		
	Modification-Id	A unique identifier used to distinguish between possible multiple modifications planned for the same model.

DMSO Model and Simulation Directory
Logical Data Model

Entity Header	Attribute Name	Attribute Definition
	Modification-Description	A description of the planned modification of the model.
	Projected-Completion-Date	The projected date that the modification will be completed and released.
MULTIPLE		
	Number-Of-Sides	Indicates the number of sides that can be represented in competition in the model.
	Symmetry	An indication of whether the distribution of capabilities to sides in the conflict are asymmetric or symmetric.
	Reactive	An indicator whether the sides to react to interactions with opponents.
ORGANIZATION		
	Organization-Id	A unique identifier for an organization.
	Organization-Name	The name of the organization.
	Address	The address of the organization.
ORGANIZATION_RESPONSIBILITY		
	Responsibility-Id	A unique identifier used to differentiate between possible multiple responsibilities performed by the same organization for a model version.
	Function	A unique function performed by an agency.
OUTPUT		
	Output-Id	A unique identifier used to distinguish between possible multiple outputs from the same model version.
	Output-Type	The type of output of the model.
	Output-Description	A description of this type of output from the model.
	Output-Security-Classification	The security classification of this model output.
PERIPHERAL		
	Peripheral-Id	A unique identifier used to distinguish between possible multiple peripherals of the same computing system.
	Peripheral-Name	The name of the peripheral device.
	Peripheral-Type	The type of peripheral hardware.
	Peripheral-Description	A description of the peripheral.
PERSON		
	Person-Id	A unique identifier for a person.

DMSO Model and Simulation Directory
Logical Data Model

Entity Header	Attribute Name	Attribute Definition
	Person-Title	The title of the person.
	Person-Name	The name of the person.
	Office-Symbol	The office symbol identifier of the individual.
	Commercial-Phone	The commercial phone number of the individual.
	DSN-Phone	The Defense Switching Network phone number of the individual.
	FAX-Phone	The facsimile machine phone number of the individual.
	E-Mail-Address	The electronic mail address of the individual.
PROPONENCY		
PURPOSE		
	Purpose-Id	A unique identifier of the purpose keyword or key phrase.
	Purpose-Keyword	A word or phrase that identifies a purpose for categorization of the model or simulation.
QUALITY_ASSURANCE		
	Date-Completed	The date that the QA function was completed.
	QA-Type	A type of quality assurance performed by a QA agency.
RANDOMNESS		
	Method-Id	A unique identifier used to distinguish between possible multiple randomness techniques used within the same model version.
	Method-Name	The name of the randomness method used.
	Method-Description	A description of the randomness method used and how it is applied in the model.
RELEASE		
RUN_TIME_CRITICAL_PARAMETER		
	Parameter-Id	A unique identifier used to distinguish between multiple input parameters from the same model version input.
	Parameter-Name	The name of an input parameter.
	Parameter-Description	A description of the input parameter.
	Parameter-Affect-On-Run-Time-Description	A description of the affect on run-time contributed by this input parameter.
SCOPE_OF_CONFLICT		

DMSO Model and Simulation Directory
Logical Data Model

Entity Header	Attribute Name	Attribute Definition
	SOC-Keyword	A word or phrase that identifies the scope-of-conflict for categorization of the model or simulation.
SINGLE		
SOFTWARE_LANGUAGE		
	Language-Id	A unique identifier used to distinguish between possible multiple languages used by a single model version.
	Language-Name	The name of the language that the model version is implemented in.
	Language-Vendor	The name of the company that produces the compiler or interpreter for the software language.
	Language-Version	The version number of the compiler.
SPECIAL_SOFTWARE		
	Utility-Id	A unique identifier to distinguish between multiple software utilities used by a single model version.
	Utility-Name	The name of the utility software.
	Utility-Version	The version number of the utility software.
	Utility-Vendor	The name of the company that produces the utility software.
	Utility-Type	The type of utility software.
STANDARD		
	Standard-Id	An identifier for the standard.
	Effective-Date	The date that the standard became effective or will become effective.
	Standard-Name	The formal name of the standard.
	Standard-Issuing-Organization	The name of the organization issuing the standard.
STATIC		
	Estimated-Run-Time	An estimate of the typical time necessary to run the model on this computing platform.
VALIDATION		
	Validation-Type	Indicates the type of verification performed.
VALIDATION_DATASET		
VERIFICATION		
	Verification-Type	Indicates the type of validation performed.

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INTELLIGENCE COMMUNITY MODELING & SIMULATION CATALOG

Dr. John D. Griffiths
System Simulation
P.O. Box 6357
Arlington, VA 22206
(703) 820-2841

I.C. M&S CATALOG TERMS OF REFERENCE

- Gather data on M&S accomplishments, activities, and centers of interest in the Intelligence Community
- Store and access information to share technology, methodology and data regarding I. C. M&S
- Make M&S information available to Government Agencies and sponsored support, consistent with security constraints

EXISTING M&S CATALOGS

- On-Line at DMSO via Internet
  - JCS J-8 Catalog (Defense-wide, but not up-to-date)
    - » Also Hardcopy and CD-ROM via NTIS and DTIC
  - Army M&S Catalog
  - Navy M&S Catalog
  - Air Force Rome Labs M&S Catalog
- These catalogs already contain the Intelligence models that are being used by Service agencies
- DMSO Modeling and Information System
  - Unclassified, non-proprietary, unlimited distribution
  - Will contain additional Service catalogs and data
  - Available to qualified users via Internet

IC M&S CATALOG

- Two Components of Catalog
- Unclassified Component
  - Will Parallel J-8 and Service Catalogs
  - Will exist both at DMSO and on classified component machine
  - Will be available via Internet to qualified users via DMSO
  - Intelligence Agencies will be able to exclude sensitive but unclassified programs and data
  - In such cases unclassified catalog will contain only a POC
- Classified Component
  - Will exist on dedicated stand-alone PC in CIA spaces
  - Data available to qualified cleared users via hardcopy and softcopy
  - Agencies will be able to determine qualifications and clearance level of individuals to have access to listed programs and data
  - POCs only for specially compartmented M&S programs
  - Classified database machine will also contain unclassified DMSO catalogs for use of personnel and agencies without Internet access
- Catalogs Contain Only Descriptions of M&S Programs, Not the Actual Programs or Data

IC M&S CATALOG

Status

386/33 machine, 170 Mb removable storage, x3

Oracle, dBase IV, Alpha Four, MS Access
  Alternative data input, output, manipulation

DMSO M&S catalogs to reside on machine also
  For Intelligence Community members without Internet access

Data Call to be issued as soon as new M&S catalog standard
  is translated into data call format

Classified portion of IC M&S catalog will contain additional fields

INSTITUTE FOR DEFENSE ANALYSES

Database Directory and Model & Simulation Directory Implementation Plans

Michael Frame

Seventh M&S I/DBTG Meeting

February 17, 1994

IDA

Current Status

- A logical design for the Database Directory exists
- A prel. ninary logical design for the M&S Directory exists, JDBE is incorporating changes that resulted from a recent review
  - one more review - not yet scheduled
- A plan has been developed for creating and populating the database and for providing user access

IDA

Implementation Steps

- Integrage Logical Design of M&S and Database Directories
- Initial Physical Database Design and Implementation
- Final Physical Database Design and Implementation
- Develop Support for Database Population
- Develop Support for Database Query and Browsing
- Install Production Version

IDA

Implementation Steps
Physical Database

- Create Initial Physical Database using ORACLE
  - Database Directory physical database
  - M&S Directory physical database
- Completion, March 1994 on IDA prototype system
- Collect information about major sources of data
  - who
  - data volume
  - data formats
  - method of transmittal
  - updating approaches
- Create Final Physical Database Design using ORACLE
- Completion, June 1994 on IDA prototype system

IDA

Develop Support for Database Population

- Create bulk-loading procedures, scripts, and programs
  - test (with data from real providers)
- Create low volume data entry forms (paper and electronic)
- Create user interface for data entry/data loading
- Develop a plan for database maintenance
- Some of this may be used for *both* databases

IDA

Develop Support for Database Query and Browsing

- Determine a standard set of queries and browsing "paths" for each database
- Implement "scripts" for the standard query and browsing set
- Design and implement a user interface that provides
  - access to the standard query and browsing "scripts"
  - management information capture and reporting
  - help facility to support unusual query requests
  - ability to save query/browsing results in a useful form
- The user interface will support both databases

IDA

Testing

- Provide access to the IDA prototype system to selected users for testing
  - data loading
  - user interface
  - standard queries/browsing (for correctness and efficiency)
  - management reporting

Production Installation

- Move the prototype environment to a production system
- Provide support during a transition period

IDA

Summary

- Preliminary physical database "operational" in March, 1994
- Final physical database "operational" in June, 1994
- Requirements for remaining tasks defined, and schedule for remaining tasks completed in early summer, 1994
- Aiming for a production system in early 1995, but that depends on the scope of work required to support data loading and user access

IDA

The Joint Modeling and Simulation System

J-MASS

Presentation to

DMSO I/DB Task Group

17 Feb 94

Capt Bill Cashman
J-MASS Program Office
DSN 785-3969
(513) 255-3969/ Fax-3682
cashmawm@rerw.wpafb.af.mil

J-MASS Focuses on THIS Problem:

- o Current M&S designed for specific, narrowly-defined purposes
  - interoperability and reuse not built in
- o Lack of a Common M&S System
  - lack of consistent/credible results
  - major effort to upgrade/modify existing models
  - new models have to start from “square one”
  - infrastructure continually reinvented
  - VV&A has to start from “square one”

What does J-MASS Provide?

STANDARDS that promote reusable, modifiable, maintainable, interoperable, more easily validated M&S

TOOLS that make those standards transparent to the user

COMMON SYSTEM for developing, using & reusing M&S

An Analogy...

Word Processor or Presentation S/W	**J-MASS**
Create documents/ briefings, Modify, Manipulate, Cut/Paste, Merge, etc...	- Does same thing for models/simulations - Lets you benefit from work of others

*** Obviously, M&S is more complex**

A Common M&S System

Toolset that lets the user:

- Create models
- "Pull in" existing models and modify them
- Set up simulation runs
- Execute simulations
- Analyze simulation results

Models are not "hard coded" into J-MASS

- Models may be added/removed/modified without changing the J-MASS toolset

J-MASS provides toolset, EXPERTS provide models

Design Goals

- Both Real Time and Non Real Time
- Support for varying levels of model fidelity
- Scalable
- Portable (*Currently on Sun*, Silicon Graphics in Mar/Apr)
- Distributed (networks of multiple heterogeneous processors)
- Ability to play in DIS exercises
- License free (common tools in everyone's hands)
- Ability to customize (COTS, etc)
- Ability to connect to Legacy models
- Support for Ada and C++ models
- Visual programming to generate/modify models

How was J-MASS Designed?

- J-MASS is a general purpose M&S system

- Not designed around:
  - specific models
  - specific types of scenarios
  - answering specific analysis questions

- Focused on providing:
  - model building standards
  - tools to enforce those standards
  - ability for models to play together

Providing a common architecture the experts can use to build models for the DoD community

J-MASS Today (Rel 2.0)

- Provides first real functionality to build models, run simulations, and analyze results within J-MASS
  - Previous versions were mainly demo capability
  - Currently contains only a few example models
- Runs on a Sun Workstation
  - Silicon Graphics version due out in Mar/Apr 94
- SAIC (Science Applications Int'l Corp) was prime contractor

Current Features (Rel 2.0)

- o Modular J-MASS design
  - Easier upgrades, maintenance, incorporation of tools
- o Initial Simulation Runtime Agent
  - Faster simulations
  - First step towards distributed processing (helps scalability)
  - Targeted specific areas for future speed improvement
  - Language experiment to *improve run* time was first step towards J-MASS language independence (Ada/C++)
- o Graphical model development tool
  - *Key* to enforcing standard model development, and ensuring compatibility of models with future J-MASS releases
- o Simple plotting and animation tools
- o Help screens throughout J-MASS
- o Initial Graphical User Interface (previous GUI was demo only)
- o Initial Modeling Library (not central repository -- local user areas)
- o Demonstration of J-MASS/DIS Interface (Using DIS 1.0 PDUs)
  - Identified J-MASS areas that would have to be enhanced to better support DIS exercises

J-MASS Users/Beta Sites

Current Users: DIA Missile and Space Intelligence Center
National Air Intelligence Center
Wright Laboratory/MNGA

Beta Sites

AFOTEC/SAN
AIL SYSTEMS INC
APPLIED RESEARCH LABORATORIES (UT AUSTIN)
APPLIED RESOURCES INC
BALL SYSTEMS
CAE-LINK CORPORATION
CENTER FOR NAVAL ANALYSIS
COLEMAN RESEARCH CORP
COMPUTER SCIENCE AND APPLICATIONS
ELECTRONIC SYSTEM CENTER/XRPM
GEODYNAMICS
GEORGIA TECH RESEARCH INSTITUTE
GREYSTONE TECHNOLOGY INC
HRB SYSTEMS
LOCKHEED MISSILES & SPACE COMPANY
LOS ALAMOS NATIONAL LABORATORY
MITRE CORPORATION
NAVAL AIR WARFARE CENTER (China Lake)
NATIONAL AIR INTELLIGENCE CENTER
NCCOSC RDTE DIVISION
NICHOLS RESEARCH CORP
NORTHROP CORP, ADV TECH DESIGN CENTER
NORTHROP CORP, ESD
PHILLIPS LABORATORY
RAND CORPORATION
ROCKWELL INTERNATIONAL
SPECTRA RESEARCH
US ARMY ELECTRONIC PROVING GROUND
US ARMY FSTC
US ARMY REDSTONE TECHNICAL CENTER
WRIGHT LAB
UNIV OF COLORADO

Remember: First functional version (Rel 2.0) just now available
--> To date, not much real use of system

J-MASS Release 3.0 (Dec 94)

First General Release of J-MASS

- Suitable for wide distribution (fewer "rough edges")
- Formal customer support
- McDonnell Douglas is prime contractor
  - -- SAIC is technology insertion contractor

Features:

- Initial Real-Time simulation capability
- Ability to split simulations across multiple processors
- Ability to use both Ada and C++ models
- Backward compatibility with Release 2.0
- Accompanied by a "How To" Manual

Beyond Release 3.0

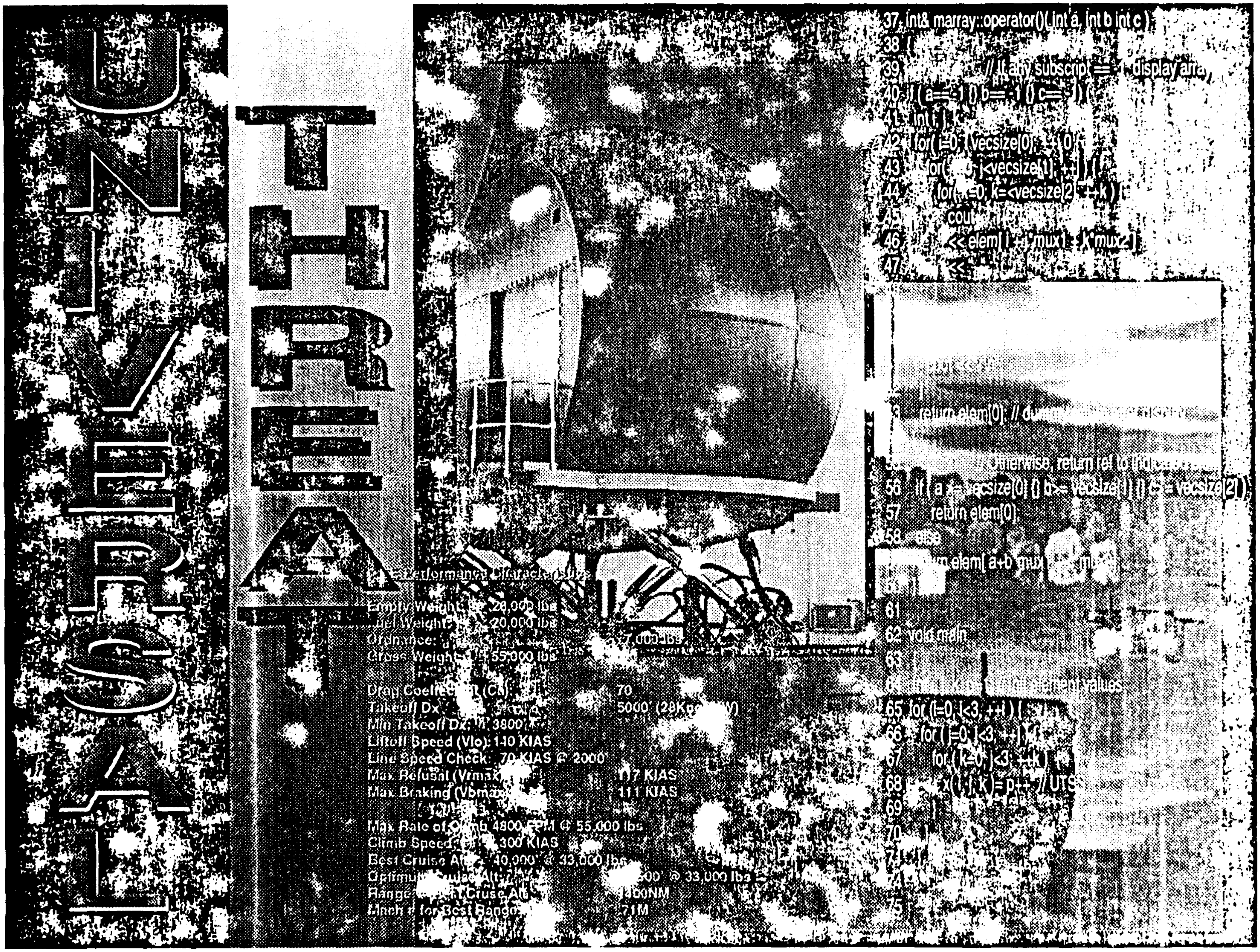
(not all-inclusive)

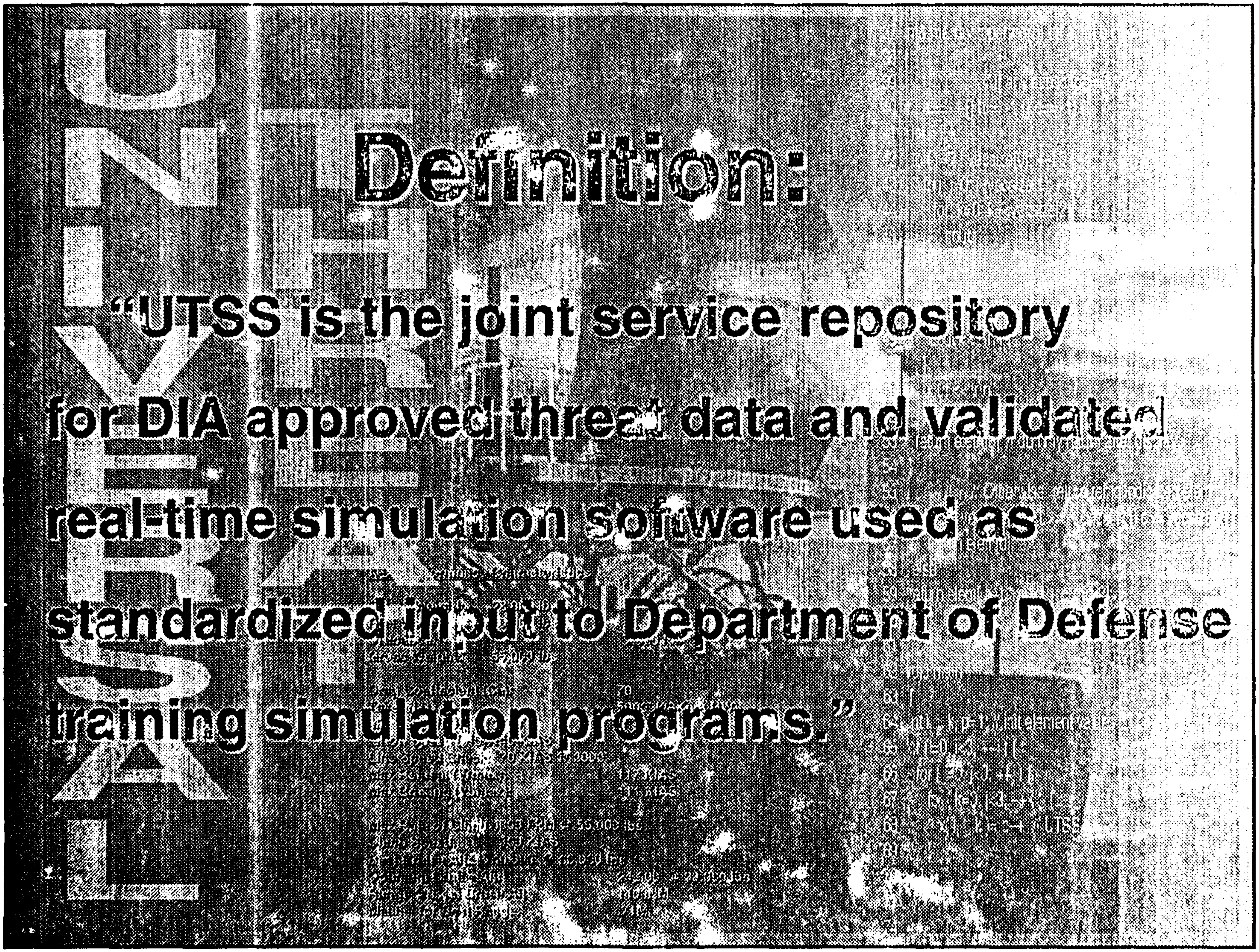
- Improved model development tools
- Better simulation configuration capability
- Data Base Mgt System
- Inclusion of DIS interface
- Faster execution
- Inclusion of experiment manager
- Legacy models
- Improved multispectral capability
- IBM RS6000 support
- Specific hardware in the loop
- Ada 9X (long term)
- Better C++ integration
- Additional analysis features

Summary

- J-MASS represents many years of engineering and prototyping--many "lessons learned"
- Open system, object based, well documented, non-proprietary, portable
- Release 2.0 provides the first real functionality for analysts--the prototype is on the street; it's not "vaporware"
- Designed to support a broad array of M&S requirements
- Continuing to tackle the issues

Provides the strong foundation M&S needs


UNIVERSAL
THREAT
37 int& marray::operator()(int a, int b int c)
42 for(i=0; i<vecsize[0]; ++i) {
56 if (a >= vecsize[0] || b>= vecsize[1] || c>= vecsize[2])
57 return elem[0];
62 void main
65 for (i=0; i<3; ++i) {
66 for (j=0; j<3; ++j) {
67 for (k=0; k<3; ++k)
Empty Weight: 28,000 lbs
Fuel Weight: 20,000 lbs
Gross Weight: 55,000 lbs
Min Takeoff Dx: 3800'
Liftoff Speed (Vlo): 140 KIAS
Line Speed Check: 70 KIAS @ 2000'
117 KIAS
111 KIAS
Climb Speed: 300 KIAS


Definition:
"UTSS is the joint service repository
for DIA approved threat data and validated
real-time simulation software used as
standardized input to Department of Defense
training simulation programs."

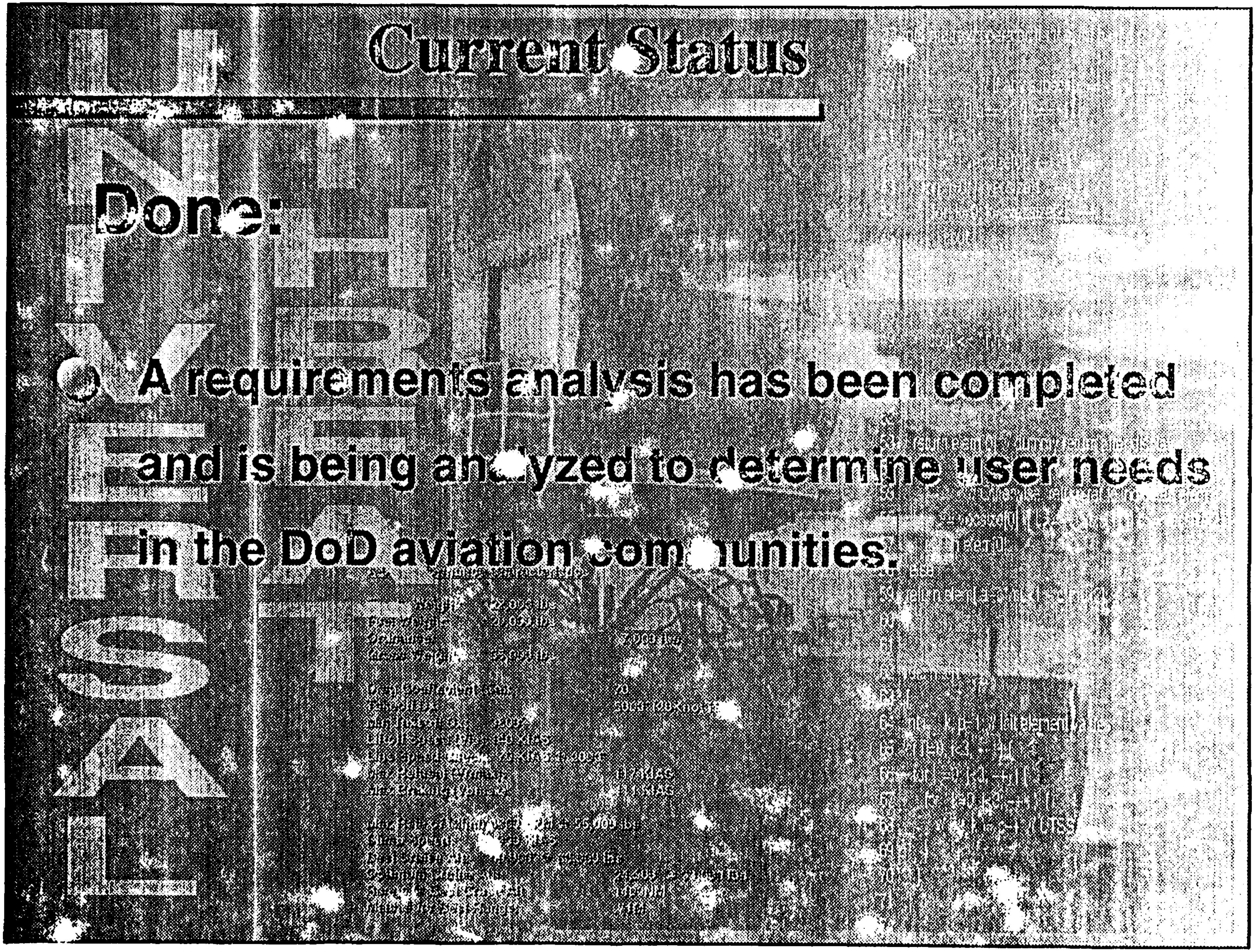
Background

Participants:

- The UTSS Program has the support of the Air Force, Army, Navy, Marine Corps, and Defense Intelligence Agency.
- The Navy is the lead service.
- NAVAIR PMA 205 is the Program Manager.

NAVAIR UTSS

Universal Threat System for Simulators


Current Status
Done:
A requirements analysis has been completed and is being analyzed to determine user needs in the DoD aviation communities.

Current Status

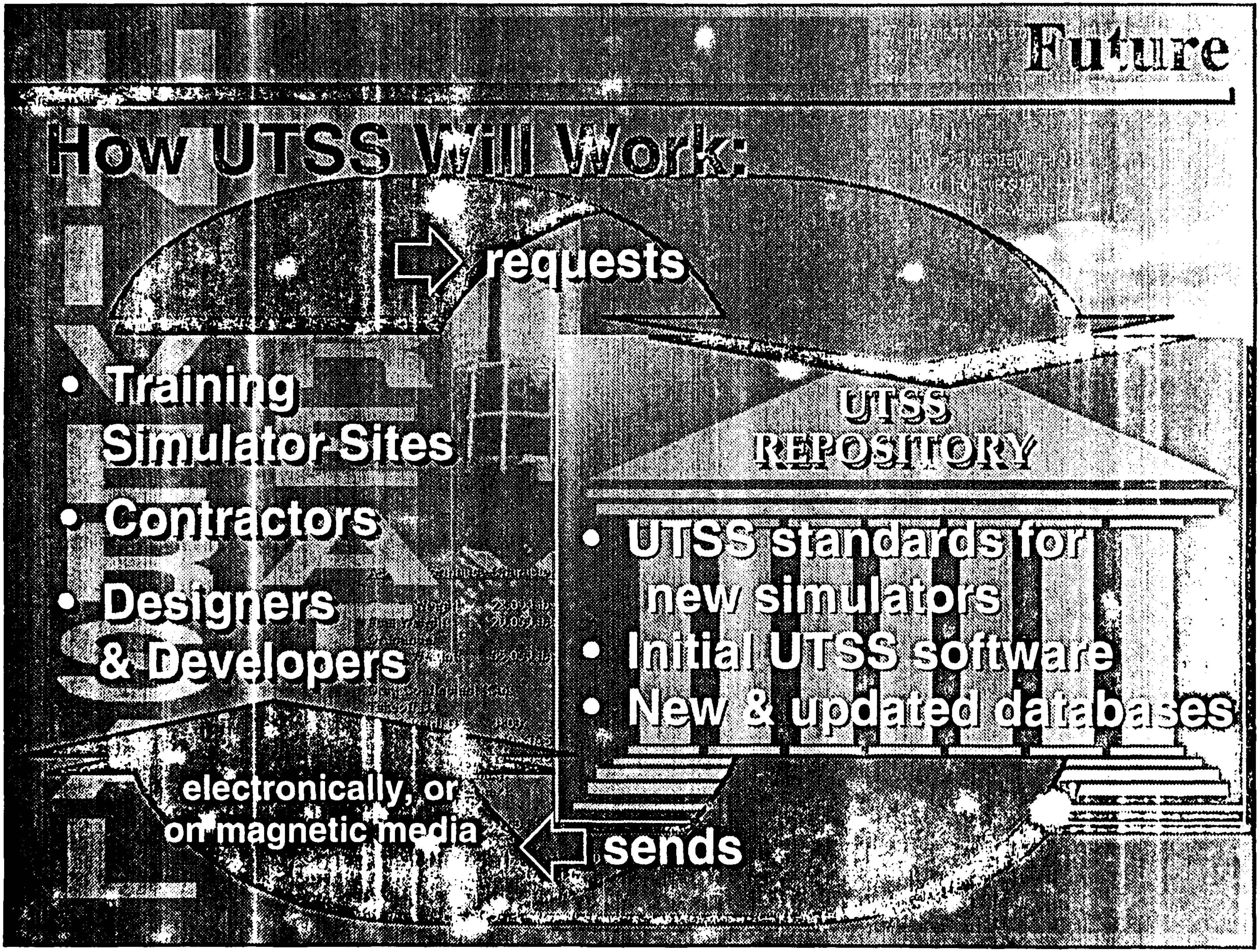
In Progress:

- A technology evaluation has been completed and is in review by the UTSS working groups and the EXCOM.
- The User Needs Analysis (UNA) has been drafted and is in review by the UTSS working groups.

Current Status

Current Findings:

- The Technical Evaluation and the User Needs Analysis have produced:
  - 87 aircrew requirements
- Jan 94: perform UTSS Requirements Analysis Survey on Army ground forces, Navy, submarine and surface forces.


Future
How UTSS Will Work:
requests
• Training Simulator Sites
• Contractors
• Designers & Developers
UTSS REPOSITORY
• UTSS standards for new simulators
• Initial UTSS software
• New & updated databases
sends
electronically, or on magnetic media


Future
Government Built:
Current plans are to build the system using government resources.
Naval Air Warfare Center (NAWC) Indianapolis

Future

Joint Programs:

- UTSS simulations will be Distributed Interactive Simulation (DIS) compliant.
- UTSS is working with Combat Arms Tactical Trainer (CATT) and Battle Force Tactical Trainer (BFTT) to determine their threat needs.
- UTSS is envisioned to provide the necessary threat simulations for mission rehearsal scenarios.
- Standardized databases and simulations will enhance the capability to network simulators.

UTSS/ JDBE TEAMING EFFORT

- JDBE PERSONNEL REPRESENTED ON UTSS WORKING GROUPS
- DRAFT SOW IN REVIEW
- IDEF1X DATA MODELING
- IDEF0 PROCESS MODELING SUPPORT

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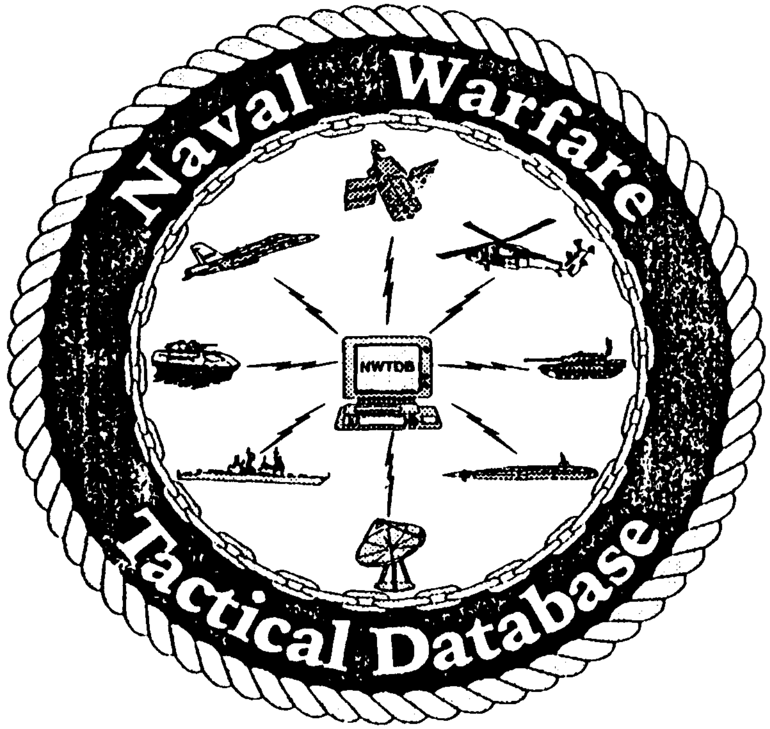
NAVAL WARFARE TACTICAL DATABASE (NWTDB)



Briefing to the I/DB Task Group

17 February 1994

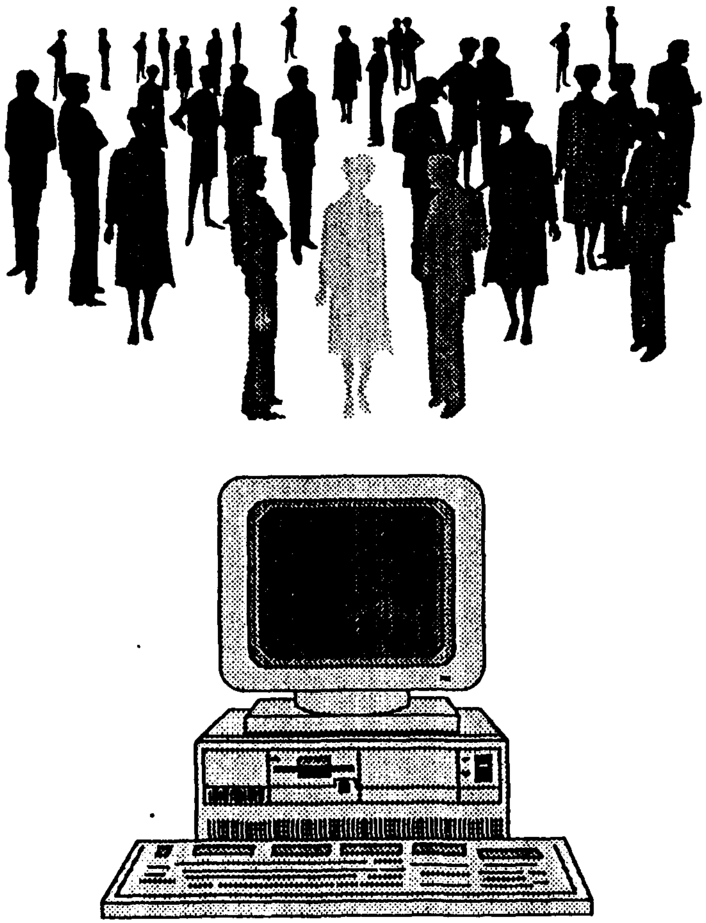
LCDR John Letaw
(703) 697-3033

BRIEFING AGENDA

- What is NWTDB?
- Program Evolution
- The DOD Data Administration Program
- The NWTDB Process
- Future Direction of NWTDB

NWTDB

NWTDB IS. . .



- A Management Process
  - *Complies with DOD directives*
- A Common Database Architecture
  - *Not a stand-alone database*
  - *More than a metadata repository*
- A Path to Common Sensor-to-Shooter Connectivity

OPNAV (N65)

BACKGROUND

In 1984, CNO asked about the consistency of databases between ships. A Flag Officer Steering Group was formed, which concluded:

- Lack of standard data structures impeded sharing of data
- Lack of designated data sources yielded conflicting data

NAVINTCOM (now ONI) was tasked to find a solution. In 1986, they produced a prototype Naval Intelligence Database (NID).

In May, 1990 NWTDB was formally established by OPNAVINST 9410.5, adding environmental, cryptologic, forces & facilities. Functional Database Managers assigned.

Sep, 92: Published the NWTDB Management Plan

NWTDB

BACKGROUND (cont.)

Jan 93: DODI 8320.1-M-1 published, describing DOD data element standardization process

June, 93: Received OSD Gold Nugget Award for "excellence, innovation, and creativity" in finding joint solutions to information management problems.

July, 93: Published first edition of NWTDB Standards Manual

Revised OPNAVINST to conform to DOD data administration procedures; added SPAWAR as a M&S functional database manager

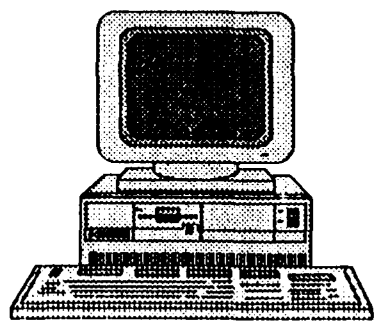
Jan, 94: Formed the NWTDB Implementation Panel to consider and resolve issues relating to data migration of existing systems.

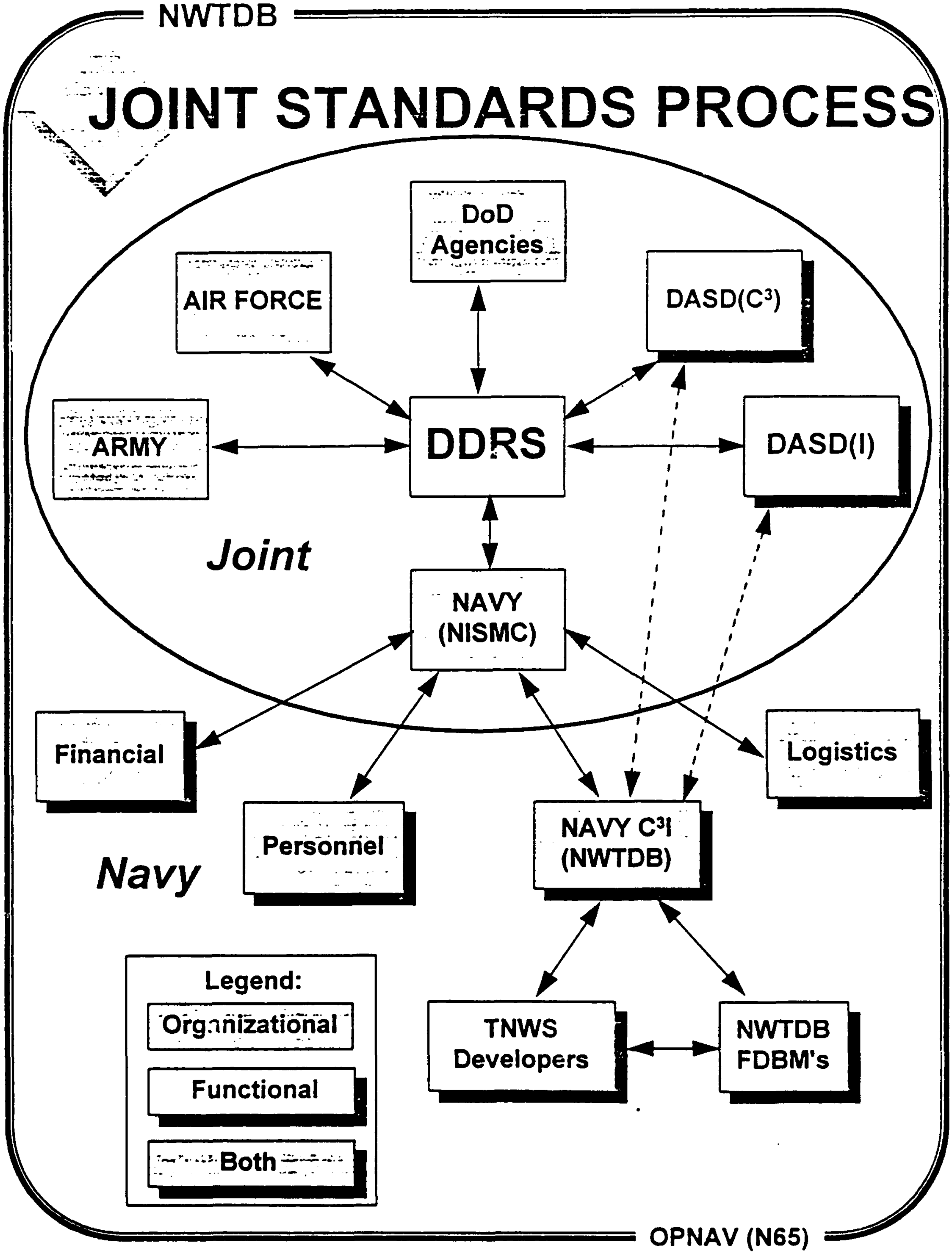
DOD DATA ADMINISTRATION PROGRAM

- Established by DoD Directive 8320.1, September 1991
  - Initiates the Defense Data Repository System
- Data Element Standards described in DoD Instruction 8320.1-M-1, January 1993
- Data administration policy (8320.1-M) still in draft
  - OPNAVINST 9410.6 supports draft policy

DEFENSE DATA REPOSITORY SYSTEM (DDRS)

- Administered by Center for Information Management
- Used to register developmental, interim, or candidate data elements
  - Once approved, they become standard data elements
- All components/agencies vote on candidate DEs
- Navy's Data Administrator is NISMC (Rebecca Wade): The only Navy person authorized to input to DDRS




NWTDB
JOINT STANDARDS PROCESS
DoD Agencies
AIR FORCE
DASD(C³)
ARMY
DDRS
DASD(I)
Joint
NAVY (NISMC)
Financial
Logistics
Personnel
NAVY C³I (NWTDB)
Navy
Legend:
Organizational
Functional
Both
TNWS Developers
NWTDB FDBM's
OPNAV (N65)

FUNCTIONAL DATABASE MANAGERS

NAVAL:

Office of Naval Intelligence: C & P for non-US platforms and equipment; Standards and Structures Administrator

SPAWAR 31: U.S. Navy C & P (in support of modeling and simulation)

EWOPFAC: Radar parameters data: Blue, white, red

COMNAVSECGRU: Signals exploitation

COMNAVOCEANCOM: Oceanographic, meteorologic, MC&G

MARCORSYSCOM: Land warfare

NON-NAVAL:

DIA: Non-US installations, equipment, order of battle

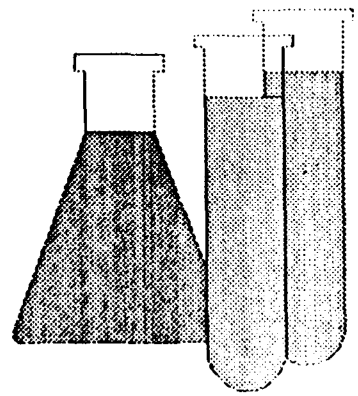
AIC/JICPAC: Theater-specific installations and order of battle

ECAC: U.S. emitters (military, federal, civil): C&P and installations

NWTDB

NWTDB PROCESS

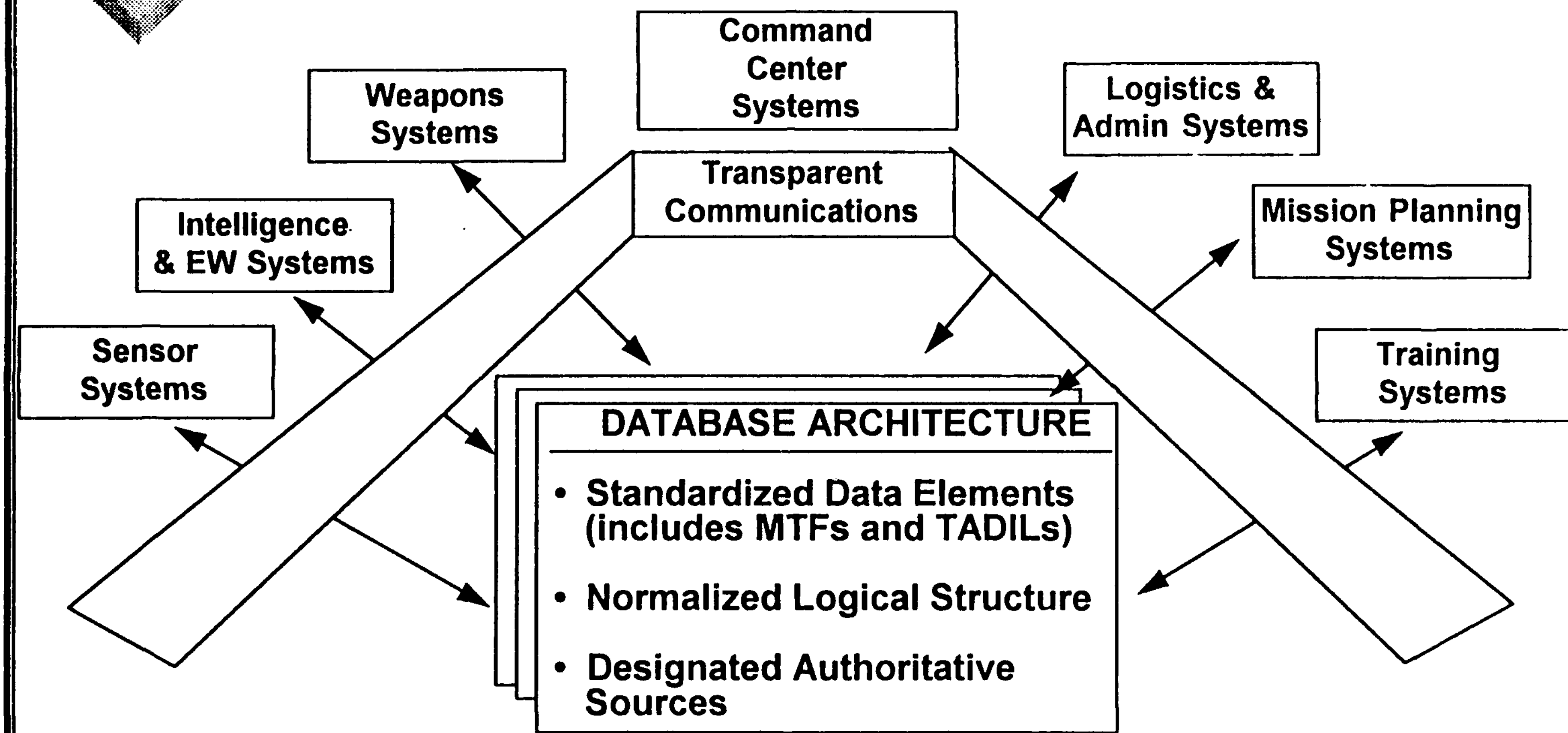
- Information Requirements and User Validation
- Data Standards and Structures Definition and Validation
- Reference Data Base Production
- System Implemenation
- Operational Data Base Management



OPNAV (N65)

NWTDB

COMMON INTERFACE "LANGUAGE"



- Improved reaction times
- Interoperable warfare systems
- Command and Control facilitated by deconflicted information exchange
- No unnecessary duplication of effort

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NWTDB

EVOLUTION TO AN OPEN SYSTEMS ARCHITECTURE

Present Applications Oriented Architecture

Application 1	Application 2	Application n
System 1	System 2	System n
Data Base 1	Data Base 2	Data Base n

↓

NWTDB Systems Information Directory (SID)

Register Data Elements In SID	Produce NWTDB Standards and Structures Manuals	Register Data Elements In SID	Revised and Expanded Manuals
• DDRS • MIIDS/IDB • JOPES • NID • NERF/RAPDS • AFAD • NCDB • OAML • NODDES • MTFs • LINKs • OTG • n.............	• Forces and Facilities • Weapons Systems • Cryptologic • Environmental • n...........	• ACDS • AEGIS • AN/BSY-2 • BFTTS • COMBAT DF • NTCS-A • OBU • OSS • SNAP • TAMPS • TCTS • TESS • TWCS • n...........	• Normalized Data Base Structure • *Statement of* Navy Tactical Data Requirements for: - CIM - C^4I for the Warrior

FY 93 — Implementation — FY 95

↓

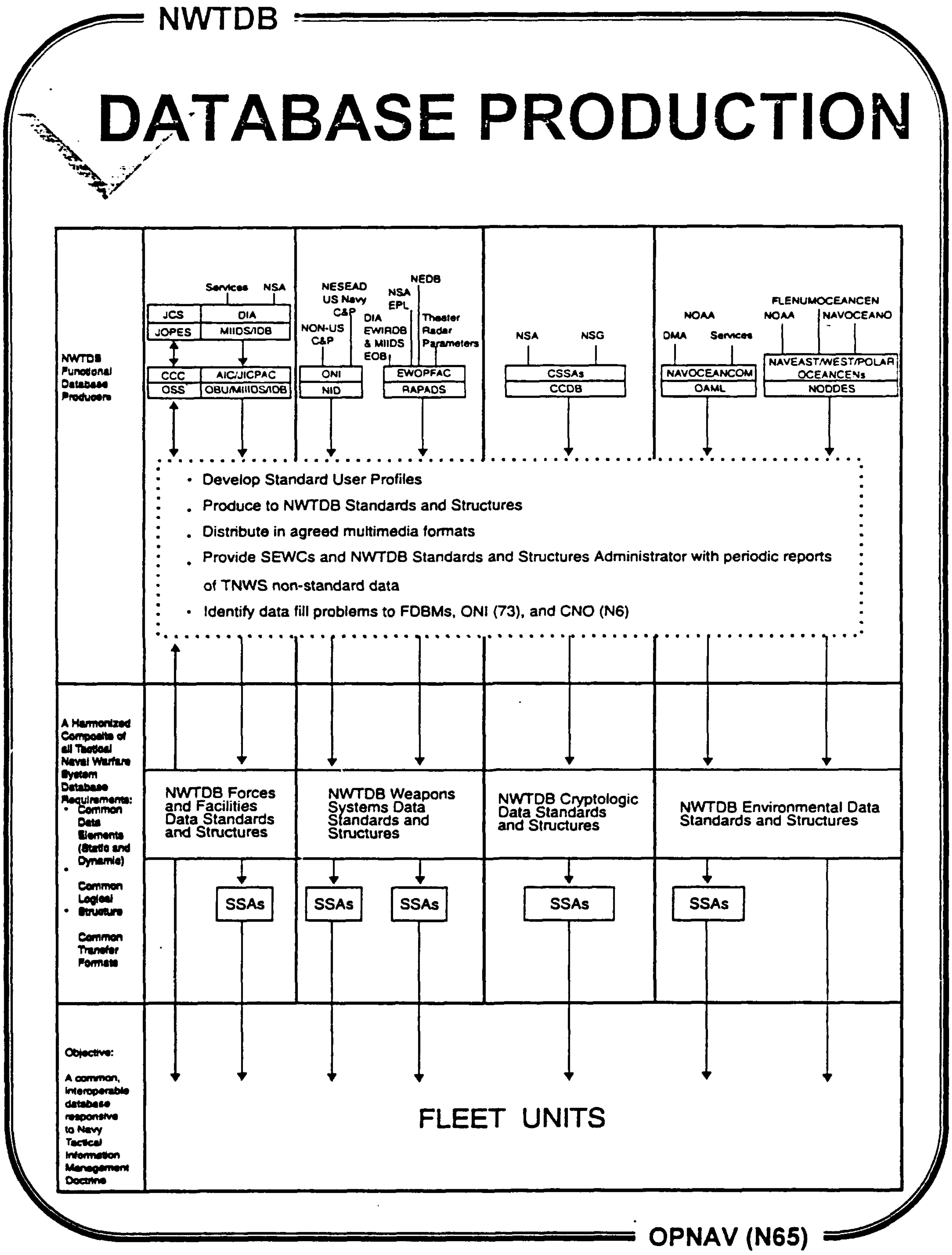
Objective Open Architecture

Application	Application	Application

COE/NGCR Based Systems

Common Data Base Architecture (NWTDB)

OPNAV (N65)


NWTDB
DATABASE PRODUCTION
NWTDB Functional Database Producers
Services NSA
JCS DIA
JOPES MIIDS/IDB
CCC AIC/JICPAC
OSS OBU/MIIDS/IDB
NESEAD US Navy C&P
NON-US C&P
NSA EPL
DIA EWIRDB & MIIDS EOB
NEDB
Theater Radar Parameters
ONI
NID
EWOPFAC
RAPADS
NSA NSG
CSSAs
CCDB
NOAA
DMA Services
NAVOCEANCOM
OAML
FLENUMOCEANCEN
NOAA NAVOCEANO
NAVEAST/WEST/POLAR OCEANCENs
NODDES
• Develop Standard User Profiles
• Produce to NWTDB Standards and Structures
• Distribute in agreed multimedia formats
• Provide SEWCs and NWTDB Standards and Structures Administrator with periodic reports of TNWS non-standard data
• Identify data fill problems to FDBMs, ONI (73), and CNO (N6)
A Harmonized Composite of all Tactical Naval Warfare System Database Requirements:
• Common Data Elements (Static and Dynamic)
• Common Logical Structure
• Common Transfer Formats
NWTDB Forces and Facilities Data Standards and Structures
NWTDB Weapons Systems Data Standards and Structures
NWTDB Cryptologic Data Standards and Structures
NWTDB Environmental Data Standards and Structures
SSAs
SSAs
SSAs
SSAs
SSAs
Objective:
A common, interoperable database responsive to Navy Tactical Information Management Doctrine
FLEET UNITS
OPNAV (N65)

NWTDB

FUTURE DIRECTION OF NWTDB

- Focus on high quality, timely data fill
- Add tactical system data structures into NWTDB
  - NTCS-A and OSS completed
- Revise Standards Manual about every six months
  - Include CD-ROM version
- Prepare Configuration Management Plan
  - More specific guidance on response to fleet requirements
  - Draft to be distributed this month
- Integrate NWTDB standards into the DoD C2 data model
  - Began this process on 9 Nov 93
- Envision goal of 1997 to evolve existing DEs to joint standards

OPNAV (N65)

NWTDB

ONGOING THRUST AREAS

Create NWTDB Configuration Management Plan

Expand NWTDB process to include USMC, ECAC, NCTC

Incorporate and deconflict USMC data structures

Incorporate and deconflict ECAC data structures

Continue semi-annual release of Standards Manual; add CD-ROM

Continue semi-annual Working Group meetings

Coordinate Naval Data Migration Plan through the NWTDB Implementation Panel

Conduct FDBM bi-monthly policy and planning meetings

Rewrite existing data elements IAW DODD 8320.1-M-1

Integrate NWTDB data models into DOD Core C2 Data Model

Quarterly distribution of databases. Continually seek sources of higher-quality, more current data.

Integrate NWTDB with Modeling and Simulation data elements (DMSO project)

THE BIG BANG!

FROM A VISION OF STANDARDIZED PRODUCER DATABASES, AN EXPLOSION OF ACTIVITY ...

OPNAV (N65)

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DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, DC 20350-2000

IN REPLY REFER TO

OPNAVINST 9410.6
N65
13 July 1993

OPNAV INSTRUCTION 9410.6

From: Chief of Naval Operations

Subj: NAVAL WARFARE TACTICAL DATABASE (NWTDB) REQUIREMENTS FOR TACTICAL NAVAL WARFARE SYSTEMS

Ref: (a) DOD Directive 8320.1 of 26 Sep 91, "DOD Data Administration" (NOTAL)
(b) DOD Manual 8320.1-M-1 of 15 Jan 93, "DOD Data Element Standardization Procedures" (NOTAL)
(c) DOD Directive 4630.5 of 12 Nov 92, "Compatibility, Interoperability and Integration of Tactical Command, Control, Communications and Intelligence (C3I) Systems" (NOTAL)
(d) OPNAVINST 9410.5, "Database and Communication Standards Interoperability Requirements for Tactical Naval Warfare Systems" (NOTAL)
(e) SECNAVINST 5400.15 of 5 Aug 91, "Department of the Navy Research, Development, and Acquisition Responsibilities" (NOTAL)
(f) SECNAVINST 5000.2A of 9 Dec 92, "Implementation of Defense Acquisition Management Policies, Procedures, Documentation, and Reports" (NOTAL)
(g) OPNAVINST 5000.42D of 19 Apr 93, "OPNAV Role and Responsibilities in the Acquisition Process" (NOTAL)
(h) NWTDB Management Plan of Sep 92 (NOTAL)
(i) OPNAVINST 3430.23B of 12 Jun 92, "Tactical Electronic Warfare Reprogrammable Library Support Program" (NOTAL)
(j) OPNAVINST 3140.54 of 3 Nov 86, "Submission of Oceanographic and Meteorological Requirements" (NOTAL)
(k) OPNAVINST 3140.55 of 5 Mar 87, "Submission of Requirements for Mapping, Charting, and Geodesy (MC&G) Products and Services" (NOTAL)

Encl: (1) Definitions
(2) NWTDB Reference Database Production Architecture
(3) Interim NWDTB User Feedback/Requirements Report

1. <u>Purpose</u>. To establish responsibilities and procedures for evolving to a common tactical database architecture that supports naval, joint, and combined operations. Specifically, to:

a. Implement Command, Control, Communications, and Intelligence (C^3I) data administration and systems interoperability requirements in accordance with references (a) through (c);

b. Provide a management framework for Navy to resolve data interoperability issues which impact tactical naval warfare;

c. Designate Functional Database Managers (FDBMs) and specify their duties; and

d. Reduce long term naval warfare system acquisition costs by evolving to a joint and theater compatible information architecture which will be applied to both the requirements and engineering processes.

2. Supercession. The guidance in this instruction supersedes guidance found in reference (d) regarding NWTDB. All other provisions of reference (d) remain in effect until canceled or superseded by other means.

3. Scope/Applicability. This policy is issued in accordance with, and in amplification of, references (e) through (g). It applies to all organizations acquiring and supporting Tactical Naval Warfare Systems (TNWSs) and associated database production, including those organizations acquiring systems under rapid prototyping and fleet initiative programs.

4. Definitions. Terms used in this instruction are defined in enclosure (1).

5. Background

a. Systems involved in warfare and warfare support must be able to exchange data. Incompatible data definitions, naming conventions, and structures make this difficult. Program managers are forced to develop and maintain unique databases with specialized interface design specifications to other systems because data standardization efforts have been fragmented, community specific, and inadequate. This is neither operationally effective nor cost efficient.

b. The Department of Defense Corporate Information Management (CIM) effort was initiated in 1990 to reduce acquisition costs. CIM is chartered to develop Department of Defense process models, data models, and information systems, and to standardize the computing and communications infrastructure of DOD. A primary CIM objective is to develop a single DOD data element dictionary to improve interoperability among systems and facilitate data exchanges. The Defense Information Systems Agency (DISA) is developing the Defense Data Repository System (DDRS) to support this effort. DOD components are directed to participate in the process as described in references (a) and (b). Per reference (a), applicable Federal, national, and international data standards are preferred over unique DOD standards. Thus, where Navy or DOD develops unique standards, future modifications will be necessary to evolve to higher-precedence standards once available. NWTDB provides the management framework for achieving this evolution for Navy tactical data standards once approved joint standards are available.

c. The Joint "C^4I for the Warrior" and Navy "Copernicus" efforts set forth concepts, unifying themes, and principles for achieving C^4I interoperability that is global, reliable, secure, affordable, and responsive to warfare operations. Interoperable databases and data standardization are essential to achieving the common systems processing required to support these objectives.

d. The concept for achieving tactical data interoperability is contained in reference (h). This concept includes NWTDB reference database production as depicted in enclosure (2), as well as data requirements and Navy C^3I data administration.

6. Policy

a. Reference (a) requires that information be treated as an asset directly accessible throughout an organization. Effective data administration provides the means to share data, control redundancy, minimize data handling, and improve data integrity.

b. All Navy system developers and database producers will transition to NWTDB data standards and structures by the year 2000. At present, NWTDB includes only a minimum baseline of data standards. Additional data elements or data sets required for tactical naval warfare may be developed by or in coordination with system developers as candidate DOD standards. This includes the data elements required to support modeling and simulation, as well as training. Chief of Naval Operations (N6) and Office of Naval Intelligence (ONI-73) will provide management support to assist developers in this endeavor.

c. It is the responsibility of system sponsors and developers to plan and budget for the evolution of existing systems to approved joint and Navy standards. Navy C^3I baseline data standards will be derived from existing data element formats and definitions by Functional Database Managers (FDBMs) in cooperation with system developers. These formats, in turn, will be coordinated with joint standards managers as described in reference (b). In the long term, NWTDB will reduce both software development and maintenance costs. A phased integration of functional data standards using budgeted funds through normal configuration management is less expensive than proliferation of unique data formats, with translators for each new application. System milestone reviews shall address data interoperability.

d. The NWTDB process refocuses existing resources to

(1) Identify and integrate user and system data requirements,

(2) Register existing Tactical Naval Warfare System (TNWS) data elements to use in baseline standards,

(3) Institute and manage Navy-approved C^3I data standards, and submit these as, or evolve to, joint data standards,

(4) Implement approved standards in all TNWSs, and

(5) Provide consistent, authoritative tactical reference data.

e. NWTDB policy execution does not:

(1) Dictate hardware or software for systems use,

(2) Dictate which standard data elements to implement,

(3) Dictate system applications, or

(4) Dictate internal system data handling.

7. Responsibilities

a. Director of Space and Electronic Warfare (N6) will:

(1) Act as the Chief of Naval Operations' (CNO) point of contact for C^3I data administration and information technology issues. Provide overall management and direction for NWTDB.

(2) Coordinate and submit Navy position and submit recommendations to DOD agencies regarding integrated C^3I interoperability standards. Positions will be submitted via the Navy data administrator when required by SECNAV instruction.

(3) Integrate Navy configuration management of C^3, Combat, and Intelligence data standards (Database, Message Text Formats, and Tactical Data Information Links).

(4) Prepare a Configuration Management Plan for detailed instruction on submission of requirements and approval process of candidate data elements.

(5) Plan, program, and budget adequate resources to ensure Navy command and control systems implement Joint and Navy C^3I data standards.

b. Director of Naval Intelligence (N2) will:

(1) Manage for the CNO the submission and status of Tactical Naval Warfare Systems intelligence production requirements to Commanders in Chief and agencies.

(2) Support N6 in Navy C^3I data administration and data element harmonization.

(3) Plan, program, and budget adequate resources to ensure Navy General Defense Intelligence Program and Tactical Cryptologic Program systems implement Joint and Navy C^3I data standards.

c. Oceanographer of the Navy (N096) will:

(1) Manage for the CNO the coordination and submission of TNWS mapping, charting, and geodesy requirements to the Defense Mapping Agency (DMA); and meteorology, oceanography, and astrometry requirements.

(2) Support N6 in Navy C^3I data administration and data element standardization.

(3) Plan, program, and budget adequate resources to ensure Navy environmental systems implement Joint and Navy C^3I data standards.

d. Deputy Chief of Naval Operations for Resources, Warfare Requirements, and Assessments (N8) will:

(1) Ensure Navy modeling and simulation systems use NWTDB standards and structures.

(2) Support N6 in Navy C^3I data administration and data element standardization.

(3) Use NWTDB format in production and maintenance of U.S. Navy weapons systems, and for platform characteristics and performance data to meet the needs of wargaming and implementation on TNWSs.

e. CNO Resource and Program Sponsors will:

(1) Submit existing TNWS data element formats and definitions to the Office of Naval Intelligence for registration and consolidation into candidate DOD standards.

(2) Ensure new or upgraded systems use NWTDB standards and structures, and that existing systems transition by the year 2000, unless systems have been specifically given exemptions by N6.

f. System Development Managers (Systems Commands, Program Executive Officers, and Direct Reporting Program Managers) will:

(1) Coordinate the implementation of NWTDB in TNWSs through the Force Warfare Systems Engineering Board.

(2) Prepare implementation plans to support the requirements of this instruction within their commands.

(3) Designate a single point of contact for external coordination of data standardization issues.

(4) Provide existing TNWS data element definitions and formats to ONI for registration in NWTDB.

g. Office of Naval Intelligence (ONI) will:

(1) Act as the NWTDB Standards and Structure Administrator for CNO (N6).

(2) Register TNWS data elements in the NWTDB Systems Information Directory, and coordinate preparation of candidate joint standards for submission to the DISA Defense Data Repository System (DDRS) for approval as joint standard data elements.

(3) Identify conflicting, redundant, or required production of data and recommend solutions to CNO (N6).

(4) Coordinate data set design and dissemination of the NWTDB Standards and Structures Manual.

(5) Develop and manage NWTDB dissemination procedures with the FDBMs, including maintenance of a master list of users and holdings.

(6) Coordinate the NWTDB configuration management process, to include review of submitted data elements for technical accuracy.

h. Navy FDBMs (listed in paragraph 7i below) will:

(1) Coordinate NWTDB data set structure design with ONI, to comply with reference (b) standards.

(2) Disseminate data in accordance with NWTDB data element format and data set structures. The common medium for file dissemination between database producers and users will be American Standards Code for Information Interchange (ASCII) unless all parties agree upon a substitute coding format which is approved by ONI. The intent is to evolve to a single, industry compatible, dissemination standard which permits data compression for communication transfer. Enclosure (2) illustrates the projected standard reference database production.

(3) Oversee NWTDB configuration management within their functional area to include functional review of submitted data elements to ensure they meet operational requirements. Produce applicable portion of the NWTDB Standards and Structures Manual in coordination with ONI.

i. Navy NWTDB FDBMs and their areas of concern are as follows:

(1) ONI - Characteristics and performance (C&P) data of non-U.S. equipment and merchant ships,

(2) Commander, Space and Naval Warfare Systems (COMSPAWARCOM) - Provide U.S. Navy C&P data in support of modeling and simulation and TNWSs,

(3) Officer in Charge, Electronic Warfare Operational Programming Facility (EWOPFAC) - Radar parameters data (reference (i) pertains),

(4) Commander, Naval Security Group (COMNAVSECGRU) - Cryptologic (i.e., communications intelligence) data, and

(5) Commander, Naval Oceanography Command (COMNAVOCEANCOM) - Oceanography, meteorology, astrometry, and mapping, charting, and geodesy (references (j) and (k) pertain).

j. Participating non-Navy NWTDB FDBMs are:

(1) Defense Intelligence Agency - Non-U.S. installations, equipment, and order of battle data.

(2) Atlantic Intelligence Command (AIC)/Joint Intelligence Center Pacific (JICPAC) - Theater specific installation, amphibious, lines of communication and order of battle.

k. Navy Center for Tactical Systems Interoperability (NCTSI) will:

(1) Review proposed changes to NWTDB standards and structures for impact on tactical system implementation and interoperability of Tactical Data Information Links and Message Text Format systems.

(2) Monitor compliance with NWTDB standards in conjunction with C4I systems interoperability testing efforts.

l. Fleet Commanders in Chief will:

(1) Identify data standards, structure, fill, or transfer problems/requirements to appropriate FDBM. If it is unclear which FDBM is appropriate, submit requirements to ONI. Enclosure (3) may be used for submission of requirements until a formal configuration management plan is published or electronic submission becomes available.

(2) Ensure TNWSs developed under rapid prototyping and fleet initiative programs incorporate NWTDB standards. Recommend to appropriate FDBM the producer of data where not otherwise assigned.

8. <u>Procedures</u>

a. Reference (b) and the proposed DOD manual 8320.1-M, "Data Administration Procedures", describe procedures to be followed in data administration and data element standardization. These procedures are fully supported and adopted by the NWTDB process.

b. A configuration management plan and an implementation plan are being produced by OPNAV (N6) in support of this instruction. In the interim, enclosure (3) may be used to submit requirements to FDBMs or ONI-73.

9. Report. The reporting requirement contained in enclosure (3) is assigned symbol OPNAV 9410-1 and is approved for three years from the date of this instruction.

Jerry O. Tuttle
JERRY O. TUTTLE

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	A1J1A	(PEOTACAIR)
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	A1J1C	(PEOCMPANDUAV)
	A1J1D	(PEOSPACOMMSENS)
	A1J1F	(PEOSUBCBTWPNSYS)
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DEFINITIONS

Sources of definitions are listed where available.

Application Data Element. A data element used in an automated information system. (An application data element may, or may not, be a standard data element.)

Attribute. A property or characteristic of one or more entities; for example, COLOR, WEIGHT, SEX. Also, a property inherent in an entity or associated with that entity for database purposes. (FIPS Pub 11-3)

Corporate Information Management (CIM). The DOD effort to apply computing, telecommunications, and information management capabilities effectively in the accomplishment of the Department mission.

Data. A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automatic means. (FIPS Pub 11-3)

Data Administration (DAdm). That function of the organization which oversees the management of data across all functions of the organization, and is responsible for central information planning and control. (NBS Special Pub 500-149)

Data Administrator (DAd). A person or group that ensure the utility of data used within an organization by defining data policies and standards, planning for the efficient use of data, coordinating data structures among organizational components, performing logical database design, and defining data security procedures. (NBS Special Pub 500-152)

Data Attribute. A characteristic of a unit of data such as length, value, or method of representation. (FIPS Pub 11-3)

Data Category. All data sets necessary to define a functional category, e.g., sensors. The number of data sets per category is based on specific data file record capabilities.

Data Content. What goes in a data element as defined by the data element definitions and formats.

Data Dictionary. A specialized type of database containing metadata that is managed by a data dictionary system; a repository of information describing the characteristics of data used to design, monitor, document, protect, and control data in information systems and databases; and application of a data dictionary system. (FIPS Special Pub 500-152)

Data Element. A named identifier of each of the entities and their attributes that are represented in a database. (FIPS Pub 11-3)

Data Element Standardization. The process of documenting, reviewing, and approving unique names, definitions, characteristics, and representations of data elements according to established procedures and conventions.

Data Element Standards. The standardization and management of data element definitions, formats, content, and relationships between data elements.

Data Entity. An object of interest to the enterprise, usually tracked by an automated system. (NBS Special Pub 500-149)

Data File. All data elements comprising a single table of information relating to a data entity.

Data Fill. The actual data (or lack of) in the data element fields.

Data Merging. The ability to combine data from multiple digitized sources. A prerequisite to computer data merging is deconfliction of data element standards and database structure.

Data Model. In a database, the user's logical view of the data in contrast to the physically stored data, or storage structure. A description of the organization of data in a manner that reflects the information structure of an enterprise. (FIPS Pub 11-3)

(1) **Logical Data Model.** A model of the data stores and flows of the organization derived from the conceptual business model. (NBS Special Pub 500-149)

(2) **Physical Data Model.** A representation of the technologically independent requirements in a physical environment of hardware, software, and network configurations representing them in the constraints of an existing physical environment.

Data Set. A group of data elements that collectively describe a composite object, e.g., platform, weapon, sensor, installation, or other object.

Data Set Structure. A representation of the logical relationships that exist among the data elements comprising the data set. The data set structure defines unique identifiers within the data set, subordinate relationships, repeating or multi-valued occurrences, and coded or constrained elements.

Data Structure. The logical relationships which exist among units of data and the descriptive features defined for those relationships and data units; an instance or occurrence of a data model. (NBS Special Pub 500-152)

Data Translation. The computer conversion of one data element format into another format; e.g., truncation of the 30 character ship name field into a 26 character field for use by a hardware and/or software constrained system.

Database. A collection of interrelated data, often with controlled redundancy, organized according to a schema to serve one or more applications; the data are stored so that they can by used by different programs without concern for the data structure or organization. A common approach is used to add new data and to modify and retrieve existing data. (FIPS Pub 11-3)

Defense Data Repository System (DDRS). The database administered by the Center for Information Management for managing the submission, review, and approval of DOD standard data elements.

Information. Any communication or reception of knowledge such as facts, data, or opinions, including numerical, graphic, or narrative forms, whether oral or maintained in any medium, including computerized databases, paper, microforms, or magnetic tape. (DODD 8000.1 of 27 October 1992 (NOTAL))

Information Architecture. A database schema of information categories (data sets) containing standardized data elements with designated data sources. The information architecture in the NWTDB Data Standards and Structures Manuals is a guide for defining essential elements of information to support operational functionality, and for internal system design to achieve a common relational database. The NWTDB structure is hardware and software independent.

Information Standards. The standardization of data elements, database structure, message text formats, and tactical digital information links.

Information System. The organized collection, processing, maintenance, transmission, and dissemination of information in accordance with defined procedures, whether automated or manual. (DODD 5200.28 of 21 March 1988)

Integrated Database (IDB) - Transaction Format (TF). IDB-TF is a DIA approved, generalized transaction structure which is used to communicate Integrated Database maintenance data between IDB systems.

Interface. A boundary or point common to two or more command and control systems or subsystems, communication systems or equipment, or other entities across which necessary information flow takes place. A joint interface implies that the boundary is shared by two or more services/agencies. A combined interface is shared by entities from one or more U.S. services/agencies and an allied nation.

(1) **Technical Interface.** A specification of the functional, electrical, and physical characteristics necessary to allow the exchange of information between systems. An Interface Requirements Specification (IRS) is used to specify the functional and physical requirements of an interface between systems; DI-MCCR-80026A pertains. An Interface Design Document (IDD) is used to describe the detailed design of the requirements within the IRS; DI-MCCR-80027A pertains. Warfare System Controlled Interface Documents (WSCIDs) are used to describe functional, physical, and electrical interface characteristics.

(2) **Procedural Interface.** A specification for accomplishing exchange of information across an interface; e.g., OPSPEC 411, OPSPEC 516, OPSPEC OTG. A procedural interface defines:

(a) The form or format in which information is to be exchanged.

(b) The prescribed information exchange language, syntax, and vocabulary to be used in the information exchange.

(c) The operating procedures that govern information exchange.

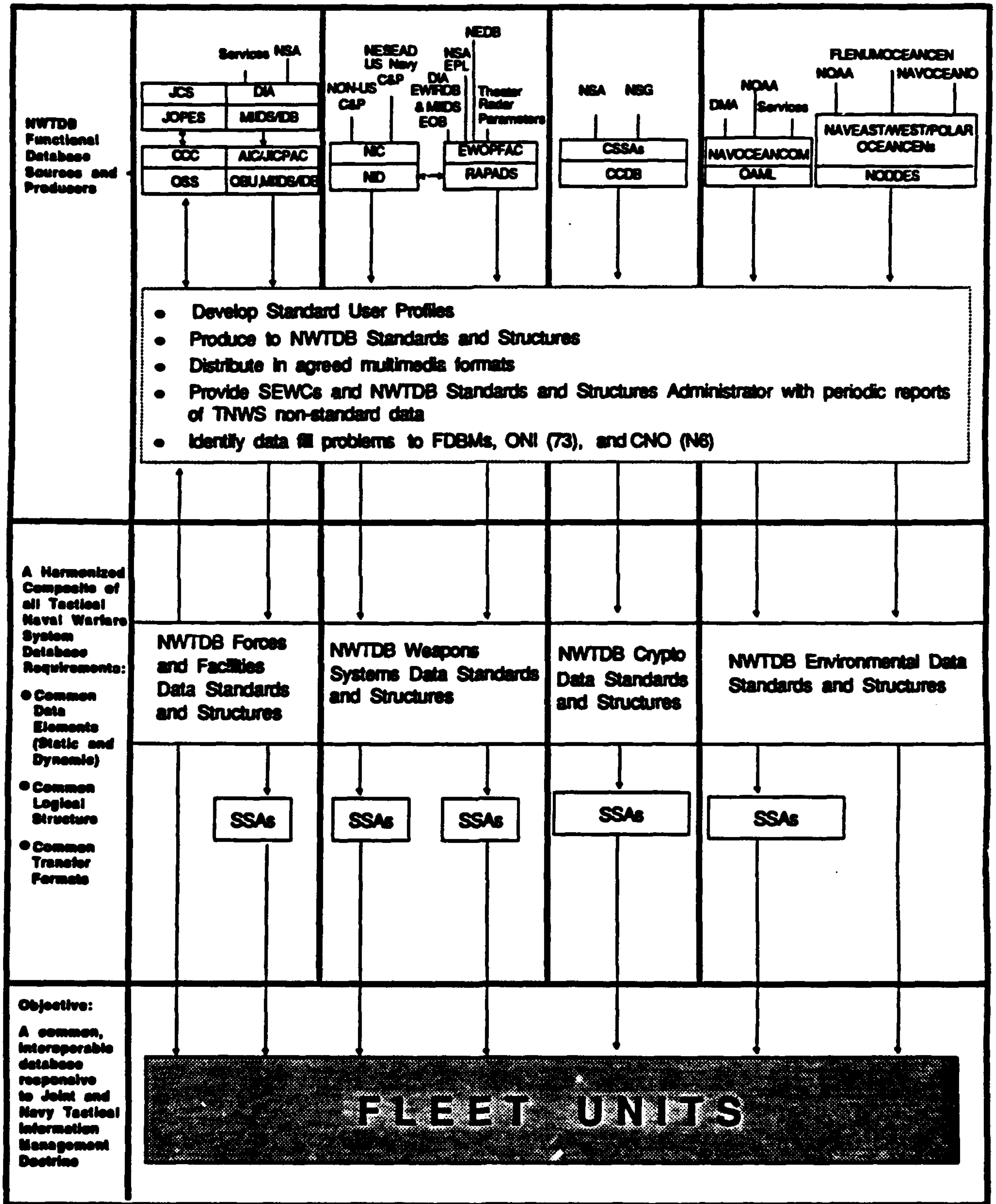
Interoperability. The ability of systems, units or forces to provide services to, and accept services from, other systems, units or forces, and to use the services so exchanged to enable them to operate effectively together (JCS Pub 1).

Naval Warfare Tactical Database (NWTDB). (1) The management process to evolve to the common tactical database that meets the needs of the Composite Warfare Commander and Joint Task Force Commander, supporting naval, joint, and combined operations. (2) The authoritative tactical database, or subsets thereof, distributed by designated producers in accordance with the information architecture contained in the functional volumes which comprise the NWTDB Data Standards and Structures Manuals. Coordination of standards and structure permits the merging of data from multiple producers.

Tactical Information Interoperability. The ability of tactical naval warfare systems to use approved joint and Navy information standards, especially tactical data information links, message text formats, Naval Warfare Tactical Database (NWTDB), and/or Over-the-Horizon Gold formats.

Tactical Naval Warfare System (TNWS). Any C^3, Intelligence (includes surveillance), or Combat system that supports naval warfare.

NWTDB Reference Database Production Architecture



INTERIM NWDTB USER FEEDBACK/REQUIREMENTS REPORT

Following items are keyed to report paragraph numbers.

1. **USER IDENTIFICATION.** Identify the user command and point of contact. Include mail and message addresses plus telephone and facsimile numbers
2. **SYSTEM AND DATA PRODUCT IDENTIFICATION.** Identify name, edition or version of the data product and system(s) involved.
3. **DATA REQUIREMENT OR FEEDBACK REPORT.** Identify new or changed requirement or rate a product's required performance in specific operational environments and applications. This should include the full range of product characteristics including media and user documentation.
4. **IMPACT ASSESSMENT.** Operational impact is defined in terms of the current and potential operational impacts on users. Assess impact for both the system in question and the network of affected systems. Make specific projections for wartime and crisis situations based on experienced or projected increased activity and availability of backup capability in those cases.
5. **CAUSAL ANALYSIS.** Identify known and suspected causes for the problem. Relate to specific applications and functions, software, or hardware and analyze in sufficient detail to support impact assessment and corrective actions. Typical content includes the following:
5.a **INFORMATION REQUIREMENTS ANALYSIS.** Briefly describe information requirements not being fulfilled. Since requirements change as systems and situations evolve, this analysis should identify new or significantly changed requirements. Reduced requirements are important.
5.b **OPERATIONAL SUPPORT ANALYSIS.** Review relevancy and timeliness of the database performance and information outputs in terms of satisfying command and control and targeting needs.
5.c **STRUCTURE AND FILL ANALYSIS.** Identify and analyze database structure, fill, and related processing associated with the reported problem. This includes ability to interface with related systems, internal and external communications, and operational procedures. Relevant factors include, but are not limited to: (a) completeness in terms of the full range of information needs (b) redundant data; (c) non-standard formats or addresses; (d) errors in content; (e) errors in structure; and (f) errors in correlation/track management.
5.d **HUMAN FACTORS ANALYSIS.** If applicable, address the problem in terms of ease of use, training, or experience, availability or suitability of documentation, time required for interpretation of outputs, etc.

5.e ARCHIVING AND LOGGING CAPABILITY ANALYSIS. System archiving and logging capabilities inherent in the product under consideration will be analyzed in terms of completeness and responsiveness. A key issue is whether or not the integral system capability supports rapid detection, documentation, and resolution of problems.
6. SOLUTION DEVELOPMENT. When possible, preferred solutions should be proposed in context of importance and urgency. Major deficiencies are normally resolved by whatever means possible and then reported. Minor deficiencies are more frequently put into the appropriate support channels and worked around until a permanent solution is received. Given the need for inter-platform and inter-theater interoperability, all solutions should be assessed for their impact on Navy, joint, and combined operations.
7. IMPLEMENTATION AND MONITORING. Report whether special implementation and monitoring actions are necessary. Identify actions already taken to report and resolve the issues.

Note: Message may be used for urgent feedback.

Ser xxx/

From:

To: (Functional Database Manager, if known. If not, send to ONI-73 for determination and action. Addresses listed below.

Subj: NAVAL WARFARE TACTICAL DATABASE FEEDBACK REPORT

Ref: (a) OPNAVINST 9410.6, "Naval Warfare Tactical Database (NWTDB) Requirements for Tactical Naval Warfare Systems."

Encl: (1) NWTDB Requirement (or Report) Number CY-xx
(Use calendar year, followed by two-digit sequential number, starting with 01 each calendar year, e.g. 94-03.)

1. The following NWTDB requirement (or report) is forwarded as provided in reference (a).

1. USER IDENTIFICATION.
2. SYSTEM AND DATA PRODUCT IDENTIFICATION.
3. DATA REQUIREMENT OR FEEDBACK REPORT.
4. IMPACT ASSESSMENT.
5. CAUSAL ANALYSIS.
   a. INFORMATION REQUIREMENTS ANALYSIS.
   b. OPERATIONAL SUPPORT ANALYSIS.
   c. STRUCTURE AND FILL ANALYSIS.
   d. HUMAN FACTORS ANALYSIS.
   e. ARCHIVING AND LOGGING CAPABILITY ANALYSIS.
6. SOLUTION DEVELOPMENT.
7. IMPLEMENTATION AND MONITORING.

Copy to:
CNO (N65)
ONI-73
NCTSI (Code 5)

Enclosure (3)

NWTDB REQUIREMENTS AND FEEDBACK REPORT ADDRESSES

PLATFORMS/SYSTEMS CHARACTERISTICS AND PERFORMANCE DATA - NID

Director, Office of Naval Intelligence
Attn: ONI-222
4301 Suitland Road
Washington D.C. 20395-5000

RADAR PARAMETERS DATA - RAPADS

Officer in Charge, Electronic Warfare Operational
Programming Facility (EWOPFAC)
5100 Relay Road
Chesapeake, VA 23322-4499

OCEANOGRAPHIC AND METEOROLOGICAL DATA - OAML AND NODDES

Commander, Naval Oceanography Command
Attn: Code N522
1020 Balch Boulevard
Stennis Space Center, MS 39529-5000

MILITARY INTELLIGENCE DATA - MIIDS/IDB

Atlantic Intelligence Command
Attn: Code IS7
7941 Blandy Road, Ste 100
Norfolk, VA 23511-2498

or: Joint Intelligence Center, Pacific
Attn: RD
Box 500
Pearl Harbor, HI 96860-7450

CRYPTOLOGIC DATA - CCDB

Commander, Naval Security Group Command
Attn: G32
Naval Security Group Command Headquarters
3801 Nebraska Avenue, N.W.
Washington, DC 20393-5210

Enclosure (3)

MODELING AND SIMULATION DATA

Commander, Space and Naval Warfare Systems Command
Attn: SPAWAR 31
2451 Crystal Drive
Arlington, VA 22245-5200

- Copy to (except cryptologic):

Chief of Naval Operations
Attn: CNO (N65)
Department of the Navy
Washington, DC 20350-2000

Director, Office of Naval Intelligence
Attn: ONI-73
4301 Suitland Road
Washington, DC 20395-3000

Commanding Officer, Navy Center for Tactical Systems Interoperability
Attn: Code 5
53690 Tomahawk Drive, Suite 125A
San Diego, CA 92147-5082

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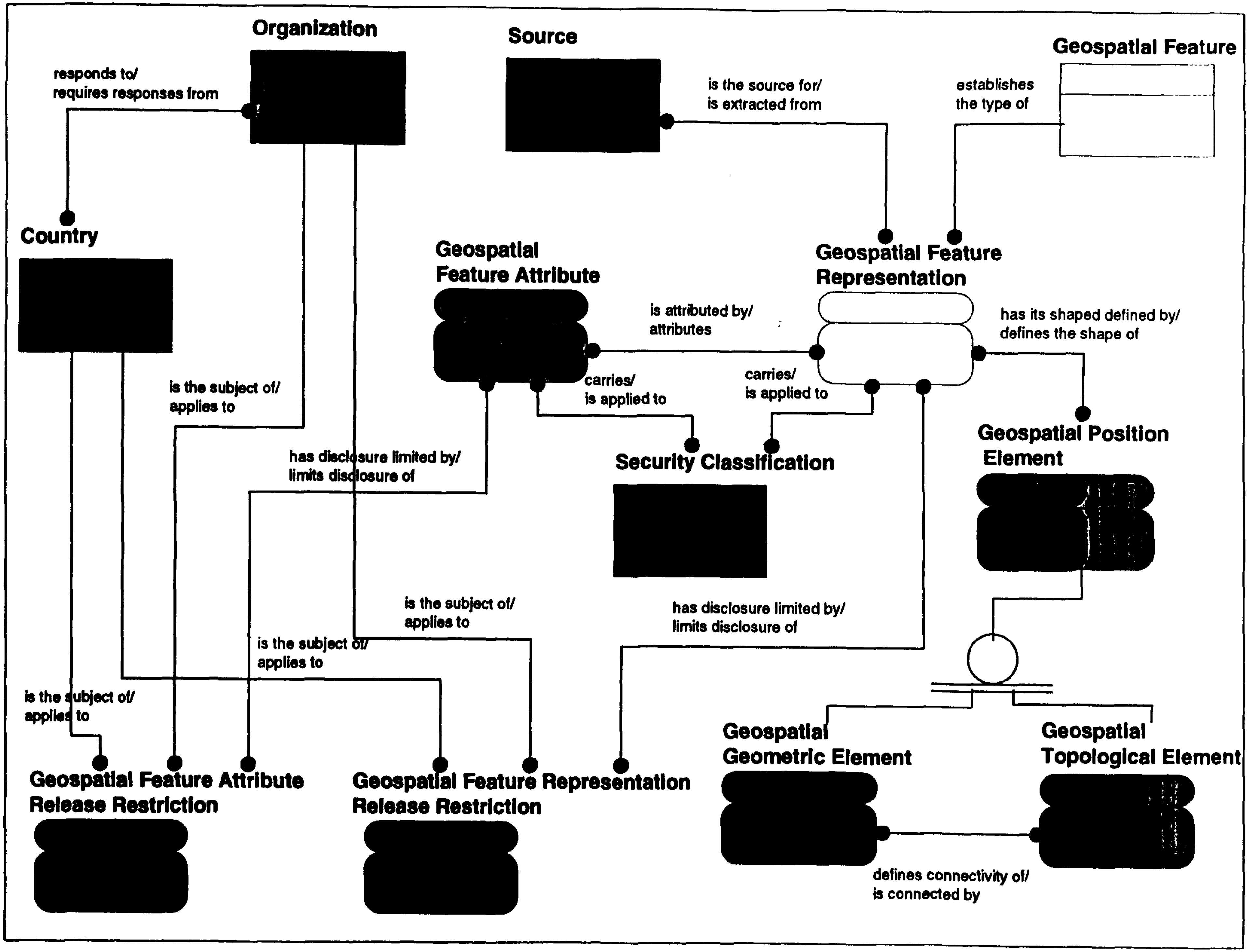
DoD Project on Spatial Data Element Standardization

DMA Data Element Pilot Project

- DMA recently completed a Pilot Project on MC & G Data Standardization
- This project created a fully attributed Data Model for MC&G Data
- The project Identified 75 potential Standard Data Elements
- An Initial Package of 10 Elements Submitted
  - Dealt with basic ingredients of FEATURE
- Geometry and Topology Packages in Work

Dr. J Teller
DMA/TIM
2/17/94


Organization
Source
Geospatial Feature
responds to/
requires responses from
is the source for/
is extracted from
establishes
the type of
Country
Geospatial
Feature Attribute
Geospatial Feature
Representation
is attributed by/
attributes
has its shaped defined by/
defines the shape of
carries/
is applied to
carries/
is applied to
is the subject of/
applies to
has disclosure limited by/
limits disclosure of
Security Classification
Geospatial Position
Element
is the subject of/
applies to
has disclosure limited by/
limits disclosure of
is the subject of/
applies to
is the subject of/
applies to
Geospatial
Geometric Element
Geospatial
Topological Element
Geospatial Feature Attribute
Release Restriction
Geospatial Feature Representation
Release Restriction
defines connectivity of/
is connected by

DMA Not Alone!

- During this modeling effort we discovered other players modeling many spatial aspects of MC & G data:
  - Strategic and Tactical Arena,
  - Logistics
  - Transportation
  - Modeling & Simulation Community,
  - Command and Control,
  - Facilities
  - Intel
  - Combat Search and Rescue,
  - Air Defense

Dr. J Teller
DMA/TIM
2/17/94

Conflict Areas

- **We ran into conflicts over basic concepts:**
  - FEATURE (definitions, uses)
  - LOCATION - POINT - AREA - VOLUME
  - ATTRIBUTE (as an attribute)
  - COORDINATE (class word/definitions/use)
- **Lesson learned:**
  - DMA CANNOT ACHIEVE THIS DATA STANDARDIZATION EFFORT ALONE.
  - STANDARDIZATION OF COMMONLY USED DATA ELEMENTS REQUIRES A JOINT DoD APPROACH

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2/17/94

Solution- A Joint Team Approach

- Assemble a team from interested organizations
  - DMA will enlist the authority of the DoDDAd and FDAdm to aid in identifying stakeholders
  - Try to include other Federal agencies
    - » USGS
    - » NOS, etc
- With guidance/lead from DISA, DMA will help orchestrate and particpate in joint project
- Project will be Funded through CIM Initiative

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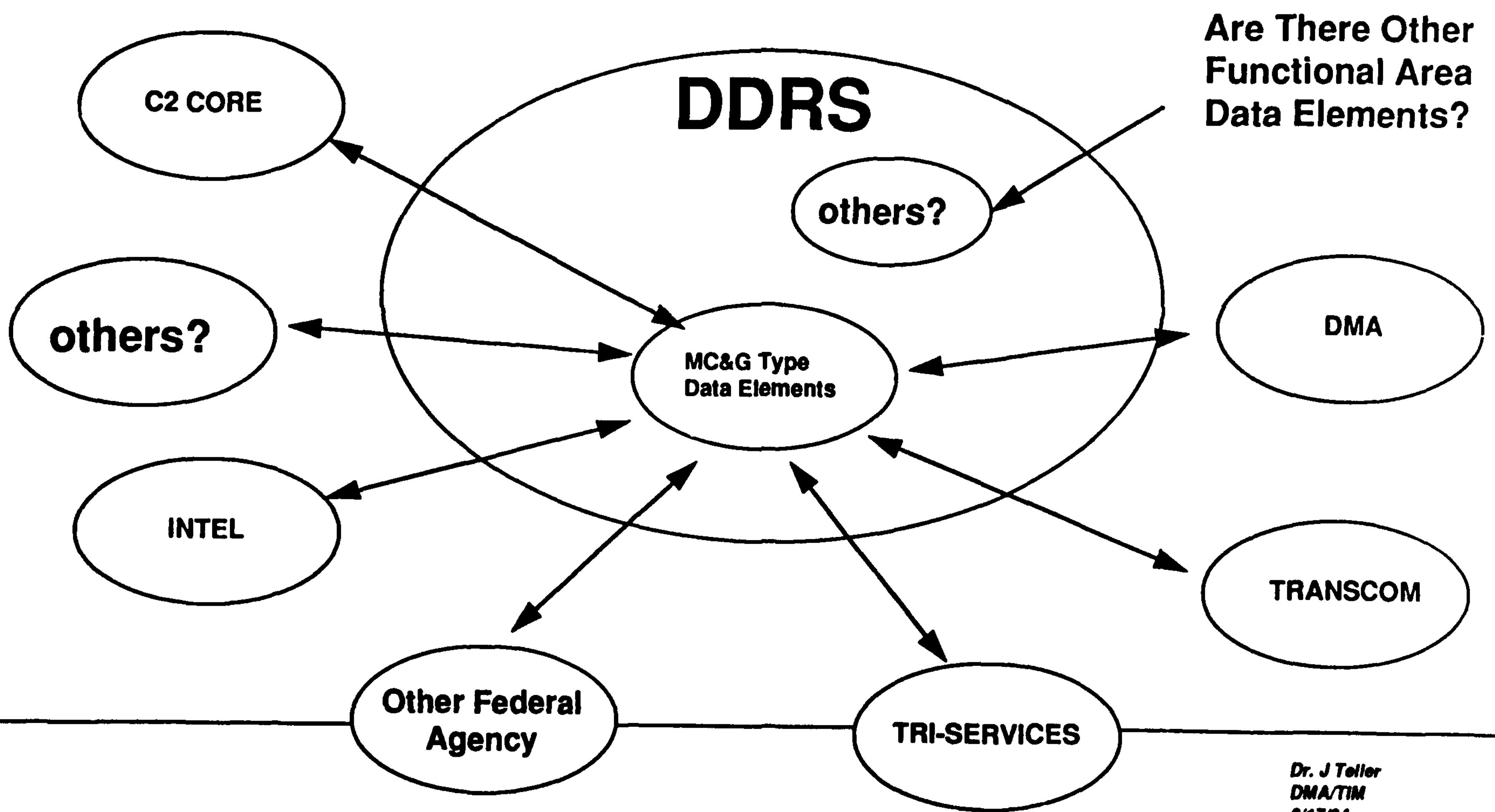
DoD Joint Effort to Standardize Spatial Data Elements



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Joint Implementation Plan

- **Identify Team members**
- **Develop Scope** scope effort must contain:
  - Attempt to integrate existing activity models with DoD Enterprise Model
  - Well defined boundaries sized to resources & timeframe
  - Prioritization of data elements
- **Brief & Obtain Scope Approval**
  - Incorporate suggested changes

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Joint Implementation Plan (cont.)

- **Perform Data Modeling Effort:**
  - Consistent Activity Model(s) that interface to Enterprise
  - Fully attributed, standardized Data Model
  - Submission package with at least 10% of the Feature Attribute Coding Catalog objects (and associated data elements) defined
  - Schedule for producing the remaining Data Element packages

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Benefits

- Eliminates duplication of effort
  - Overall savings (time and $) within DoD
- Data Elements that everyone can use
- Opportunity to enhance the DoD Enterprise Model with detailed activity models from the Joint Team efforts.
- Coordination can proceed to FDAd approved candidate status
- Brings DoD and other Federal Agencies closer together on Spatial Data Standards

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DISADVANTAGES

- Requires commitment from all participants
  - Not so easy to do!
  - <u>Must</u> get right functional areas to play
- Must have experienced players on team
  - Players must be empowered to speak for their organizations!

Dr. J Teller
DMA/TIM
2/17/94

AFSAA DB Management

Mr Stephen T Boyd

Maj Karen Barland

Air Force Studies & Analyses Agency

Force Enhancement Division

Force Projection Division

Feb 17, 1994

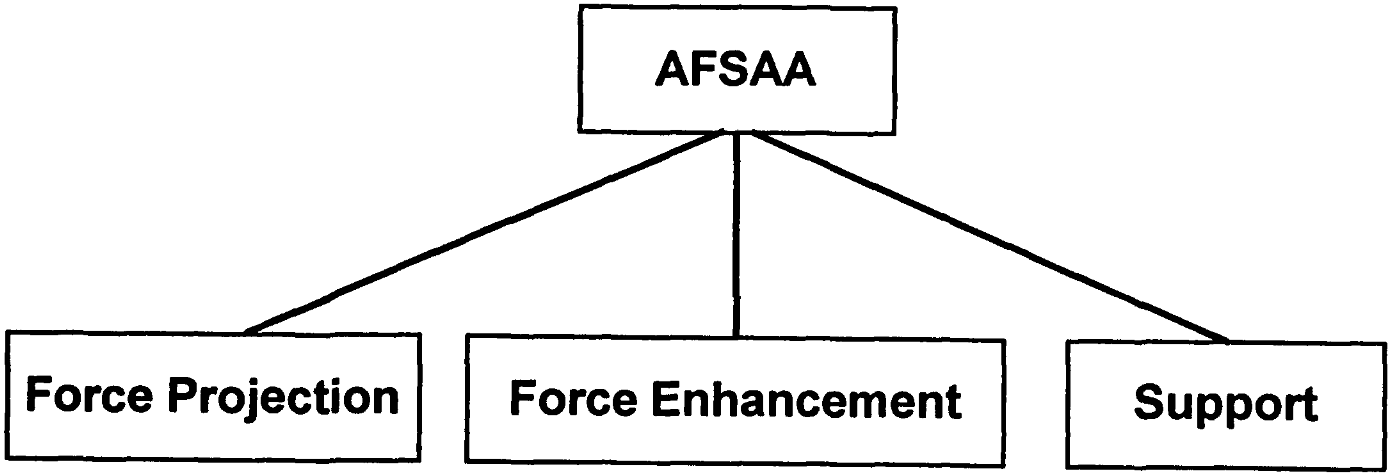
DRAFT

OVERVIEW

- AFSAA Products and Tasks
- Model Abstraction
- The Opportunity - Data
- The Solution - Data Management
- Implementation

Air Force Studies & Analyses Agency

AFSAA Products and Tasks



Products: Long Term Studies, Support to COEAs, Responses to Air Staff Questions, Part of the Program Acquistion Cycle

Tasks: To do Analyses of weapons systems and Deliver the results in different formats

DRAFT

Air Force Studies & Analyses Agency

Model Abstraction

- **Analysis is Supported by computer models**

Campaign Level

Engagement Level

Functional Level

Engineering Level

Abstract, aggregated and somewhat difficult to see impact of modest changes in equipment or weapon parameters

Detailed, most complete representation of equipment or weapon; functional change easy to see, difficult to evaluate the "global value" of the change, as the value is scenario dependent

DRAFT

The Opportunity - DATA

- Study manager is responsible for all aspects of data
- Difficult to create consistent scenarios for models with different levels of abstraction
- Difficult to capture knowledge of the data process from study managers
- Increasing detail (realism) in abstract models
- Smaller staff to do analyses

A Solution - Data Management

- Turn SA OR skills to our own ‘Opportunity’
- Centralize data base collection for SA
- Data management tools to help study manager
- Study management tools to help study manager
- Cartographic / geographic display of analysis starting conditions and results
- Tools will capture a history or ‘macro’ of a study and display results

Implementation

- Incremental approach
- Combine current SA data management functions into a single set of processes
- Create data management standards
- Avoid requiring model changes to implement the data management processes

Define a Product to Meet Need

- Studies & Analyses Data Base (PPDB)
- Tool set for data base development
- Tool set for analysis with data and models

PPDB Products

- Graphical User Interface (GUI)
  - Data Management
  - Study Management for Analysis
  - Cartographic Display
- Make Data Available to Model & Study Managers
- Make Data & Analysis Archival Tools

Costs Of Implementation

- Increase in overhead to support SA tasks
- Data base management costs resources
  - Computers & mass storage
  - Implementation of procedures
  - Maintenance of management software
  - Time / resources to populate & maintain data bases
- Data management functions split between the study manager and data manager, may cause slower reaction time to 'set up' process

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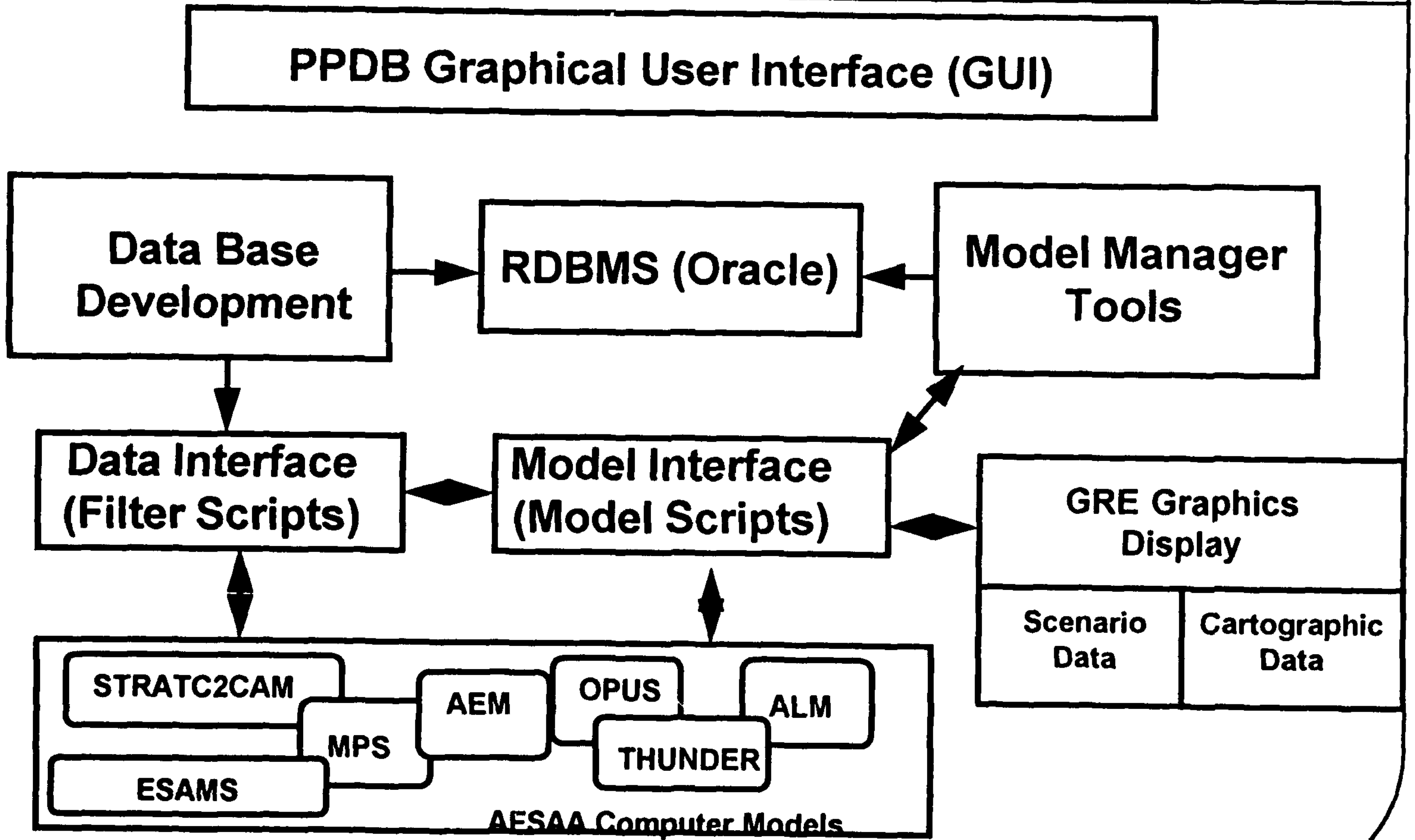
PPDB Architecture



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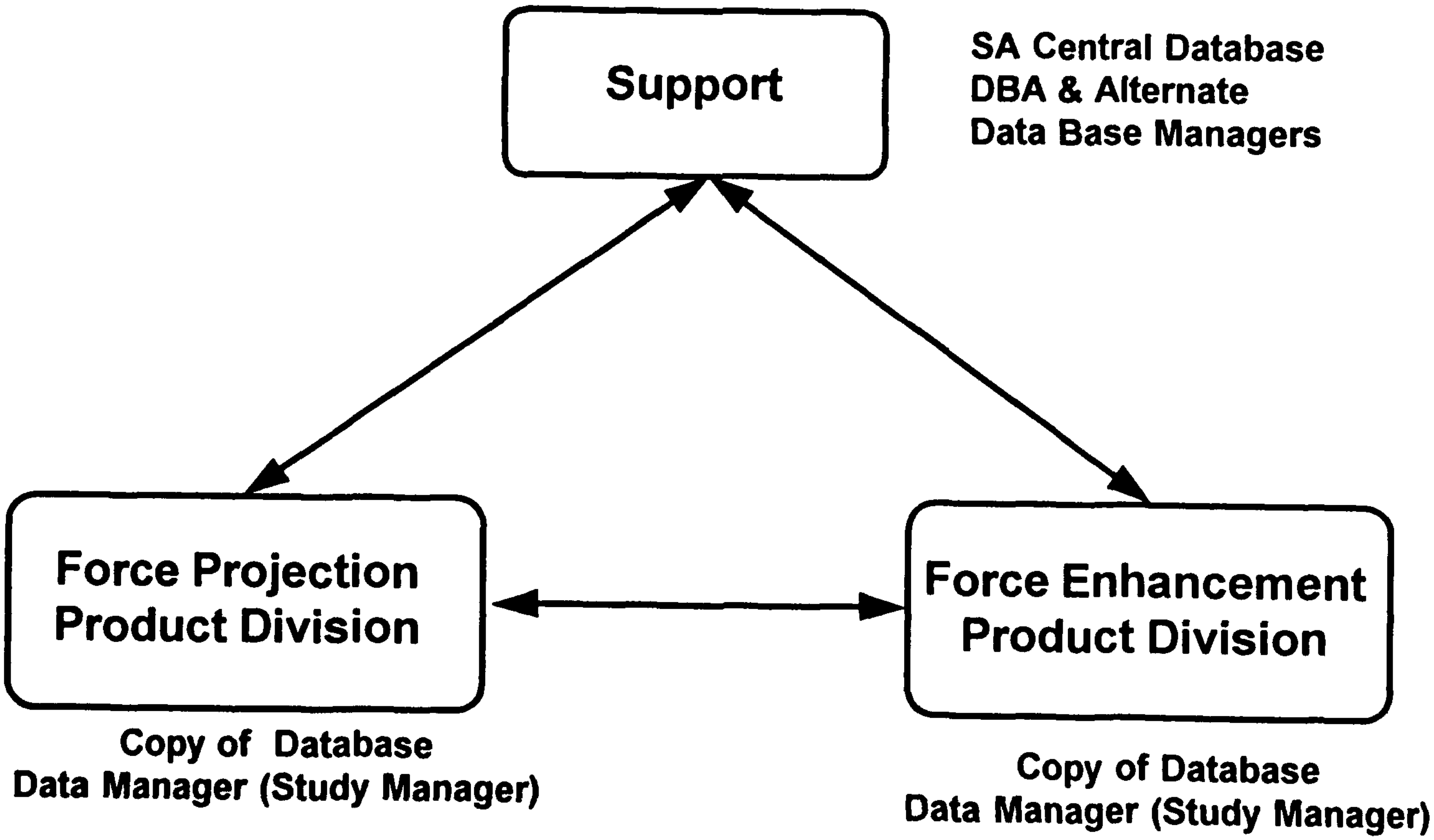
PPDB Topology



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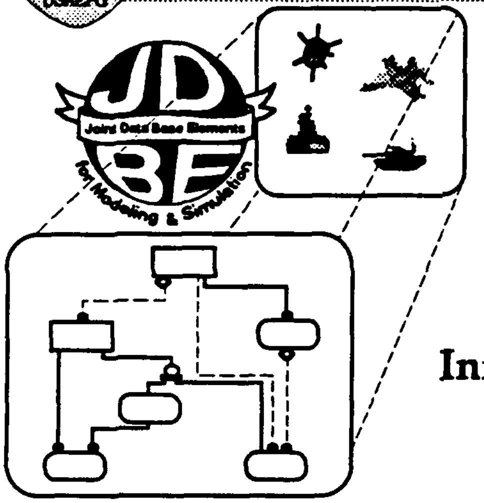
Design PPDB Requirements

- Define Requirements for :
  - Data Management GUI
  - Study Management GUI
  - Cartographic Display GUI
- Establish Timelines
- Establish Integration / Model Tests

Joint Data Base Elements for Modeling & Simulation (JDBE)



Data Sharing and Standardization through Information Modeling

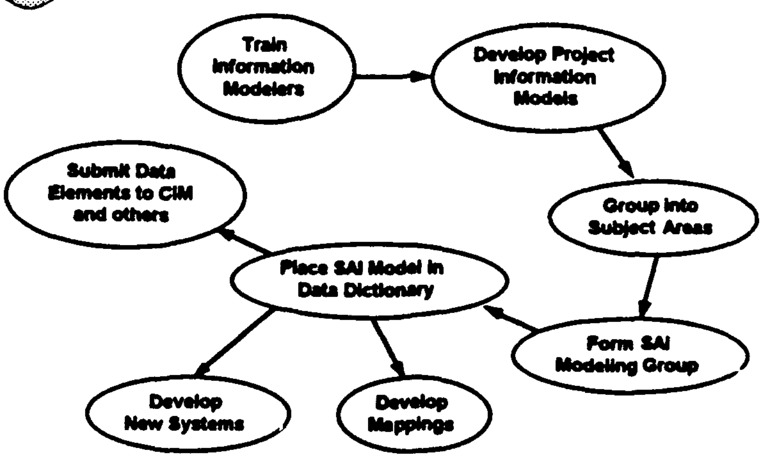
JDBE Project

- Develops candidate standard data elements and data models for Modeling and Simulation.
- Provides the Modeling and Simulation community with a reverse-engineering data modeling methodology.
- Provides a methodology for the creation of integrated schemas to share data between data bases.
- Creates a Military Handbook with a living electronic appendix.

JDBE Approach

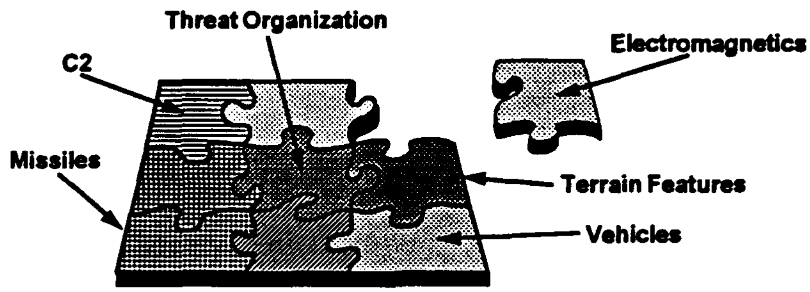
- Bottom - Up Using Existing Data Bases
- Involve Data Base Developers and Users
- Apply IDEF1X Data Model Methodology
- Create Integrated Data Models by Subject Area
- Interface with Top-Down CIM Data Models

JDBE Process

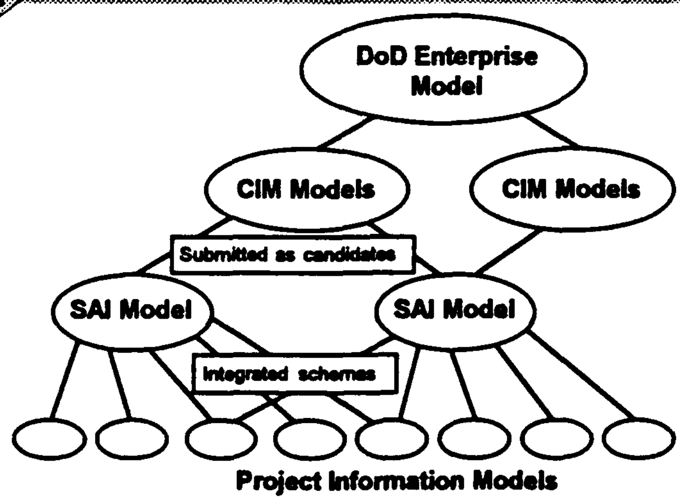


Reverse Engineering Approach

- Bottom-up, instead of top-down analysis.
- Addresses existing data resources.
- Incremental, one bite at a time!



JDBE Model Integration



JDBE Project Status

ITEM	STATUS
• Military Handbook	- Draft Completed
• SAI Model for Electromagnetic Equipment Characteristics	- First Version Completed
• Data Dictionary/Directory Tools	- Demo Version Working
• Data Repository (Interim Design)	- Being Populated

JDBE SAI Model

Project Models Used

- CROSSBOW
- ECAC (EC/S)
- ECE Threat
- EMETF DBR
- EWIR
- MUES
- RASPUTIN
- TEARS

Views	Entities	Attributes
• Antenna	136	506
• RF Signal	134	645
• RF Equipment	96	563

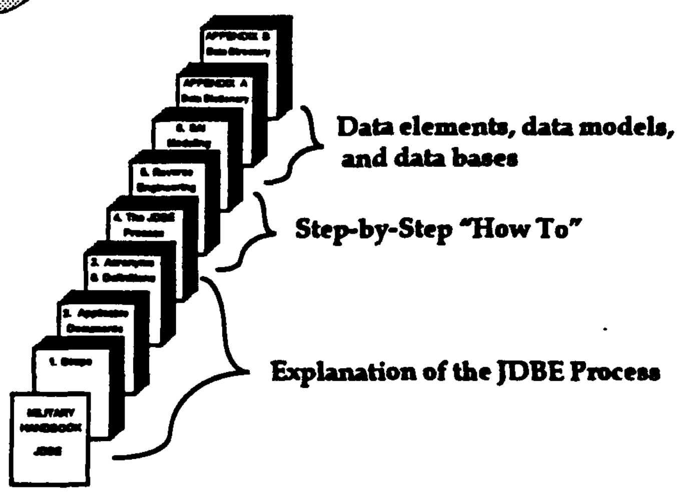
Purpose of the Handbook

- Provides Guidance
- Describes Procedures

For development of Subject Area Information Models via JDBE Process

- Method for Reverse Engineering of Existing Data Bases Using IDEF1X
- Method for Integration of Resulting Project Information Models
- For M&S Data Base Activities (or any other information modeling)

JDBE Military Handbook



Data Dictionary and Directory

- Draft Includes Printed Examples from JDBE Proof of Concept SAI Model for Electromagnetic Equipment Characteristics
  - Data Dictionary
    - » IDEF1X Diagrams
    - » Entity Tables and Definitions
    - » Attribute Tables and Definitions
  - Data Directory
    - » Data Sources
    - » Descriptions
    - » POC Information
- Computer Files to be Published Separately

Data Dictionary/Directory (Cont.)

- Electronic appendix to the Military Handbook
- PC-based software (MS-DOS/Windows)
- Data base of :
  - Data elements and descriptions
  - Data entities and descriptions
  - Current data bases
  - Current Modeling and Simulation projects
- Royalty-free distribution
- Stand-alone

USAEPG

Data Dictionary and Directory

- Server version
  - JDBE working repository
  - DBMS back end
- Stand alone version
  - Requires ERwin
  - Project data models
  - SAI model
  - Mappings
- Read only version
  - Help file format
  - Electronic copy of Mil-Handbook and Appendixes

USAEPG

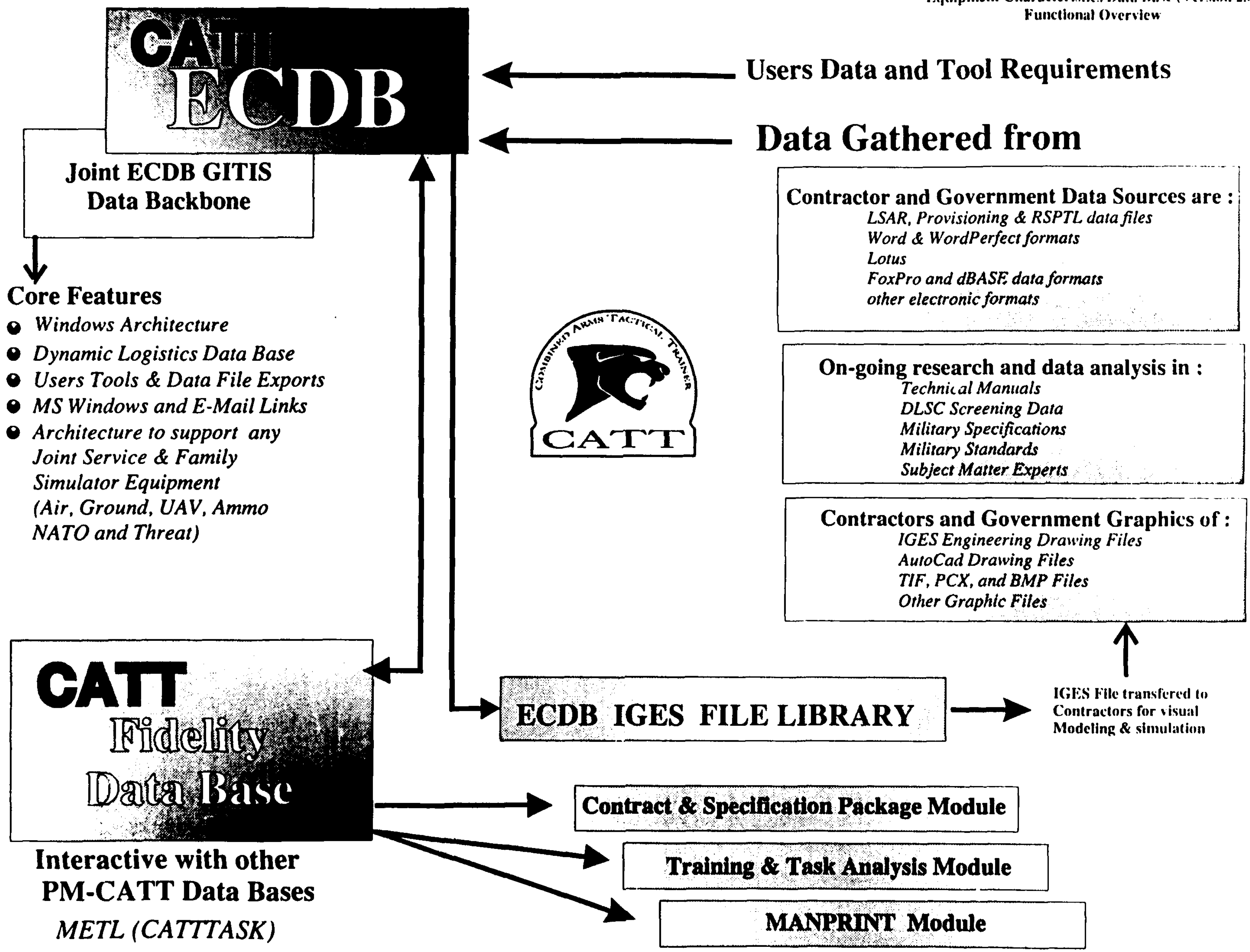
Potential JDBE Efforts for DMSO

- Extension of JDBE Methodology
  - 8320 Series Implementation
  - Complex data types
- Refinement of Data Dictionary Tool
  - Data element submission
  - Automated mapping tool
  - Complex data Types
- Metrics
- DoD Standardization Program
  - Data Modeling Assistance to projects
  - Technical support on IDEF1X and ERwin to projects

JDBE Support to Other Projects

- UTSS
  - IDEF1X and ERwin Training
  - Data Modeling
  - Data Base Design
  - Consulting Technical support
- MICOM
  - IDEF1X and ERwin Training
  - Data Modeling Consulting (possible)
- CCTT and CENTCOM (possible)

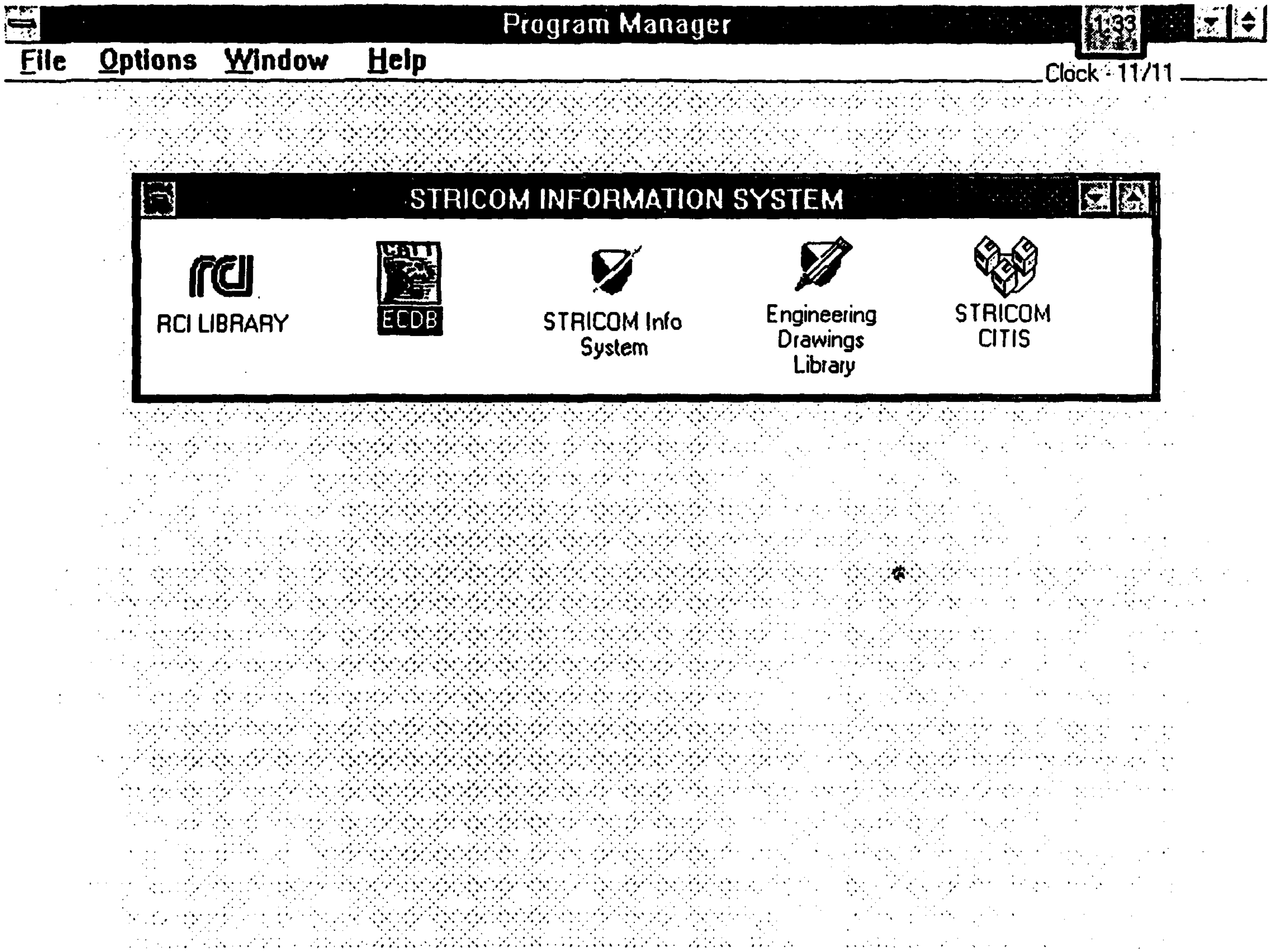
Joint Data Base Elements for Modeling & Simulation


CATT
ECDB
Users Data and Tool Requirements
Data Gathered from
Joint ECDB GITIS
Data Backbone
Core Features
Windows Architecture
Dynamic Logistics Data Base
Users Tools & Data File Exports
MS Windows and E-Mail Links
Architecture to support any Joint Service & Family Simulator Equipment (Air, Ground, UAV, Ammo NATO and Threat)
Contractor and Government Data Sources are :
LSAR, Provisioning & RSPTL data files
Word & WordPerfect formats
Lotus
FoxPro and dBASE data formats
other electronic formats
On-going research and data analysis in :
Technical Manuals
DLSC Screening Data
Military Specifications
Military Standards
Subject Matter Experts
Contractors and Government Graphics of :
IGES Engineering Drawing Files
AutoCad Drawing Files
TIF, PCX, and BMP Files
Other Graphic Files
COMBINED ARMS TACTICAL TRAINER
CATT
CATT
Fidelity
Data Base
ECDB IGES FILE LIBRARY
IGES File transfered to Contractors for visual Modeling & simulation
Contract & Specification Package Module
Training & Task Analysis Module
MANPRINT Module
Interactive with other
PM-CATT Data Bases
METL (CATTTASK)

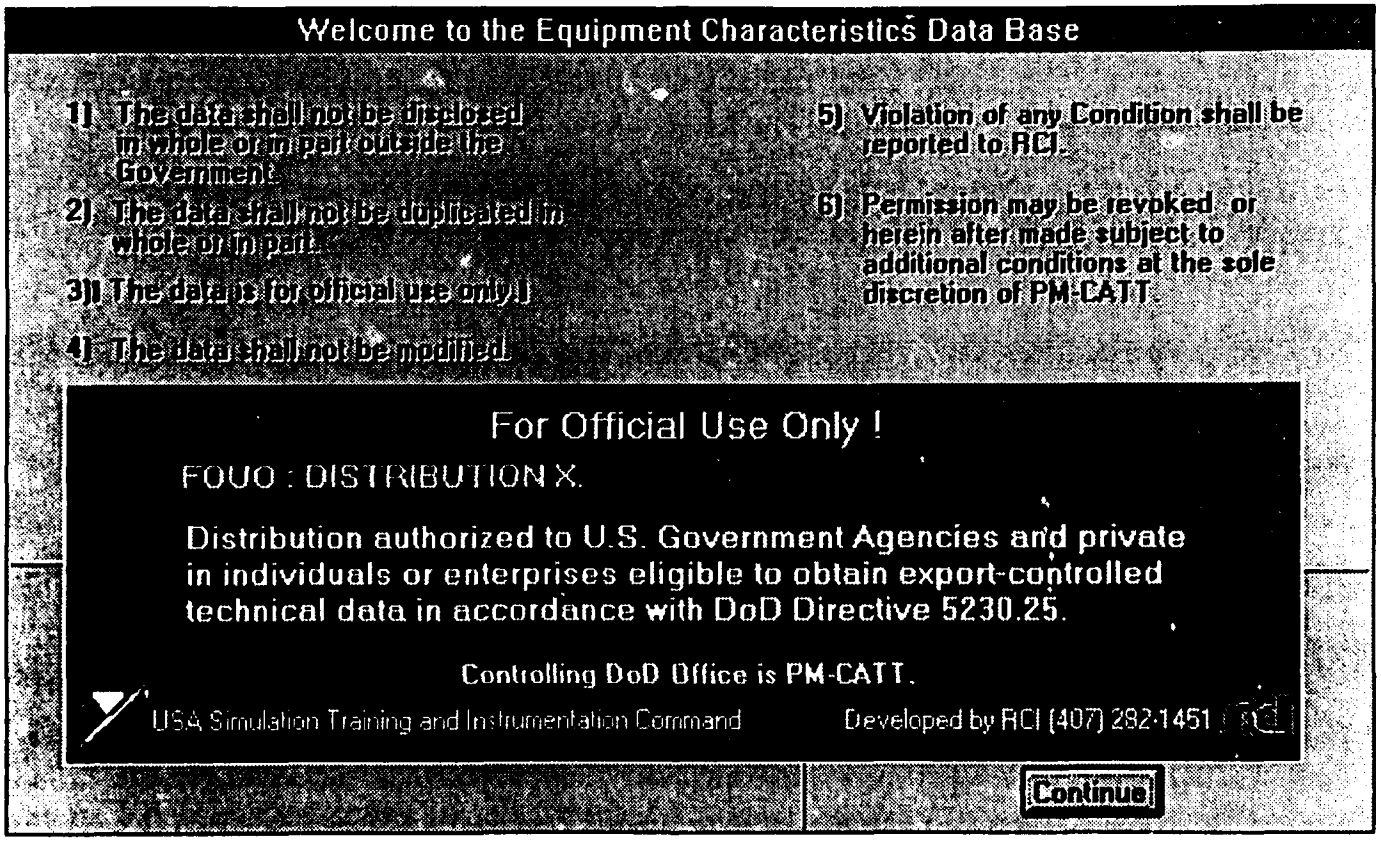
Equipment Characteristics Data Base (Version 2.0) Functional Requirements

ECDB Version 2.0 primary functional capabilities :

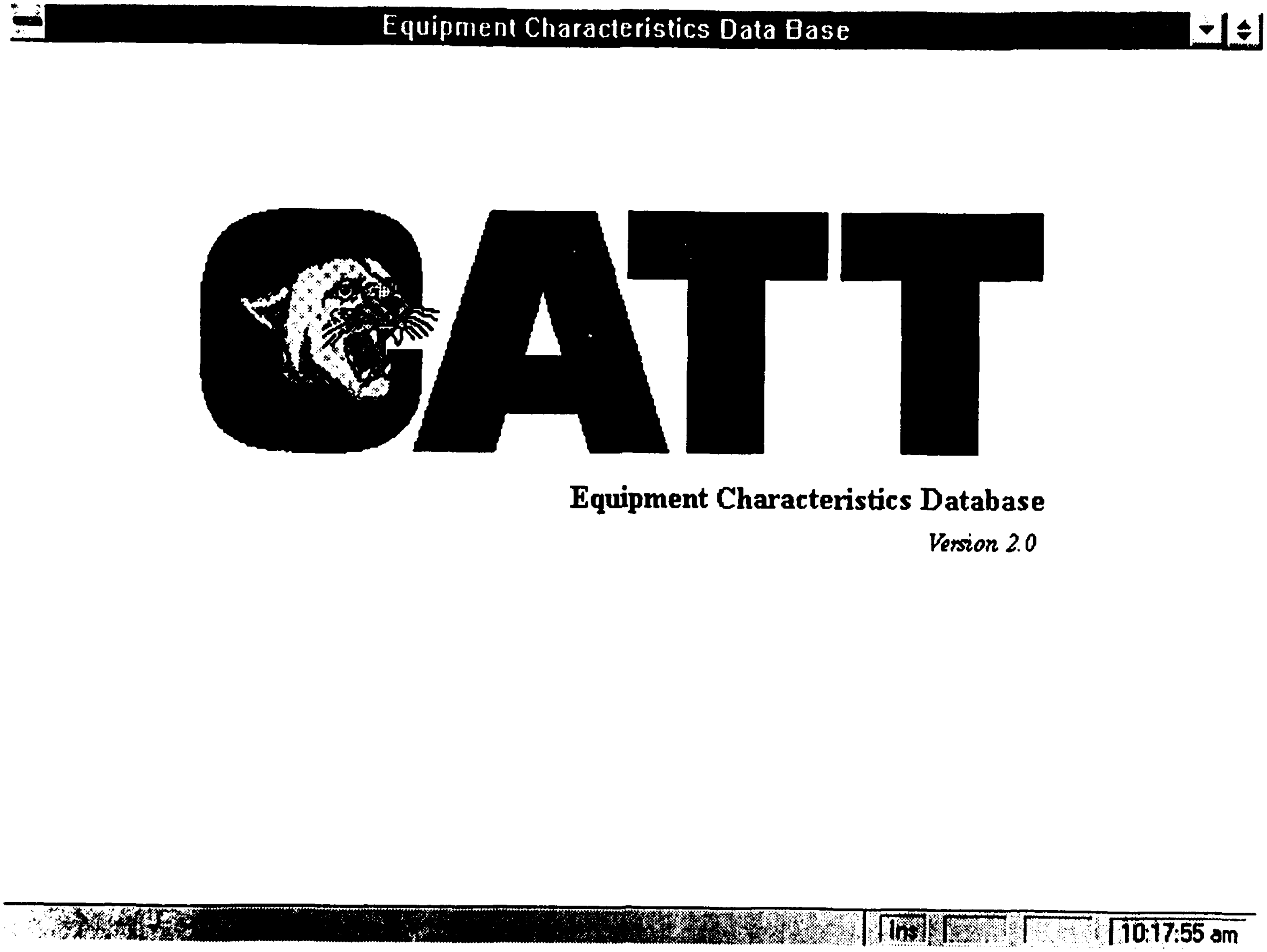
- *Transtion orginial DOS Equipment Parameters Data Base into a Windows Environment Architecture*
- *Create a Dynamic Data Base Architecture that is capable of handling :*
  - o o *Wide array of equipment identified on the CCTT specification Table A-1 which includes Ground Armor, Tactical Wheeled, Aircraft, UAVs,, etc.*
  - o o *Equipment data to the piece part level and develop a common verified parts master file,*
  - o o *Imported LSAR, Provisioning and IGES data files.*
- *Test the functionality of a dynamic data base*
- *Encourage users to submit ideas and data to increase the productivity of the ECDB*
- *Creation of data management and editing tools for ECDB data managers*
- *Analyze and build the Table A-1 parts information in the ECDB as the core data stream.*
- *Confirmation of Table A-1 parts information with Equipment Program Managers & Subject Matter Experts thus promotes concurrent engineering.*
- *After confirmation, build and expand characteristics data files and IGES library*
- *Applicable to other simulation programs (i.e. AVCATT, WARSIM 2000, DIS)*



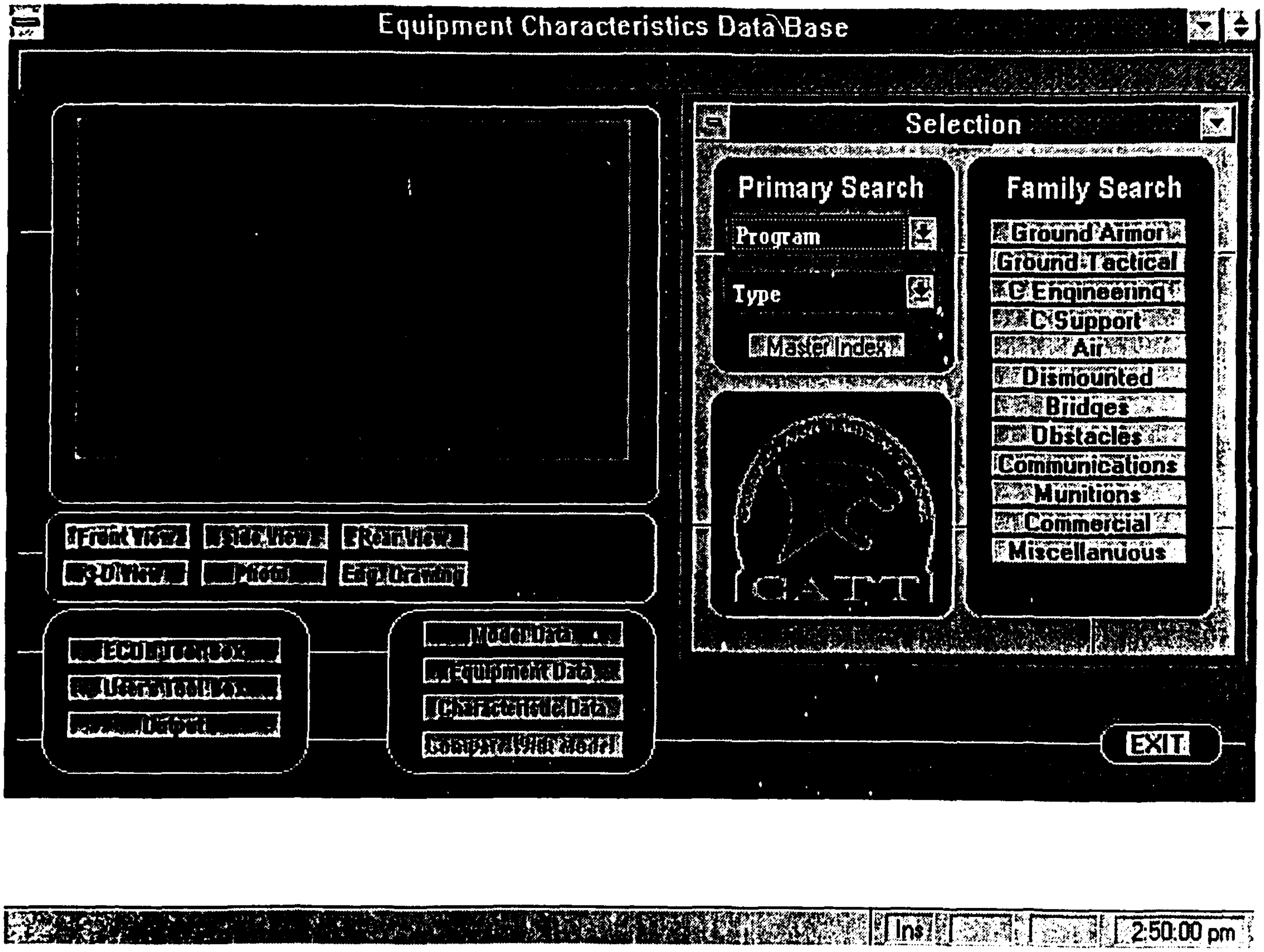
Launching from Windows Menu



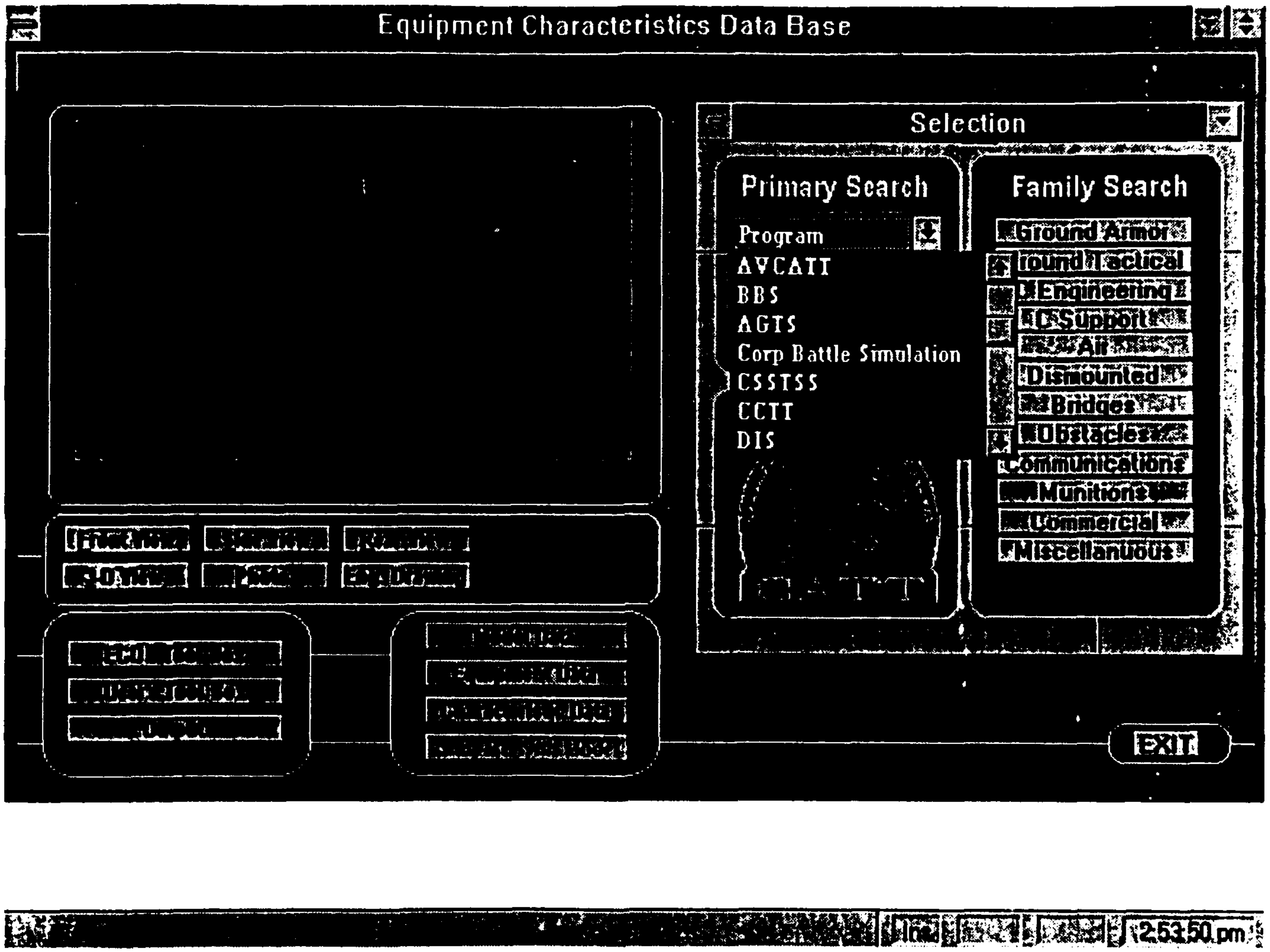
Official Use Only Screen - Press and continue



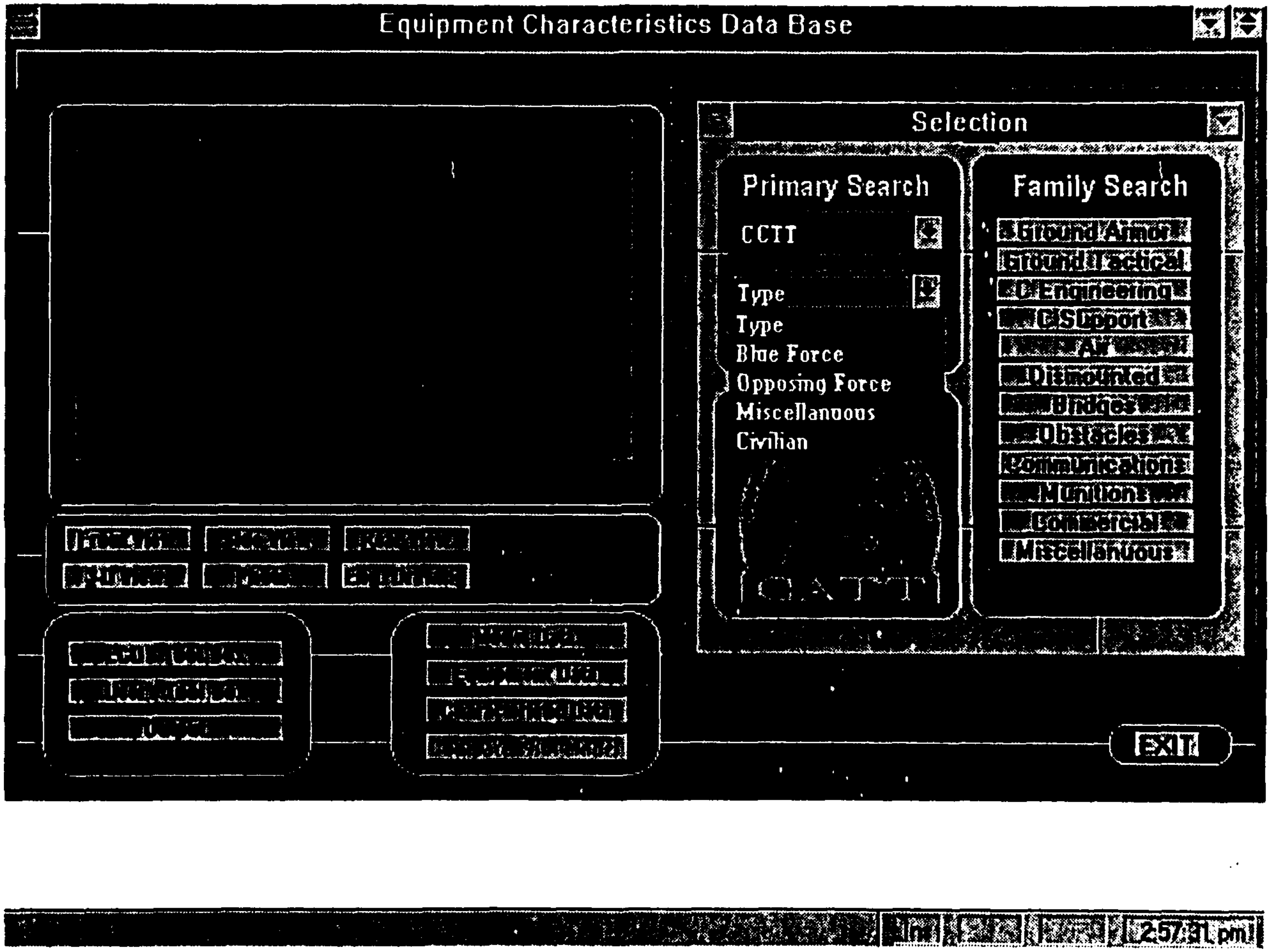
CATT Wallpaper *(Image Only)*



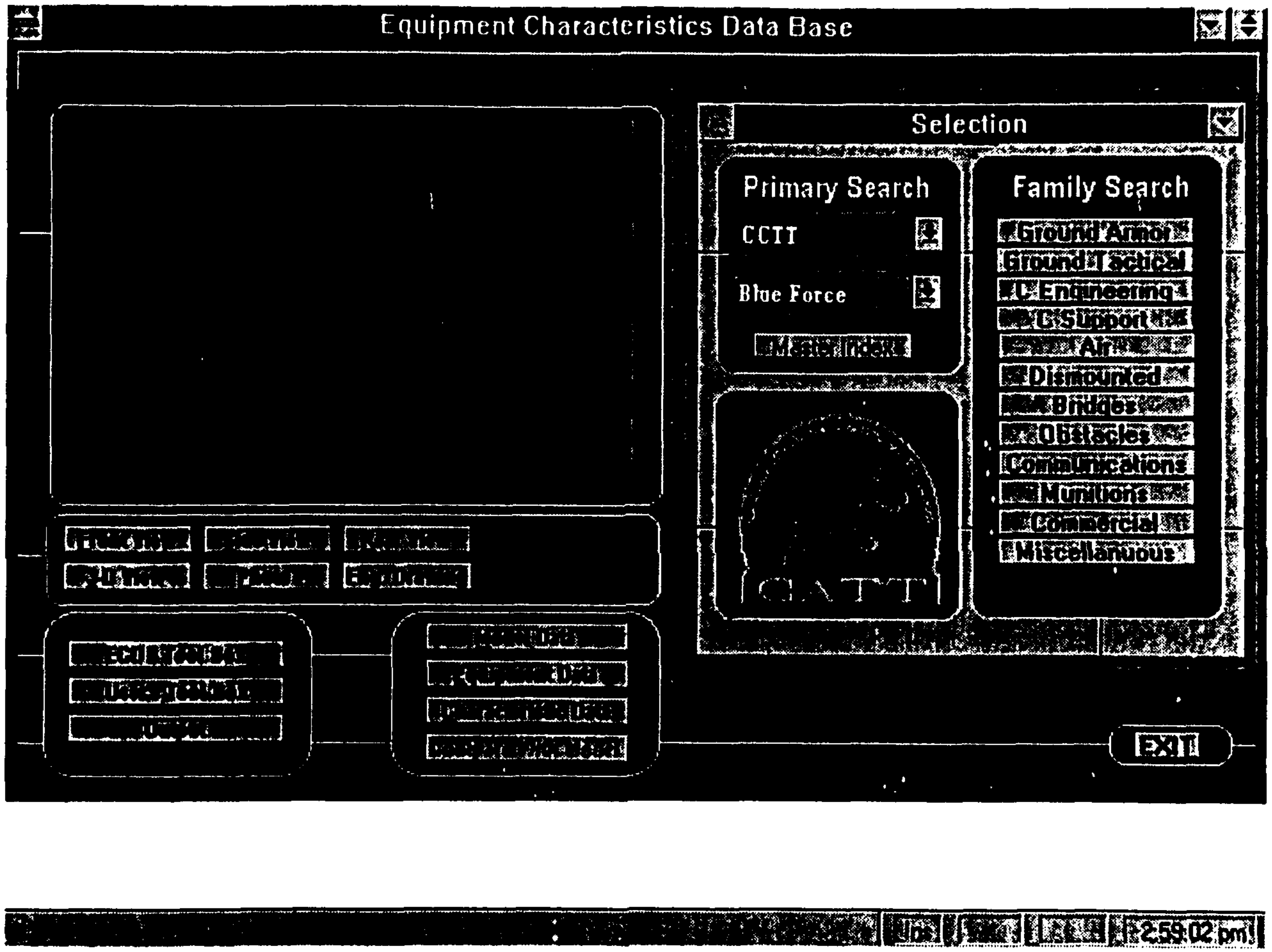
ECDB Opening Selection Screen



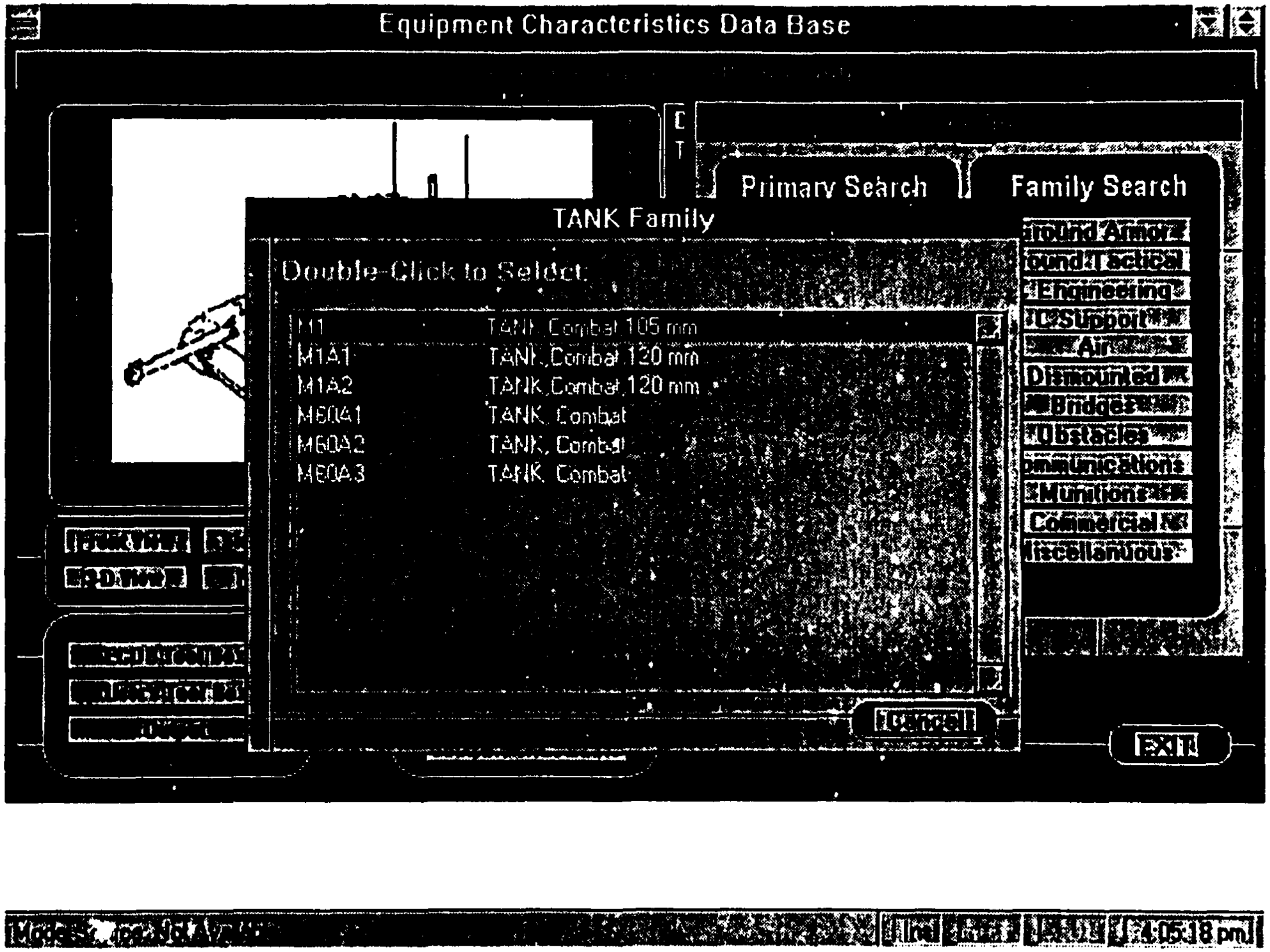
Opening *Program Selection* Pull Down Menu
(The *CCTT* Program is selected)



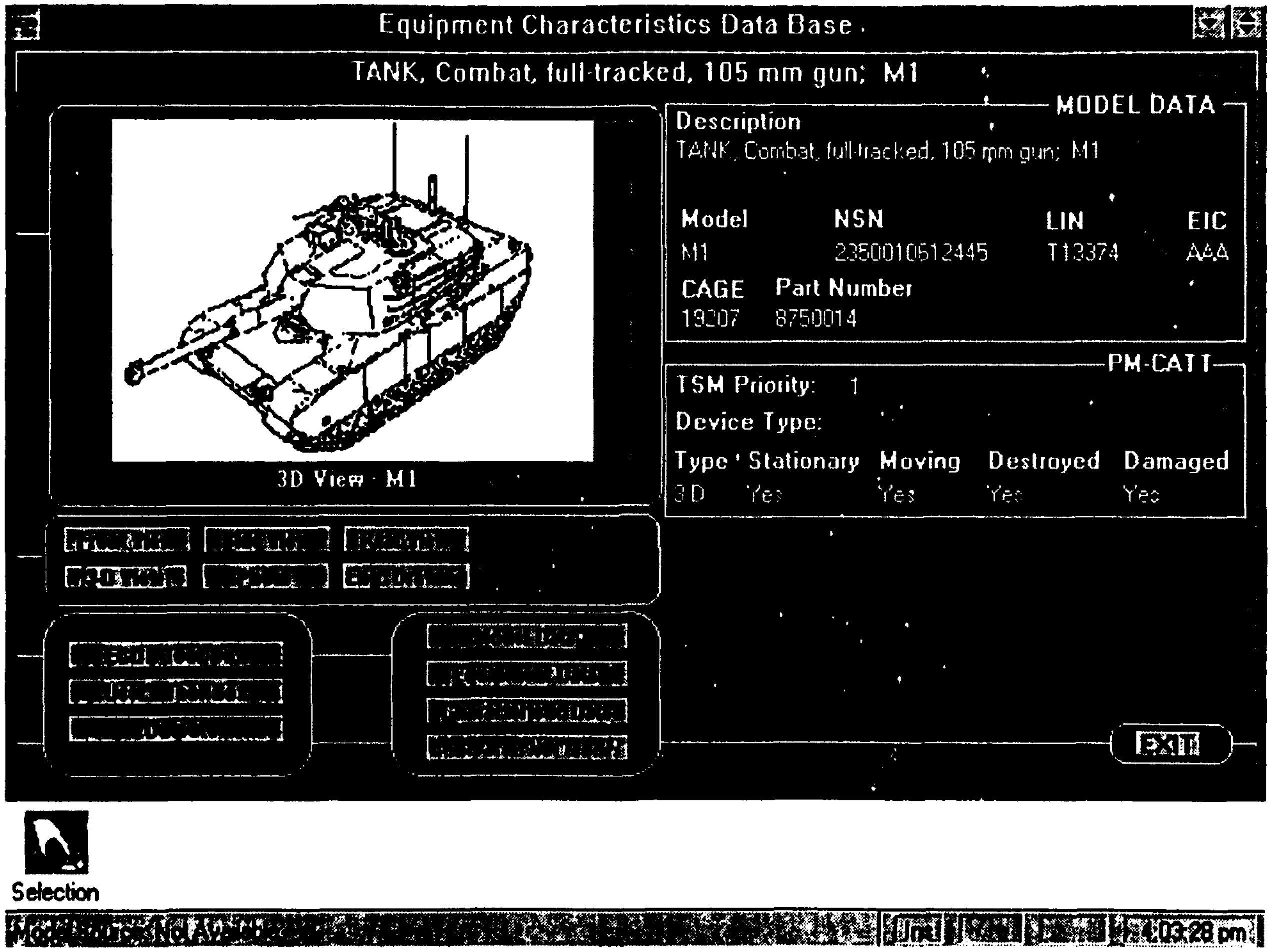
Opening *Type of Force Selection* Pull Down Menu
(The Type is selected)



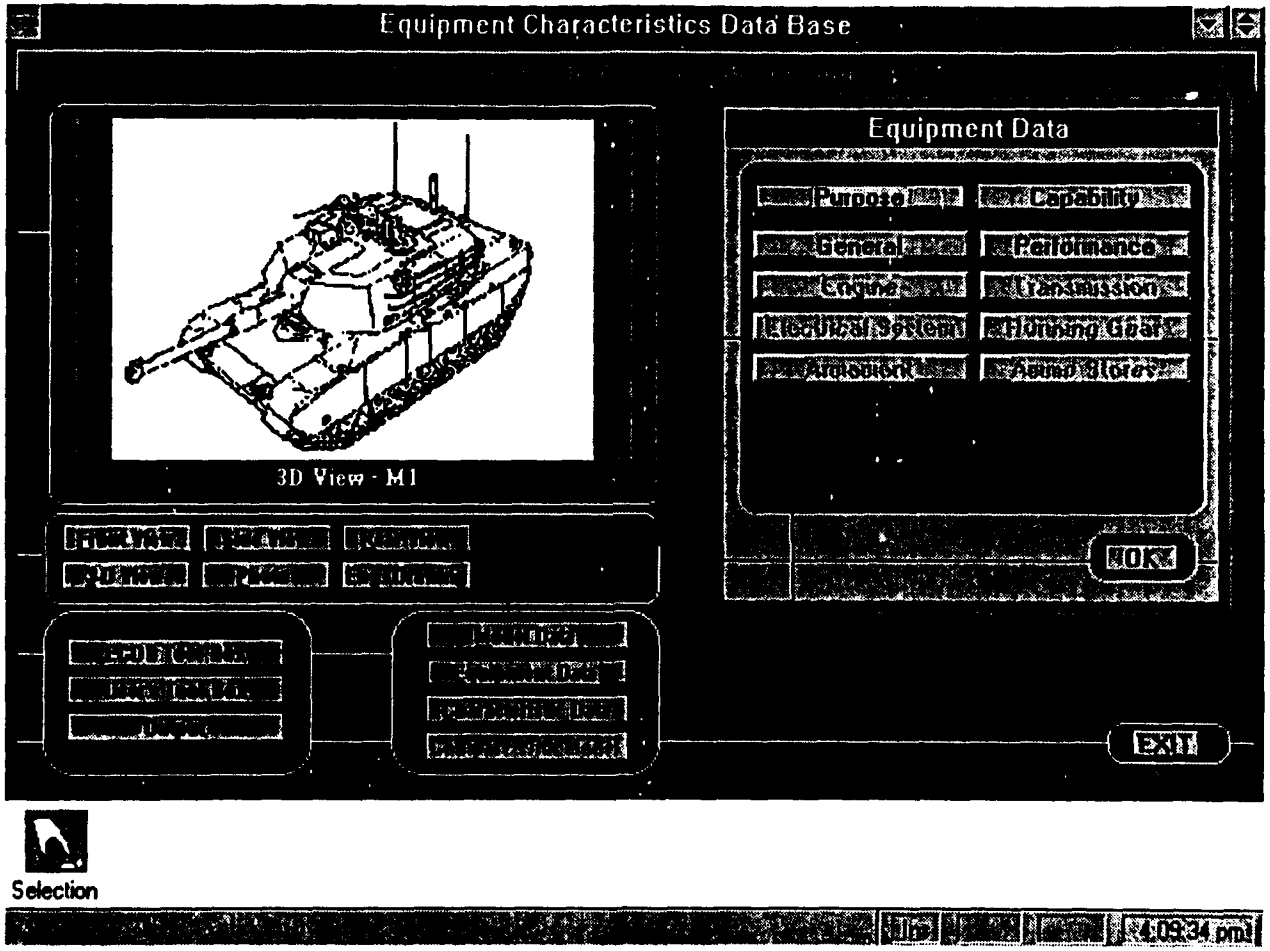
CCTT Program **and *Blue Force* Information has been selected**
(The Equipment can be selected)



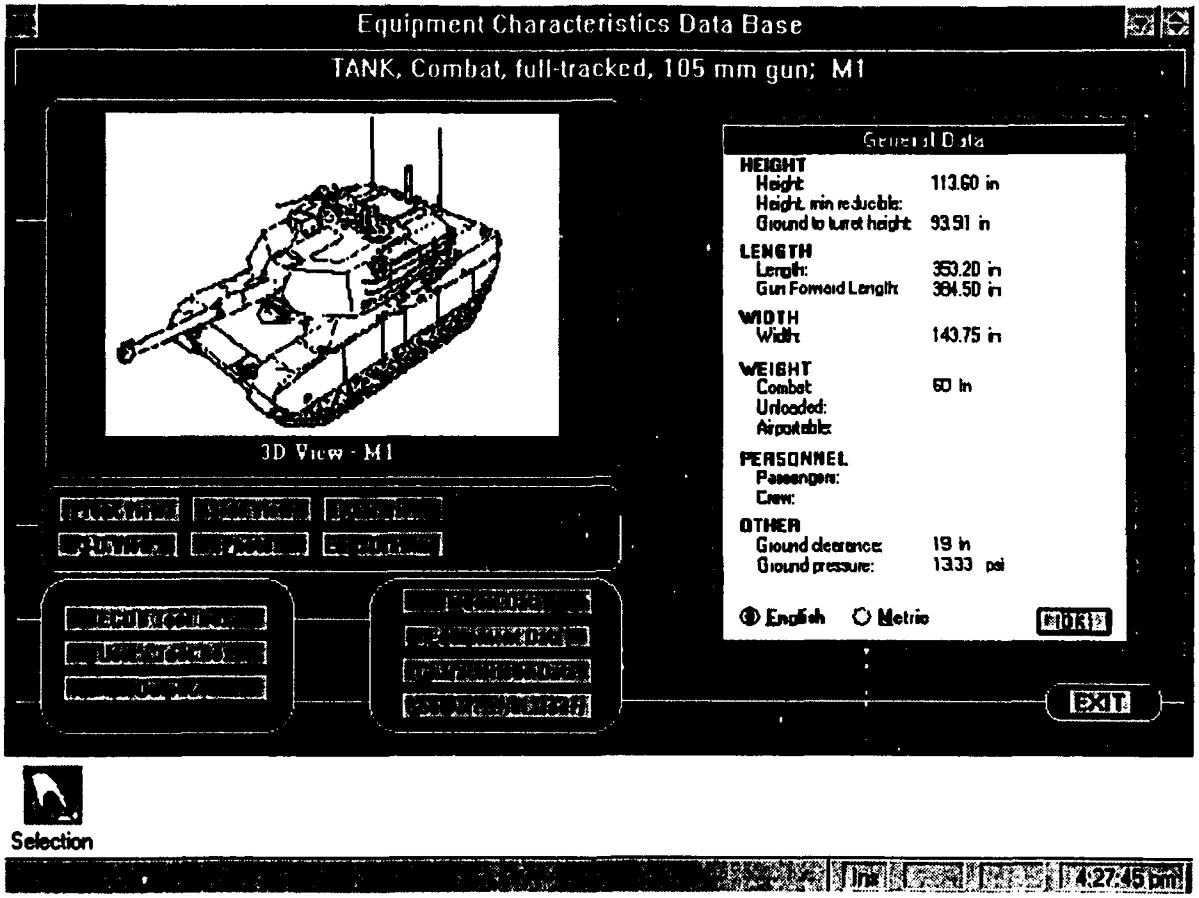
***TANK Family* Pull Down Menu**
(M1 is selected)



M1 Equipment **Main Parts Data Screen Opened**

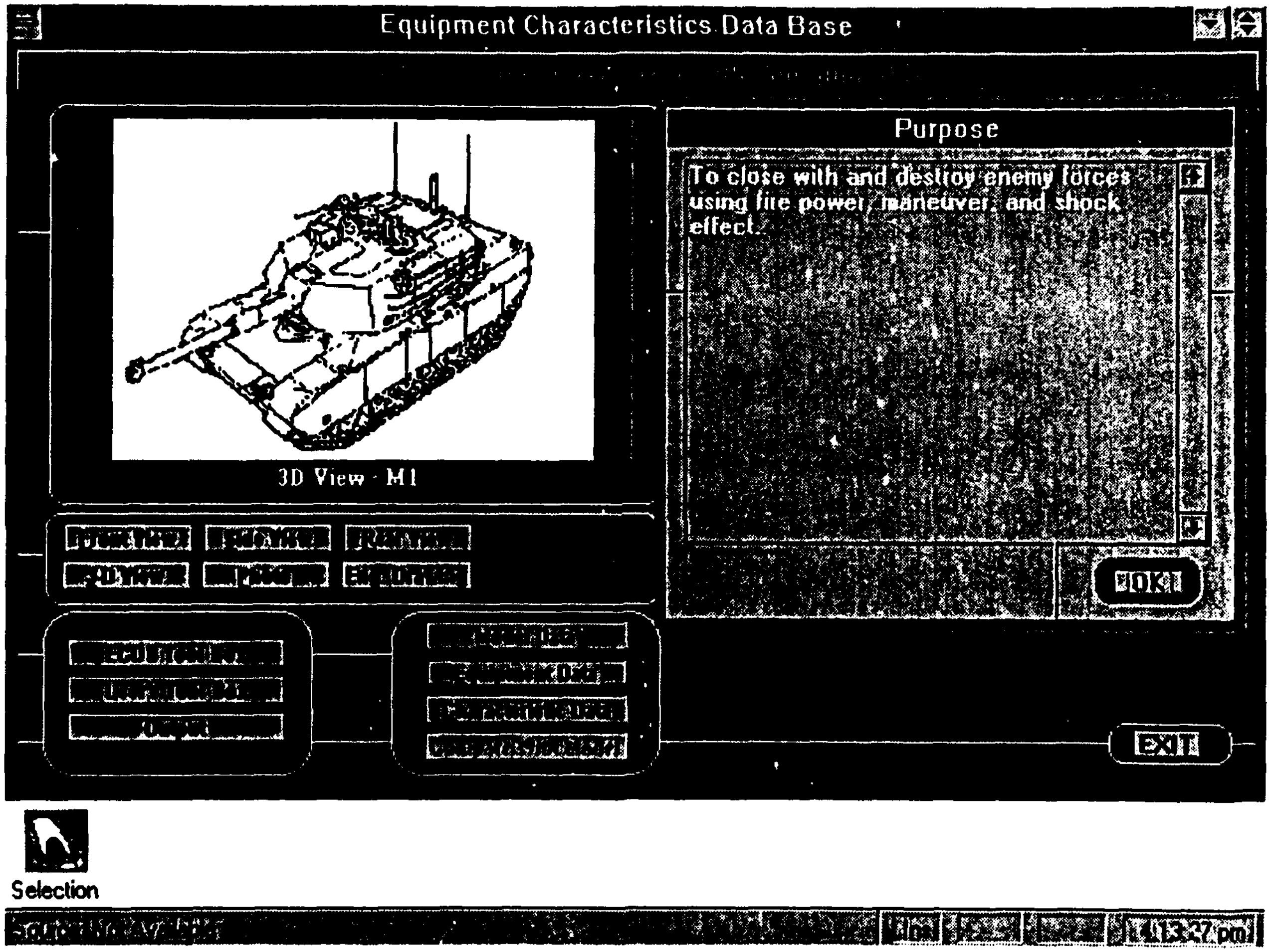


M1 Equipment Data Menu **Screen Opened**

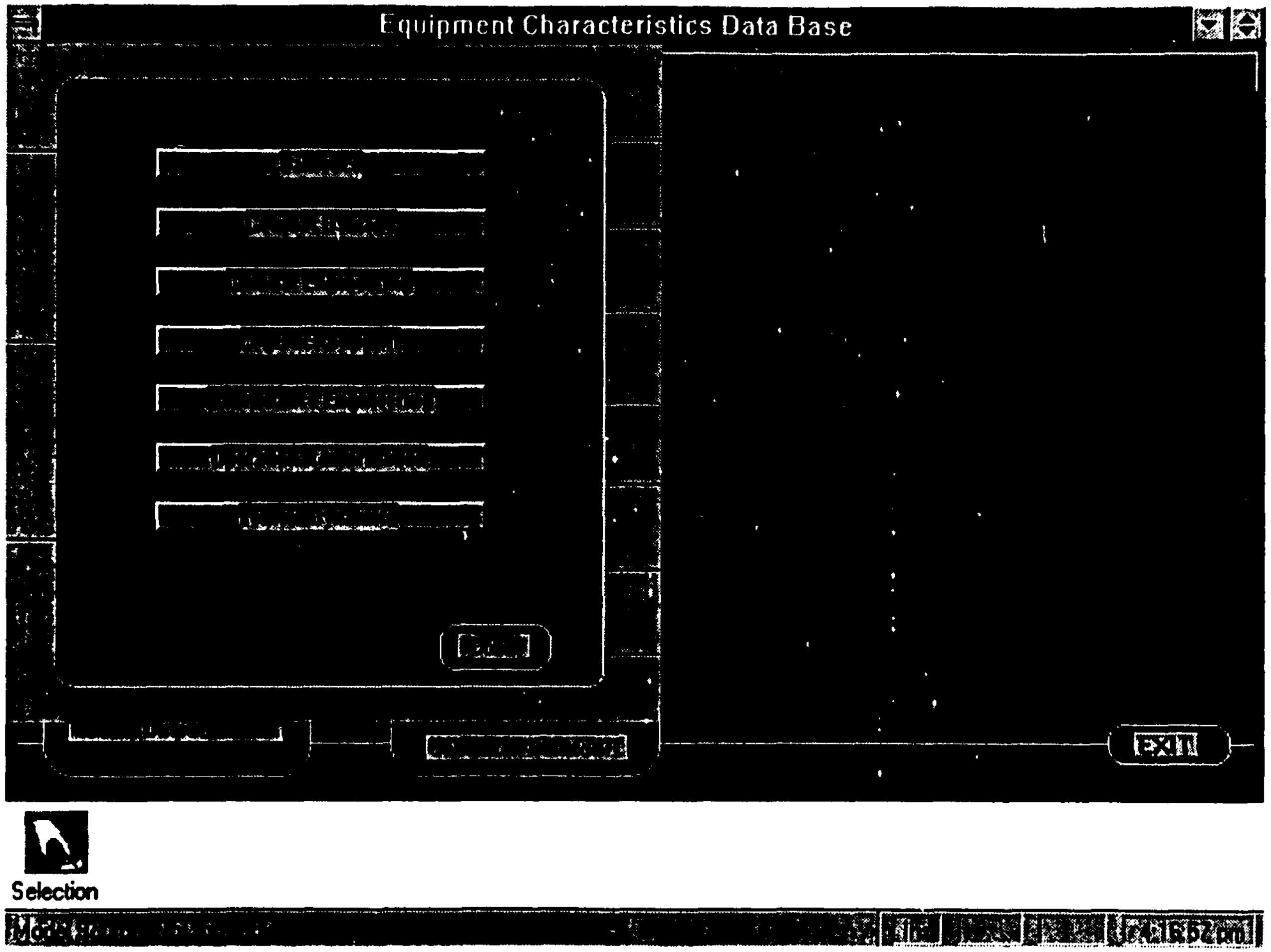


M1 General Data Information Screen Displayed

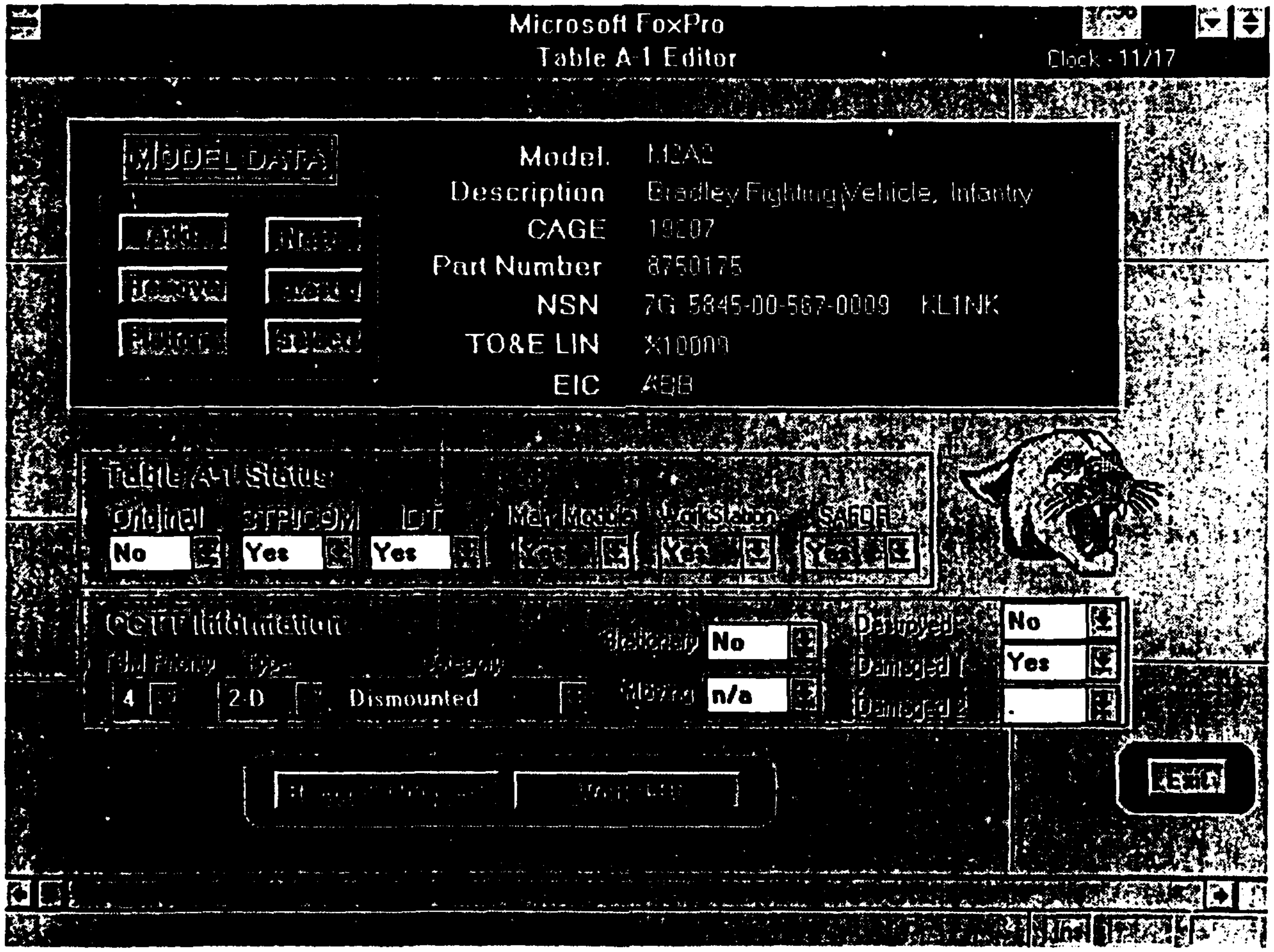
Note : Screen not functioning at the time of printing



M1 Equipment Purpose Data Screen Opened



Characteristics Data Menu Screen Opened



TABEL A-1 Data Editor and Report Generator **attached to ECDB Main Data Engine**

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An ECDB Overview ...

This chapter explains the standard features of the *ECDB* and briefly tells you what to expect from this alpha-test version. After you installed your *ECDB* (Section 2) and registered your *ECDB* copy with PM-CATT (Section 3), you can refer to this *User's Guide* for complete, step-by-step instructions for all software operations (Section 4).

Welcome to ECDB for Windows ....

PM-CATT welcomes you to the *Equipment Characteristics Data Base* (ECDB). As you start using the *ECDB*, you soon discover that is it very easy to use whether you're in management, research or software programming. As you begin using the *ECDB*, PM-CATT will encourage its *ECDB* subscribers to participate in the expansion of the programs functionality, capabilities and data base.

What the ECDB provides....

The *ECDB* is a living data library initially built for CCTT Specification Table A-1 equipments. Being a living data library, the *ECDB* data will be forever growing by data contributions from Subject Matter Experts to contractor's data deliverables. To support this data growth, the *ECDB* has a robust open architecture permitting it to function on four different levels. These functional levels provide :

- General information used by management about the equipment that will be or is being simulated
- Specific data used by analysts for developing algorithms or where to locate additional information in the PM-CATT library system
- IGES engineering drawings used by the visual data base programmers who must create and store the equipment's simulator image or those people required to use engineering drawings in their work (i.e. logistics engineers, technical writers)
- Reuse of stored information, illustrations and engineering drawing files to be used by all *ECDB* users.

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Current *ECDB 2* features ...

ECDB 2 for Windows is an alpha-test version that is capable of providing basic user functions and preliminary information about the Table A-1 equipments. As the *ECDB* matures, the features below will become the standard *ECDB* features.

- ### Open CALS architecture

The *ECDB* design meets the process requirements of MIL-HDBK-59B Computer-aided Acquistion and Logistics Support (CALS) Implementation Guide. These requirements provide guidelines for common interfaces and neutral file formats necessary for the effective access, interchange and use of digitial data. The cornerstone of this effectiveness is the application of the Integrated Weapon System Database (IWSDB) to provide the open acrhitecture for *ECDB*. This open architecture permits PM-CATT to create and manage a living data base.

- ### Living Data Base

ECDB has two functional components. The first component is resident on your computer and the other component resides at PM-CATT. The component on your computer is the data engine. This engine processes your searches, comparisons, requests data downloads, and makes reports. The second component is the living data base (because *ECDB* data is growing and maturing on a daily basis). By having a living data base, *ECDB* users are assured that the information is current, and the need for installing new a *ECDB* everytime the data is upgraded is eliminated.

- ### Graphics

To assist the user, *ECDB* supplies illustrations showing the front, side, rear, isometric (3-D) and photo of the equipment selected. Please remember that this is an evolving and maturing database, not all equipment will have graphics. Remember that the quality of all *ECDB* graphics are directly dependent on your monitor and printer.

In keeping with the CALS initiatives, *ECDB* graphic files are transportable to your computer for reuse. These graphics are suitable for use in view graph presentations and engineering and management reports only. Users are encouraged to contribute either better quality graphics or additional graphic views to this PM-CATT graphics library.

Features ...

- ### IGES Engineering Drawing Reuse Library

The *ECDB 2 for Windows* features the capability for the user to read, edit and receive IGES or CALS engineering drawings. These engineering drawings are supplied directly from TACOM, AMCCOM, etc. and stored in the *ECDB* Engineering Drawings Library.

The *ECDB* library maintains top level engineering and outline drawings for equipment. For the analysts, the top level engineering drawings provide a method to validate equipment configurations and part numbers. For the visual database programmer, the outline drawings can be used to create polygon drawings for use in their image generators.

- ### IGES Polygon Reuse Library

As the visual programmers for CCTT complete the polygon images for their simulators, they will transmit these images to PM-CATT *ECDB* for library storage and reuse. The contractor will transmit two types of images. The first will be the IGES generic polygon image drawings needed for reuse by other contractors. The second image will be a "TIF Format" image showing the rendered image of the generic polygon file. Since this is a living database, these drawings will be available to library users upon reciept from the software developers.

- ### Other than Table A-1 Equipment

The *ECDB 2 for Windows* primary function is to support that equipment identified on Table A-1. Although the Table A-1 equipment list is impressive, it does not reflect the entire inventory of equipment available to military analysts and planners during tactical operations.

To assist these military planners and analysts, the *ECDB 2* will have general information on the non-Table A-1 equipments. This is to correct potential problems on misidentfying equipment. ECDB users must expect limited information of parts information and some general characteristics (i.e. speed, weight). Graphics illustrations of these equipments will be limited. The *ECDB* IGES library is not required to acquire these files. However, the *ECDB* library will accept data and IGES drawing donations to enhance the PM-CATT capabilities.

- ### Print

In the alpha-test versions of *ECDB 2*, this feature will not be available. As an alpha test user, you are encouraged to work with the *ECDB* architect to design specific and general use reports for your community.

Features ...

- ### Model comparsions

To help managers and analysts, the *ECDB 2 for Windows* will have the capability to compare characterisics of several pieces of equipment. At the time of the first alpha test versions of *ECDB 2* this feature will be available. Alpha test users are encounaged to work closely with the *ECDB* architect in suggesting comparsion reports beneficial to your area of interest.

- ### Government Integrated Technicial Information System (GITIS) & Contractor's Integrated Technical Information Services (CITIS) Functionality.

An *ECDB 2 for Windows* important design feature is its open architecture that is transparent to the user. Since the *ECDB* architecture is fully CALS compliant, the *ECDB* has created a baseline GITIS backbone that can provide data downloading (re: MIL-C-CITIS).

This GITIS functionality will permit the *ECDB* to have active data links to other PM-CATT data librarys resident at RCI. The libraries to be linked are *DOCATS, CATT Tracker*, and *CATT Task*.

In the future, PM-CATT and *ECDB* users could benefit from the *ECDB* GITIS functionality because it maximizes the reuse of logistics data and IGES drawings in the PM-CATT libraries. With the GITIS functionality, the *ECDB* could be enhanced to manage all PM-CATT logistics and maintenance engineering and field data under one common file.

- ### Screen Colors

The *ECDB 2 for Windows* screen colors are under automatic control from your *Windows 3.1* Control Panel. An architectural decision was made to avoid fixing screen colors during the early phases of product development. It is the designers intent to present dynamic screen images after the design is solidified. We request your suggestions about these matters.

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What to expect from *ECDB 2* . . .

alpha test version

With this release of *ECDB 2 for Windows, ECDB* transitions from an academic prototype *FoxPro for DOS* product to open architecture and Wide Area Network (WAN) *FoxPro for a Windows* product. With this transition to the windows environment, the *ECDB's* has greatly increased functionality, connectivity, and capabilities, not easily achievable under *DOS*.

In the early software development phase of *ECDB 2 for Windows*, the PM-CATT has requested to have this program available on the WAN as soon as possible. To meet these requests, the *ECDB 2* is released as a alpha-test version. To the user, this version of the *ECDB* will function close to the final product, but requires some final software adjustments and testing. A benefit of the alpha-test version encourages users to participate in product improvements and data expansion. By working together, this product will mature quickly and become a valuable tool for research and development. In summary, here is what you can expect with this version.

• Performance

The alpha-test version of *ECDB 2 for Windows* will function at approximately 65% of its planned functionality. The focus of the *ECDB* development efforts have been the creation and functional testing of:

- User friendly navigational menus and user designed tools.
- Validating core parts information for Table A-1 equipment.
- Graphics storage capabilties and quality levels.
- Creating internal data management tools that could be reused for for PM-CATT community use.

• FoxPro for Windows Limitations

PM-CATT selected *FoxPro 2.5 for Windows* as the data base platform for all PM-CATT contracts. *FoxPro* is an excellent platform for data base applications and provides excellent connectivity to other PM-CATT data bases.

The *ECDB 2 for Windows* design is pushing the outer limits of the current *FoxPro 2.5* capabilities. The *ECDB* has experienced file size limitations when handling high resolution illustrations for possible future reuse in technical manuals. Working within those limitations, the *ECDB* graphics are suitable for management reports, view graphs or analytical studies. It is anticipated that some future releases of *FoxPro for Windows* could correct these limitations.

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What to expect...

- ## IGES Drawings

Any IGES drawing in the ECDB library are stored in "as recieved" condition as supplied by the Program Mangaers. PM-CATT can not assume responsiblity for the accuracy of these drawing. PM-CATT will, however, provide a point of contact for the user to contact the originator of these engineering drawing.

- ## Data Population and Population Schema

Like any new complex information system, the data must be gathered, assimulated and presented to the users in straightforward and simple manner. The *ECDB* is no exception. Careful planning and scheduling of data population will make *ECDB* a success and beneficial tool.

Help Us..... Help You.....
At first, the *ECDB* alpha test users must expect that the *ECDB* may not answer all their questions. When an alpha test user locates an area that they can contribute, they will be expected to help PM-CATT populate that area.

Population Schema .....
To request data from others and have nowhere to immediately reuse the data is poor planning. The *ECDB* plan or schema is to provide an accessible home for data and create a common dialogue tool for everyone to use. The following generalized tasks wili guide this effort:

① Validate that the equipment identified in the CCTT Table A-1 have the correct CAGE Code, Part Numbers, Approved Item Names and other select acquisitions data elements as presented in the Federal supply system AMDEF data.

② Populate the *ECDB* with core AMDEF information after Table A-1 is validated, and using TRADOC Weapon Systems Names. Essentially, build the foundation to place future data gathered.

③ Create data managment tools to rapidily input and edit the *ECDB* information stream. Then, create a Table A-1 management tool for TSM-CATT and PM-CATT to monitor and generate reports using only the *ECDB*.

④ Populate the *ECDB* with general characteristics information using Technical Manuals. Acquire the Table A-1 IGES outline drawings to begin libraries.

⑤ Schedule specific data population using CCTT software development schedule.

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ECDB Points of Contact ....

The *ECDB* is not just a software program, but a team effort between PM-CATT, RCI and you the user. It is this team that will make the *ECDB* a beneficial tool. WE welcome you as part of the *ECDB* team. Let us know how we can serve you. The following is a description of each of the team members.

CATT

- **Program Manager for Combined Arms Tactical Trainers (PM-CATT)**

  - **Program Manager (PM) :**

    Colonel James Shiflett is the Program Manager for CATT assigned by Simulation, Training and Instrumentation Command (STRICOM).

  - **Assistant Program Manager (APM) :**

    Major Bill Johnson is the Assistant Program Manager for CATT assigned by STRICOM.

Mailing Address :

PM-CATT
Suite 100
3051 Techonlogy Parkway
Orlando, Florida 32826-3299

Phone : (407) 384-3211
Fax :
DSN : 960-3211

CCMail : PM
APM

Avon : PM
APM

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Starting *ECDB* for the first time and everytime....

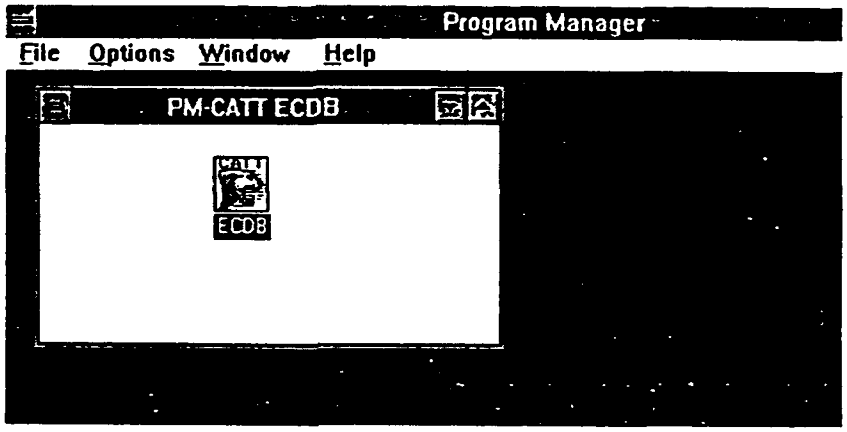
This procedure will be used every time to start and login into the *ECDB*. Please have your password and login codes available. If you fail to have your password available, the *ECDB* will not be connected to the PM-CATT library. Although not connected to the master library, the *ECDB* will default to local use and work with only those files you downloaded or test data.

1 **STARTING . . .**

Double Click the **ECDB** icon to start *ECDB*.

The *ECDB for Windows* icon is located inside the **PM-CATT Program Group** in the *Windows* **Program Manager.**

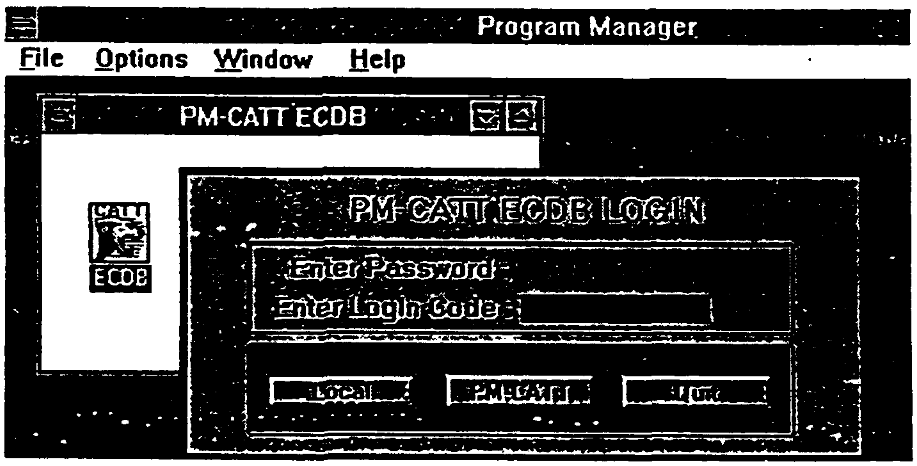
Displayed here is a custom Program Manager that has only one Program Group. Your Program Manager and Program Groups will appear different.



LOGGING IN . . .

2 Type your **Password** on the **Password Box :**

3 Type your **Login Code** on the **Login Box :**



Decision Time for you.

Failure to log in will result in a default to using ECDB with local or test data.

4 Press **Local** for using the ECDB locally without connecting to the PM-CATT Library.
Press **PM-CATT** to be linked to the PM-CATT Library, or
Press **Quit** to exit ECDB without any connections.

Group 000 Table
Ground Combat Vehicles

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
1B000	n/a	n/a	**Ground Comabt Vehicles Group 000**
	EIAC : Tanks		**Main Battle Tank Systems**
1B001 *+	M1	*19207:* 8750014	Tank, Combat, full-tracked, 105 mm
1B002 *+#	M1A1	*19207:* 8750015	Tank, Combat, full-tracked, 120 mm
1B003 *+#	M1A2	*19207:* 8750231	Tank, Combat, full-tracked, 120 mm
1B004	M60A1	*19207:* 8750112	Tank, Combat, full-tracked, 105 mm
1B005	M60A2	*19207:*	Tank, Combat, full-tracked, 105 mm
1B006 *+	M60A3	*19207:* 8756945	Tank, Combat, full-tracked, 105 mm
	EIAC : Bradley		**Bradley Fighting Vehicles**
1B00A+	M2	*19207:* XM2	Vehicle, Infantry Fighting
1B018 *#	M2TOW	*19207:*	Vehicle, Infantry Fighting w/ TOW *[MS52267]*
1B012 *	M2A1	*19207:* 8750134	Vehicle, Infantry Fighting
1B013 *	M2A2	*19207:* 8750175	Vehicle, Infantry Fighting
1B00B	M3	*19207:* XM3	Vehicle, Cavalry Fighting
1B019 *#	M3TOW	*19207:*	Vehicle, Infantry Fighting w/ TOW
1B014 *	M3A1	*19207:* 8750135	Vehicle, Cavalry Fighting
1B015 *	M3A2	*19207:* 8750176	Vehicle, Cavalry Fighting
1B016 *	XM	*19207:*	Vehicle, Cavalry Fighting w/ Stinger
	EIAC : APC		**Armored Personnel Carriers**
1B020 *	M113A1	*19207:* 8736562	Carrier, Personnel, full-tracked, armored
1B021 *	M113A1/TOW	*19207:* 10399048	Carrier, Guided missile, TOW
1B022 *	M113A2	*19207:* 8750024	Carrier, Personnel, full-tracked, armored *[MS52201]*
1B023 *	M113A2/TOW	*19207:* 11508962	Carrier, Guided missile, TOW
1B024 *+	M113A3	*19207:* 8750170	Carrier, Personnel, full-tracked, armored
1B025 *	M106A1	*19207:* 8736578	Carrier, Mortar, 107 mm, sp, armored
1B026 *+	M106A2	*19207:* 8750026	Carrier, Mortar, 107 mm, sp, armored *[MS52199]*

Legend :

*	Item identified on Table A-1
+	Identified as a priority data item (Source IDT quarterly report)
#	TSM Priority of 1
☐	Non- Table A-1 Equipments

Group 000 Table
Ground Combat Vehicles *(continued)*

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC : APC		**Armored Personnel Carriers**
1B027	M125A1	*19207:* 8736579	Carrier, Mortar, 81 mm, sp, armored
1B028	M125A2	*19207:* 8750027	Carrier, Mortar, 81 mm, sp, armored
1B029 +	M577A1	*19207:* 8736577	Carrier, Command post, full-tracked, armored
1B030 *	M577A2	*19207:* 8750025	Carrier, Command post, full-tracked, armored *[MS52198]*
1B031	M548	*19207:* 8736607	Carrier, Cargo, full-tracked
1B032 +	M548A1	*19207:* 8750029	Carrier, Cargo, full-tracked
1B00D +	M548A2	*19207:* n.y.d.-8	Carrier, Cargo, full-tracked
1B033	M1015A1	*19207:* 5051440-1	Carrier, Electronic shelter, full-tracked
1B034	M730	*19207:* 8736744	Carrier, Guided mssile equipment
1B035	M730A1	*19207:* 8750067	Carrier, Guided mssile equipment
1B036	M730A2	*19207:* 8750132	Carrier, Guided mssile euipment
1B037	M741	*19207:* 8736753	Carrier, Gun, anti-air, Vulcan 20 mm
1B038	M741A1	*19207:* 8750030	Carrier, Gun, anti-air, Vulcan 20 mm
1B039	M667	*19207:* 10160025	Carrier, Guided missile, Lance
1B00C	XM901	*19207:* 8736977	Combat Vehicle, Antitank, improved, TOW
1B040 +	M901A1	*19207:* 8750063	Combat Vehicle, Antitank, improved, TOW
1B041 +	M981	*19207:* 8750031	Combat Vehicle, Fire support team *[MS52255]*
1B042	M1059	*19207:* 8750136	Carrier, Smoke generator *[MS52264]*
1B043	M1059E1	*19207:* n.y.d.	Carrier, Smoke generator
1B044	M806E1	*19207:* 8736888	Recovery Vehicle, Light
1B045	XM1101A3	*19207:* n.y.d.-1	Carrier, Smoke Obcurants mechanized
1B046	OSV/BMP-2	*19207:* n.y.d.-2	Opposing Forces Surragate Vehicle
1B047	XM548A3-DS	*19207:* n.y.d.-3	Carrier, Cargo, full-tracked w/ drop sides
1B048	XM548A3-MHC	*19207:* n.y.d.-4	Carrier, Cargo, full-tracked w/ m.h. crane
1B049 #	M1064A3	*19207:* n.y.d.-5	Carrier, Mortar, 120 mm, sp, armored
1B050	XM-UNIVERSAL	*19207:* n.y.d.-6	Carrier, Multi-Purpose universal (Concept)
1B051	XM113A3	*19207:* n.y.d.-7	Carrier, Mortar, 120 mm, sp, armored

Legend :

- * Item identified on Table A-1
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- ☐ Non- Table A-1 Equipments

Group 000 Table
Ground Combat Vehicles *(continued)*

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC : Guns		**Self-Propelled Guns**
1B062	M109A2		Howitzer, Medium, self-propelled, 155 mm
1B063 +	M109A3		Howitzer, Medium, self-propelled, 155 mm
1B064	M109A4		Howitzer, Medium, self-propelled, 155 mm
1B065 * #	M109A5		Howitzer, Medium, self-propelled, 155 mm
1B066 *	M109A6		Howitzer, Medium, self-propelled, 155 mm
1B067	M110A1		Howitzer, Heavy,self-propolled, 8 inch *[MS52270]*
1B068 +	M110A2		Howitzer, Heavy, self-propelled, 8 inch *[MS52251]*
1B070 *+	M163A1	*19207:* 9360800	Gun, Air Defense Artillery, self-propelled
1B069	M163A2	*19207:* 12314755	Carrier, Valcun
	EIAC : LAV		**Light Armor Vehicle (LAV)**
1B090 *+#	LAV-25	*19207:*	LAV
1B091 *+#	LAV-25 TOW	*19207:*	LAV, TOW launcher
1B092 *#	LAV-25 105	*19207:*	LAV,
1B093 *#	LAV-25 MC	*19207:*	LAV, Mortar carrier
1B094 *#	LAV-25 PC	*19207:*	LAV, Personnel carrier
1B095 *#	LAV-25 MCC	*19207:*	LAV, Maintenance carrier
	EIAC :		**(open)**

Legend :

- * Item identified on Table A-1
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- ☐ Non- Table A-1 Equipments

Group 100 Table
Tactical Wheeled Vehicles

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
1B100			Tactical Wheeled Vehilces : **Group 100**
	EIAC : CCUV		**Commercial Utility Cargo Vehicle**
1B101	-	*19207:* 8750075	Truck, Cargo
1B102	-	*19207:* 8750076	Truck, Cargo
1B103	-	*19207:* 8750077	Truck,Utility
1B104	-	*19207:* 8750078	Truck, Ambulance
1B105	-	*19207:* 8750081	Truck, Shelter carrier
1B106	-	*19207:* 8750086	Truck, Chassis
1B107	-	*19207:* 8750131	Truck, Shelter carrier
	EIAC : GOER		
1B108	M520	*19207:* 11614317	Truck, Cargo w/ winch
1B109	M520	*19207:* 11614317-1	Truck, Cargo
1B110	M553	*19207:* 11614318	Truck, Wrecker
1B111	M559	*19207:* 11614319	Truck, Tanker, Fuel, 2,500 gallons w/ winch
1B112	M559	*19207:* 11614319-1	Truck, Tanker, Fuel, 2,500 gallons
1B113	M877	*19207:* 11614317-3	Truck, Cargo, w/ material handling crane
1B114	M877	*19207:* 11614317-2	Truck, Cargo, w/ material handling crane

Legend :

*	Item identified on Table A-1
+	Identified as a priority data item (Source IDT quarterly report)
#	TSM Priority of 1
☐	Non- Table A-1 Equipments

Group 100 Table
Tactical Wheeled Vehicles *(Continued)*

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC : HEMTT		**Heavy Expanded Mobility Tactical Truck**
1B115 *	M977	*19207:* CHEMTTH06	Truck, Cargo
1B116 *	XM977	*19207:* CHEMTTH01	Truck, Cargo
1B117 *+	XM978	*19207:* CHEMTTH02	Truck, Tanker
1B118 *+	XM978	*19207:* CHEMTTH07	Truck, Tanker
1B119	XM983	*19207:* CHEMTTH03	Truck, Tractor
1B120	M983	*19207:* CHEMTTH08	Truck, Tractor
1B121	M983E1	Unknown Model	Truck, Tractor (No match model number)
1B122	XM984	*19207:* CHEMTTH04	Truck, Wrecker
1B123 *	XM984E1	*19207:* XM984E1	Truck, Wrecker
1B124 *+	M985	*19207:* CHEMTTH09	Truck, Cargo
1B125	M985E1	Unknown Model	Truck, Cargo (No match model number)
	EIAC : HET70		**Heavy Equipment Transporter**
1B126	M746	*19207:* CPR10201	Heavy Equipment Transporter
	EIAC : HMMWV		**High Mobility Multi-purpose Wheeled Vehicle**
1B127 *	M998	*19207:* 8750057	Truck, Utility, cargo /troop
1B128 *+	M1038	*19207:* 8750058	Truck, Utility, cargo
1B129 *	M966	*19207:* 8750055	Truck, Utility, TOW carrier
1B130	M1045	*19207:* 8750120	Truck, Utility, TOW carrier
1B1K1	M1046	*19207:* 8750123	Truck, Utility, TOW carrier
1B131 *	M1025	*19207:* 8750082	Truck, Utility, armament carrier
1B132 *	M1026	*19207:* 8750083	Truck, Utility, armament carrier

Legend :

- * Item identified on Table A-1
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- ▭ Non- Table A-1 Equipments

Group 100 Table
Tactical Wheeled Vehicles *(Continued)*

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC : HMMWV		**High Mobility Multi-purpose Wheeled Vehicle**
1B133 *#+	M1043	*19207:* 8750121	Truck, Utility, armament carrier *w/ Mk19*
1B134 *#+	M1044	*19207:* 8750122	Truck, Utility, armament carrier *w/ M2 .50*
1B135 *	M1037	*19207:* 8750117	Truck, Utility, S-250 shelter carrier
1B136 *	M1042	*19207:* 8750124	Truck, Utility, S-250 shelter carrier
1B137	M996	*19207:* 8750060	Truck, Ambulance
1B138	M997	*19207:* 8750059	Truck, Ambulance
1B139	M1035	*19207:* 8750116	Truck, Ambulance

listed

Note : No HMMWV Model numbers have been lisited with DLSC

Notes	Model Number	Part Number	Model Name
	EIAC : MAN		**M.A.N Vehicle System**
1B140	M1001	*D3273:* 81991288916	Truck, Tractor
1B141	M1002	*D3273:* 81991288918	Truck, Tractor
1B142	M1013	*D3273:* 81991288917	Truck, Tractor
1B143	M1014	*D3273:* 81991288919	Truck, Tractor

Note : This EIAC series is built by MAN Nutzfahzeuge GMBH, Germany.

Notes	Model Number	Part Number	Model Name
	EIAC: M35		**Truck , 2 1/2 Ton, 6 x 6**
1B1K2 *	M35A1	*19207:* 8736236	Truck, Cargo
1B1K3 *	M35A1	*19207:* 8736237	Truck, Cargo *w/ winch*
1B144 *	M35A2	*19207:* 8736581	Truck, Cargo
1B145 *	M35A2	*19207:* 8736582	Truck, Cargo *w/ winch*
1B146 *	M35A2C	*19207:* 8736733	Truck, Cargo
1B147 *	M35A2C	*19207:* 8736735	Truck, Cargo *w/ winch*
1B148 *	M35E8	2320-00-542-5635	Truck, Cargo (No match Model No or NSN)
1B149	M36A2	*19207:* 8736592	Truck, Cargo, dropsides

Legend :

- * Item identified on Table A-1
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- [ ] Non- Table A-1 Equipments

Group 100 Table
Tactical Wheeled Vehicles *(Continued)*

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: M35		Truck , 2 1/2 Ton, 6 x 6
1B150	M36A2	*19207:* 8736593	Truck, Cargo *w/ winch*
1B154	M36A2C	*19207:* 8736836	Truck, Chassis
1B1K5	M44A1	*19207:* 8736440	Truck, Cargo
1B151	M44A1	*19207:* 8736470	Truck, Chassis
1B152	M44A2	*19207:* 8736576	Truck, Chassis
1B153	M44A2	*19207:* 8736594	Truck, Chassis
1B155	M45A2	*19207:* 8736574	Chassis, Truck
1B156	M45A2	*19207:* 8736575	Chassis, Truck *w/ winch*
1B157	M46A2	*19207:* 8736595	Chassis, Truck
1B158	M46A2C	*19207:* 8736573	Chassis, Truck
1B159	M46A2C	2320-00-077-1630	Chassis, Truck
1B160	M49A1C	*19207:* 8736353	Truck, Tanker, fuel, 1200 gals.
1B1K4	M49A1C	*19207:* 8736352	Truck, Tanker, fuel *w/ winch*
1B161	M49A2C	*19207:* 8736567	Truck, Tanker
1B162	M49A2C	*19207:* 8736566	Truck, Tanker, fuel, 1200 gals. *w/ winch*
1B1K6	M50A1	*19207:* 8736353	Truck, Tanker, water
1B1K7	M50A1	*19207:* 8736354	Truck, Tanker, water *w/ winch*
1B163	M50A2	*19207:* 8736355	Truck, Tanker,water, 1000 gals.
1B164	M50A2	*19207:* 8736568	Truck, Tank
1B1K8	M50A2	*19207:* 8736596	Truck, Tanker, water, 1000 gals.
1B165	M50A3	*19207:* 8736775	Truck, Tanker, water, 1000 gals
1B166	M50A3	*19207:* 8736780	Truck, Tank *w/ winch*

Legend :

- * Item identified on Table A-1
- + Identified as a priority data item (Source IDT quarterly report)
- # TSM Priority of 1
- [shaded box] Non- Table A-1 Equipments

Group 100 Table
Tactical Wheeled Vehicles *(Continued)*

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: M35		Truck , 2 1/2 Ton, 6 x 6
1B167	M109A1	*19207:* 8736281	Truck, Van *w/ winch*
1B168	M109A1	*19207:* 8736274	Truck, Van, shop
1B169	M109A2	*19207:* 8736357	Truck, Van, shop
1B170	M109A2	*19207:* 8736356	Truck, Van *w/ winch*
1B171	M109A3	*19207:* 8736569	Truck, Van
1B172	M109A3	*19207:* 8736570	Truck, Van *w/winch*
1B173	M185A1	*19207:* 8736466	Truck, Shop, instrument repair
1B174	M185A2	*19207:* 8736467	Truck, Shop, instrument repair
1B175	M185A2	4940-00-987-8800	Truck, Shop, instrument repair
1B176	M185A3	*19207:* 8736600	Truck, Shop, instrument repair
1B1K9	M185A9	*19207:* 8736588	Truck, Repair Shop *w/ winch*
1B1K0	M275A1	*19207:* 8736359	Turck, Tractor
1B177	M275A2	*19207:* 8736571	Truck, Tractor
1B178	M275A2	*19207:* 8736597	Truck, Tractor
1B179	M292A2	*19207:* 8736572	Truck, Van, expansible
1B180	M292A3	*19207:* 8736653	Truck, Van, expansible
1B1L3	M292A4	*19207:* 8736654	Truck, Van, expansible
1B181	M292A5	*19207:* 8736655	Truck, Van, expansible
1B182	M342A2	*19207:* 8736598	Truck, Dump
1B1L4	M342A2	*19207:* 8736589	Truck, Dump *w/ winch*
1B183	M602	*19207:* 8736378	Truck, Cargo
1B1L5	M602	*19207:* 8736134	Truck, Cargo
1B184	M607	Unknown Model	Truck, Tractor 2320-00-695-9457
1B185	M609A1	*19207:* 8736658	Truck, Van
1B1L6	M609A1	*19207:* 8736659	Truck, Van
1B1L7	M610	*19207:* 8736648	Truck, Tanker, water
1B186	M610	*19207:* 8736474	Truck, Tanker, water, 1000 gals.

Legend :

- * Item identified on Table A-1
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- [ ] Non- Table A-1 Equipments

Group 100 Table
Tactical Wheeled Vehicles *(Continued)*

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: M35		Truck , 2 1/2 Ton, 6 x 6
1B1L8	M611C	*19207:* 8736476	Truck, Tanker, gasoline, 1000 gals.
1B187	M611C	*19207:* 8736650	Truck, Tanker, gasoline, 1200 gals.
1B188	M613	*19207:* 8736638	Truck, Shop, instrument repair
1B189	M614	*19207:* 8736656	Truck, Dump
1B1L9	M614	*19207:* 8736657	Truck, Dump *w/ winch*
1B1ZA	M615 **	*19207:* 8736688	Truck, Ambulance
1B1ZB	M616 **	*19207:* 8736641	Chassis, Truck *w/ winch*
1B1ZC	M616 **	*19207:* 8736669	Chassis, Truck
1B1ZD	M617 **	*19207:* 8736642	Chassis, Truck
1B1ZE	M618 **	*19207:* 8736644	Chassis, Truck
1B1ZF	M619 **	*19207:* 8736665	Chassis, Truck
1B1ZG	M619 **	*19207:* 8736666	Chassis, Truck
1Z1ZH	M620 **	*19207:* 8736645	Chassis, Truck
1B190	M621	*19207:* 8736718	Truck, Cargo
1B191	M622	*19207:* 8736721	Truck, Tanker, fuel, 1200 gals.
1B192	M623	*19207:* 8736722	Truck, Van
1B193	M624	*19207:* 8736720	Truck, Dump
1B1ZI	M626 **	*19207:* 8736847	Tractor, Truck
1B1ZJ	M656 **	*19207:* 8736700	Tractor, Cargo
1B1ZK	M656 **	*19207:* 8736751	Tractor, Cargo *w/ winch*
1B1ZL	M748A1 **	*19207:* 8736846	Tractor, Bolster
1B1ZM	M748E2 **	*19207:* 8736750	Tractor, Bolster *w/ winch*
1B194	M751A2	*19207:* 8736788	Truck, Bolster
1B195	M756A2	*19207:* 8736769	Truck, Pipeline construction
1B196	M763	2320-00-937-5979	Truck, Maintenance, telephone
1B1L0	M764	*19207:* 8736782	Turck, Maintenance, telephone
1B197	V17A/MTQ	*19207:* V17AMTQ	Truck, Maintenance
1B198	V18A/MTQ	*19207:* V18AMTQ	Truck, Maintenance

Legend :

- * Item identified on Table A-1
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- ** Model Number requires validation if in M35 Series of trucks
- [ ] Non- Table A-1 Equipments

Group 100 Table
Tactical Wheeled Vehicles *(Continued)*

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: M39		**Truck , 5 Ton**
1B199	M51A1	*19207:* 8736449	Truck, Dump
1B11A	M51A1	*19207:* 8736448	Truck, Dump *w/ winch*
1B11B	M51A2	*19207:* 8736516	Truck, Dump *w/ winch*
1B11C	M51A2	*19207:* 8736517	Truck, Dump
1B1LA	M51A2	*19207:* M51A2	Truck, Dump *w/ winch*
1B11D	M52A1	*19207:* 8736432	Truck, Tractor
1B1LB	M52A1	*19207:* 8736433	Truck, Tractor *w/ winch*
1B11E	M52A2	*19207:* 8736519	Truck, Tractor
1B11F	M52A2	*19207:* M52A2	Truck, Tractor
1B11G	M52A2	*19207:* 8736518	Truck, Tractor *w/ winch*
1B11H	M54A2	*19207:* 8736520	Truck, Tractor
1B11I	M54A2	*19207:* 8736521	Truck, Tractor
1B11J	M54A2C	*19207:* 8736734	Truck, Cargo *w/ winch*
1B11K	M54A2C	*19207:* 8736732	Truck, Cargo
1B11L	M55A2	2320-00-055-9259	Truck, Cargo *w/ winch*
1B1LC	M59	*19207:* 8736732	Truck, Dump
1B1LD	M59	*19207:* 8736732	Truck, Dump *w/ winch* **(to be discontinued)**
1B11M	M61A2	2320-00-965-0321	Chassis, Truck **(No match Model No or NSN)**
1B11N	M61A2	2320-00-055-9264	Chassis, Truck **(No match Model No or NSN)**
1B11O	M63A2	2320-00-285-3757	Chassis, Truck **(No match Model No or NSN)**
1B11P	M63A2	2320-00-226-6251	Chassis, Truck **(No match Model No or NSN)**
1B11Q	M63A2C	2320-00-969-4113	Chassis, Truck **(No match Model No or NSN)**
1B11R	M246A2	*19207:* 8736732	Truck, Tractor *w/ winch*
1B11S	M291A1	*19207:* 8736842	Truck, Van
1B11T	M291A1C	*19207:* 8736843	Truck, Van
1B11U	M291A1D	*19207:* 8736844	Truck, Van

Legend :

- * Item identified on Table A-1
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- ☐ Non- Table A-1 Equipments

Group 100 Table
Tactical Wheeled Vehicles *(Continued)*

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: M39		**Truck , 5 Ton**
1B11V	M291A2	*19207:* 8736692	Truck, Van
1B11W	M291A2C	*19207:* 8736693	Truck, Van
1B11X	M291A2D	*19207:* 8736694	Truck, Van
1B1LC	M328A1	*19207:* 8736845	Truck, Stake
1B11Y	M328A2	2320-00-087-2317	Truck, Stake (No match Model No or NSN)
1B1LD	M543A1	*19207:* 8736465	Truck, Wrecker
1B11X	M543A2	*19207:* 8736537	Truck, Wrecker *w/ winch*
1B11Y	M748A1	*19207:* 8736846	Truck, Bolster *w/ winch*
1B11Z	M748E2	*19207:* 8736750	Truck, Bollster *w/ winch*
	EIAC: M123		**Truck , 10 Ton, 6 x 6**
1B1A1	M123A1C	*19207:* 8736634	Truck, Tractor *w/ winch*
	EIAC: M151		**Truck , 1/4 Ton, 4 x 4**
1B1A2	M151A1	*19207:* 8736678	Truck, Utility
1B1A3	M151A1C	*19207:* 8736677	Truck, Utility
1B1A4	M151A2	*19207:* 8736905	Truck, Ambulance, Frontline
1B1A5	M718A1	*19207:* 8736906	Truck, Ambulance, Frontline
	EIAC: M561		**Truck**
1B1A6	M561	*19207:* 8736407-1	Truck, Cargo
1B1A7	M792	*19207:* 8736827	Truck, Ambulance
	EIAC: M656		**Truck**
1B1A8	M656	*19207:* 8736700	Truck, Cargo
1B1A9	M656	*19207:* 8736751	Truck, Cargo
1B1A0	XM757	*19207:* 8736770	Truck, Tractor
1B1B1	XM757	*19207:* 8736771	Truck, Tractor
1B1B2	XM791	*19207:* 8736826	Truck, Van, expansible
1B1B3	XM791	*19207:* 8736825	Truck, Van, expansible

Legend :

*	Item identified on Table A-1
+	Identified as a priority data item (Source IDT quarterly report)
#	TSM Priority of 1
☐	Non- Table A-1 Equipments

Group 100 Table
Tactical Wheeled Vehicles *(Continued)*

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: M809		**Truck, 5 Ton, 6 x 6**
1B1F2	M809	*19207:* 8736849	Chassis
1B1F3	M809	*19207:* 8736850	Chassis
1B1F4	M809A1	*19207:* 8736856	Chassis
1B1F5	M810	*19207:* 8736858	Chassis
1B1F6	XM810	*19207:* 8736859	Chassis
1B1F7	M811	*19207:* 8736864	Chassis
1B1F8	M811	*19207:* 8736865	Chassis
1B1F9	M811A1	*19207:* 8736868	Chassis
1B1F0	M811A2	*19207:* 8736870	Chassis
1B1G1	M812	*19207:* 8736874	Chassis
1B1G2	M812A1	*19207:* 8736876	Chassis
1B1G3	M813	*19207:* 8736851	Truck, Cargo
1B1LE	M813	*19207:* 8736852	Truck, Cargo
1B1LF	M813A1	*19207:* 8736853	Truck, cargo, dropside *w/ winch*
1B1LG	M813A1	*19207:* 8736854	Truck, cargo, dropside
1B1LH	M814	*19207:* 8736866	Truck, Cargo
1B1G4	M814	*19207:* 8736867	Truck, Cargo
1B1G5	M815	*19207:* 8736855	Truck, Bolster *w/ winch* *[MS52187]*
1B1G6	M816	*19207:* 8736857	Truck, Work *[MS52188]*
1B1G7	M817	*19207:* 8736860	Truck, Dump *[MS52189]*
1B1G8	M817	*19207:* 8736861	Truck, Dump *[MS52189]*
1B1G9	M818	*19207:* 8736862	Truck, Tractor *[MS52190]*
1B1G0	M818	*19207:* 8736863	Truck, Tractor *[MS52190]*
1B1H1	M819	*19207:* 8736869	Truck, Tractor, wrecker *w/ winch* *[MS52191]*
1B1H2	M820	*19207:* 8736871	Truck, Van, expansible *[MS52192]*
1B1H3	M820A1	*19207:* 8736872	Truck, Van, expansible
1B1H4	M820A2	*19207:* 8736873	Truck, Van, expansible
1B1H5	M821	*19207:* 8736875	Truck, Stock Brg, transporter

Legend :

- * Item identified on Table A-1
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- (shaded box) Non- Table A-1 Equipments

Group 100 Table
Tactical Wheeled Vehicles *(Continued)*

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: M876		**Truck**
1B1B4	XM876	*19207:* XM976TACOM	Truck, Maintenance telephone *w/ winch*
	EIAC: M880		**Truck**
1B1B5	XM880	*19207:* 8736960	Truck, Cargo
1B1B6	XM881	*19207:* 8736960-1	Truck, Cargo
1B1B7	XM882	*19207:* 8736960-2	Truck, Cargo
1B1B8	XM883	*19207:* 8736960-3	Truck, Cargo
1B1B9	XM884	*19207:* 8736960-4	Truck, Cargo
1B1C0	XM885	*19207:* 8736960-6	Truck, Cargo
1B1C1	XM886	*19207:* 8736962	Truck, Ambulance
1B1C2	XM887	*19207:* 8736964	Chassis
1B1C3	XM888	*19207:* XM888	Truck, Telephone Maintenance
1B1L1	XM889 **	*86403:* W300	Truck, Cargo
1B1C4	XM890	*19207:* 8736961	Truck, Cargo
1B1C5	XM891	*19207:* 8736961-1	Truck, Cargo
1B1C6	XM892	*19207:* 8736961-2	Truck, Cargo
1B1C7	XM893	*19207:* 8736963	Truck, Ambulance
	EIAC: M915		**Truck**
1B1C9	XM915	*19207:* XM915	Truck, Line haul tractor *[MS52202]*
1B1C0	XM916	*19207:* XM916	Truck, Light equipment transporter
1B1D1	XM917	*19207:* XM917CHASSIS	Truck, Dump, 20 Ton
1B1D2	XM918	*19207:* XM918CHASSIS	Distributor, Bituminious material
1B1D3	M919	*19207:* XM919CHASSIS	Turck, Concrete mobile
1B1D4	M920	*19207:* XM920	Truck, Medium equipment transporter

Legend :

- * Item identified on Table A-1
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- [ ] Non- Table A-1 Equipments

Group 100 Table
Tactical Wheeled Vehicles *(Continued)*

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: M915A1		**Truck, Line Haul Tractor**
1B1D5	M915A1	*19207:* M915A1	Truck, Line haul tractor
	EIAC: M939		**Truck**
1B1D6	M923	*19207:* 8736986-2	Truck, Cargo
	M923	*34623:* M923	Truck, Cargo
1B1D7 *	M925	*19207:* 8736986-1	Truck, Cargo
	M925	*34623:* M925	Truck, Cargo
1B1D8	M927	*19207:* 8736987-2	Truck, Cargo, XLWB
1B1D9	M928	*19207:* 8736987-1	Truck, Cargo, XLWB
1B1D0	M929	*19207:* 8736989-2	Truck, Dump
1B1E1	M930	*19207:* 8736989-1	Truck, Dump
1B1E2	M931	*19207:* 8736990-2	Truck, Tractor
	EIAC: M939		**Truck**
1B1E3	M932	*19207:* 8736990-1	Truck, Tractor
	M932	*34623:* M932	Truck, Tractor
1B1E4	M933	2320-01-047-8768	Truck, Tractor **(No match Model No or NSN)**
1B1E5	M934	*19207:* 8736992	Truck, Van, expansible
1B1E6	M935	*19207:* 8736993	Truck, Van, expansible, WHLG
1B1E7 *	M936	*19207:* 8736998	Truck, Wrecker
*	M936	*34623:* M936	Truck, Wrecker
1B1E8	M939	**No part number and to be discontinued**	Truck, 5 Ton, PIP 2320-01-048-2450
1B1E9	M940	**No part number and to be discontinued**	Truck, Chassis 2320-01-047-8743
1B1E0	M941	**Unknown Model**	Truck, Chassis 2320-01-048-8742
1B1F1	M945	*19207:* 8736984	Truck, Chassis *w/ winch*

Legend :

* Item identified on Table A-1
\+ Identified as a priority data item (Source IDT quarterly report)
\# TSM Priority of 1
[ ] Non- Table A-1 Equipments

Group 200 Table
Combat Engineering Vehicles

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
1B200			**Combat Engineering Vehicles : Group 200**
	EIAC: ACE		**Truck , Heavy Equipment, Commercial**
1B2B1 *+=	M9	*19207:* 8750001	Bulldozer, Earthmover, armored combat *[MS52271]*
1B2B2 *	D7F	D7F	Bulldozer, Erathmover
	EIAC: ARV		**Armored Recovery/ Engineering Vehicles**
1B202 *	M88A1	*19207:* 8736888	Armored Recovery Vehicle, full-tracked
1B203 *	M88A2	*19207:*	Armored Recovery Vehicle, full-tracked
1B204 *+=	M728	*19207:* 8750112	Combat Engineering Vehicle, full-tracked
1B205 *	BAT-2	*19207:*	RTE Clearing Vehicle
1B206 *	MTK-2	*19207:*	Mine Clearer
1B207 *	PMR-3	*19207:*	Mine Layer
1B208 *	M93	*19207:*	WBC Recon. Vehicle
	EIAC: CE_ASS		**Combat Engineering Accessories**
1B2A1 *	MT-5K	*19207:*	Roller / Plow
1B2A2 *	KMT-4 / 6		Mine Plow
	EIAC: AVLB		**Armored Bridges**
1B2A1 *+#	MT-20	*19207:* 8892020	Armored Vehicle Launched Bridge
1B2A2 *	MT-55		Bridge
			BRIDGE, HEAVY ASSAULT
	EIAC: TRAILR		**Shelter**
~~1B2A1~~ *	M-105	*19207:*	Shelter

Legend :

* Item identified on Table A-1

\+ Identified as a priority data item (Source IDT quarterly report)

\# TSM Priority of 1

[ ] Non- Table A-1 Equipments

Group 300 Table
Aircraft Systems (All types)

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
1B300			**Aircraft Systems : Group 300**
	EIAC: Rotor		**Rotory Aircaft**
1B301 *+=	AH-1S		Attack Helicopter, *Cobra*
1B302 *	AH-1P		Attack Helicpoter, *Cobra*
1B303 *	AH-1G		Attack Helicopter, *Cobra*
1B304 *+=	AH-64A		Attck Helicopter, *Apache*
1B305 *	CH-47		Transport Helicpoter, Medium lift, *Chinook*
1B306 *+=	OH-58D		Scout Helicopter, *Kiowa Warrior*
1B307 *	RAH-66		Utility Helicopter, *Huey*
1B308 *+	UH-1H		Utility Helicopter, *Huey*
1B309 *+	UH-60A		Transport Helicopter, *Blackhawk*
1B310 *+	UH-60L		Transport Helicopter, *Blackhawk*
	EIAC: Fixed		**Fixed Wing Aircaft**
1B360 *	AV-8B		Harrier
1B361 *+=	A-7		Corsait
1B362 *+	A-10		Warthog
1B363 *+	F-4		Phantom
1B364 *	F-15		Eagle
1B365 *	F-15E		Eagle
1B366 *+	F-16		Falcon
1B368 *	F/A-18		Hornet
1B367 *	F-117		Stealth
1B369 *+	Hughes 500		Gunship
	EIAC: UAV		**Unmanned Aeriel Aircaft**

Legend :

* * Item identified on Table A-1
* \+ Identified as a priority data item (Source IDT quarterly report)
* \# TSM Priority of 1
* [ ] Non- Table A-1 Equipments

Group 400 Table
Guide Missile Systems (all types)

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
1B400			**Guided Missile Systems : Group 400**
	EIAC: GMS		**Guided Missile Sysems, Large**
1B401 *	M48A2	1440-01-106-3089	GMS, Intercept-aerial, carrier-mounted
1B402 *	M48A2E1		GMS, Intercept-aerial, carrier-mounted
1B403 *	M48A3		GMS, Intercept-aerial, carrier-mounted
1B404 *	STINGER		Air Defense System, Manportable
1B405 *	M270		Mutliple Rocket Launchers (MLRS)
	EIAC: Man-GMS		**Manportable Guided Missile System**
1B430 *	MANPADS		Air Defense System, Manportable
1B431 *	M136 (AT-4)		Launcher, Heat, 84 mm
1B432 *	DRAGON 2		Assault Weapon System, Medium , M47
1B433 *	JAVELIN		Advanced Anti-Tank Weapon System, Medium
1B434 *	TOW-2A		
1B435 *	TOW-2B		
1B436 *	HELLFIRE		
1B437 *	AVENGER		HMMWV, Pedestal-mounted, *Stinger*
1B438			
	EIAC: GMS		**Guided Missile Sysems, Airborne**
1B4A1 *	ATM-9	1440-01-106-3089	Sidewinder
1B4A2 *	ATM-21		Sparrow
1B4A3 *	M48A3		Rocket, 2.75 inch
1B4A4 *	STINGER		Rocket, 5 inch
1B4A5 *	M270		Rocket, 120 mm
1B4A6 *	M26		Rocket, 270 mm tactical w/ M77 warhead
1B4A7 *	M26		Rocket, 270 mm tactical w/ TGW warhead
1B4A8 *	M26		Rocket, 270 mm tactical w/ SADARM warhead
1B4A9 *	M26		Rocket, 270 mm tactical w/ AT2 warhead
1B4A0 *			Rocket, Volcano

Legend :
- * Item identified on Table A-1
- + Identified as a priority data item (Source IDT quarterly report)
- # TSM Priority of 1
- (shaded) Non- Table A-1 Equipments

Group 500 Table
Communications Systems and Equipments

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
IB500			**Communication Systems : Group 500**
	EIAC: Comm		**Communications Systems and Equipment**
IB501	AN/GRC125	*80063*: PPL-1887	RADIO SET, AN/GRC-125
IB502	AN/GRC160	*80058*: ANGRC160	RADIO SET, AN/GRC-160
IB503	AN/VDR-1	*80058*: AN/VDR-1	RADIOLOGICAL WARNING DEVICE, AN/VDR-1
IB504	AN/VRC-87C	*80063*: A3141516-1	RADIO SET, AN/VRC-87C
IB505	AN/VIC-1 V	*80058*: ANVIC1(v)	INTERCOMMUNICATIONS SET, AN/VIC-1(V)
IB506	AN/VRC-53	*80063*: PPL-1886	RADIO SET, AN/VRC-53
IB507	AN/VRC-64	*80058*: ANVRC64	RADIO SET, AN/VRC-64
IB508	AN/VRC-87A	*80063*: A3080227-1	RADIO SET, AN/VRC-87A Sincgars
IB509	AN/VRC-88A	*80063*: A3080228-1	RADIO SET, AN/VRC-88A Sincgars
B510	AN/VRC-89A	*80063*: A3080229-1	RADIO SET, AN/VRC-89A Sincgars
B511	AN/VRC-90A	*80063*: A3080230-1	RADIO SET, AN/VRC-90A Sincgars
B512	AN/VRC-91A	*80063*: A3080231-1	RADIO SET, AN/VRC-91A Sincars
B513	AN/VRC-92A	*80063*: A3080232-1	RADIO SET, AN/VRC-92A Sincgars
B514	AN/PRC119A	*80063*: A3080226-1	RADIO SET, AN/PRC-119A Sincgars
B515	AS1729/VRC	*80063*: SM-D-542001	ANTENNA, AS-1729/VRC
B516	AS27319GRC	*80058*: AS-23719( )/GRC	ANTENNA ASSEMBLY, Whip AS-27319( )/GRC
B517	OA3633/GRC	*80063*: SM-D-454880	AMPLIFIER-POWER SUPPLY GROUP; OA-3633/GRC
B518	RT-1523(C)/U		Receiver-Transmitter, RT-1523(C)/U S

Group 600 Table
Mortars and Grenade Launchers

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
1B600			**Mortars & Grenande Launchers : Group 300**
	EIAC: Mortar		**Mortars**
1B601 *	M30	*19204* : 8401840	Mortar, 4.2 inch
1B604			
1B605			
1B606			
1B607			
1B608			

Non- Table A-1 Equipments

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Group 700 Table
Machine Guns, Weapons and Rifles

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
1B700			**Machine Guns, weapons & rifles : Group 700**
	EIAC: MG		**Machine Guns (MG) all types**
1B701 *	Mk. 19 Mod.3	*10001* : 3269419	MG, Caliber, 40 mm
1B702 *	M2	*19204* : 8401485	MG, Caliber .50; Browning flexible, w/e
1B703 *	M2	*19204* : 5910630	MG, Caliber .50; Browning M48 turret type
1B704 *	M60	*19204* : 7269100	MG, Cailber, 7.62 mm
1B705 *	M73	1005-00-869-8816	MG, Caliber, 7.62 mm
1B706 *	M73A1	1005-00-937-7323	MG, Caliber, 7.62 mm
1B707 *	M219	1005-00-077-2354	MG, Caliber, 7.62 mm
1B708 *	M249	*19207* : 9348199	Machine Gun, 5.56 mm *w/ equipment*
1B709	M249	*19207* : 9348200	Machine Gun, 5.56 mm (SAW) *(Not Procureable- Use 9348199)*
1B710	M242	19200 : 1252400	Gun Automatic, 25 mm
1B711	M60D		MG, Caliber, 7.62 mm
	EIAC: Rifles		**Rifles all types**
1B750 *	M16	*19204* : 8448600	Rifle, 5.56 mm
1B751 *	M16A1	1005-00-073-9421	Rifle, 5.56 mm
1B752 *	M16A2		Rifle, 5.56 mm
750 751 & 752		1005-00-921-5004	Magazine, Cartridge, 30 round
705 751 & 752		1005-00-165-4336	Sling, small arms
	EIAC: Weapon		**Hand held weapons all types**

Legend :

- * Item identified on Table A-1
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- ☐ Non- Table A-1 Equipments

Group 800 Table
Mines and Grenades

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
1B800			**Mines & Hand Grenande : Group 800**
	EIAC: Mines		**Mines all types**
1B801 *	BarMine		Mine, Antitank
1B802 *	M19		Mine, Antitank
	EIAC: GL		**Grenade Launchers all types**
1B880 *	M203	*19204* : 8448300	Grenade Launcher, 40 mm
1B881 *	M79	*19204* :	Grenade Launcher, 40 mm
	EIAC: HG		**Hand & Rifle Grenades all types**
1B8A0	ABC-M25A1	*19203* : 13-25-27	Grenade, Hand; riot, cn1 LCC-A, MSR: 8746046 (DoDAC: 1330-G927)
1B8A1	ABC-M25A2	*19203* : 13-25-25	Grenade, Hand; riot, cs1 LCC-A, MSR: 8746046 (DoDAC : 1330-G924)
1B8A2 *	AN-M8	*19203* : 13-19-32	Grenade, Hand; smoke LCC-A, AMCTC 3408 (DoDAC : 1330-G900)
1B8A3	AN-M14	*19203* : 13-17-3	Grenade, Hand; incendiary, TH-3 LCC-A, AMCTC 3408 (DoDAC : 1330-G930)
1B8A4 *	L8A1	*19203* : TW74GF	Grenade, Launcher, smoke : screening, RP LCC-A (DoDAC :1330-G815)
1B8A5 *	L8A3	*19203* : D13-19-100	Grenade, Launcher, smoke : screening, RP LCC-A (DoDAC :1330-G815)
1B8A6	Mk 1	*19203* : 344573	Grenade, Hand; illuminating Obselete (DoDAC : 1330-G895)

<u>Legend :</u>

- * Item identified on Table A-1
- \+ Identified as a priority data item (Source IDT quarterly report)
- ≠ TSM Priority of 1
- ☐ Non- Table A-1 Equipments

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Group 800 Table
Mines and Grenades (Continued)

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: HG		**Hand & Rifle Grenades all types**
1B8A7	Mk 1A1	*19203* : 82-1-7	Grenade, Hand; illuminating Obselete MSR 11756003
1B8A8	Mk 2	*19203* : 82-0-143	Grenade, Hand; fragmentation, delay Obs. AMCTC 6558 (DoDAC : 1330-G890)
1B8A9	Mk 3A2	*19203* : 9215459	Grenade, Hand; offensive, delay Obs. MSR 11756003 (DoDAC : 1330-G911)
1B8AA *	M7	*19203* : 13-21-3	Grenade, Hand; smoke, wp MSR: 8746046 (DoDAC :1330-G960)
1B8AB *	M7A1	*19203* : 13-21-7	Grenade, Hand; smoke, wp MSR: 8746046 (DoDAC :1330-G960)
1B8AC	M7A3	*19203* : 13-22-35	Grenade, Hand; riot, cs LCC-A, MSR: 8746046 (DoDAC :1330-G963)
1B8AD *	M15	*19203* : 13-19-18	Grenade, Hand; smoke MSR: 11756003 (DoDAC :1330-G935)
1B8AE *	M19A1	*19203* : 82-0-109	Grenade, Rifle; smoke, wp MSR: 11756003 (DoDAC :1330-H030)
1B8AF *	M22	*99999* : 1330-G995	Grenade, Rifle; smoke, green, impact MSR: 11756003 (DoDAC :1330-G995)
1B8AG *	M22	*99999* : 1330-H010	Grenade, Rifle; smoke, red, impact MSR: 11756003 (DoDAC :1330-H010)
1B8AH *	M22	*99999* : 1330-H020	Grenade, Rifle; smoke, violet, impact MSR: 11756003 (DoDAC :1330-H020)
1B8AI *	M22A2	*99999* : 1330-H035	Grenade, Rifle; smoke, yellow, impact MSR: 11756003 (DoDAC :1330-H035)
1B8AJ *	M22A2	*99999* : 1330-G995	Grenade, Rifle; smoke, green, impact MSR: 11756003 (DoDAC :1330-G995)

Legend :

- `*` Item identified on Table A-1 for smoke munitions
- `+` Identified as a priority data item (Source IDT quarterly report)
- `#` TSM Priority of 1
- ☐ Non- Table A-1 Equipments

Group 800 Table
Mines and Grenades (Continued)

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: HG		**Hand & Rifle Grenades all types**
1B8AK *	M22A2	*99999 :* 1330-H010	Grenade, Rifle; smoke, red, impact MSR: 11756003 (DoDAC :1330-H010)
1B8AL *	M22A2	*99999 :* 1330-H020	Grenade, Rifle; smoke, violet, impact MSR: 11756003 (DoDAC :1330-H020)
1B8AM *	M22A2	*99999 :* 1330-H035	Grenade, Rifle; smoke, yellow, impact MSR: 11756003 (DoDAC :1330-H035)
1B8AN *	M23	*99999 :* 1330-H000	Grenade, Rifle; smoke, green, impact MSR: 11756003 (DoDAC :1330-H000)
1B8AO *	M23	*99999 :* 1330-H015	Grenade, Rifle; smoke, red, impact MSR: 11756003 (DoDAC :1330-H015)
1B8AP *	M23	*99999 :* 1330-H025	Grenade, Rifle; smoke, violet, impact MSR: 11756003 (DoDAC :1330-H025)
1B8AQ *	M23	*99999 :* 1330-H040	Grenade, Rifle; smoke, yellow, impact MSR: 11756003 (DoDAC :1330-H040)
1B8AR *	M23A1	*99999 :* 1330-H000	Grenade, Rifle; smoke, green, impact MSR: 11756003 (DoDAC :1330-H000)
1B8AS *	M23A1	*99999 :* 1330-H015	Grenade, Rifle; smoke, red, impact MSR: 11756003 (DoDAC :1330-H015)
1B8AT *	M23A1	*99999 :* 1330-H025	Grenade, Rifle; smoke, violet, impact MSR: 11756003 (DoDAC :1330-H025)
1B8AU *	M23A1	*99999 :* 1330-H040	Grenade, Rifle; smoke, yellow, impact MSR: 11756003 (DoDAC :1330-H040)
1B8AV	M26	*19203 :* 82-0-190	Grenade, Hand; fragmentation, delay MSR: 11756003 (DoDAC :1330-G890)
1B8AW	M26A1	*19203 :* 9212181	Grenade, Hand; fragmentation, delay, LCC-A, AMCTC 5666 (DoDAC : 1330-G890)
1B8AX	M26A2	*19203 :* 8840255	Grenade, Hand; fragmentation, delay MSR: 10826016 (DoDAC : 1330-G889)

Legend :

- * Item identified on Table A-1 for smoke munitions
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- ☐ Non- Table A-1 Equipments

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Group 800 Table
Mines and Grenades (Continued)

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: HG		**Hand & Rifle Grenades all types**
1B8AY	M29	*19203* : 8864102	Grenade, Rifle; practice, AT MSR: 11756003 (DoDAC :1330-G980)
1B8AX	M30	*19203* : 8861647	Grenade, Rifle; practice, delay MSR: 11756003 (DoDAC :1330-G915)
1B8B0	M31	*19203* : 82-0-195	Grenade, Rifle; heat MSR: 11756003 (DoDAC :1330-G970)
1B8B1	M33	*19203* : 8810741	Grenade, Hand; fragmentation, delay MSR: 11756003 (DoDAC :1330-G888)
1B8B2	M33A1	*19203* : 8833936	Grenade, Hand; fragmentation, impact LCC-A, AMCTC 7764 (no model/ part number matches)
1B8B3 *	M34	*19203* : 13-7-4	Grenade, Hand; smoke, wp MSR : 11756003 (DoDAC : 1330-G937)
1B8B4	M47	*19203* : D13-25-70	Grenade, Hand; riot, cs LCC-A, MSR: 87446046 (DoDAC :1330-G922)
1B8B5 *	M48	*19203* : D13-25-71	Grenade, Hand; smoke LCC-A, MSR : 8746046 (DoDAAC : 1330-G932)
1B8B6	M57	*19203* : 9210138	Grenade, Hand; fragmentation, impact MSR: 10826016 (no model/ part number matches)
1B8B7	M58	*19203* : 13-21-16	Grenade, Hand; riot, pocket, cs LCC-A, MSR: 8746046 (DoDAAC :1330-G933)
1B8B8	M59	*19203* : 8833936	Grenade, Hand; fragmentation, impact LCC-A, AMCTC 7764, (DoDAAC : 1330-G887)
1B8B9	M61	*19203* : 9231594	Grenade, Hand; fragmentation, delay LCC-A, AMCTC 6446 (DoDAAC : 1330-G880)

Legend :

* Item identified on Table A-1 from smoke munitions
\+ Identified as a priority data item (Source IDT quarterly report)
\# TSM Priority of 1
[ ] Non- Table A-1 Equipments

Group 800 Table
Mines and Grenades (Continued)

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: HG		**Hand & Rifle Grenades all types**
1B8AY	M29	*19203* : 8864102	Grenade, Rifle; practice, AT MSR: 11756003 (DoDAC :1330-G980)
1B8AX	M30	*19203* : 8861647	Grenade, Rifle; practice, delay MSR: 11756003 (DoDAC :1330-G915)
1B8B0	M31	*19203* : 82-0-195	Grenade, Rifle; heat MSR: 11756003 (DoDAC :1330-G970)
1B8B1	M33	*19203* : 8810741	Grenade, Hand; fragmentation, delay MSR: 11756003 (DoDAC :1330-G888)
1B8B2	M33A1	*19203* : 8833936	Grenade, Hand; fragmentation, impact LCC-A, AMCTC 7764 (no model/ part number matches)
1B8B3 *	M34	*19203* : 13-7-4	Grenade, Hand; smoke, wp MSR : 11756003 (DoDAC : 1330-G937)
1B8B4	M47	*19203* : D13-25-70	Grenade, Hand; riot, cs LCC-A, MSR: 87446046 (DoDAC :1330-G922)
1B8B5 *	M48	*19203* : D13-25-71	Grenade, Hand; smoke LCC-A, MSR : 8746046 (DoDAAC : 1330-G932)
1B8B6	M57	*19203* : 9210138	Grenade, Hand; fragmentation, impact MSR: 10826016 (no model/ part number matches)
1B8B7	M58	*19203* : 13-21-16	Grenade, Hand; riot, pocket, cs LCC-A, MSR: 8746046 (DoDAAC :1330-G933)
1B8B8	M59	*19203* : 8833936	Grenade, Hand; fragmentation, impact LCC-A, AMCTC 7764, (DoDAAC : 1330-G887)
1B8B9	M61	*19203* : 9231594	Grenade, Hand; fragmentation, delay LCC-A, AMCTC 6446 (DoDAAC : 1330-G880)

Legend :

* Item identified on Table A-1 from smoke munitions
\+ Identified as a priority data item (Source IDT quarterly report)
\# TSM Priority of 1
☐ Non- Table A-1 Equipments

Group 800 Table
Mines and Grenades (Continued)

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: HG		**Hand & Rifle Grenades all types**
1B8BA	M62	*19203* : 9231597	Grenade, Rifle; practice, delay MSR: 11756003 (DoDAC :1330-G914)
1B8BB	M67	*19203* : 9235492	Grenade, Hand; fragmentation, delay LCC-A, AMCTC 7764 (DoDAAC : 1330-G881)
1B8BC	M68	*19203* : 9235493	Grenade, Hand; fragmentation, impact MSR: 8846004 (DoDAAC : 1330-G882)
1B8BD	M69	*19203* : 9235208	Grenade, Rifle; practice, delay LCC-A, AMCTC 8345 (DoDAC :1330-G918)
1B8BE *	M76	*19203* : 13-19-150	Grenade, Launcher, smoke: IR screening LCC-A, MSR 5856004 (DoDAC :1330-G826)

Legend :

- * Item identified on Table A-1 from smoke munitions
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- [shaded box] Non- Table A-1 Equipments

Group 900 Table 509
Obstacles, Defilades, Positions

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
1B900			**Obstacles, Defilagws & Positions : Group 800**
	EIAC: Obstak		**Obstacles all types**
1B901 *			Long Cribs, rectangle
1B902 *			Long Cribs, triangle
1B903 *			Tank Ditch, 100' x 44'
1B904 *			Tank Ditch, 200' x 44'
1B905 *			Tank Ditch, 300 x 44'
1B906 *			Abatis, 14 tree
1B907 *			Abatis, 8 tree
	EIAC: Defil		**Defilade Positions all types**
1B9A1 *			Defilade Poistion, mortar carrier
1B9A2 *			Defilade Poistion, fighting vehicle
1B9A3 *			Defilade Poistion, tank
1B9A4 *			Defilade Poistion, armored vehicle
1B9A5 *			Defilade Poistion, mortar carrier
	EIAC: Posit		**Positions all types**
1B9C1 *			Infantry Fighting Positions
1B9C2 *			Machine Gun prepared position
1B9C3 *			Anti-armor weapon position
1B9C4 *			Overhead Cover Infantry Position
	EIAC: PreStk		**Prestock entities all types**
1B9P1 *			Prestock : Ammunition
1B9P2 *			Prestock : Fuel

Legend :
- * Item identified on Table A-1
- \+ Identified as a priority data item (Source IDT quarterly report)
- \# TSM Priority of 1
- ☐ Non- Table A-1 Equipments

Group A00 Table
US Dismounted Infantry Forces

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
1BA00			**US Dismounted Infantry Forces : Group A00**
	EIAC: Dismount		**Dismounted Forces all types**
1BA01	4.27.1 4.27.2	TOE	U.S Scouts, 2 personnel, SAW & Comm
1BA02		TOE	US ATGM, 2 personnel, Dragon & M16
1BA03	38.36.2 38.6.3	TOE	US Infantry Fire Team, 6 personnel weapons
1BA04		TOE	US Sniper, Gunner & single person
1BA05		TOE	US Dismounted Engineer Element, 10 person
1BA06		TOE : *44-1752-400*	US Stinger Gunner, single person

Legend :

*	Item identified on Table A-1
+	Identified as a priority data item (Source IDT quarterly report)
#	TSM Priority of 1
☐	Non- Table A-1 Equipments

Group B00 Table
Environment : Building, Bridges

Notes	Model Number	Part Number	Model Name
			Blue Force Equipments Master Index List
	EIAC: Building		**Buildings/ Structures of all types**
1BB00 *			Covered Machine Gun Bunker
1BB01 *			Indirect Fire Damaged Building
1BB02 *			Burned-out Building
1BB03			
1BB04			
1BB05			
1BB06			
1BB07			
1BB08			
1BB09			
	EIAC: Bridge		**Bridges of all types**
1BBC0 *			Bridge, 60 ft, AVLB launched
1BBC1 *			Bridge, Ribbon 10 section
1BBC2 *			Bridge, ribbon, 14 section
1BBC3			
1BBC4			
1BBC5			
1BBC6			
1BBC7			
1BBC8			
	EIAC: Fences		**Fences of all types**
1BBF1 *			Fence, Concertina, 2 roll
1BBF2 *			Fence, Concertina, 3 roll

Legend :

*	Item identified on Table A-1
+	Identified as a priority data item (Source IDT quarterly report)
=	TSM Priority of 1
☐	Non- Table A-1 Equipments

Group C00 Table
Ammunitions : Cartridges

FoVN	Model Number	Part Number	Model Name
1B			**Blue Force Equipments Master Index List**
	EIAC: Ammo		**Cartridges of all types**
1BC01 *	DM13	*19200* : DM13	CARTRIDGE, Caliber 120 mm; APFSDS-T
1BC02 *	DM23	*19200* : DM23	CARTRIDGE, Caliber 120 mm; APFSDS-T
1BC03 *	DM38	*19200* : DM38	CARTRIDGE, Caliber, 120 mm; LKL- CKE
1BC04 *	DM128	*19200* : DM128	CARTRIDGE, Caliber, 105 mm, TPCSDS-T
1BC05 *	M1	*19200* : M1 *(50mm Incend)*	CARTRIDGE, Caliber .50 mm, incendiary
1BC06 *	M1A1	*19200* : M1A1	CARTRIDGE, Caliber .50 mm, blank
1BC07 *	M2	*19200* : M2 (5.56GL)	CARTRIDGE, Caliber 5.56 mm, grenade launcher
1BC08 *	M2	*19200* : M2 (AP)	CARTRIDGE, Caliber .50 mm, armor piercing incendiary
1BC09 *	M2	*19200* : M2 (Ball)	CARTRIDGE, Caliber .50 mm, ball
1BC10 *	M2	*19200* : M2 (Dummy)	CARTRIDGE, Caliber .50 mm, dummy
1BC11 *	M2	*19200* : M2 (Plain)	CARTRIDGE, Caliber .50 mm, plain tip
1BC12 *	M2A1	*19200* : M2A1	CARTRIDGE, Caliber 4.2 inch; Gas
1BC13 *	M8	*19200* : M8 (Crtg)	CARTRIDGE, Caliber .50 mm, armor piercing incendiary
1BC14 *	M10	*19200* : M10	CARTRIDGE, Caliber .50 mm, tracer
1BC15 *	M17	*19200* : M17	CARTRIDGE, Caliber .50 mm, tracer
1BC16 *	M20	*19200* : M20	CARTRIDGE, Caliber .50 mm, incendiary
1BC17 *	M21	*19200* : M21	CARTRIDGE, Caliber .50 mm, tracer
1BC18 *	M23	*19200* : M23	CARTRIDGE, Caliber .50 mm, incendiary
1BC19 *	M33	*19200* : M33	CARTRIDGE, Caliber .50 mm, Ball
1BC20 *	M51A2	*19200* : M51A2	CARTRIDGE, Caliber 20 mm, dummy
1BC21 *	M55A2	*19200* : M55A2	CARTRIDGE, Caliber 20 mm, Target Practice - Tracer
1BC22 *	M56A3	*19200* : M56A3	CARTRIDGE, Caliber 20 mm, High Expolsive - Incendiary
1BC23 *	M56A4	*19200* : M56A4	CARTRIDGE, Caliber 20 mm, High Expolsive - Incendiary

Legend :

* Item identified on Table A-1

Group C00 Table
Ammunitions : Cartridges

FoVN	Model Number	Part Number	Model Name
1B			**Blue Force Equipments Master Index List**
	EIAC: Ammo		**Cartridges of all types**
1BC24 *	M59	19200 M59	CARTRIDGE, Caliber 7.62 mm, ball
1BC25 *	M61	19200 M61	CARTRIDGE, Caliber 7.62 mm, ball
1BC26 *	M62	19200 M62	CARTRIDGE, Caliber 7.62 mm, tracer
1BC27 *	M63	19200 M63	CARTRIDGE, Caliber 7.62 mm, tracer
1BC28 *	M80	19200 M80	CARTRIDGE, Caliber 7.62 mm, ball
1BC29 *	M82	19200 M82	CARTRIDGE, Caliber 7.62 mm, blank
1BC30 *	M193	19200 M193	CARTRIDGE, Caliber 5.56 mm, ball
1BC31 *	M196	19200 M196	CARTRIDGE, Caliber 5.56 mm, tracer
1BC32 *	M199	19200 M199	CARTRIDGE, Caliber 5.56 mm, dummy
1BC33 *	M200	19200 M200	CARTRIDGE, Caliber 5.56 mm, blank
1BC34 *	M220	19200 M220	CARTRIDGE, Caliber 20 mm, TP-T
1BC35 *	M246	19200 M246	CARTRIDGE, Caliber 20 mm; HEIT-SD
1BC36 *	M246A1	19200 M246A1	CARTRIDGE, Caliber 20 mm; HEIT-SD
1BC37 *	M328	19200 M328	CARTRIDGE, Caliber 4.2 inch, Smoke
1BC38 *	M328A1	19200 M328A1	CARTRIDGE, Caliber 4.2 inch, Smoke
1BC39 *	M329	19200 M329	CARTRIDGE, Caliber 4.2 inch, High Explosive
1BC40 *	M329A1	19200 M329A1	CARTRIDGE, Caliber 4.2 inch, High Explosive
1BC41 *	M329B1	19200 M329B1	CARTRIDGE, Caliber 4.2 inch, High Explosive
1BC42 *	M335	19200 M335	CARTRIDGE, Caliber 4.2 inch, Illumination
1BC43 *	M335A1	19200 M335A1	CARTRIDGE, Caliber 4.2 inch, High Explosive
1BC44 *	M335C1	19200 M335C1	CARTRIDGE, Caliber 4.2 inch, High Explosive
1BC45 *	M381	19200 M381	CARTRIDGE, Caliber 40 mm, High Explosive
1BC46 *	M382	19200 M382	CARTRIDGE, Caliber 40 mm, High Explosive
1BC47 *	M383	19200 M383	CARTRIDGE, Caliber 40 mm, High Explosive

Legend :

* Item identified on Table A-1

Group C00 Table
Ammunitions : Cartridges

FoVN	Model Number	Part Number	Model Name
1B			**Blue Force Equipments Master Index List**
	EIAC: Ammo		**Cartridges of all types**
1BC48 *	M385A1	19200 M385A1	CARTRIDGE, Caliber 40 mm, Training Practice
1BC49 *	M385E4	19200 M385E4	CARTRIDGE, Caliber 40 mm, Training Practice
1BC50 *	M386	*19200* : M386	CARTRIDGE, Caliber 40 mm, High Explosive
1BC51 *	M387	*19200* : M397	CARTRIDGE, Caliber 40 mm, High Explosive - Air Burst
1BC52 *	M392	*19200* : M392	CARTRIDGE, Caliber, 105 mm; APDS-T
1BC53 *	M393	*19200* : M393	CARTRIDGE, Caliber, 105 mm; HEP-T
1BC54 *	M393A1	*19200* : M393A1	CARTRIDGE, Caliber, 105 mm, TP-T
1BC55 *	M3A9A2	*19200* : M329A2	CARTRIDGE, Caliber 4.2 inch, High Explosive
1BC56 *	M406	*19200* : M406	CARTRIDGE, Caliber 40 mm, High Explosive
1BC57 *	M407A1	*19200* : M407A1	CARTRIDGE, Caliber 40 mm, Training Practice
1BC58 *	M416	*19200* : M416	CARTRIDGE, Caliber, 105 mm, smoke WP-T
1BC59 *	M430	*19200* : M430	CARTRIDGE, Caliber 40 mm, High Explosive-Dual Purpose
1BC60 *	M433	*19200* : M433	CARTRIDGE, Caliber 40 mm, High Explosive-Dual Purpose
1BC61 *	M441	*19200* : M441	CARTRIDGE, Caliber 40 mm, High Explosive
1BC62 *	M456	*19200* : M456	CARTRIDGE, Caliber, 105 mm, HEAT-T
1BC63 *	M457	*19200* : M457	CARTRIDGE, Caliber, 105 mm, dummy
1BC64 *	M467	*19200* : M467	CARTRIDGE, Caliber, 105 mm, TP-T
1BC65 *	M490	*19200* : M490	CARTRIDGE, Caliber, 105 mm, TP-T
1BC66 *	M494	*19200* : M494	CARTRIDGE, Caliber, 105 mm, APERS-T
1BC67 *	M630	*19200* : M630	CARTRIDGE, Calibaer 4.2 inch, Tactical
1BC68 *	M728	*19200* : M728	CARTRIDGE, Caliber, 105 mm; APDS-T
1BC69 *	M735	*19200* : M735	CARTRIDGE, Caliber, 105 mm; APFSDS-T
1BC70 *	M774	*19200* : M774	CARTRIDGE, Caliber, 105 mm, APFSDS-T
1BC71 *	M829	*19200* : M829	CARTRIDGE, Caliber, 120 mm, APFSDS-T

Legend :

* Item identified on Table A-1

Group C00 Table
Ammunitions : Cartridges

FoVN	Model Number	Part Number	Model Name
1B			**Blue Force Equipments Master Index List**
	EIAC: Ammo		**Cartridges of all types**
1BC72 *	M829A1	*19200* : M829A1	CARTRIDGE, Caliber, 120 mm, APFSDS-T
1BC73 *	M830	*19200* : M830	CARTRIDGE, Caliber, 120 mm, HEAT-MP-T
1BC74 *	M831	*19200* : M831	CARTRIDGE, Caliber, 120 mm, Target Practice - Tracer
1BC75 *	M865	*19200* : M865	CARTRIDGE, Caliber, 120 mm, TPCSDS-T
1BC76 *	M918	*19200* : M918	CARTRIDGE, Caliber, 40 mm, Target Practice
1BC77 *	PATEC	*19200* : PATEC	CARTRIDGE, Caliber, 40 mm
1BC78 *	XM195	*19200* : XM195	CARTRIDGE, Caliber, 5.56 mm grenade
1BC79 *	XM576E1	*19200* : XM576E1	CARTRIDGE, Caliber, 40 mm, Multiple Projectile
1BC80 *	XM576E2	*19200* : XM576E2	CARTRIDGE, Caliber, 40 mm, Multiple Projectile
1BC81 *	XM583	*19200* : XM583	CARTRIDGE, Caliber, 40 mm, White Star - Parachute
1BC82 *	XM585	*19200* : XM585	CARTRIDGE, Caliber, 40 mm, White Star - Cluster
1BC83 *	XM651E1	*19200* : XM651E1	CARTRIDGE, Caliber, 40 mm, Tactical
1BC84 *	XM661	*19200* : XM661	CARTRIDGE, Caliber, 40 mm, Green Star - Parachute
1BC85 *	XM662	*19200* : XM662	CARTRIDGE, Caliber, 40 mm, Red Star - Parachute
1BC86 *	XM663	*19200* : XM663	CARTRIDGE, Caliber, 40 mm, Green Star - Cluster
1BC87 *	XM664	*19200* : XM664	CARTRIDGE, Caliber, 40 mm, Red Star - Cluster
1BC88 *	XM674	*19200* : XM674	CARTRIDGE, Caliber, 40 mm, Riot Control
1BC89 *	XM676	*19200* : XM676	CARTRIDGE, Caliber, 40 mm, Smoke Canopy

Legend :

* Item identified on Table A-1

Group C00 Table
Ammunitions : Cartridges

FoVN	Model Number	Part Number	Model Name
1B			**Blue Force Equipments Master Index List**
	EIAC: Ammo		**Cartridges of all types**
1BC90 *	XM679	*19200* : XM679	CARTRIDGE, Caliber, 40 mm, Smoke Canopy
1BC91 *	XM680	*19200* : XM680	CARTRIDGE, Caliber, 40 mm, White Smoke Canopy
1BC92 *	XM681	*19200* : XM681	CARTRIDGE, Caliber, 40 mm, Violet Smoke Canopy
1BC93 *	XM682	*19200* : XM682	CARTRIDGE, Caliber, 40 mm, Red Smoke Canopy
1BC94 *	XM695	*19200* : XM695	CARTRIDGE, Caliber, 40 mm, Orange Star - Parachute

Legend :

* Item identified on Table A-1

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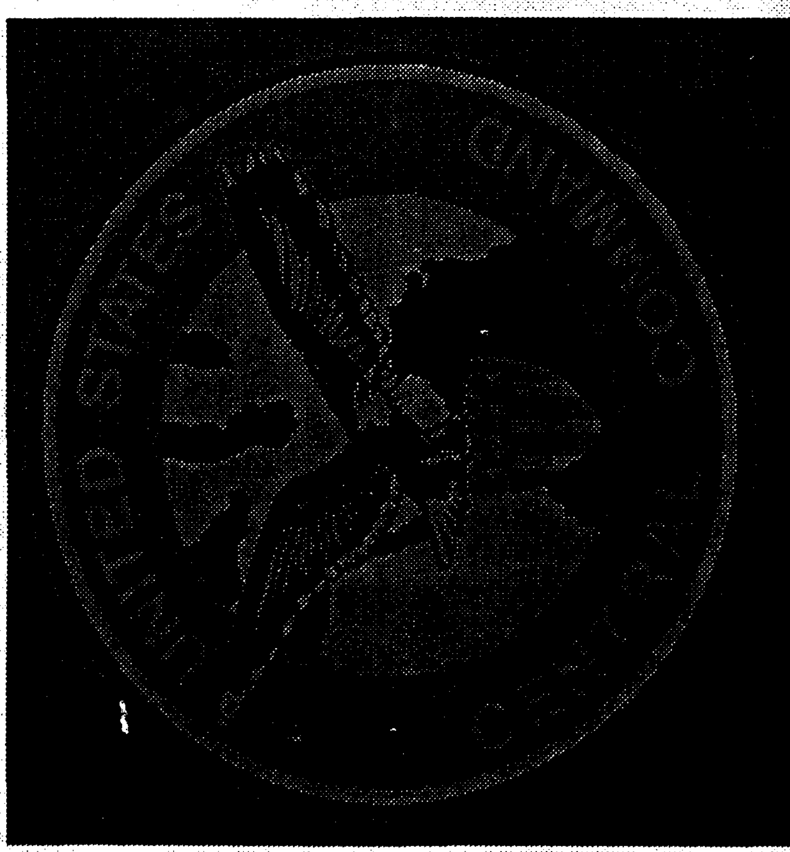
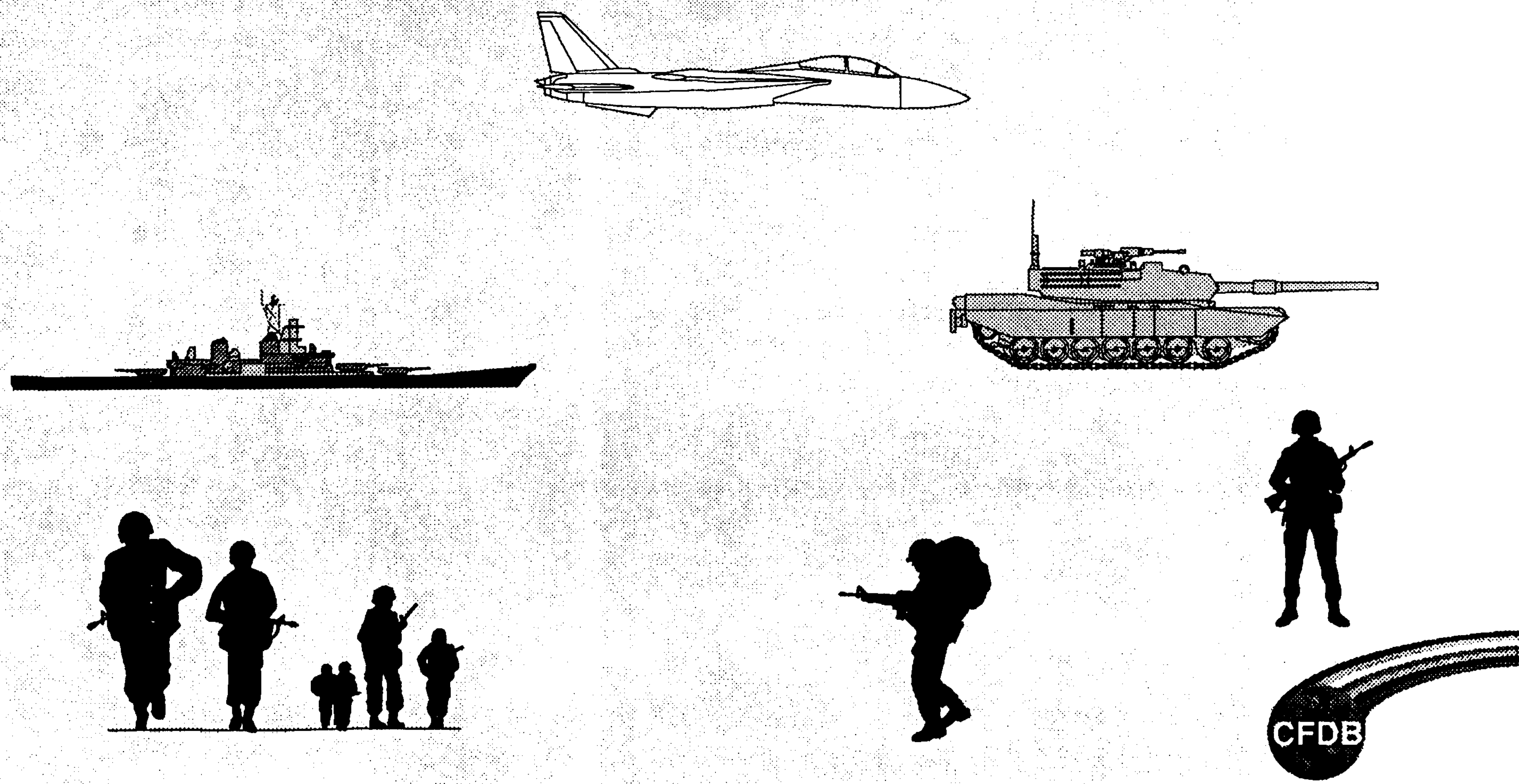

UNITED STATES
COMMAND

CONVENTIONAL
FORCE DATA BASE
CFDB



BRIEFING PURPOSE

- ❑ OVERVIEW OF CFDB
- ❑ DESCRIBE CFDB's VV & A PROCESS
- ❑ DESCRIBE FUTURE CFDB VV&A DEVELOPMENTS

CFDB

BRIEFING PURPOSE

- ❑ OVERVIEW OF CFDB
- ❑ DESCRIBE CFDB's VV & A PROCESS
- ❑ DESCRIBE FUTURE CFDB VV&A DEVELOPMENTS

CFDB

CONVENTIONAL FORCE DATA BASE TASK

DEVELOP A DATA BASE SYSTEM WITH:

UNITS

PERSONNEL

EQUIPMENT

CFDB

USCENTCOM COMBAT ANALYSIS GROUP DATA BASE MISSION

- ❑ RESEARCH DOD & SERVICE DATA BASES
- ❑ COLLECT AND VALIDATE DATA
- ❑ PROVIDE WARGAMERS/ANALYSTS WITH:
  - DATA
  - SCENARIO GENERATION TOOLS
  - MODEL INTERFACES

CFDB

CONVENTIONAL FORCE DATA BASE IS A MODELERS DB WITH:

UNITS

- ALL SERVICES, INCLUDING COAST GUARD
- RESERVE AND NATIONAL GUARD
- DEPLOYABLE UNITS AND THOSE UNITS THAT SUPPORT
- UNITS AT THE LOWEST LEVEL REPORTING PERSONNEL & EQUIPMENT

PERSONNEL

- TOTAL PERSONNEL ASSIGNED TO A UNIT
- BROKEN DOWN BY GRADE AND OCCUPATION

EQUIPMENT

- RESTRICTED TO EQUIPMENT APPROPRIATE FOR MODELING
- CATEGORIES:

VEHICLES	MEDICAL
WEAPONS & COMBAT SYSTEMS	CONSTRUCTION
POL CONSUMING EQUIPMENT	RADAR
COMMUNICATIONS	CHEMICAL

CFDB

PURPOSE

1. PROVIDE THE MODELING COMMUNITY WITH A SINGLE SOURCE TO REQUIRED MODEL DATA

2. REDUCE MODEL DATA BASE PREPARATION TIME

3. PROVIDE SYSTEM TO CHECK DATA ACCURACY

CFDB

INITIAL EFFORT

JCS SPONSORED, USCENTCOM DEVELOPED & HOSTED, TPDC SUPPORTED

THREE MAN EFFORT

IDENTIFY, LOCATE, & OBTAIN APPROPRIATE DATA

CFDB

CFDB
INTERACTIVE MENU SYSTEM

- DBA TOOL TO:

  SELECT AND PROCESS SOURCE DATA

  VERIFY, VALIDATE, AND EVALUATE DATA ACCURACY

  PRODUCE ASCII DATA FILES FOR USERS

- ANALYSTS TOOL TO:

  RETRIEVE, DISPLAY, & ANALYZE UNIT INFORMATION

  BUILD TASK FORCES TO INTERFACE WITH DATA

  INTERFACE WITH MANY TYPES OF INFORMATION

  DEFINE DATA ELEMENTS, CODES, AND CURRENCY OF DATA

CFDB V3.0
MAJOR FUNCTIONAL AREAS

CFDB USER / DBA INTERACTIVE MENU SYSTEM

PREPROCESSING INCOMING SOURCES

1. UNLOAD DATA FROM TAPE
2. PROCESS DATA
3. PRELOAD DATA TO INGRES
4. CHECK DATA ACCURACY
5. REPLACE OLD DATA W / NEW

   OR

6. DELETE NEW DATA

FORCE STRUCTURING

1. BASELINE
2. TASK ORGANIZE
3. CREATE
4. EDIT
5. UTILITY

RETRIEVAL ANALYSIS

BLUE FORCES

1. UNIT SELECTION
2. UNIT DATA DISPLAY

RED FORCES

3. UNIT SELECTION
4. UNIT DATA DISPLAY

POSTPROCESSING

1. 16 OUTPUT FILES
2. FILES BY SERVICE

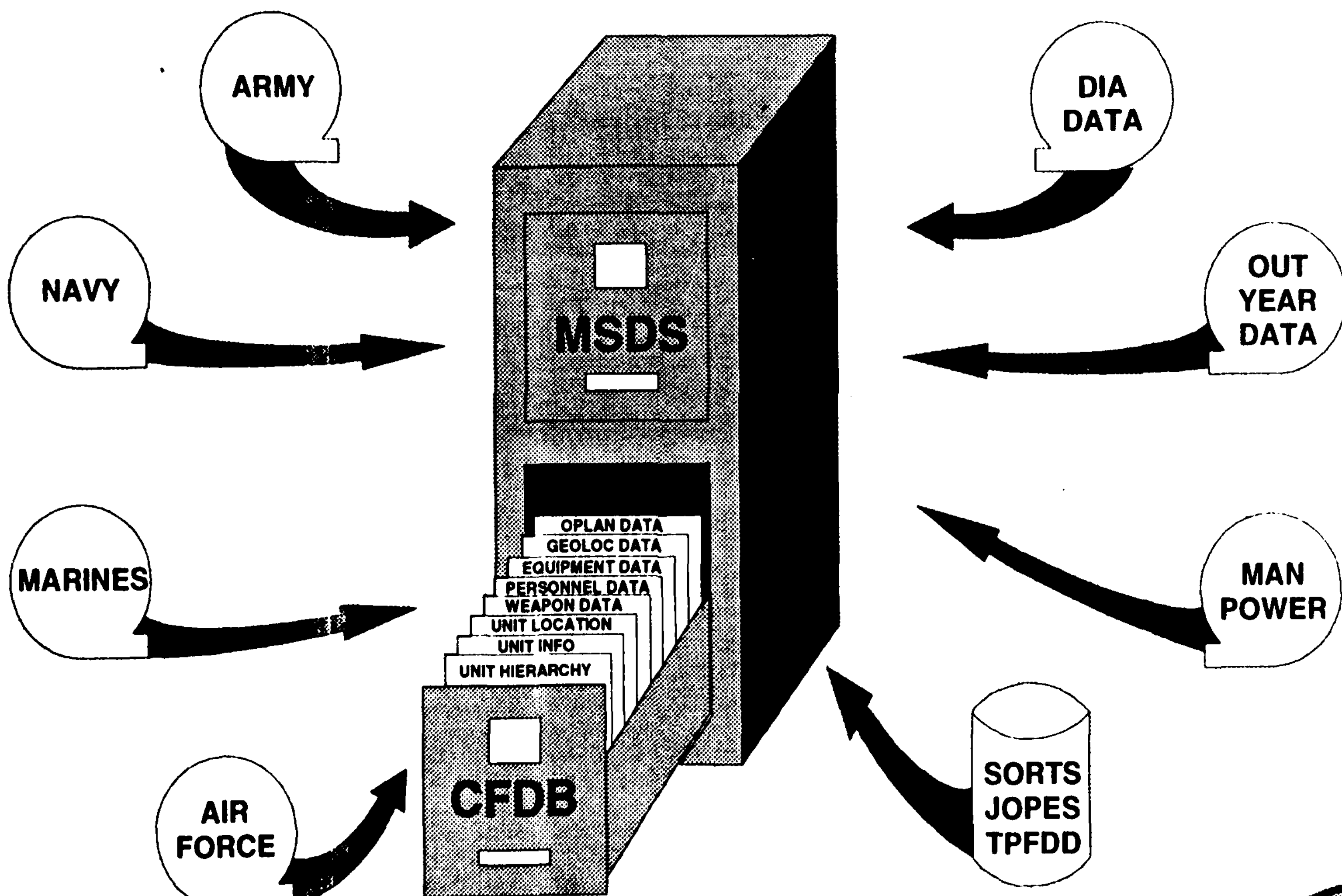
   A. UNITS
   B. AIRCRAFT
   C. PERSONNEL
   D. EQUIPMENT

UTILITIES

1. GEO DATA
2. DATE TIME STAMP

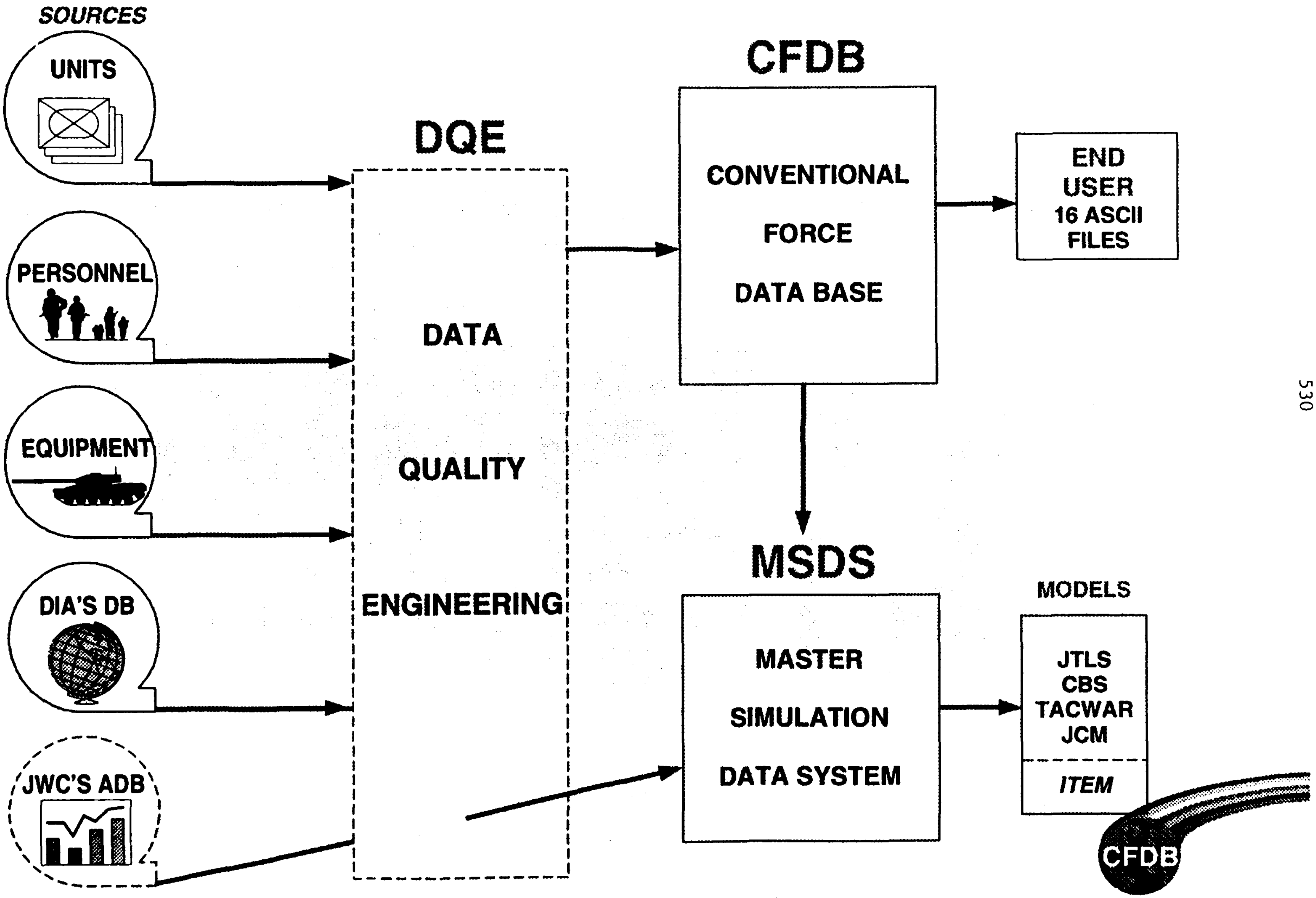
CFDB

JOINT MODELING & SIMULATION DATA BASE SUPPORT - CFDB/MSDS



CFDB

USCENTCOM'S MODELING DATA ARCHITECTURE



CFDB / MSDS DATA SYSTEM

- CFDB
  - LOADS DYNAMIC FORCE DATA FROM DOD, SERVICES
  - VALIDATES, VERIFIES, AND CHECKS DATA ACCURACY
  - BUILDS FORCE STRUCTURES AND DISPLAYS UNIT DATA
  - POSTPROCESSES DATA
- MSDS
  - LOADS CFDB AND DIA DYNAMIC FORCE DATA
  - BUILDS SCENARIO DATA BASE
  - TRANSLATES FORCE DATA TO MODEL FORMATS
  - WILL PROCESS STATIC CHARACTERISTICS DATA

CFDB / MSDS JM&S DATA BASE HIGHLIGHTS

- SPONSORED BY USCENTCOM AND THE JOINT STAFF J-8, HOSTED AT USCENTCOM
- HAS BEEN IN PRODUCTION SINCE 1989
- RECEIVES SOURCE DATA MONTHLY / QUARTERLY
- DATA AND/OR SOFTWARE PROVIDED QUARTERLY TO 23 SITES
- INTERFACES DEVELOPED FOR CBS, JTLS, TACWAR AND JCM MODELS
- OPERATIONAL IN THE UNIX AND VMS ENVIRONMENTS

CFDB / MSDS DATA BASE USERS

JOINT STAFF J-8

USEUCOM

CFC-K

USSOCOM

USPACOM

USCENTCOM

USACOM

USSPACECOM

OSD PA&E

HQS USMC

DEFENSE NUCLEAR AGENCY

21ST TAACOM

JOINT WARFIGHTING CENTER

USMC WARGAMING CENTER

HQS FORCES COMMAND

USAF WARGAMING CENTER

NATIONAL DEFENSE UNIVERSITY

TRADOC ANALYSIS COMMAND

US ARMY WAR COLLEGE

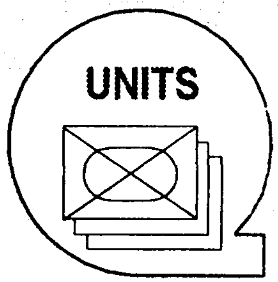
US ARMY CONCEPTS ANALYSIS AGENCY

WARRIOR PREP CENTER

US ARMY TACTICAL C & C
EXPERIMENTATION SITE

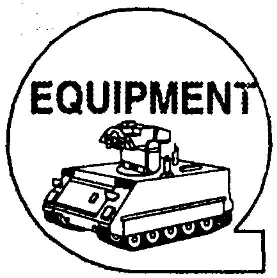
USAF NATIONAL SECURITY
EMERGENCY PREPAREDNESS

CURRENT DATA SOURCES



JOINT OPERATION PLANNING &
EXECUTION SYSTEM - JOPES

DEFENSE MANPOWER DATA CENTER



AIR FORCE LOGISTICS COMMAND - AFLC
MARINE CORPS LOGISTICS BASE - MCLB
SHIPS PARTS CONTROL CENTER - SPCC
ARMY MATERIEL COMMAND - AMC

NAVAL SEA LOGISTICS CENTER - NSLC
AIR FORCE LOGISTICS COMMAND - AFLC
COAST GUARD AVIATION BRANCH

CFDB

FUTURE / OTHER DATA

TYPES	SOURCES
U.S. OUT YEAR DATA	
FUTURE ARMY FORCES	*HQS DEPARTMENT OF THE ARMY*
FUTURE ARMY EQUIPMENT	*ARMY MATERIEL COMMAND - AMC*
AIR FORCE OUT YEAR SUPPORT EQ	*AIR FORCE LOGISTICS COMMAND - AFLC*
OTHER COUNTRIES DATA BASES	
UNIT, PERSONNEL, AND EQUIPMENT	*DEFENSE INTELLIGENCE AGENCY - DIA*
TARGET DATA (PLANNED)	*DEFENSE INTELLIGENCE AGENCY - DIA*
OTHER TYPES OF DATA	
U.S TYPE UNIT EQ CHARACTERISTICS (TUCHA), READINESS, OPLAN	*JOINT DEPLOYMENT SYSTEM - JDS* USCENTCOM

CFDB

MAJOR INCOMING FILES

FILE	SOURCE	MEDIA	SIZE IN RECORDS INCOMING BYTES	BYTES USED
		ARMY		
** EQUIP / AC	REQ-VAL / AMC	9 TRACK	913266	459829
FUTURE EQUIP / AC	TAEDP / AMC	9 TRACK	2188146	2188146
* PERSONNEL	DMDC	9 TRACK	653667	653667
SB 700-20	LIN FILE / AMC	9 TRACK	37800	1974
		AIR FORCE		
UNITS	PAS / HQAF	9 TRACK	13692	13692
** EQUIPMENT	C008 / AFLC (E)	9 TRACK ON LINE	835611	835611
AIRCRAFT	REMIS / AFLC	ON LINE	16127	851
* PERSONNEL	DMDC	9 TRACK	323204	323204
		MARINE		
UNITS	RUC / MCLB	9 TRACK	3897	3897
** EQUIPMENT	LUAF / MCLB	9 TRACK	222610	15696
AIRCRAFT	AIR / NAVSEALOGCMD	9 TRACK	6564	6564
* PERSONNEL	DMDC	9 TRACK	68354	68354
		NAVY / CG		
UNITS	WSF / SPCC	9 TRACK	2579	2597
CG AIRCRAFT	AC FILE / HQ USCG	PRINT OUT	250	200
** EQUIPMENT	SCLSIS / SPCC	23 - 9 TRACK	12 MIL	31442
* PERSONNEL	DMDC	9 TRACK	359227	359227
		JOINT		
PLAN DATA	JOPES	ON LINE	PLAN DEPENDENT	PLAN DEPENDENT
GEOGRAPHIC LOC	JOPES	9 TRACK	53443	53443
DIA OB	DIA	9 TRACK		
ALL UNITS	JDS UI FILE	ON LINE	64000	46844

* PERSONNEL DATA ALSO HAS ASSOCIATED OCCUPATION CODES (8,443)
** EQUIPMENT DATA ALSO HAS ASSOCIATED CODES

CFDB

CFDB SECURITY CLASSIFICATION MATRIX

DATA/CLASSIFICATION	UNCLASSIFIED	CONFIDENTIAL	SECRET	TOP SECRET
ALL PERSONNEL DATA	X			
SOME JDS UNITS			X #	
JDS UI DEs	X			
JDS TUCHA	X			
NAVY/CG/AF/MAR EQ	X			
AF AIRCRAFT	X			
NAVY/MAR AC		X		
ARMY REQ-VAL		X		
ARMY TAEDP			X	
ARMY FAS			X	
DIA DATA			X *	
ALL OTHER SPT FILES	X			
OVERALL CFDB DATA			X	

MOST UNITS ARE UNCLASSIFIED, SOME ARE SECRET
* ALSO REQUIRES A WAIVER FROM DIA FOR CONTRACT SUPPORT
* NOFORN

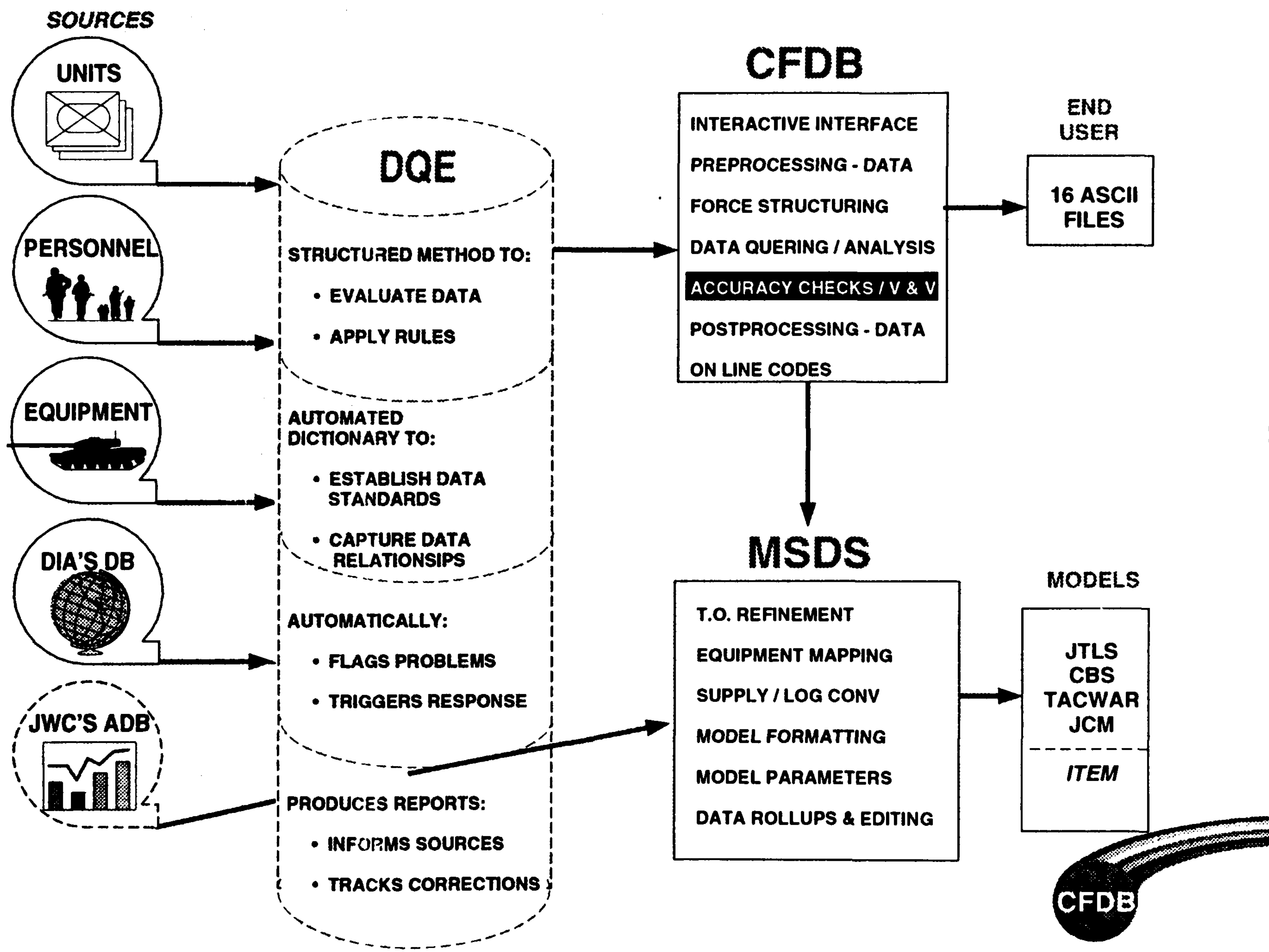
CFDB

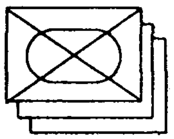
BRIEFING PURPOSE

- ❑ OVERVIEW OF CFDB
- ❑ DESCRIBE CFDB's VV & A PROCESS
- ❑ DESCRIBE FUTURE CFDB VV & A DEVELOPMENTS

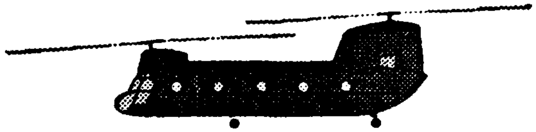
CFDB

USCENTCOM'S MODELING DATA ARCHITECTURE





CFDB MAIN MENU



CONVENTIONAL FORCE DATA
UNIT ~ PERSONNEL ~ EQUIPMENT

(1) EXIT

(2) PREPROCESS SOURCE DATA

(3) FORCE STRUCTURING

(4) RETRIEVE/ANALYZE DATA

(5) POSTPROCESS & FORMAT USER DATA

(6) UTILITIES

Exit(1) Preproc(2) Forces(3) Retrieve(4) Postproc(5) > :

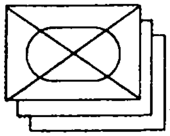
CFDB

CONVENTIONAL FORCE
POSTPROCESSOR OUTPUT FILE OPTIONS

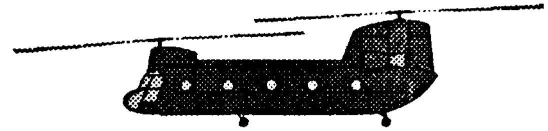
FCS INPUT TABLE: **cf_fcs_bl_af** TOTAL UNITS :

ARMY	AIRFORCE	MARINE	NAVY/CG
UNITS EQUIPMENT AIRCRAFT PERSONNEL	UNITS EQUIPMENT AIRCRAFT PERSONNEL	UNITS EQUIPMENT AIRCRAFT PERSONNEL	UNITS EQUIPMENT AIRCRAFT PERSONNEL

Exit(1) Process(2) Select(3)



CFDB MAIN MENU



CONVENTIONAL FORCE DATA
UNIT ~ PERSONNEL ~ EQUIPMENT

(1) EXIT

(2) PREPROCESS SOURCE DATA

(3) FORCE STRUCTURING

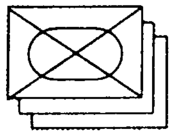
(4) RETRIEVE/ANALYZE DATA

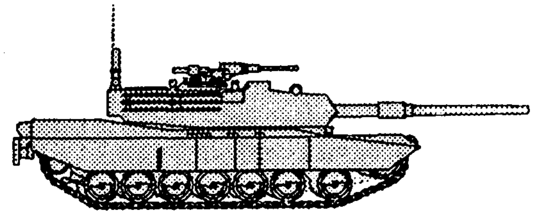
(5) POSTPROCESS & FORMAT USER DATA

(6) UTILITIES

Exit(1) Preproc(2) Forces(3) Retrieve(4) Postproc(5) > :

CFDB





CONVENTIONAL FORCE DATA
UNIT ~ PERSONNEL ~ EQUIPMENT

DIRECTORY : **/home3/cf30/fcshier/**

HIER FILE : ______ UIC FILE : ______

FCS TABLE : ______ UIC : ______ NAME : ______

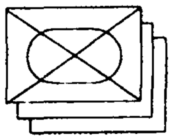
EQUIPMENT : ______ OCCUPATION : ______ UTC : ______

TOE/SRC : ______ TE : ______

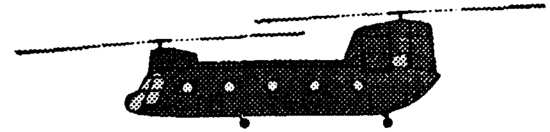
CFDB FORCE CONFIGURATION BASELINE TABLES

SERVICE	AIR FORCE	ARMY	COAST GUARD	MARINES	NAVY
# FCS UNITS	**13355**	**15274**	**386**	**561**	**8306**
DATE	**23-aug-93**	**24-aug-93**	**23-aug-93**	**23-aug-93**	**23-aug-93**

Exit(1) Retrieve(2) List(3) Codes(4) Form Info(5)



CFDB MAIN MENU



CONVENTIONAL FORCE DATA
UNIT ~ PERSONNEL ~ EQUIPMENT

(1) EXIT

(2) PREPROCESS SOURCE DATA

(3) FORCE STRUCTURING

(4) RETRIEVE/ANALYZE DATA

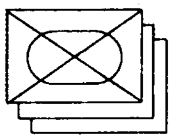
(5) POSTPROCESS & FORMAT USER DATA

(6) UTILITIES

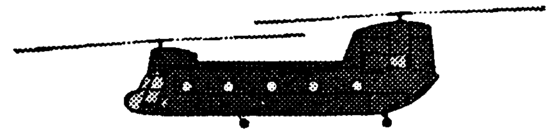
Exit(1) Preproc(2) Forces(3) Retrieve(4) Postproc(5) > :

CFDB

```
                    CONVENTIONAL FORCE
                      UNIT HIERARCHY
TABLE: cf_f _bl_army                  Number of Units: 15252

0       MASTER RECORD
HDA---    HQS DEPARTMENT OF ARMY FM
W0ZUFF      W0ZU HEADQUARTERS U.S. ARMY
W0Z2AA        W0Z2 DCS FOR OPNS AND PLANS
WBRRT0          0036 MD DET REAR
W0ZUAA        W0ZU OFC OF THE CHIEF OF STAFF
W00MAA          W00M OCE DEP MIL FUNC
W0ZZAA          W0ZZ DCS PERSONNEL
W1FBAA            W1FB HQ S FACULTY USMA
WCETAA              0004 SC BN ARMY AREA
WCTRAA              0000 AG BND US MILITARY ACD
WDQQAA              0021 EN BN COMBAT ARMY
WDQSAA              0001 FA BN 01 105 T
WDQTAA              0001 AR SQ 04 CAVALRY

LEVEL  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4

Exit(1)  Edit FM(2)  Edit Unit(3)  Select(4)  Insert(5)  >
```



CFDB MAIN MENU



CONVENTIONAL FORCE DATA
UNIT ~ PERSONNEL ~ EQUIPMENT

(1) EXIT

(2) PREPROCESS SOURCE DATA

(3) FORCE STRUCTURING

(4) RETRIEVE/ANALYZE DATA

(5) POSTPROCESS & FORMAT USER DATA

(6) UTILITIES

Exit(1) Preproc(2) Forces(3) Retrieve(4) Postproc(5) > :

CFDB

CONVENTIONAL FORCE
PREPROCESSOR SOURCE FILE OPTIONS

ALL SERVICES

UNITS: SORTS/JDS — PLAN DATA: JOPES/JDS — GEO LOC: GEO/JDS
PERSONNEL: DMDC/TPDC — OCCUPATION MOS: DMDC/TPDC — DIA DATA: OB/DIA

AIR FORCE

UNITS: PAS/AFMPC
EQUIPMENT: C008/AFLC
AIRCRAFT: REMIS/AFLC
NSN CODES: NSN CONTROL FILE

ARMY

EQUIPMENT: REQ-VAL/AMC
AIRCRAFT: REQ-VAL/AMC
LIN CODES: SB700-20

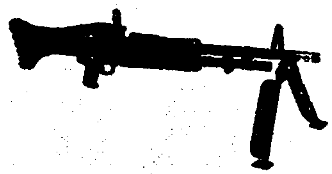
MARINE

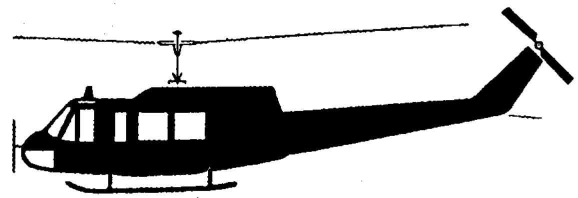
EQUIPMENT: LUAF/MCLB
AIRCRAFT: AIRS/NASC
FSN CODES: FSN NOMEN FILE

NAVY/CG

EQUIPMENT: SCLSIS/SPCC
NAVY AIRCRAFT: AIRS/NASC
CG AIRCRAFT: AC FILE/HQS USCG
RIC CODES: RIC NOMEN FILE

EXIT(1) PROCESS(2)





CONVENTIONAL FORCE
PREPROCESSOR SELECTION SEQUENCE FOR SOURCE DATA
UNITS: ARMY EQUIPMENT / AIRCRAFT

(1) EXIT

(2) UNLOAD SOURCE DATA FROM TAPE

(3) PREPROCESS DATA

(4) PRELOAD DATA INTO CONVENTIONAL FORCE DATA SYSTEM

(5) PERFORM VERIFICATION VALIDATION AND ACCURACY PROCEDURES

(6) REPLACE CONVENTIONAL FORCE DATA WITH NEW DATA

EXIT(1) UNLOAD(2) PREPROCESS(3) PRELOAD(4) PERFORM(5) > :

CFDB

CONVENTIONAL FORCE
PREPROCESSOR VERIFICATION VALIDATION AND ACCURACY
ARMY EQUIP/AC: REQ-VAL/AMC

INSTRUCTIONS
Select TABLE NAME for preprocessor preload table names to compare with CF.

UNIT UIC	DISPLAY/OUTPUT
CF DATA TABLE(1): CFDB UNITS	TABLE(1): NEW UNITS NOT IN CFDB
PRELOAD TABLE(1): NEW UNITS IN EQUIP FILE	TABLE(1): CFDB UNITS NOT IN NEW DATA
OUTPUT FILE PATH/NAME:	
EQUIPMENT	
CF DATA TABLE(2): CFDB ARMY EQUIP	DISPLAY/OUTPUT
PRELOAD TABLE(2): NEW ARMY EQUIP	TABLE(1): ARMY EQUIP DIFFERENCES
OUTPUT FILE PATH/NAME(2):	
AIRCRAFT	
CF DATA TABLE(3): CFDB ARMY AC DATA	DISPLAY/OUTPUT
PRELOAD TABLE(3): NEW ARMY AC DATA	TABLE(1): ARMY AC DIFFERENCES
OUTPUT FILE PATH/NAME(3):	

EXIT(1) TABLE(2) PROCESS(3) DISPLAY/FILE(4)

CONVENTIONAL FORCE
PREPROCESSOR VERIFICATION
ARMY EQUIP/AC: REQ-

INSTRUCTION
Select TABLE NAME for preprocessor preload

RETRIEVAL CRITERIA

Tables will be built to determine the difference in quantities with percentages calculated. Retrievals will be based on both the difference and percentage criteria. To retrieve all records enter zero(0) in both fields.

DIFFERENCE >= 1
PERCENTAGE >= 1%

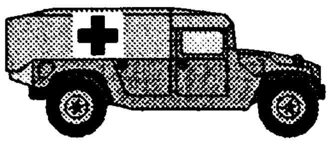
UNIT UIC
CF DATA TABLE(1): CFDB UNITS
PRELOAD TABLE(1): NEW UNITS IN EQUIP FILE
OUTPUT FILE PATH/NAME(1):

EQUIPMENT
CF DATA TABLE(2): CFDB ARMY EQUIP
PRELOAD TABLE(2): NEW ARMY EQUIP
OUTPUT FILE PATH/NAME(2)

AIRCRAFT
CF DATA TABLE(3): CFDB ARMY AC DATA
PRELOAD TABLE(3): NEW ARMY AC DATA
OUTPUT FILE PATH/NAME(3):

DISPLAY/OUTPUT
TABLE(1): ARMY AC DIFFERENCES

EXIT(1) CONTINUE PROCESS(2)



CONVENTIONAL FORCE
PREPROCESSOR VERIFICATION AND VALIDATION
ARMY EQUIP/AC: REQ-VAL/AMC

NEW UNITS NOT IN EXISTING CF DATA

UIC	UNIT NAME
WAP2AA	0087 IN BN 01
WAR390	
WB5BAA	0515 OD CO SPECIAL AMMO GS
WCAHTO	0009 PO BN HQ SPT PROV
WD7STO	0090 PO CO HQ DET PROV
WSR5AA	0110 MI BN LIGHT INFANTRY
WEQ2AA	0007 FA BN 02
WFPTAA	0025 AV BN 02
WG4MTO	0008 PO BN HQ SPT PROV

TOTAL RECORDS: 27

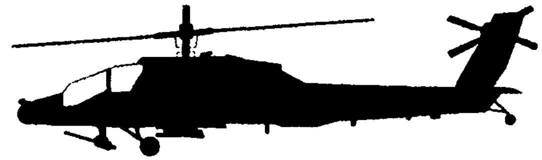
EXISTING CF UNITS NOT IN NEW DATA

UIC	UNIT NAME
WSCFAA	0349 MD HSP GEN 1000 BED
WSCLAA	0452 MD HSP GEN 1000 BED
WSCRAA	0364 MD HSP GEN 1000 BED
WSCTAA	0455 MD HSP GEN 1000 BED
WSCVAA	0810 MD HSP STA 300 BED
WSCZAA	0356 MD HSP STA 300 BED
WSDHAA	0349 MD HSP COMBAT SUPPORT
WTLJAA	0343 MD HSP EVACUATION
WTLKAA	0365 MD HSP EVACUATION SMBL

TOTAL RECORDS: 107

EXIT(1) SEARCH(2) FILE(3)

CFDB



CONVENTIONAL FORCE
PREPROCESSOR VERIFICATION VALIDATION AND ACCURACY
ARMY EQUIP/AC: REQ-VAL/AMC

UN
CF
PR
OU

EQ
CF
PR
OU

AI
CF
PR
OU

OnHand — QUANTITY DIFFERENCE TABLE

UIC	CODE	DESCRIPTION	NEW_QTY	CF_QTY	DIFFER	PERCENT
W439AA	H31110	HCPTR OBS OBSVN OH58	0	1	-1	-100
W439AA	H44644	HCPTR ATTACK AH-1F	0	7	-7	-100
W439AA	K31795	HCPTR UTILITY UH-1H	0	7	-7	-100
W439AA	K32293	HCPTR UTILITY UH-60A	0	16	-16	-100
WDU9AA	K32293	HCPTR UTILITY UH-60A	0	4	-4	-100

DIFFER: 1 PERCENT: 1% TOTAL RECORDS: 5

EXIT(1) SEARCH(2) FILE(3)

BRIEFING PURPOSE

- OVERVIEW OF CFDB
- DESCRIBE CFDB's VV & A PROCESS
- DESCRIBE FUTURE CFDB VV & A DEVELOPMENTS

CFDB

SOURCE DATA PROBLEMS

- ❑ NO UIC
- ❑ NO UNITS, ONLY TYPES OF UNITS
- ❑ WRONG TAPE
- ❑ WRONG FORMATS
- ❑ UNINTENDED PACKED FIELDS
- ❑ CODES NOT IAW REGULATIONS
- ❑ NO RECORD COUNTS
- ❑ RESERVE UNIT INFORMATION NOT PROVIDED
- ❑ MISSING UNITS
- ❑ UNEXPECTED FILES ON TAPE
- ❑ DUPLICATE RECORDS
- ❑ WRONG SIZE TAPES
- ❑ BAD DATA
- ❑ MISSING DATA

CFDB

UIC	NAME	OPCON GEO UTC ULC UDC	APAX	
WADOAA			0	- AR OR FA
WADOB00041	IN BN 01 CO B MECH	WADOAAHSUEHSUE06IJJCO A	0	- GONE
WAPKAA0001	AR HHB DIV ARTY	WAPBFFAZENAZEN18HACHHBA	0	6 OF 41 & 2 OF 41
WAPKFF0008	FA DAY DIV ARTY HHB	WAPBAAAZENAZEN1TUTLDAYA	0	
WAM5AA [redacted]			0	
WAM5B00041	FA BN 06 BTY B	WAM5AAMTHBMTHB1FDEEBTYA	0	- UNITS DON'T EXIST
WAM5C00041	FA BN 06 BTY C	WAM5AAMTHBMTHB1FDEEBTYA	0	
WAM5S00041	FA BN 06 SV BTY	WAM5AAMTHBMTHB1FDECBTYA	0	
WAM5T00041	FA BN 06 HHB	WAM5AAMTHBMTHB1FDECHHBA	0	
WAM6010041	FA BN 02 FIST 30 BDE	WAM6AAAPCDAPCD1FRACTM A	0	
WAM6020041	FA BN 02 FIST 1-4 INF	WAM6AAAPCDAPCD1FRACTM A	0	
WAM6030041	FA BN 02 FIST 1-7 INF	WAM6AAAPCDAPCD1FRACTM A	0	
WAM6040041	FA BN 02 FIST 4-66 AR	WAM6AAAPCDAPCD1FRACTM A	0	
WAM6A00041	FA BN 02 BTY A 155 SP	WAM6AAATGRATGR1FDEEBTYA	0	
WAM6AA [redacted]			0	
WAM6B00041	FA BN 02 BTY B 155 SP	WAM6AAATGRATGR1FDEEBTYA	0	
WAM6C00041	FA BN 02 BTY C 155 SP	WAM6AAATGRATGR1FDEEBTYA	0	
WAM6S00041	FA BN 02 SV BTY 155SP	WAM6AAATGRATGR1FDECBTYA	0	
WAM6T00041	FA BN 02 HHB 155 SP	WAM6AAATGRATGR1FDECHHBA	0	
WQQNA00133	EN BN CO A COMBAT HVY	W8A4AAVVRKVVRK36QNNCO C	0	- WRONG OP UIC
WQQNA10133	EN BN CO A DET 1	W8A4AAYSNXYSNX4FRACDETC	0	
WQQNAA0133	EN BN CBT HVY	W8A4AATQCTTQCT45QNNBN C	0	
WQQNB00133	EN BN CO B COMBAT HVY	W8A4AAUPVSUPVS36QNNCO C	0	
WQQNB10133	EN BN CO B DET 1	W8A4AAUVVCUVVC4FRACDETC	0	
WQQNC00133	EN BN CO C COMBAT HVY	W8A4AANDYUNDYU36QNNCO C	0	
WQQNT00133	EN BN HSC CBT HVY	W8A4AATQCTTQCT46QNNHHCC	0	- WRONG OP UIC
WQQN910133	EN BN CBT HVY FTS AUG	W8A4AATQCTTQCT4AUGUAUGC	0	
WQQRA00204	EN BN CO A EQ MNT	W8BNAASKDUSKDU36QNNCO C	0	
WQQRA10204	EN BN CO A DET 1	W8BNAAYTWTYTWT4FRACDETC	0	
WQQRC10204	EN BN CO C DET 1	W8BNAALRBRLRBR4FRACDETC	0	
WQQRAA0204	EN BN CBT HVY	W8BNAABQUCBQUC45QNNBN C	0	
WQQRB00204	EN BN CO B COMBAT HVY	W8BNAALBCFLBCF36QNNCO C	0	- WRONG OP UIC
WQQRC00204	EN BN CO C COMBAT HVY	W8BNAABQUCBQUC36QNNCO C	0	
WQQRT00204	EN BN HSC CBT HVY	W8BNAABQUCBQUC46QNNHHCC	0	
WQQR910204	EN BN CBT HVY FTS AUG	W8BNAABQUCBQUC4AUGUAUGC	0	

THESE ARE WRONG
OPCON UICs

WPPRA0 WPPRB0 WPPRC0 WPPRT0 WPPR10	WORKS FOR WPQRAA NOT W8BNAA

WQQRAA'S OPCON UIC IS W8BNAA

WQQNAA'S OPCON UIC IS W8A4AA

WQQNA0 WQQNB0 WQQNC0 WQQNT0 WQQN91	OPCON UIC IS WQQNAA

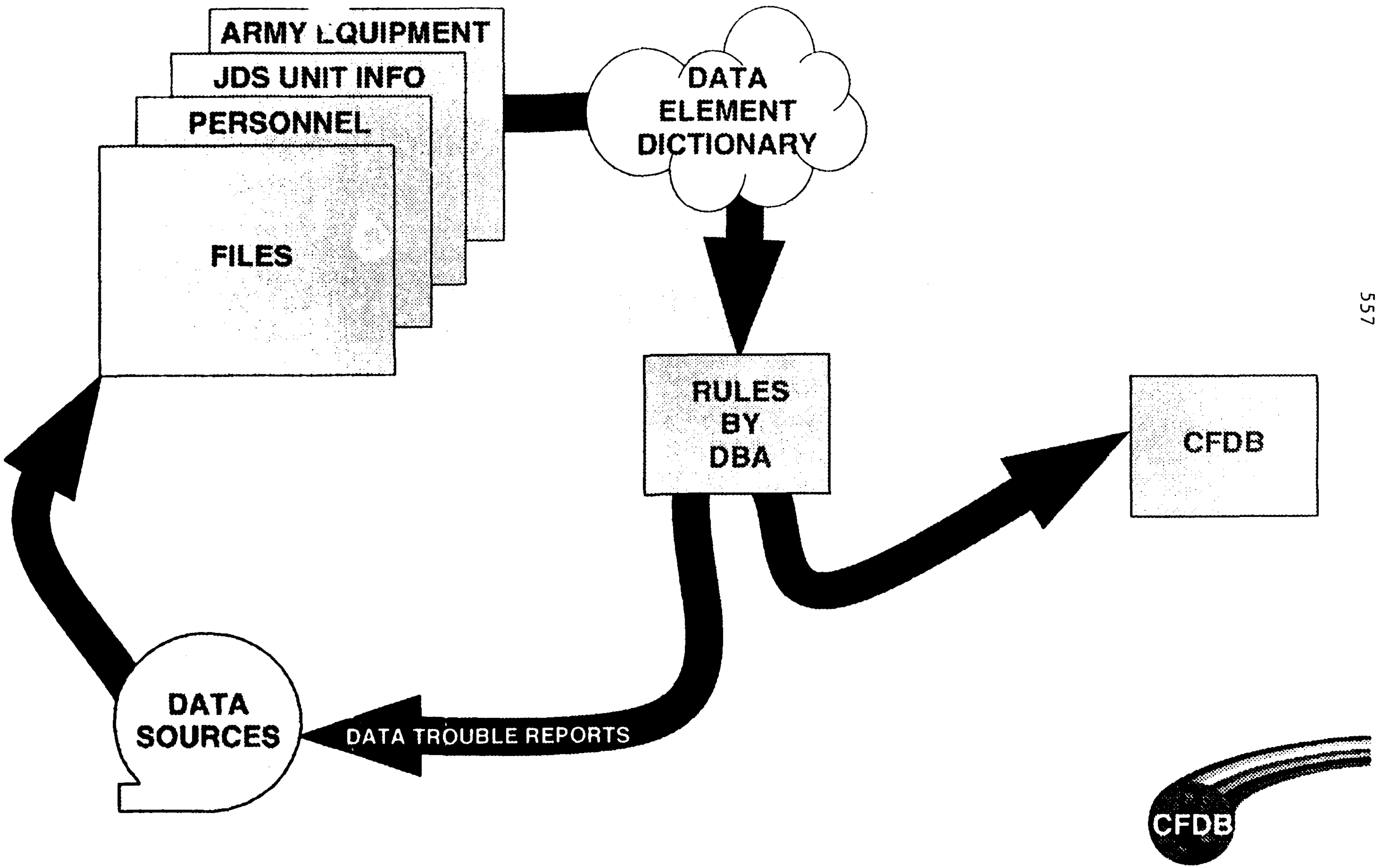
UIC NAME		OPCON GEO UTC ULC	UDC	APAX	
FFHHN00000 SAC	CM OL SE00	CSFAAOL	X	0	- NOT IN PAS
FF5DC0AIRLIFT COMM	DV OL 0F00	FF3PG0TWLRTWLR6FAAAOL	X	0	- NOT IN PAS
FFJ0R0 [redacted]				0	
FFLL00 [redacted]			I	0	- 46TH WEATHER SQ
FFZW40AFELM DECA	AG DT 0213	9AZ99DET	X	0	
FFLF10 [redacted]				0	
FFLF30				0	
FFM740				0	
FFM7800439 COMM	FT	[redacted] 6FAAAFT	L	0	
FFQ9R00018 [redacted]	SG DET 004	FFIDL0HCMLHCML7FVAADET	W	0	
FFXS10TAC AIR	CM OL A000	FFIDL0HJAQHJAQCSFAAOL	X	0	
FFXSC0TAC AIR	CM OL DA00	FFIDL0MUHJMUHJCSFAAOL	X	0	
FFXSD0TAC AIR	CM OL AC00	FFIDL0MUHJMUHJCSFAAOL	X	0	
FFXSF0TAC AIR	CM OL DE00	FFIDL0MUHJMUHJCSFAAOL	X	0	
FFXSG0TAC AIR	CM OL D000	FFIDL0MUHJNUHJCSFAAOL	X	0	
FFXSH0TAC AIR	CM OL DP00	FFIDL0MUHJMUHJCSFAAOL	X	0	
FFXSI0TAC AIR	CM OL HC00	FFIDL0MUHJMUHJCSFAAOL	X	0	
FFXSK0TAC AIR	CM OL IG00	FFIDL0MUHJMUHJCSFAAOL	X	0	
FFXSL0TAC AIR	CM OL IN00	FFIDL0MUHJNUHJCSFAAOL	X	0	
FFXSM0TAC AIR	CM OL JA00	FFIDL0MUHJMUHJCSFAAOL	X	0	
FFXSN0TAC AIR	CM OL LG00	FFIDL0MUHJMUHJCSFAAOL	X	0	
FFXSQ0TAC AIR	CM OL OI00	FFIDL0MUHJMUHJCSFAAOL	X	0	
FFXSR0TAC AIR	CM OL SE00	FFH7B0MUHJNUHJCSFAAOL	X	9	
FFXSS0TAC AIR	CM OL SG00	FFIDL0MUHJMUHJCSFAAOL	X	0	
FFXST0TAC AIR	CM OL XP00	FFIDL0MUHJMUHJCSFAAOL	X	0	
FFS [redacted]				0	- NOT IN PAS
FFS3C0MAC	CM OL MAIM	[redacted] CSFAAOL	U	0	- NOT IN PAS
FFS3H0MIL ALFT	CM OL MAXP	FFCRS0VDYDVDVDCSFAA0FCD		0	- OK
FFS3L0MIL ALFT	CM OL MADE	FFCRS0VDYDVDVDCSFAA0FCD		0	- NOT IN PAS
FFS3P0MIL ALFT	CM OL MA01	FFCRS0VDYDVDVDCSFAA0FCD		0	- OK
W43FAA0008 IN DIV	NCO ACADEMY	WAT6FFAZENAZENLTDNUACD	X	0	
WAPF9A0003 IN HHC 01 BDE		WAPFAAJBYZJBYZ0FRAGACT	A	0	
WAPF9B0008 IN HHC 01 BDE		WAPFAAJBYZJBYZ0FRAGACT	A	0	
WAPF3C0008 IN HHC 01 BDE		WAPFAAJBYZJBYZ0FRAGACT	A	0	
WAPF9D0008 IN HHC 01 BDE		WAPFAAJBYZJBYZ0FRAGACT	A	0	
WAPF9E0008 IN HHC 01 BDE		WAPFAAJBYZJBYZ0FRAGACT	A	0	
WAPC9C0008 IN HHC 02 BDE		WAPFAAAZENAZEN0FRAGACT	A	0	
WAPG9D0008 IN HHC		WAPFAAAZENAZEN0FRAGACT	A	0	
WAPH9B0008 IN HHC 03 BDE AUG		WAPGAAUVFDUVFD0FRAGACT	A	0	
WAPH9C0008 IN HHC 03 BDE AUG		WAPGAAUVFDUVFD0FRAGACT	A	0	
WAPH9D0008 IN HHC 03 BDE AUG		WAPGAAUVFDUVFD0FRAGACT	A	0	
WACX890008 IN DIV 03 BDE AUG		[redacted] 2AUCUAUC	A	0	
WABPT20008 IN HHC	RPC DET 1	WABPT0XWYCKWYCLFRAGDET	A	0	
WACU2A0008 IN HHC	DIV RPC	WACUAASDSBSDSB2FRAGDET	A	0	
WACU390008 IN HHC	AUG	[redacted] 2AUCUAUC	A	0	
WACUAA0008 IN HHC	DIV	[redacted] 2U88CHHC	A	0	
WACUF10008 IN HHC	PBO DIV	WACUAAHNLPHNLP1ZZZZACT	X	0	
WACUF20008 IN HHC	PBO	WACUFFHNLPHNLP1ZZZZACT	X	0	
WACVSA0001 AR HHC 01 BDE SWA FWD		[redacted] 2FRAGDET	A	0	
WACZA10008 IN HHC	PBO DIV ARTY	WACZAAZSNRZSNR1ZZZZACT	W	0	
WADDA00041 IN BN 01 CO A MECH		WADDAGHSUEHSUEDBTTTCO	A	0	

NOT IN PAS

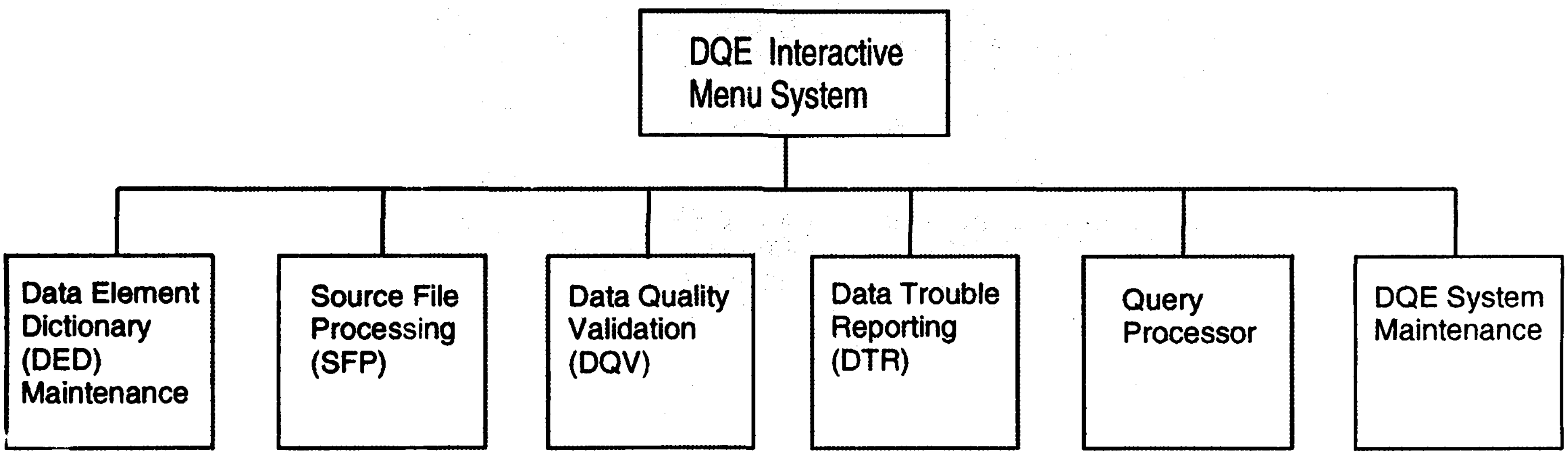
AF PERSONNEL ACCOUNTING SYSTEM

8TH IN DIV IS GONE

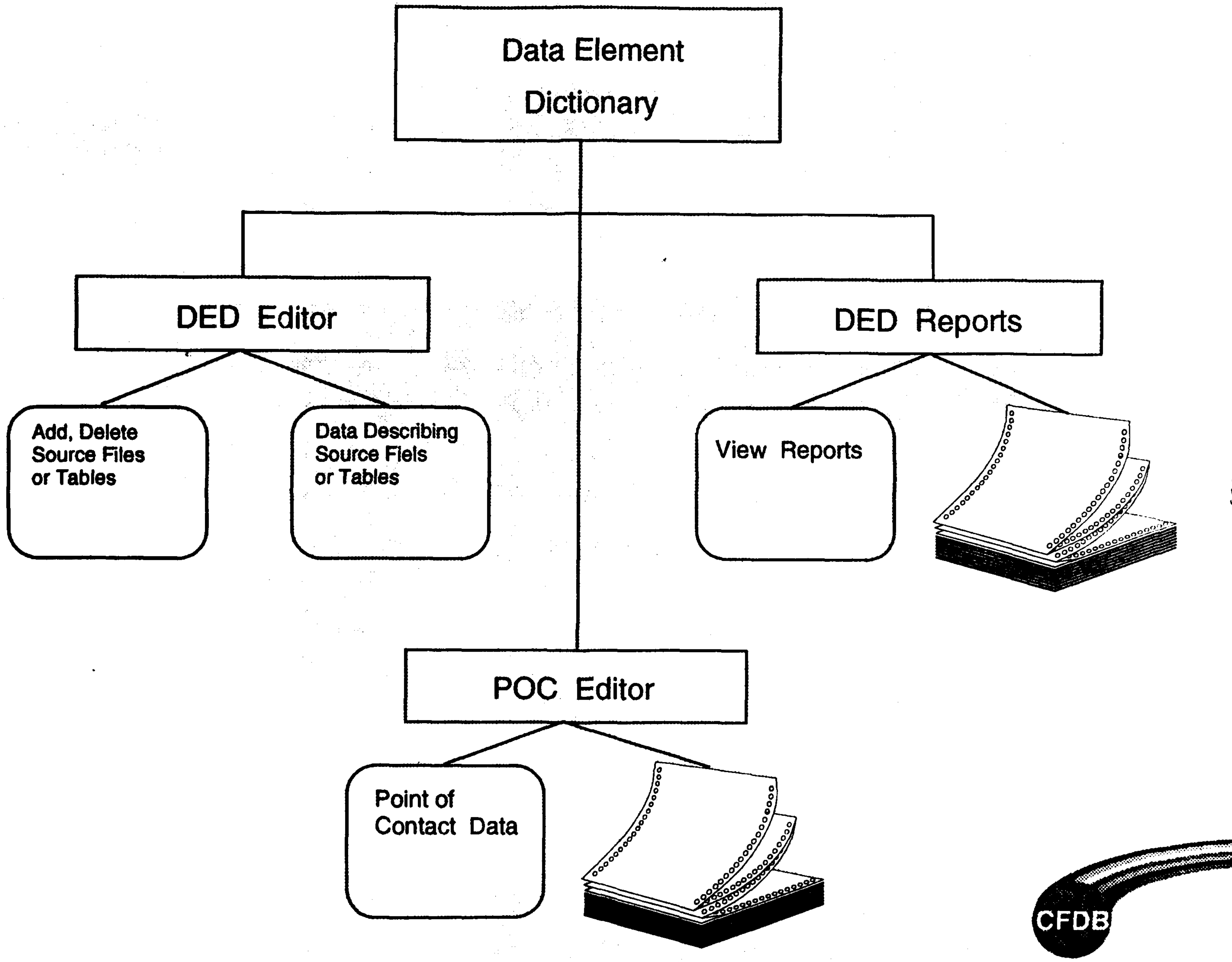
DQE PROCESS


ARMY EQUIPMENT
JDS UNIT INFO
PERSONNEL
FILES
DATA ELEMENT DICTIONARY
RULES BY DBA
CFDB
DATA SOURCES
DATA TROUBLE REPORTS
CFDB

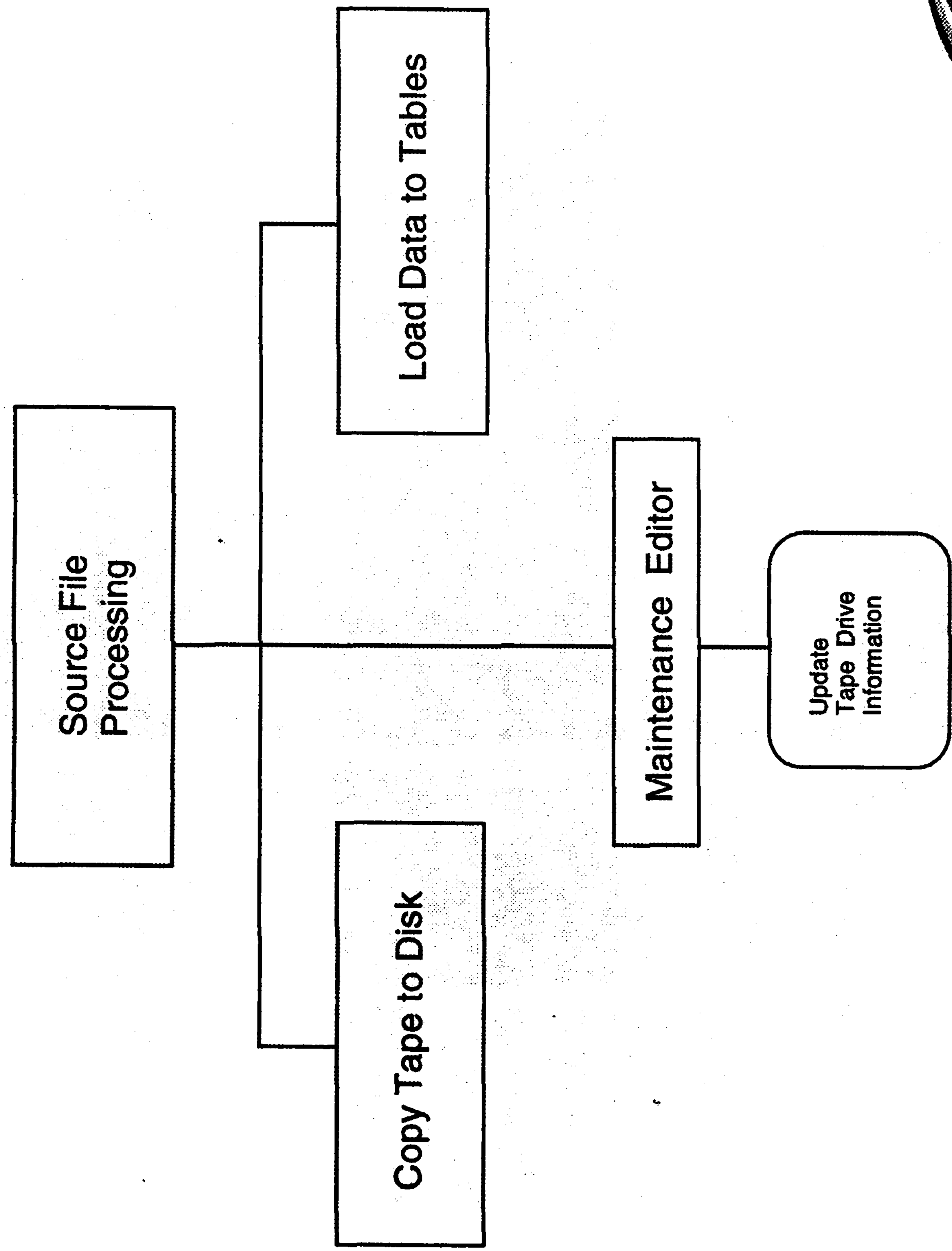
DATA QUALITY ENGINEERING (DQE) MAJOR FUNCTIONAL AREAS

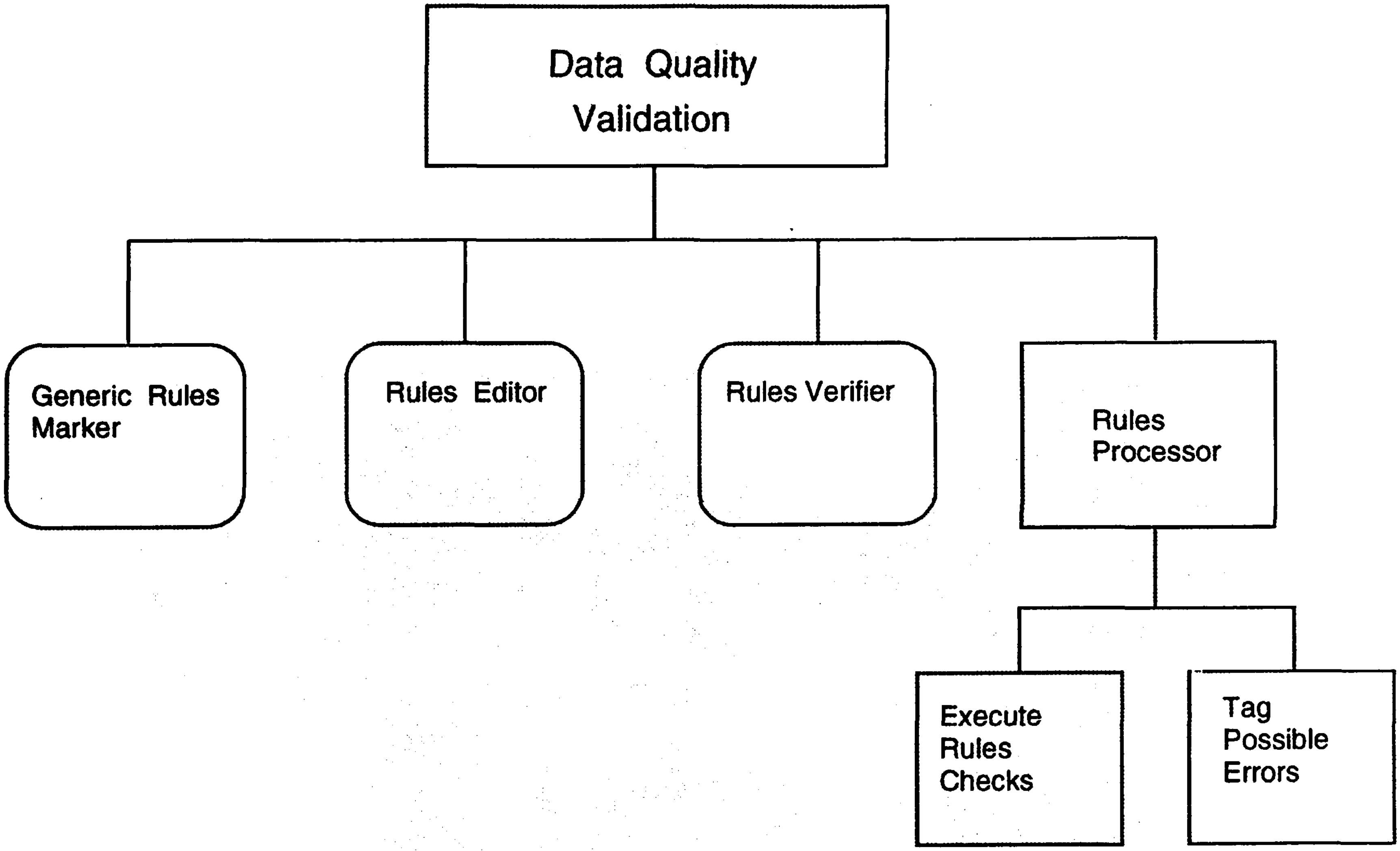


CFDB

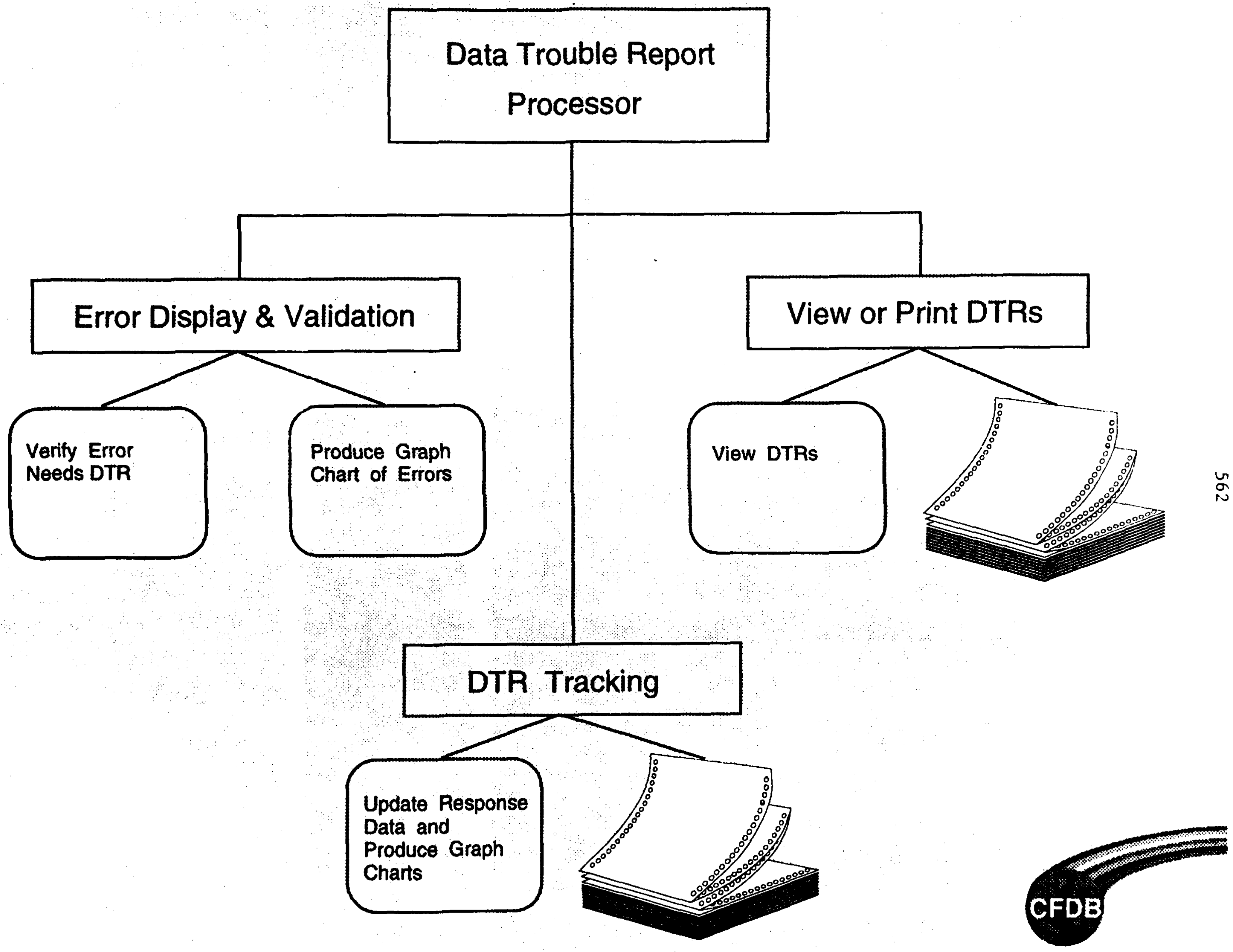


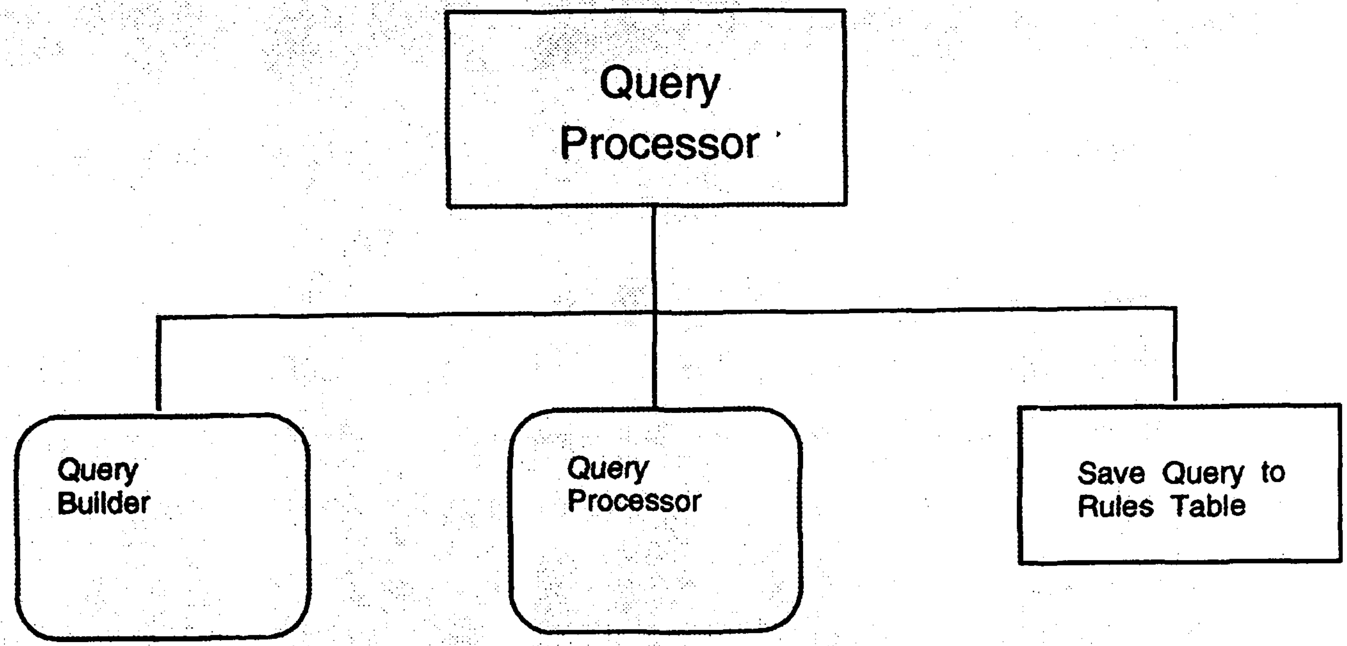
Data Element Dictionary
DED Editor
Add, Delete Source Files or Tables
Data Describing Source Fiels or Tables
DED Reports
View Reports
POC Editor
Point of Contact Data
CFDB

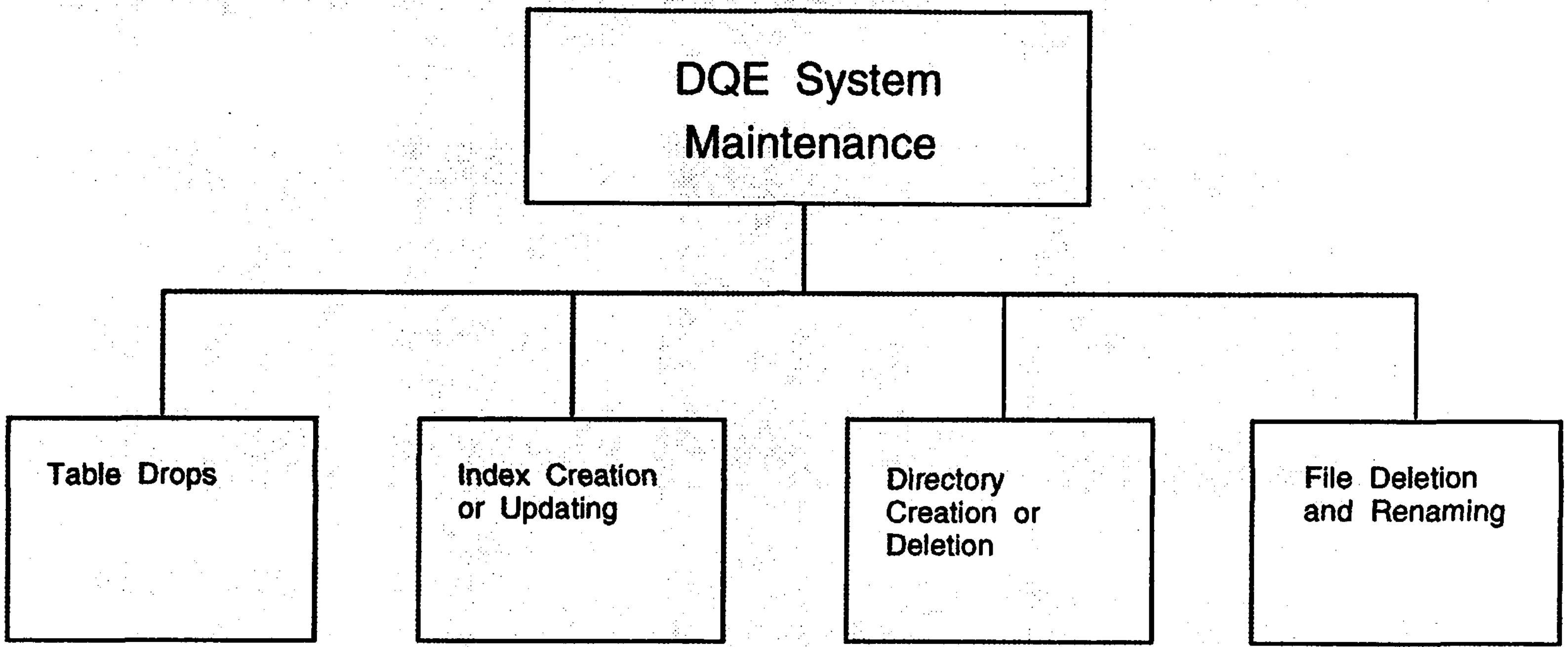

Source File Processing
Load Data to Tables
Copy Tape to Disk
Maintenance Editor
Update Tape Drive Information


Data Quality Validation
Generic Rules Marker
Rules Editor
Rules Verifier
Rules Processor
Execute Rules Checks
Tag Possible Errors

CFDB


Data Trouble Report Processor
Error Display & Validation
Verify Error Needs DTR
Produce Graph Chart of Errors
View or Print DTRs
View DTRs
DTR Tracking
Update Response Data and Produce Graph Charts
CFDB


Query Processor
Query Builder
Query Processor
Save Query to Rules Table


DQE System Maintenance
Table Drops
Index Creation or Updating
Directory Creation or Deletion
File Deletion and Renaming

CFDB

DQE FUNCTIONALITY

- WILL PRODUCE BETTER DATA BY:
  - STANDARDIZING DATA
  - PROVIDING A PROBLEM REPORTING PROCESS
  - IMPROVING DB VV & A CHECKS
  - ENHANCING DATA ADMINISTRATION
  - TRACKING DATA ELEMENT SOURCES AND MODELS

CFDB

DQE FUNCTIONALITY (CONT'D)

- ❑ WILL PROVIDE AN ARCHITECTURE TO STANDARDIZE DATA DESCRIPTIONS & DATA ELEMENTS
- ❑ WILL PROVIDE AN AUTOMATED PROCESS TO CHECK DATA THROUGH:
  - AUTOMATED COMPARISONS
  - RULES - OPERATIONAL, TECHNICAL, & PROCEDURAL
  - MATH COMPUTATIONS
  - ACCEPTABLE RANGES
  - STATISTICAL TESTS

CFDB

PERSONNEL SOURCE DATA

RECORD LAYOUT

ITEM	POSITION	LENGTH	TYPE
UNIT IDENTIFICATION CODE	1	8	CHAR
PRIMARY MILITARY OCCUPATION CODE	9	7	CHAR
PRIMARY GRADE CODE	16	3	CHAR
STATUS CODE A = ACTIVE R = RESERVE	19	1	CHAR

DQE RULES FOR JOINT PERSONNEL SOURCE DATA

- ❑ UNIT IDENTIFICATION CODE FIELD
  - CHECK ONLY THE FIRST 6 CHARACTERS
  - UICs CAN ONLY CONTAIN ALPHA (A THRU Z EXCLUDING I AND O) OR NUMERIC (1 THRU 0) CHARACTERS. UICs BEGINNING WITH FF CAN HAVE A BLANK IN THE 6th POSITION.
  - THE FIRST POSITION SHOULD ALWAYS BE AN ALPHA CHARACTER A, F, N, M, OR P.
- ❑ PRIMARY MILITARY OCCUPATION SPECIALTY FIELD
  - THIS FIELD IS ALLOWED TO CONTAIN BLANKS. HOWEVER, IF THIS FIELD IS BLANK AND THE PRIMARY GRADE FIELD RANGES FROM E08 TO E09, O05 TO O11, OR W04 IT SHOULD BE FLAGGED AS A POSSIBLE ERROR.

CFDB

DQE RULES FOR JOINT PERSONNEL SOURCE DATA (CONT'D)

- ❑ PRIMARY GRADE FIELD
  - THIS FIELD CAN ONLY CONTAIN E01 THRU E09, W01 THRU W04, OR O01 THRU O11.
- ❑ ACTIVE / RESERVE STATUS FIELD
  - THERE MUST BE AN A OR R IN THIS FIELD
- ❑ NO BLANKS IN ANY FIELD EXCEPT PMOS
- ❑ NO SPECIAL CHARACTERS IN ANY FIELD

CFDB


UNITED STATES
COMMAND

RAND Experiences with the 2851 SIF

Al Zobrist

Jed Marti

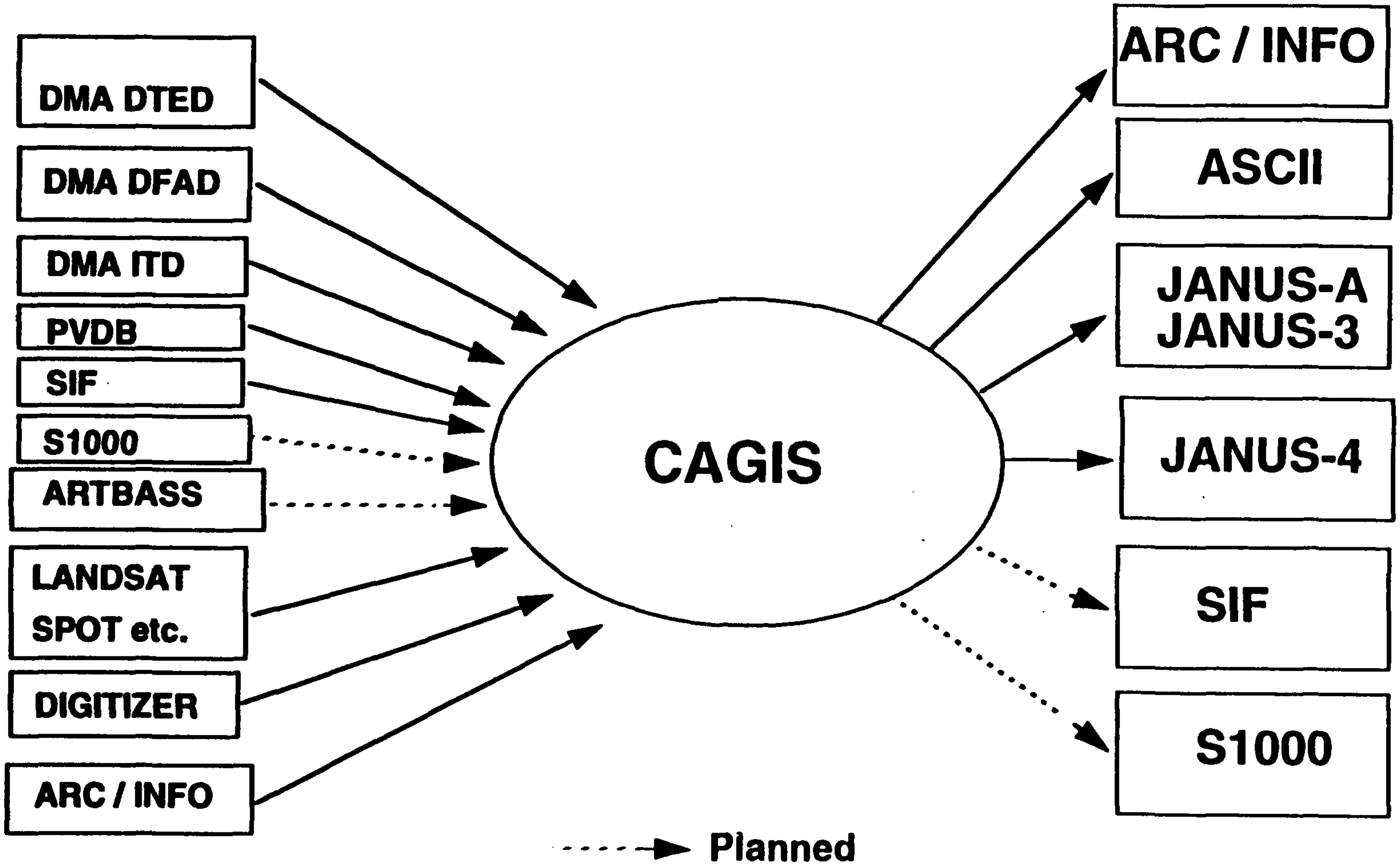
Outline

- Background
- Format Conversion
- Results
- Future Work

Background

- Convert SIF for use by JANUS 4.0 and BDS-D, NPSNET IV.
- Incorporate higher resolution data or other sources as appropriate (e.g. DMA ITD, PEGASYS).
- Utilize community standards.

CAGIS Format Conversions



4 2/15/94 1:34 PM RAND

Current Databases
Ft. Hunter Liggett

- PVDB (PEGASYS) 7 gigabytes. 1, 4, 16, 64 meter resolution imagery and elevation (1, 4 meter interpolated from lower resolution).
- S1000 100x100 kilometers, partially ocean, 55 megabytes.
- DMA DTED/DFAD 100 meter resolution. DFAD is very sparse.
- 2851 SIF, 93 megabytes

JANUS 4.0 Terrain Requirements

- Polygonal terrain features (forests, lakes, roads, obstacles, etc.).
- Lineal features (fences, berms, etc.).
- Elevation Posts (resolution variable from urban combat to brigade scale).
- Buildings (surface area, height, firing port geometry, construction material).

Conversion Process

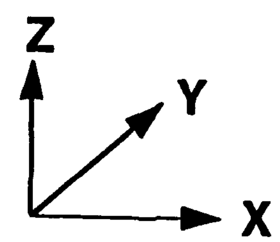
- SIF -> internal CAGIS format
  - Typed polygons (to include road width information)
  - Typed polylines
  - Points
  - 3D objects
  - Elevation raster
- Problems
  - Polygons with holes (no examples in Ft. Hunter Liggett)
  - Buildings (there are only 4 in the database)
  - Passing multiple attributes with features

3D Objects Process (In progress)

A) Ortho-project building to X-Y plane, then build polygon from composite.

B) Ortho-project building to Z axis to get maximum height.

C) Firing ports and material from table lookup.



Results

- Initial conversion to JANUS 4.0 nearly complete .
- Building projection in progress. Since the database does not seem to be complete, we will probably add buildings by hand digitizing from 1 meter PEGASYS image.
- Have begun converting S1000 → JANUS 4.0 format for comparison and as single source for experiments.
- Can substitute data from other sources at will. Digitized roads and culture map projected with wrong spheroid. Easy-to-perform correction provided to data source (PRC Corporation).
- Datum map projection operations added to CAGIS to meet accuracy needs of WGS 84.

Conclusions about the 2851 SIF DB RAND used

+ Most of format is easy to decode and create
+ Manual is excellent
– API tools incomplete
– Geolocation incorrect on our one sample through misuse of spheroids in UTM conversion
– Two 3D formats must be dealt with

Naval Command Control Ocean Surveillance Center (NCCOSC)

Research Development Test & Evaluation Division (NRaD)

San Diego, California

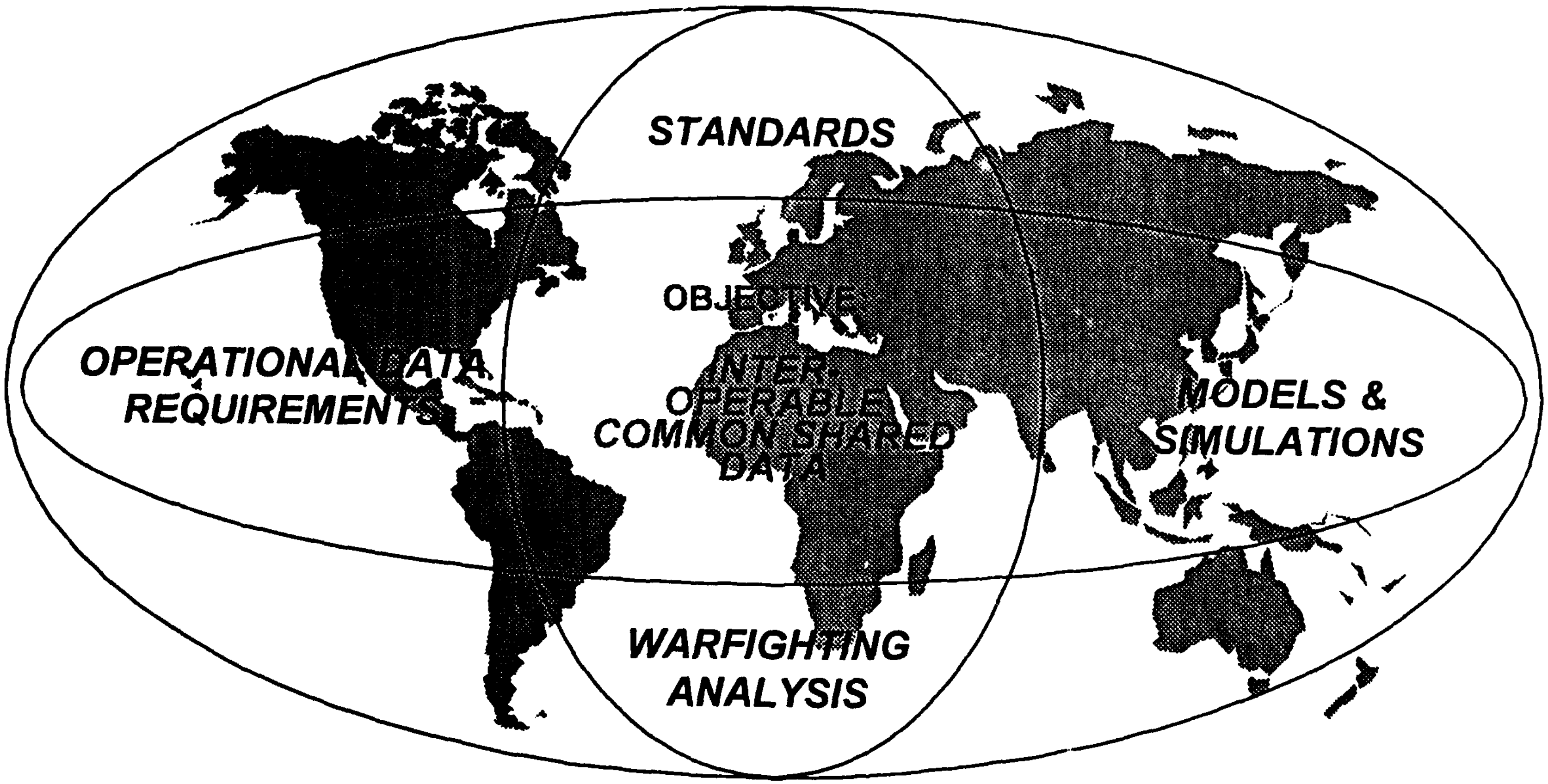
Automated Repository for Models and Simulations (ARMS)

Program Manager : Michael DaBose

Phone: (619) 553-6095
Fax: (619) 553-6083

Automated Repository for Models and Simulations (ARMS)

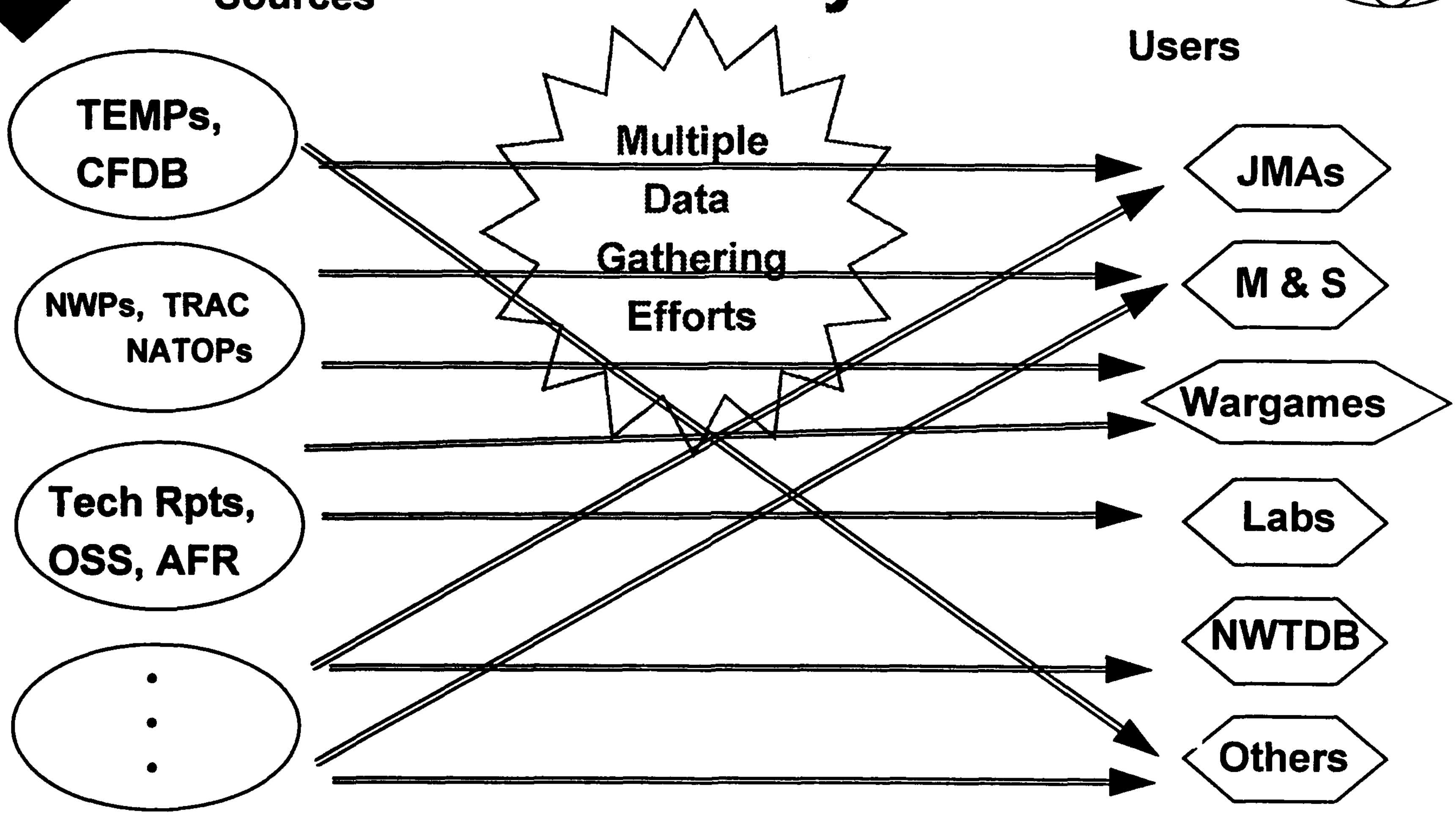
To Provide 'Common Frame of Reference' Data for Joint Mission Area Analysis



ARMS

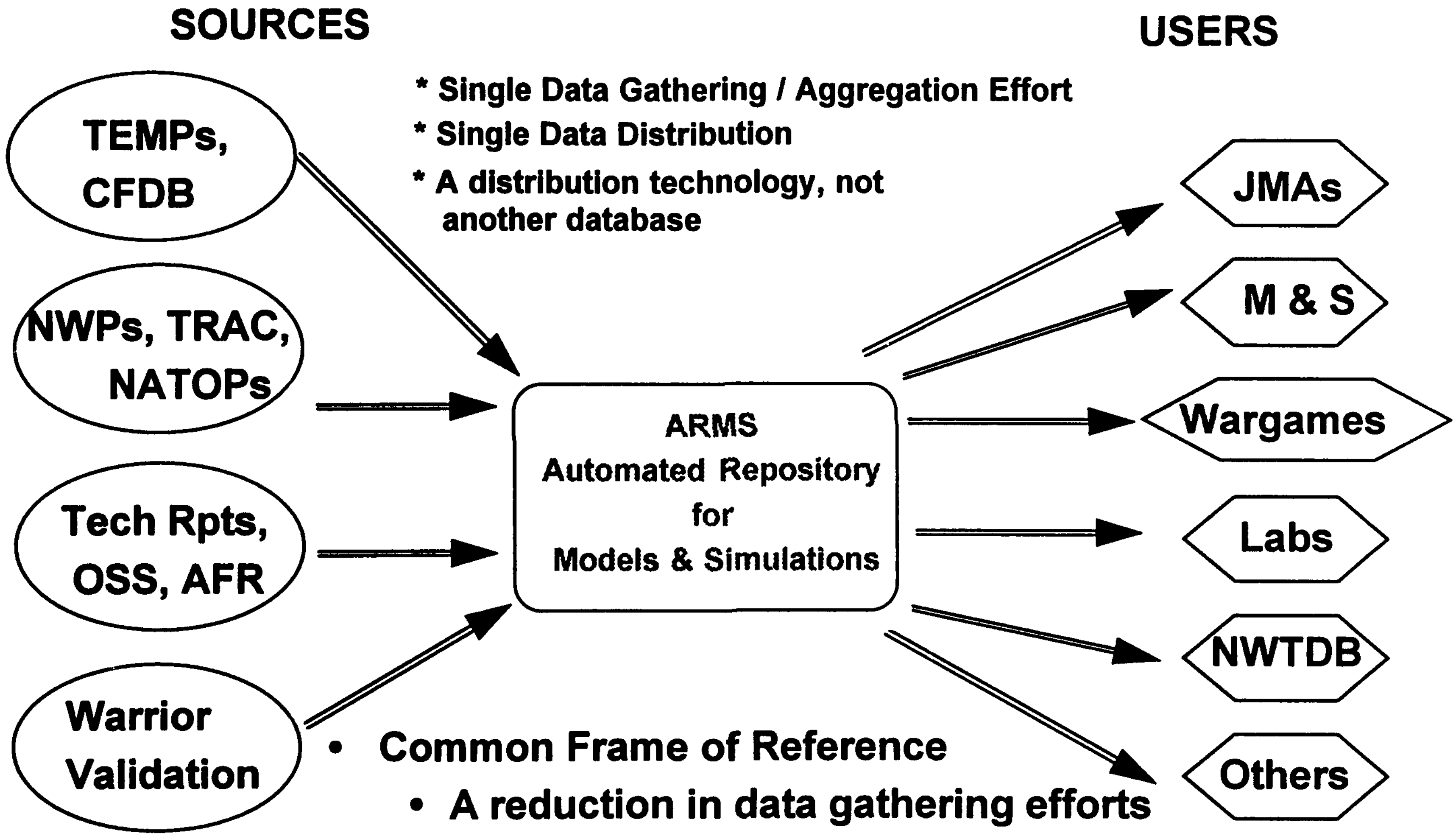
Defining the Problem

Old Way



- No Common Frame of Reference
- Redundant data gathering efforts
- Paper and Time Delay Explosion

ARMS Way



* Single Data Gathering / Aggregation Effort
* Single Data Distribution
* A distribution technology, not another database

- Common Frame of Reference
  - A reduction in data gathering efforts
  - A developing technology, not a method
  - ARMS technology applicable across a broad spectrum

What is a "Common Frame of Reference"

All "data", whether reports, charts, numbers, etc. can be reduced to various "classes" of representation (shapes, numbers, etc.). In turn, such data can be mediated from it's native form to a consistent method and format of display / transmission to the user / system, within a given context.

- The user is free of having to deal with the source methods of presentation
- The user can directly access the data. Minimal interpretation is required
- The user does not have to understand the source methods of presentation
- Data exchange / sharing between unlike systems becomes efficient and cost effective

ARMS

ARMS IS

Repository System

Definition:

A specialized set of *information management services and facilities that manage information resources*. A repository system accommodates the information *management requirements of an organization, including the areas of information systems engineering and operation*.

Source:

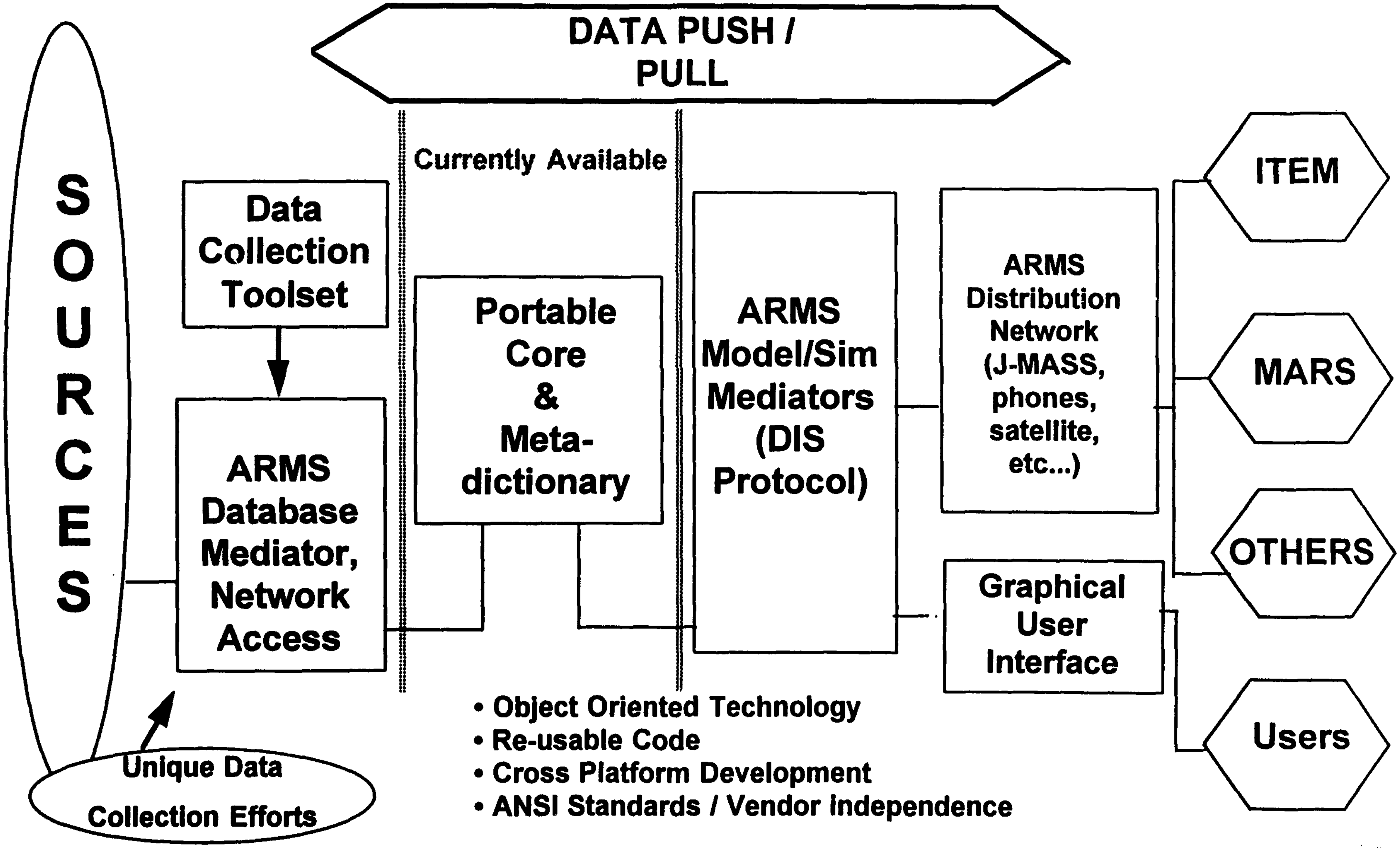
- Information Resource Dictionary System(IRDS), Reference Model Technical Report X3H4.1/92-002R3 September 24, 1992 (Draft), American National Standards Institute (ANSI)

ARMS IS

- A system that *currently exists*
- A repository and distribution technology
  - NOT ANOTHER DATABASE
- An ongoing programmatic effort that :
  - Provides a '*Common Frame of Reference*'
  - *Reduces redundant data collection / capture*
  - Maintains *continual data update*
  - Provides *traceable, authoritative data* (source tagged)
  - Enhances current systems capabilities through seamless data availability

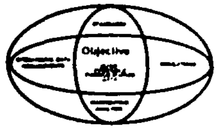
ARMS IS

Functional Diagram



- Object Oriented Technology
- Re-usable Code
- Cross Platform Development
- ANSI Standards / Vendor Independence

ARMS System Objectives



- JMA Data in a Common Frame of Reference
- Provide *Joint Modeling and Simulation data* for the Naval Warfare Tactical Database (NWTDB)
- Distribute NWTDB standards to the community
- Provide a road map for goal / objective architectures
- *Centralized Configuration Control and Repository Management*
- *Distributed Data Gathering*
- Repository of "*Lessons Learned*" (Wargames, Operations, etc.), and *Doctrine*
- *Joint Doctrine Statements* (automated update to smart systems in and entering service)

ARMS Programmatic Objectives

- Hosted on *multiple operating systems:* Apple (System 7), TAC III (HPUX), SUN (Solaris), PC (Windows)
  - *Vendor Independence*
- Provide *current and future platforms systems data* for Future Assessment Process (~ Yr 2000+ Scenario)
- Incorporate *Enterprise Model functions, processes, and data models*
- Incorporate an *Object Oriented Database Management System* (COTS)
  - *Standard ANSI / ODMG* access and query methods

    not dependent on any one vendor's products
- Establish a *Data "Clearing House"* for electronic distribution to Models, Simulations, and Users.
- Provide *standardized data elements* , as determined by responsible authority, to support Joint Interoperability

Benefits of ARMS?

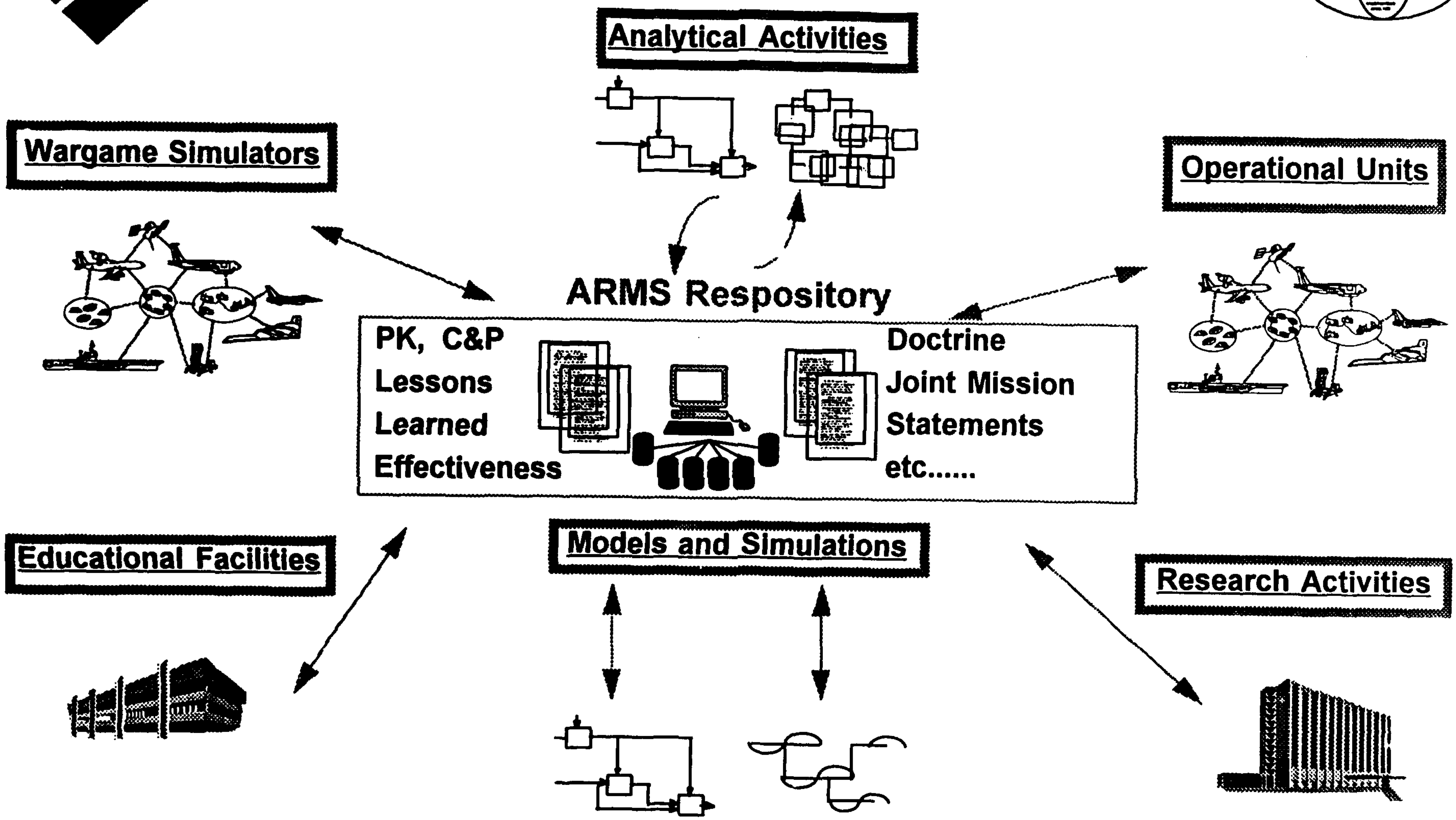
- Provide analysts with a *Single Authoritative Source of Common Format Data* for platform & systems information (Red / White / Blue), and other data for:
  - Day to day knowledge
  - Warfare simulations
  - Seminar wargames
  - Architecture *Functional Analysis relating to*:
    - Drawings: Organizational / Physical / Functional Diagrams / Process Models / Data Models, IDEF0, IDEF1X
    - Network and Communication Structures
    - Documentation
  - Characteristics of Performance (CP)
  - Effectiveness data
  - Probability of Kill (PK)

ARMS

The ARMS "Vision"

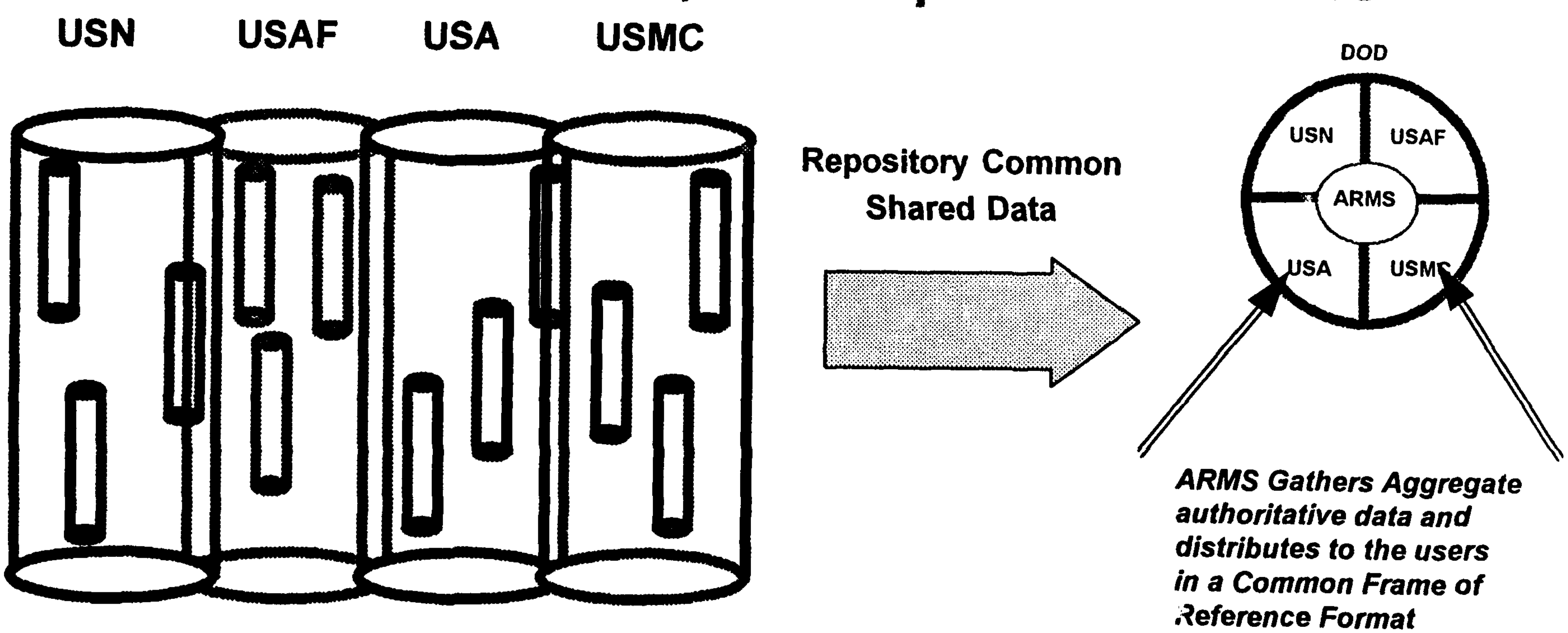
Data is Data, this technology is applicable across a broad spectrum of applications, example: California Department of Transportation "Super Highway Traffic Control Center", Why, all data is treated as objects

ARMS role in the "Big Picture"



Today to Tomorrow

- **Today: Many disparate data sources, in various media, built and maintained for specific needs**
- **Tomorrow:** ***A seamless repository providing verifiable "Common Frame of Reference" data from traceable, authoritative, and responsible sources***



WHO IS USING ARMS?

- Current and prospective users of ARMS :

Current	In Progress
OPNAV JMAs / N81	SOCOM
Labs / Contractors	NWTDB
Joint / Cinc / . . .	OSD
CENTCOM	AF M&S Office
SPAWAR 31	AF Plans Analysis
Joint Warfighting Ctr	CINCPAC
Naval War College	Oasis
Warfare Center Quantico	J8
Wargaming Community	CIA
"Black" Programs	
CINCLANT	

Appendix

B. DATA VV&C TASK FORCE MEETING BRIEFING CHARTS

DATA VERIFICATION, VALIDATION AND CERTIFICATION (VV&C) TASK FORCE MEETING

14 February 1994

Suggested Objectives for Data VV&C

and

Summary of Data VV&C Working Group Results from MORS SIMDAT Symposium

Iris Kameny

RAND

SUGGESTED OBJECTIVES FOR DATA VV&C

- **Develop guidelines for Data VV&C**
  - cost models
- **Address authoritative data sources and their responsibilities**
- Authority to certify other one's data
- **Address the role of M&S data centers between data sources and simulation applications**
- Question: do we need to distinguish metadata from data
- Management of VV&C process

- ~~[illegible]~~ Are [illegible] guidelines needed for [illegible] + long term (data stds)

DEVELOP GUIDELINES FOR DATA VV&C

- Develop definitions for data verification, validation and certification and other related concepts
- Describe tools and methods to be used in verification and validation
- Develop certification profile of metadata describing data quality of a database
- Develop policies and procedures for performing data VV&C and relate it to M&S VV&A

ADDRESS AUTHORITATIVE DATA SOURCES AND THEIR RESPONSIBILITIES

- Establish policy for determining the authoritative sources of M&S data and procedures for registering them
- Establish policies, procedures and enforcement of M&S data authoritative source responsibilities including:
  - Use of data standards
  - Carrying out of VV&C
  - Configuration management of data
  - Help to M&S users of data
  - Handling of data security issues such as data aggregation
  - Participation in M&S VV&A

ADDRESS THE ROLE OF M&S DATA CENTERS BETWEEN DATA SOURCES AND SIMULATION APPLICATIONS

- As authoritative sources
- In sharing and reusing data
- In keeping track of who they are, what their mission is, communcations among them

PRELIMINARY DEFINTIONS TAKEN FROM WORKING GROUP ON DATA VV&C AT MORS "MINI-SYMPOSIUM ON SIMULATION DATA AND ITS MANAGEMENT" (November 16-18, 1993)

- Data Verification defined for a dataset from a generic data source (e.g., DMA, DIA):
  - The use of techniques and procedures to ensure that data meets constraints defined by data standards and business rules derived from process and data modeling.
- Data Verification defined for a dataset from a source furnishing data specific to a model/simulation (e.g., TRAC Automated Data Center (TADS) or CENTCOM's Conventional Forces Database):
  - Review of input data values to ensure that they are converted and formatted properly for input into the M&S conceptual and logical design. Data reduction and transformation techniques should be addressed.

PRELIMINARY DEFINTIONS TAKEN FROM WORKING GROUP ON DATA VV&C AT MORS "MINI-SYMPOSIUM ON SIMULATION DATA AND ITS MANAGEMENT" (November 16-18, 1993)

- **Data Validation:**
  - The review of data by subject area experts and its comparison to know or best-estimate values

- **Data Certification:**
  - Determination that data have satisfied verification and validation criteria which may vary according to usag (i.e., general domain criteria or application-specific criteria).

- **Proposed alternative for Data Certification:**
  - Determination that the database/dataset has been accurately described in the attached certification profile and that all verification and validation tests described in the profile have been stringently carried out.

DATA CERTIFICATION PROFILE

- Furnished to dataset user by authoritative source to describe quality of dataset including verification and validation tests and procedures used
- Profile includes
  - Metadata concepts including: degree of completeness, degree of accuracy, confidence of belief, level of detail, precision, currency (spanning dates, effective dates, rate of update), geographic area (if applicable), etc.
  - Data describing authoritative data source, mission, purpose of dataset
- Certification profiles could have unique identifiers and could provide a complete audit trail for data from original source through value-added authoritaive sources up to use in the model.

SUMMARY OF WORKING GROUP ON DATA VV&C AT MORS "MINI-SYMPOSIUM ON SIMULATION DATA AND ITS MANAGEMENT"

- Over 40 participants
- Discussed long term goals of Data VV&C
  - Develop guidelines for Data VV&C
  - Establish procedures for identifying and registering authoritative data sources
  - Establish policies, procedures and enforcement of responsibilities of M&S authoritative data sources
- VV&C issues: definitions, V&V guidelines, multiple levels of VV&C, certification profile, role of data centers
- Ten papers were presented

FINDINGS

- Need VV&C group to address area
- Need policy, procedures, and guidelines for DB VV&C
- Need concise definition of terms
- VV&C for M&S needs to be addressed with strong interaction between analysis needs, model, and data
- Need to collect VV&C cost and cost benefit data
- There are automation tools to help with DB VV&C
- DB VV&C for M&S community needs to deal with two types of databases and data centers: *M&S supportive and generic*

1. FINDING AND RECOMMENDATION

Finding: An effort is needed to further define DB VV&C processes

Recommendation: DMSO pursue DB VV&C processes and ensure coordination of DB VV&C with M&S VV&A processes, and their associated costs and cost benefits

How (options):

(a) Expand VV&A Task Force to include DB VV&C (e.g. DB VV&C subgroup)

(b) Create new VV&C Task Force

2. FINDING AND RECOMMENDATION

Finding: **Need policy, procedures and guidelines instructing data sources and data centers in carrying out DB VV&C**

Recommendation: **DOD develop policy, procedures and guidelines for DB VV&C management processes applied to data sources and data centers to enhance affordability, efficiency, and data consistency.**

3. FINDING AND RECOMMENDATION

Finding: Need concise definitions of relevant VV&C concepts and terms

Recommendation: Enhance communications by defining DB VV&C terms that will be promulgated to the MORS community

- Follow DOD M&S definitions
- Use software engineering VV/DISA definitions as appropriate
- Consider data source, data center and M&S DB

DEFINITIONS REQUIRED

- Data
- Database
- Complex data
- Atomic data
- Data model
- Instance data
- Meta data
- Data verification
- Data validation
- Data certification
- Data center
- Data source
- Model Simulation
- VV&A (M&S)
- Database model
  - Logical
  - Physical

EXAMPLES OF DATABASE CHARACTERISTICS

- Description of subject areas and sources
- Audit trail
- Control
- Accessibility
- Currency
- Completeness
- Consistency
- Accuracy
- Precision
- Resolution
- Classification
- Credibility
- Reproducibility

MORS MINI-SYMPOSIUM ON SIMU AND ITS MANAGEMENT—VERIFICAT AND CERTIFICATION WORKI

Tuesday, 16 November 1993

1400—1430	VV&C Overview — *Long term goals including need J and procedures for data owners* — *Goals of this working group* — *VV&C definitions*	
1430—1500	Automation Tools for Data V&V	
1500—1530	Interaction and Interdependencies o Analysis, Models, and Data	
1530—1600	Verification, Validation, Accreditation and Certification Costs	Dale Pace, JHU/APL Simone Youngblood, JHU/APL
1600—1630	Discussion	

Wednesday, 17 November 1993

0800—0900	Joint Modeling and Simulation Verification, Validation and Data Accuracy	Mike Hopkins, CENTCOM LTC Wright, CENTCOM, Combat Analysis Group
0900—0930	Data Verification and Data Models	Chris Landauer, Aerospace
0930—1000	Extended Air Defense Simulation (EADSIM) Validation Methodology Using Comparisons with Field Test Data	Anil Joglekar, IDA
1000—1030	Break	
1030—1100	Contractor Data: Where does It Fit in Management?	Jim Kolding, Teledyne Brown Eng., Huntsville
1100—1130	TADS Visual Data Analysis	Howard Haeker, TRADOC Analysis Command-Study and Analysis Center
1130—1200	Oceanographic Data Base Management at the Naval Oceanographic Office	Martha Head, Naval Oceanographic Office
1200—1300	Lunch	
1300—1600	Group Discussion and Preparation of Report — *Goals:* — *Formation of VV&C Task Force* — *Definitions and Guidelines for VV&C* — *Policies for data ownership responsibility* — *Interoperability across source/derived data centers*	

List of Participants

LTC Robert C. Bailey, Jr.
Alexander B. Blair
David B. Blake
William H. Dunn (Co-Chair)
Dr. James Fox
Mary C. Fischer
Brian F. Goldiez
Kevin R. Hannon
Robert G. Hartling
Martha Head
David F. Hemingway
Iris M. Kameny (Chair)
James C. Kilding
Ralph G. Koontz
Dr. Christopher A. Landauer
Sylvia M. Lane
Pilar N. Montes
Tran N. Nguyen

Dr. Dale K. Pace (Co-Chair)
John D. Parsons
Dr. Francis M. Ponti
Robert T. Probus
John J. Rankin
Jean E. Razulis
Eleanor Schroeder
LTC Myron A. Spears, Jr.
Carol A. Subick
Brian W. Suma
Dr. Gokay Sursal
Gail S. Sweet
LtCol David S. Thomen
Charles A. Tunstall
James E. Weatherly
LtCol William G. Wright
Simone K. Youngblood
Sharon R. Nichols

Interaction and Interdependencies of Analysis, Models, and Data

by
Dr. Dale K. Pace
Ms. Simone M. Youngblood

The Johns Hopkins University Applied Physics Laboratory
Johns Hopkins Road
Laurel, Maryland 20723-6099
(301) 593-5910 (FAX)

Pace	Youngblood
(301) 953-5650	(301) 953-5000 ext. 4000
dale.pace@jhuapl.edu	simone.youngblood@jhuapl.edu

Presented at:
Military Operations Research Society (MORS) Mini-Symposium
Simulation Data and Its Management (SIMDAT)
November 16-18, 1993
Falls Church, Virginia

This material is based upon tasking from SPAWAR 31 in support of the Navy Modeling and Simulation Office (N812D)

Agenda

I. Perspective

- What's important?
- Purpose: explore analysts, models, and data relationships

II. Context

- Definitions
- Issues

III. Observations

IV. Conclusions

What's Important?

Answer: insights and meaningful results from analysis

& confidence in their correctness

Not so important: model/simulation pizzazz

Premises

Good analysis can produce insights and meaningful results in spite of tool & data limitations -- though good tools & data always help

Good tools & data do not ensure good analysis

Purpose

To explore analyst, models, and data relationships in VV&A/C context

Pertinent Definitions

General acceptance of SIMVAL/DoD M&S Directive Definitions for:

Model, simulation, verification, validation, accreditation, certification

Less consensus about data-related terms:

Data

Data Model

Data Verification

The review of input data for appropriateness of source for the intended application and consistency of use relative to the data acquisition methods employed. Any conditions or limitations on the use of the data should be examined. Data reduction and transformation techniques should be addressed.

Data Validation

Data validation is the comparison of M&S input data to the corresponding known real world or best estimate values.

Data Certification

Official assurance that the data used is acceptable for use for a specific purpose.

Issues

Data correctness:

- Intrinsically
- For the model or simulation tool
- For the purpose(s) of the analysis

License of the analyst to torque input data and tool (model or simulation) parameters for analytic purposes

Credibility of analysis/analysts drawing "conclusions" from use of inadequate data and/or tools

Observations

Quality and capabilities of model and simulation tools have increased significantly -- perhaps more than analysts' appreciation of how to exploit them fully

Availability of data has increased dramatically

"Live" data may be mixed with simulation data

Appropriateness of analytic process, model/simulation tools, and associated data has received substantial attention

Value of analysis can be limited by:
- its analyst(s) and processes
- capabilities of its model and simulation tool
- its input data and manipulation of its out put data

Conclusions

Analysis, model/simulation, and data interactions must be appreciated

- GIGO is always a concern
- Good data & bad model usually produces garbage
- Good data & good model & bad analysis produces inappropriate results
- Adroit analysis may overcome some data and model limitations

End use requirements focus leads to economies in data/model resources

- Analysis plan drives fidelity level & extent of data/model requirements
- Comprehensive analysis plans facilitate efficient model/data match/use

Current VV&A/C efforts do not treat the analysis-model-data totality

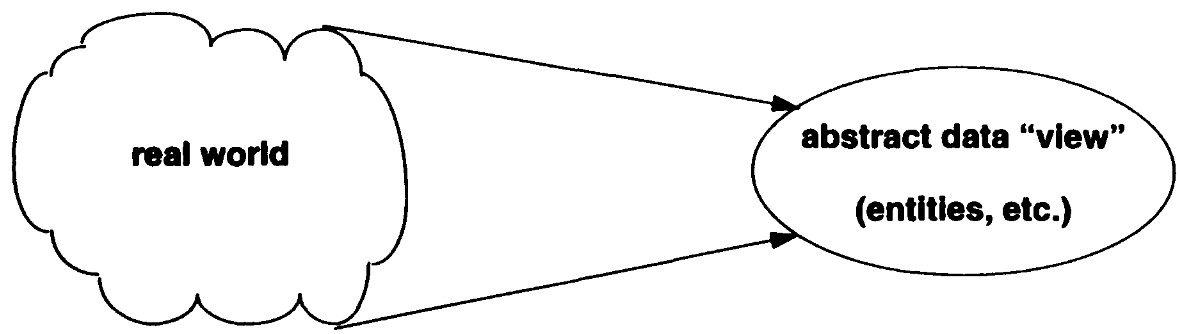
Data Quality Concepts

Data VV&C Task Force Meeting

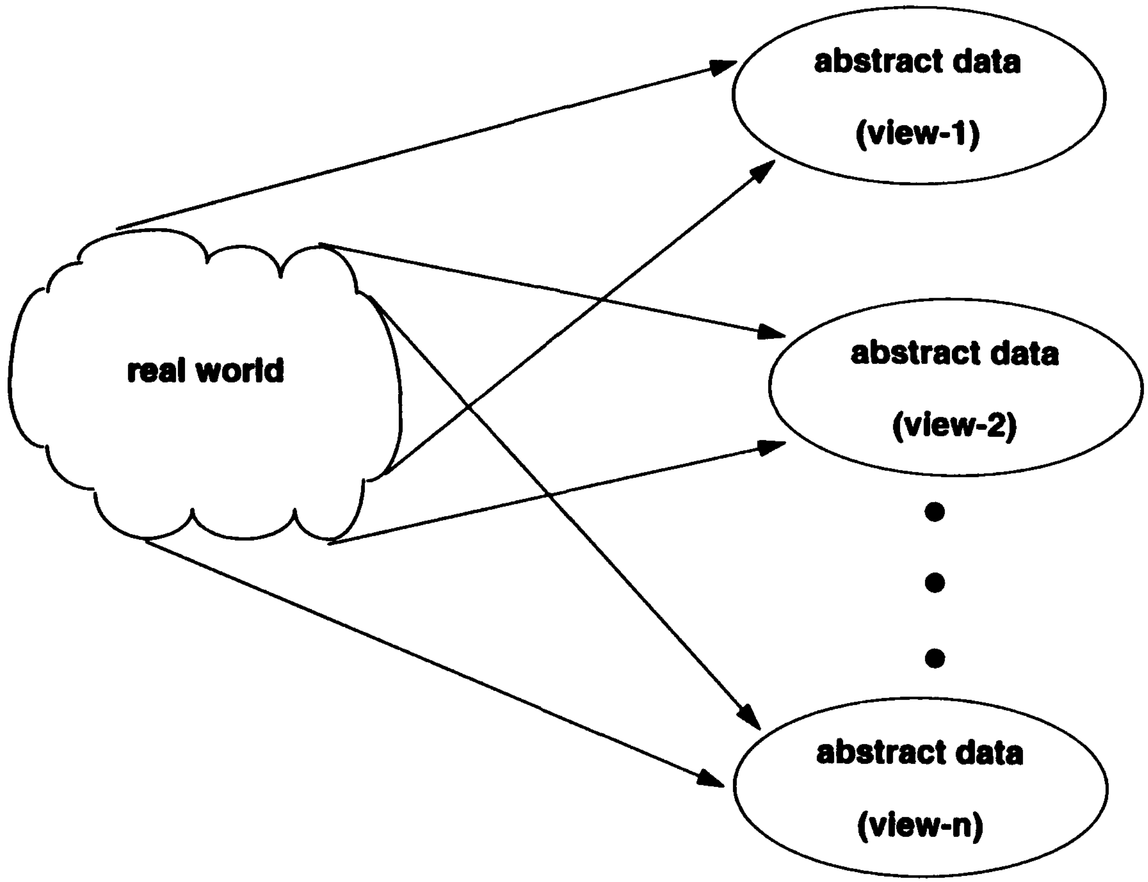
2/14/94

What *is* data?

- **It is the result of data modeling of the real world**
  - e.g., in terms of entities, attributes, relationships, etc.
- **Which produces some particular (abstract) "view"**
  - Ignoring some things, simplifying others



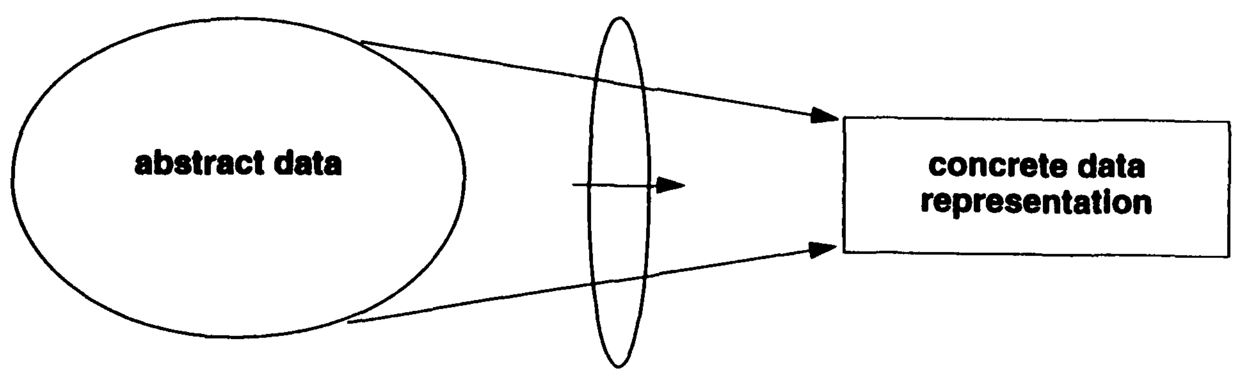
Many views of reality are possible



What is data, *really*?

- **Concretely (e.g., in a database), it is a *representation***
  - Of a data view of the real world
  - In some format, e.g., <entities, attributes, values>, relationships, etc.

- **Many alternative *representations* are possible**
  - Corresponding to different data models/formats
  - Every representation is a *model* of the abstract data



What do we mean by the "quality" of data?

- **Its suitability for some particular purpose**
  - Or range of purposes (e.g., for generic DBs)
  - Otherwise, how can we possibly evaluate its quality?

It may be useful to think of this as:

- **Its suitability for a particular "customer's" purpose**
  - Can we meaningfully speak of "customers" in our context?
  - If we can't, then *whose* purpose does data serve?
  - To what extent is the "commercial/corporate" model appropriate? useful?

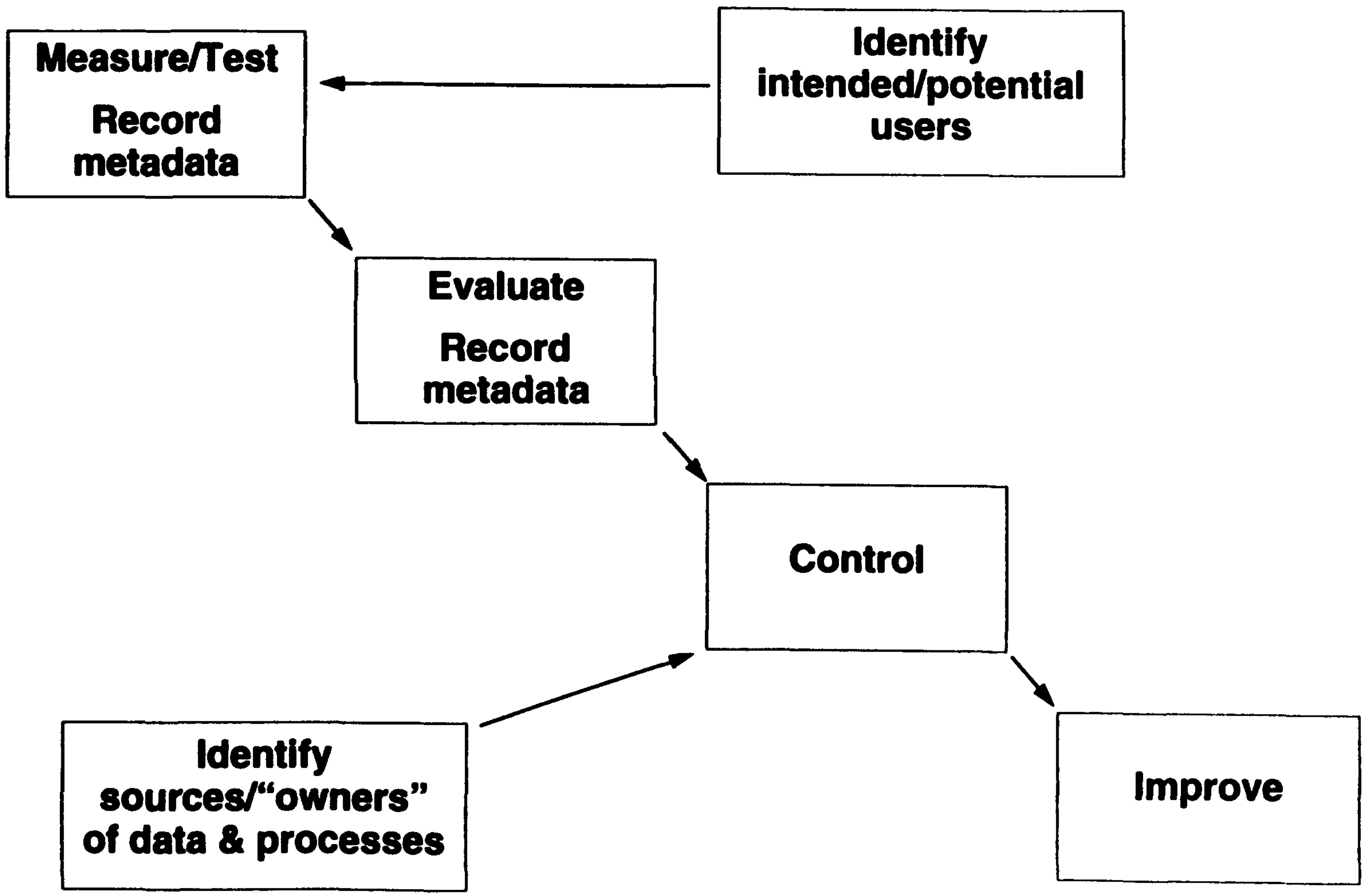
How can we promote data quality?

- **By recording sufficient metadata about data**
  - To allow determining & evaluating the quality of the data
  - Transforming & propagating this metadata as necessary

- **By performing explicit VV&C on data**
  - Testing and evaluating the data
  - In terms of its metadata (which specifies its intended users and purpose)
  - Recording the results of these evaluations in additional metadata

- **By controlling & improving the processes that affect data**
  - I.e., processes that generate, modify, and propagate data
  - In such a way as to improve the quality of the data

A framework for providing data quality



Quality depends on metadata at three levels

- DB level (instance DB)
  - Metadata that describes a DB & its data model as a whole
- The data-element level (data dictionary)
  - Metadata that describes a given data/metadata element
- The data-value level (instance DB)
  - Metadata that describe a specific data/metadata value in a DB

- May need data-element & data-value level metadata for metadata
  - Where appropriate, to allow evaluating & tracing the metadata itself
- Note: Inheritance/defaulting of metadata can reduce redundancy
  - i.e., need not have every metadata item present everywhere

DB level metadata

- **General**
  - Source/authority info for this DB
  - Intended use, range of purposes, meaning of DB
  - Rationale for structure/design
  - Global relationships to other DBs
- **Characterization**
  - Intended "resolution" (i.e., level of detail)
  - Intended degree of quality (accuracy, consistency, currency, completeness)
  - Accessibility, classification, reproducibility
- **Measured quality**
  - Accuracy, consistency, currency, completeness, relevance
  - Clarity/flexibility/robustness of DB design
- **Process control information**
  - Describing aggregation/derivation of data (*and* of metadata) in this DB
- **VV&C audit trail**
  - Auditing any VV&C that has been done on this DB

Data-element level metadata

- Meaning of this data element & its meta-values & metadata
  - What this data element represents (and what it *doesn't*)
  - Meanings of nulls: unknown value and/or applicability of attribute OR special value
  - Meanings of exceptions, counterfactuals, uncertainty metadata etc.
- Source & generation-cycle information for this data element
  - May be multiple sources (authoritative & other)/multiple, irregular generation-cycles
- Completeness, constraints & relationships to other data/DBs
  - Including entity/attribute completenes:
- Domain/datatype & units-of-measure
  - Name-equivalent types (vs. structure-equivalent)
- Resolution, precision, intended/expected accuracy
  - Including representation dependence/independence & portability issues
- Domain/datatype/units metadata
  - Rationale for these choices & their completeness, portability, flexibility, etc.
  - Audit trail of the evolution of these choices
- VV&C audit trail
  - Auditing any VV&C that has been done to evaluate the appropriateness of this data element, the restrictiveness of its domain, etc.

Data-value level metadata

- **Quality**
  - Certainty, accuracy, "expiration date", etc.
  - Including sources of these metadata themselves
- **Annotation**
  - For caveats, special values or cases
- **Source information**
  - Source, derivation, time of generation, time of entry, etc.
- **Next-source information**
  - Describing when updates are expected (from where) & what they will offer
- **Transformation audit trail**
  - Process-control information about how this value has been transformed
  - Including information on in-progress transformation transactions
- **VV&C audit trail**
  - Auditing any VV&C that has been done on this value

Data VV&C

- **Verification**
  - Consistency, statistical/auto-correlation measures
  - Relatively independent of purpose
- **Validation**
  - Of data collection/manipulation processes
  - Of data w.r.t. the real world it describes
  - Highly dependent on purpose
- **Certification**
  - "Authoritative" V&V, recorded with appropriate metadata

Certification Profile

- **Comes from VV&C audit trail metadata from all levels:**
  - DB level: certifies V&V applied to the DB as a whole
  - Data-element level: certifies V&V applied to data elements and their domains
  - Data value level: certifies V&V applied to individual data values

- **VV&C audit trail information is open-ended**
  - Specifies who has done what when to verify/validate/certify the data
  - Applies to data values, metadata values (excluding itself), data-element definitions, and the DB as a whole

Control and improve processes affecting data

- Identify relevant processes
  - Creation/generation, modification, transformation, propagation
  - Derivation (e.g., combining datasets having different features)

- Identify "owners" of data & processes
  - Ownership must be "taken" — it cannot be "assigned"
  - An owner must take responsibility; must have: capability, willingness, recognized authority, resources, power

- Empower/facilitate/support process-control & improvement
  - Obtain consensus among stakeholders
  - Develop appropriate techniques

(• Note: this is more effective than one-time or periodic cleanup
  - Especially for dynamic data that get regenerated or modified
  - But it can be combined with cleanup)

Process management steps

(adapted from Redman)

- **Establish a process owner & management team**
  - Team should have members from each relevant "functional area"
- **Describe the process qualitatively**
  - Identify "customers", suppliers, sequence of activities, information processing
  - Map "customer requirements" to roles of everyone involved in the process
- **Establish a measurement system**
  - Measure only the few, most relevant things, not everything
  - Continuously evolve/improve this measurement system itself
- **Establish process control over the process**
  - Check conformance to requirements
- **Identify & select improvement opportunities**
  - Prioritize & define focused improvement projects, with quantitative goals
- **Make & sustain improvements**
  - Organize improvement teams for projects
  - Provide resources & direction; monitor progress & support the team

First steps toward data quality

- Identify a candidate DB for a "pilot" data quality project
  - It should have relatively clear-cut "customers" (users), purposes, owners, & sources
  - Its generation/manipulation processes should not be too complex or involve too many different participating organizations
  - It should be amenable to clear-cut V&V techniques
  - It should be amenable to quality improvement
  - Its quality should have a recognized impact on the quality of M&S efforts

- Outline data quality procedures for the chosen DB
  - Identify its "customers", purposes, owners, sources, & other stakeholders
  - Identify its generation/manipulation processes & their owners & relationships
  - Identify applicable VV&C techniques
  - Define appropriate metadata & strawman metadata model
  - Create a process management plan for the DB, addressing organizational issues such as authorizing/empowering/supporting responsible parties
  - Analyze & estimate the costs of applying these procedures to the DB

Can we afford to improve data quality?

- **Data VV&C would be expensive**
  - Monitoring, measuring, testing, evaluating data
  - Storing, maintaining, propagating metadata
  - Maintaining control over data generation/manipulation processes

- **But what good is data without this?**
  - How can we believe the results of simple queries?
  - Let alone the results of running models that use data of unknown quality?

- **Can we afford *NOT* to improve data quality?**
  - (Rhetorical)

References

Data Quality Management and Technology
by Thomas C. Redman
Bantam Books, Oct. 1992 (ISBN 0-553-09149-2)

Designing Quality Databases with IDEF1X Information Models
by: Thomas A. Bruce
Dorset House, 1992 (ISBN 0-932633-18-8)

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United States Department of the Interior

GEOLOGICAL SURVEY
Reston, VA 22092

TAKE PRIDE IN AMERICA

In Reply Refer To:
Mail Stop 519

MEMORANDUM

January 27, 1994

To: FGDC Standards Working Group

From: Chairman, FGDC Standards Working Group

Subject: Draft Content Standards for Spatial Metadata

Attached is the version of the Content Standards for Spatial Metada that resulted from the FGDC Standards Working Group Meeting of January 25, 1994. The FGDC Coordination Group has received a copy and has been asked to review it by their next meeting at the end of February. The plan is for the FGDC Steering Committee to approve the Standard at their March 2, 1994, meeting. Please give this version a final review. Submit any comments you have directly to Mike Domaratz (Telephone: 703-648-4533; FAX: 703-648-5755) by February 11, 1994. Thanks in advance for all your help.

Stephen C. Guptill

Stephen C. Guptill

Attachment

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Draft

Content Standards for Spatial Metadata

Federal Geographic Data Committee

January 25, 1994

Federal Geographic Data Committee
Department of Agriculture · Department of Commerce · Department of Defense · Department of Energy
Department of Housing and Urban Development · Department of the Interior · Department of State
Department of Transportation · Environmental Protection Agency
Federal Emergency Management Agency · Library of Congress
National Aeronautics and Space Administration · National Archives and Records Administration
Tennessee Valley Authority

Federal Geographic Data Committee

Established by Office of Management and Budget Circular A-16, the Federal Geographic Data Committee (FGDC) promotes the coordinated development, use, sharing, and dissemination of geographic data.

The FGDC is composed of representatives from the Departments of Agriculture, Commerce, Defense, Energy, Housing and Urban Development, the Interior, State, and Transportation; the Environmental Protection Agency; the Federal Emergency Management Agency; the Library of Congress; the National Aeronautics and Space Administration; the National Archives and Records Administration; and the Tennessee Valley Authority. Additional Federal agencies participate on FGDC subcommittees and working groups. The Department of the Interior chairs the committee.

FGDC subcommittees work on issues related to data categories coordinated under the circular. Subcommittees establish and implement standards for data content, quality, and transfer; encourage the exchange of information and the transfer of data; and organize the collection of geographic data to reduce duplication of effort. Working groups are established for issues that transcend data categories.

For more information about the committee, or to be added to the newsletter mailing list, please contact:

Federal Geographic Data Committee Secretariat
c/o U.S. Geological Survey
590 National Center
Reston, Virginia 22092

Facsimile: (703) 648-5755
Internet: gdc@usgs.gov

Table of Contents

Metadata

0 Metadata -- data about the content, quality, condition, and other characteristics about data.
Type: compound

0.1 Metadata Element Context Syntax:

Metadata =
Identification_Information +
(Spatial_Reference) +
Status_Information +
0{Source_Information}n +
Processing_History_Information +
Entity/Attribute_Information
Distribution_Information +
Metadata_Reference_Information +

Identification Information

1 Identification Information -- identifiers and basic information about the data set.
Type: compound

1.1 Data Set Identity -- the name or title by which the data set is known.
Type: text
Domain: free text

1.2 Identification Code -- unique item or stock code by which the item can be ordered.
Type: text
Domain: free text "Not applicable" "Unknown"

1.3 Data Set Description -- a description of the spatial data set, including its intended use and limitations.
Type: text
Domain: free text

1.4 Theme -- subjects covered by the data set.
Type: compound

1.4.1 Theme Keyword -- common-use word or phrase used to describe the thematic content of a data set.
Type: text
Domain: free text (see Appendix B for the default domain)

1.4.2 Theme Keyword Thesaurus -- reference to a formally registered thesausus or similar authoritative source of theme keywords.
Type: text
Domain: free text "None" (see Appendix B for the draft thesaurus title)

1.5 Data Currentness and Quality Summary -- a general assessment of currentness and quality of the non-positional aspects of the data set. See section 3, "Spatial Data Quality," of the Spatial Data Transfer Standard (Federal Information Processing Standard 173), for additional background on accuracy assessments.
Type: compound

1.5.1 Beginning Date of Information Content -- earliest or only date for which the data are valid. In cases when a range of dates are provided, this is the earliest date for which the information are valid.
Type: date

1.5.2 Ending Date of Information Content -- latest date for which the information are valid. Used in cases when a range of dates are provided.
Type: date

1.5.3 Thematic Quality -- an assessment of the certainty of the identification of entities and assignment of attribute values in the data set.
Type: compound

1.5.3.1 Quantitative Thematic Accuracy Assessment -- numeric value assigned to the certainty of the identification of the entities and assignments of values in the data set and the description of the tests used.
Type: compound

1.5.3.1.1 Thematic Accuracy -- an estimate of the certainty of the identification of the entities and assignments of values in the data set, expressed as a percentage.

Type: integer

Domain: 0 <= Thematic Accuracy <= 100 "Unknown" "Not applicable"

1.5.3.1.2 Thematic Accuracy Explanation -- a definition of the thematic accuracy measure, and a description of how the estimate was derived.

Type: text

Domain: free text

1.5.3.2 Qualitative Thematic Accuracy Assessment -- an explanation of the certainty of the identification of the entities and assignments of values in the data set and the tests used.

Type: text

Domain: free text

1.5.4 Logical Consistency -- an explanation of the fidelity of the relationships in the data set and the tests used.

Type: text

Domain: free text "Not applicable" "Unknown"

1.5.5 Completeness -- information about omissions, selection criteria, generalization, definitions used, and other rules used to derive the data set.

Type: text

Domain: free text "Not applicable" "Unknown"

1.5.6 Horizontal Positional Quality -- an estimate of locational certainty of the horizontal positions of the spatial objects.

Type: compound

1.5.6.1 Quantitative Horizontal Positional Accuracy Assessment -- numeric value of the locational certainty of a horizontal coordinate measurement and a description of the tests used.

Type: compound

1.5.6.1.1 Horizontal Positional Accuracy -- an estimate of the locational certainty of the horizontal coordinate measurement in the data set expressed in meters.

Type: real

1.5.6.1.2 Horizontal Positional Accuracy Explanation -- a definition of the horizontal positional accuracy measure and how the estimate was derived.

Type: text

Domain: free text

1.5.6.2 Qualitative Horizontal Positional Accuracy Assessment -- an explanation of the locational certainty of a horizontal coordinate measurement and a description of the tests used.

Type: text

Domain: free text "Not applicable"

1.5.7 Vertical Positional Quality -- an estimate of locational certainty of the vertical positions of the spatial objects.
Type: compound

1.5.7.1 Quantitative Vertical Positional Accuracy Assessment -- numeric value of the locational certainty of a vertical coordinate measurement and a description of the tests used.
Type: compound

1.5.7.1.1 Vertical Positional Accuracy -- an estimate of the locational certainty of the vertical coordinate measurement in the data set expressed in meters.
Type: real

1.5.7.1.2 Vertical Positional Accuracy Explanation -- a definition of the vertical positional accuracy measure and how the estimate was derived.
Type: text
Domain: free text

1.5.7.2 Qualitative Vertical Positional Accuracy Assessment -- an explanation of the locational certainty of a vertical coordinate measurement and a description of the tests used.
Type: text
Domain: free text

1.5.8 Cloud Cover -- area of a data set obstructed by clouds, expressed as a percentage of the spatial extent.
Type: integer
Domain: 0 <= Cloud Cover <= 100 "Unknown"

1.6 Bounding Coordinates - the limits of coverage of a data set expressed by latitude and longitude values in the order western-most, eastern-most, northern-most, and southern-most.
Type: compound

1.6.1 West Bounding Coordinate -- western-most coordinate of the limit of coverage.
Type: compound

1.6.2 East Bounding Coordinate -- eastern-most coordinate of the limit of coverage.
Type: compound

1.6.3 North Bounding Coordinate -- northern-most coordinate of the limit of coverage.
Type: compound

1.6.4 South Bounding Coordinate -- southern-most coordinate of the limit of coverage.
Type: compound

1.7 Data Set G-Polygon -- the interior area(s) covered by a data set.
Type: compound

1.7.1 Data Set G-Polygon Outer G-Ring -- the closed nonintersecting boundary of an interior area.
Type: compound

1.7.2 Data Set G-Polygon Exclusion G-Ring -- the closed nonintersecting boundary of a void area (or "hole") in an interior area.

Type: compound

1.8 Geographic Keyword -- the names and types of significant areas and or places that fall within the extent of the data set.

Type: compound

1.8.1 Geographic Keyword Name -- the geographic name of significant areas and or places that fall within the extent of the data set.

Type: text
Domain: free text

1.8.2 Geographic Keyword Type -- the geographic type of significant areas and or places that fall within the extent of the data set.

Type: text
Domain: "airport" "arch" "area" "arroyo" "bar" "basin" "bay" "beach" "bench" "bend" "bridge" "building" "canal" "cape" "cave" "cemetery" "census unit" "channel" "church" "city" "cliff" "county" "crater" "crossing" "dam" "falls" "flat" "forest" "gap" "geyser" "glacier" "gut" "harbor" "hospital" "island" "isthmus" "lake" "lava" "levee" "locale" "mine" "minor civil division" "nation" "oilfield" "park" "pillar" "plain" "range" "rapids" "reserve" "reservoir" "ridge" "school" "sea" "slope" "spring" "state/territory" "stream" "summit" "swamp" "trail" "tower" "tunnel" "valley" "well" "woods" free text

1.9 Browse Graphic -- a graphic that provides an illustration of the data set. The graphic should include a legend for interpreting the graphic.

Type: compound

1.9.1 Browse Graphic File Name -- name of a related graphic file that provides an illustration of the data set, including a legend for interpreting the graphic.

Type: text
Domain: free text

1.9.2 Browse Graphic File Description -- a text description of the illustration.

Type: text
Domain: free text

1.9.3 Browse Graphic File Type -- graphic file type of a related graphic file.

Type: text
Domain:

Domain Value	Definition
"CGM"	Computer Graphics Metafile
"GIF"	Graphic Interchange Format
"JPEG"	Joint Photographic Experts Group format
"PS"	Postscript format
"TIFF"	Tagged Image File Format

1.10 Data Set Citation -- the recommended reference to be used for the data set

Type: text
Domain: free text
Form: For recommended forms, see Patrias, Karen, 1991, National Library of Medicine recommended formats for bibliographic citations (April): Bethesda, Maryland, U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Library of Medicine; and Clark, Suzanne, Larsgaard, Mary, and Teague, Cynthia, 1992, Cartographic citations a style guide: Chicago, American Library Association, Map and Geography Roundtable.

1.11 Native Data Set Environment -- a description of the data set in the producer's processing environment. For digital data, include items such as the name of the software (including version), the computer operating system, file name (including host-, path-, and filenames), and the data set size. For non-digital spatial data (such as maps), include a discussion of the medium and the scale.

Type: text
Domain: free text

1.12 Use Restrictions -- terms, including copyright, governing the use of the data set after access has been provided.

Type: text
Domain: free text

1.13 Access Restrictions -- restrictions imposed on access or distribution of the data set.

Type: text
Domain: free text

1.14 Security Information -- handling restrictions imposed on the data set because of national security, privacy, or other concerns.

Type: compound

1.14.1 Security Classification -- name of the handling restrictions on the data set.

Type: text
Domain: "Top secret" "Secret" "Confidential" "Restricted" "Unclassified" free text

1.14.2 Security Handling Description -- additional information about the restrictions on handling the data set.

Type: text
Domain: free text

1.15 String -- A connected nonbranching ordered sequence of points.

Type: compound

1.16 Latitude -- angular distance measured on a meridian north or south from the equator Expressed in degrees.

Type: real
Domain: -90.0 <= Latitude <= 90.0

1.17 Longitude -- the angle between the plane of a given meridian and the plane of the meridian of Greenwich. Expressed in degrees.

Type: real
Domain: -180.0 <= Longitude < 180.0

1.18 Identification Element Context Syntax:

```
Identification_Information =
        Data_Set_Identity +
        Identification_Code +
        Data_Set_Description +
        Theme +
        Data_Currentness_and_Quality_Summary +
        Bounding_Coordinates +
        (1{Data_Set_G-Polygon}n) +
        (1{Geographic_Keyword}n) +
        (1{Browse_Graphic}n)
        (Data_Set_Citation) +
        (Native_Data_Set_Environment) +
        (Use_Restrictions) +
        (Access_Restrictions)+
        (Security_Information)

  Theme =
        1{ 1{Theme_Keywords}n +
           Theme_Keyword_Thesausus}n

  Data_Currentness_and_Quality_Summary =
        Beginning_Date_of_Information_Content +
        (Ending_Date_of_Information_Content) +
        Thematic_Quality +
        Logical_Consistency +
        Completeness +
        Horizontal_Positional_Quality +
        (Vertical_Positional_Quality) +
        (Cloud_Cover)

    Thematic_Quality =
        [Quantitative_Thematic_Accuracy_Assessment |
           Qualitative_Thematic_Accuracy_Assessment]

      Quantitative_Thematic_Accuracy_Assessment =
        Thematic_Accuracy +
        Thematic_Accuracy_Explanation

    Horizontal_Positional_Quality =
        [Quantitative_Horizontal_Positional_Accuracy_Assessment
           Qualitative_Horizontal_Positional_Accuracy_Assessment]

      Quantitative_Horizontal_Positional_Accuracy_Assessment =
        Horizontal_Positional_Accuracy +
        Horizontal_Positional_Accuracy_Explanation

    Vertical_Positional_Quality =
        [Quantitative_Vertical_Positional_Accuracy_Assessment
           Qualitative_Vertical_Positional_Accuracy_Assessment]

      Quantitative_Vertical_Positional_Accuracy_Assessment =
        Vertical_Positional_Accuracy +
        Vertical_Positional_Accuracy_Explanation
```

Bounding_Coordinates =
West_Bounding_Coordinate +
East_Bounding_Coordinate +
North_Bounding_Coordinate +
South_Bounding_Coordinate

West_Bounding_Coordinate =
Longitude

East_Bounding_Coordinate =
Longitude

North_Bounding_Coordinate =
Latitude

South_Bounding_Coordinate =
Latitude

Data_Set_G-Polygon =
Data_Set_G-Polygon_Outer_G-Ring +
0{Data_Set_G-Polygon_Exclusion_G-Ring}n

Data_Set_G-Polygon_Outer_G-Ring =
String

Data_Set_G-Polygon_Exclusion_G-Ring =
String

Geographic_Keyword =
Geographic_Keyword_Name +
Geographic_Keyword_Type

Browse_Graphic =
Browse_Graphic_File_Name +
Browse_Graphic_File_Description +
Browse_Graphic_File_Type

Security_Information =
Security_Classification +
Security_Handling_Description

String =
4{Latitude +
Longitude}n

2 Spatial Reference -- description of the locational data or references in the data set
Type: compound

2.1 Native Spatial Data Structure -- the mechanism used to represent spatial information in the data set.
Type: text
Domain: "Point" "Vector" "Raster" "Indirect"

2.2 Indirect Spatial Reference -- name of types of geographic features, addressing schemes, or other means through which locations are referenced in the data set.
Type: text
Domain: free text

2.3 Direct Spatial Reference -- description of the means and coordinate systems, and spatial objects used to encode locational information in the data set.
Type: compound

2.3.1 Horizontal Coordinate System Definition -- the reference frame or system from which linear or angular quantities are measured and assigned to the position that a point occupies.
Type: compound

2.3.1.1 Geographic -- the quantities of latitude and longitude which define the position of a point on the Earth's surface with respect to a reference spheroid.
Type: compound

2.3.1.1.1 Geographic Coordinate Units -- units of measure used for the latitude and longitude values.
Type: text
Domain: "Decimal degrees" "Degrees and decimal minutes" "Degrees, minutes, and decimal seconds" "Radians" "Grads"

2.3.1.2 Planar -- the quantities of distances, or distances and angles, which define the position of a point on a reference plane to which the surface of the Earth has been projected.
Type: compound

2.3.1.2.1 Map Projection -- the systematic representation of all or part of the surface of the Earth on a plane or developable surface. (A developable surface is one that can be flattened to form a plane without compressing or stretching any part of it. Examples include cones and cylinders.)
Type: compound

2.3.1.2.1.1 Map Projection Name -- name of the map projection.
Type: text
Domain: "Albers Conical Equal Area" "Azimuthal Equidistant" "Equidistant Conic" "Equirectangular" "General Vertical Near-sided Projection" "Gnomomic" "Lambert Azimuthal Equal Area" "Lambert Conformal Conic" "Mercator" "Modified Stereographic for Alaska"

"Miller Cylindrical" "Oblique Mercator" "Orthographic" "Polar Stereographic" "Polyconic" "Robinson" "Sinusoidal" "Space Oblique Mercator" "Stereographic" "Transverse Mercator" "van der Grinten"

2.3.1.2.1.2 Albers Conical Equal Area, Azimuthal Equidistant, Equidistant Conic, Equirectangular, General Vertical Near-sided Projection, Gnomomic, Lambert Azimuthal Equal Area, Lambert Conformal Conic, Mercator, Modified Stereographic for Alaska, Miller Cylindrical, Oblique Mercator, Orthographic, Polar Stereographic, Polyconic, Robinson, Sinusoidal, Space Oblique Mercator, Stereographic, Transverse Mercator, van der Grinten -- specific map projections, each having a unique mathematical relationship between the Earth and the plane or developable surface.

Type: compound

2.3.1.2.1.2.1 Standard Parallel -- line of constant latitude at which the surface of the Earth and the plane or developable surface intersect.

Type: compound

2.3.1.2.1.2.2 Longitude of Central Meridian -- the line of longitude at the center of a map projection generally used as the basis for constructing the projection.

Type: compound

2.3.1.2.1.2.3 Latitude of Projection Origin -- latitude chosen as the origin of rectangular coordinates for a map projection

Type: compound

2.3.1.2.1.2.4 False Easting -- the value added to all "x" values in the rectangular coordinates for a map projection. This value frequently is assigned to eliminate negative numbers. Expressed in the unit of measure identified in Planar Coordinate Units.

Type: real
Domain: False Easting >= 0.0

2.3.1.2.1.2.5 False Northing -- the value added to all "y" values in the rectangular coordinates for a map projection. This value frequently is assigned to eliminate negative numbers. Expressed in the unit of measure identified in Planar Coordinate Units.

Type: real
Domain: False Northing >= 0.0

2.3.1.2.1.2.6 Scale Factor at Equator -- a multiplier for reducing a distance obtained from a map by computation or scaling to the actual distance along the equator.

Type: real
Domain: Scale Factor at Equator > 0.0

2.3.1.2.1.2.7 Height of Perspective Point Above Surface -- height of viewpoint above the round body, expressed in meters.
Type: real
Domain: Height of Perspective Point Above Surface > 0.0

2.3.1.2.1.2.8 Longitude of Projection Center -- longitude of the point of projection for azimuthal projections.
Type: compound

2.3.1.2.1.2.9 Latitude of Projection Center -- latitude of the point of projection for azimuthal projections.
Type: compound

2.3.1.2.1.2.10 Scale Factor at Center Line -- a multiplier for reducing a distance obtained from a map by computation or scaling to the actual distance along the center line.
Type: real
Domain: Scale Factor at Center Line > 0.0

2.3.1.2.1.2.11 Oblique Line Description -- method used to describe the line along which an oblique mercator map projection is centered.
Type: compound

2.3.1.2.1.2.11.1 Azimuthal Description -- description of the center line using the map projection origin and an azimuth.
Type: compound

2.3.1.2.1.2.11.1.1 Azimuthal Angle -- angle measured clockwise from north, and expressed in degrees.
Type: real
Domain: 0.0 <= Azimuthal Angle < 360.0

2.3.1.2.1.2.11.1.2 Azimuth Measure Point Longitude -- longitude of the map projection origin.
Type: compound

2.3.1.2.1.2.11.2 Two-Point Description -- two points near the limits of the mapped region that define the center line.
Type: compound

2.3.1.2.1.2.12 Straight Vertical Longitude from Pole -- longitude to be oriented straight up from the North or South Pole.
Type: compound

2.3.1.2.1.2.13 Scale Factor at Projection Origin -- a multiplier for reducing a distance obtained from a map by computation or scaling to the actual distance at the projection origin.
Type: real
Domain: Scale Factor at Projection Origin > 0.0

2.3.1.2.1.2.14 Landsat Number -- number of the Landsat satellite.

Type: Integer

Domain: 0 < Landsat Number < 5

2.3.1.2.1.2.15 Path Number -- number of the orbit of the Landsat satellite.

Type: integer

Domain: 0 < Path Number < 251 for Landsats 1, 2, or 3

0 < Path Number < 233 for Landsats 4 or 5

2.3.1.2.1.2.16 Scale Factor at Central Meridian -- a multiplier for reducing a distance obtained from a map by computation or scaling to the actual distance along the central meridian.

Type: real

Domain: Scale Factor at Central Meridian > 0.0

2.3.1.2.1.3 Map Projection Coordinate Units -- units of measure used for the cartesian coordinate system.

Type: text

Domain: free text "Unknown" "Not applicable"

2.3.1.2.2 Grid Coordinate System -- a plane-rectangular coordinate system usually based on, and mathematically adjusted to, a map projection so that geographic positions can be readily transformed to plane coordinates.

Type: compound

2.3.1.2.2.1 Grid Coordinate System Name -- name of the grid coordinate system.

Type: text

Domain: "Universal Transverse Mercator"

"Universal Polar Stereographic"

"State Plane Coordinate System 1927"

"State Plane Coordinate System 1983"

2.3.1.2.2.2 Universal Transverse Mercator -- a grid system based on the transverse mercator projection, applied between latitudes 84 degrees north and 80 degrees south on the Earth's surface.

Type: compound

2.3.1.2.2.2.1 UTM Zone Number -- identifier for the UTM zone.

Type: integer

Domain: 1 <= UTM Zone Number <= 60

2.3.1.2.2.3 Universal Polar Stereographic -- a grid system based on the polar stereographic projection, applied to the Earth's polar regions north of 84 degrees north and south of 80 degrees south.

Type: compound

2.3.1.2.2.3.1 UPS Zone Identifier -- identifier for the UPS zone.

Type: text

Domain: UPS Zone Identifier = ["A" | "B" | "Y" | "Z"]

2.3.1.2.2.4 State Plane Coordinate System -- a plane-rectangular coordinate system established by the National Geodetic Survey, one for each state in the United States.
Type: compound

2.3.1.2.2.4.1 SPCS Zone Identifier -- identifier for the SPCS zone.
Type: text
Domain: valid SPCS zone identifiers.

2.3.1.2.2.5 Geodetic Model -- parameters for the shape of the earth used for the map projection or grid system.
Type: compound

2.3.1.2.2.5.1 Horizontal Datum Name -- the identification given to the reference system used for defining the coordinates of points.
Type: text
Domain: free text "North American Datum of 1927" "North American Datum of 1983"

2.3.1.2.2.5.2 Ellipsoid -- a mathematical figure generated by the revolution of the ellipse about one of its axes. The ellipsoid that approximates the geoid is an ellipse rotated about its minor axis.
Type: compound

2.3.1.2.2.5.2.1 Ellipsoid Name -- identification given to established representations of the Earth's shape.
Type: text
Domain: free text "Clarke 1866" "Geodetic Reference System 80"

2.3.1.2.2.5.2.2 Semi-major Axis -- radius of the equatorial axis of the ellipsoid.
Type: real
Domain: Semi-major Axis > 0.0

2.3.1.2.2.5.2.3 Denominator of Flattening Ratio -- the denominator of the ratio of the difference between the equatorial and polar radii of the ellipsoid when the numerator is set to 1.
Type: real
Domain: Denominator of Flattening > 0.0

2.3.1.2.2.5.2.4 Semi-minor Axis -- radius of the polar axis of the ellipsoid.
Type: real
Domain: Semi-minor Axis > 0.0; Semi-minor Axis < Semi-major Axis

2.3.1.2.3 Local Planar -- any right-handed planar coordinate system of which the z-axis coincides with a plumb line through the origin that locally is aligned with the surface of the Earth.
Type compound

2.3.1.2.3.1 Local Planar Description -- a description of the local planar system that is not explicitly linked to an established Earth reference system.
Type: text
Domain: free text

2.3.1.2.3.2 Planar Georeference Information -- a description of the information provided to register the local planar system to the Earth (e.g. control points, satellite ephemeral data, inertial navigation data).
Type: text
Domain: free text

2.3.1.2.4 Planar Distance Units -- units of measure used for distances.
Type: text
Domain: free text "meters" "international feet" "survey feet"

2.3.1.3 Local -- a description of any coordinate system that is not aligned with the surface of the Earth.
Type: compound

2.3.1.3.1 Local Description -- a description of the coordinate system and its orientation to the surface of the Earth.
Type: text
Domain: free text

2.3.1.3.2 Local Georeference Information -- a description of the information provided to register the local system to the Earth (e.g. control points, satellite ephemeral data, inertial navigation data).
Type: text
Domain: free text

2.3.2 Vertical Coordinate System Definition -- the reference frame or system from which vertical distances (elevations or depths) are measured.
Type: compound

2.3.2.1 Elevation System Definition -- the reference frame or system from which elevations are measured.
Type: compound

2.3.2.1.1 Elevation Datum Name -- the identification given to the level surface taken as the surface of reference from which elevations are measured.
Type: text
Domain: free text "National Geodetic Vertical Datum of 1929" "North American Vertical Datum of 1988"

2.3.2.1.2 Elevation Distance Units -- units in which elevations are recorded.
Type: text
Domain: free text "meters" "feet"

2.3.2.2 Depth System Definition -- the reference frame or system from which elevations are measured.
Type compound

2.3.2.2.1 Depth Datum Name -- the identification given to the level surface taken as the surface of reference from which elevations are measured.

Type: text

Domain: "Chart datum; datum for sounding reduction"
"Lowest astronomical tide"
"Highest astronomical tide" "Mean low water"
"Mean high water" "Mean sea level"
"Land survey datum"
"Mean low water springs"
"Mean high water springs"
"Mean low water neap"
"Mean high water neap"
"Mean lower low water"
"Mean lower low water springs"
"Mean higher high water"
"Mean higher low water"
"Mean lower high water" "Spring tide"
"Tropic lower low water" "Neap tide"
"High water" "Higher high water"
"Low water" "Low-water datum"
"Lowest low water" "Lower low water"
"Lowest normal low water" "Mean tide level"
"Indian spring low water"
"High-water full and charge"
"Low-water full and charge"
"Columbia River datum"
"Gulf Coast low water datum"
"Equatorial springs low water"
"Approximate lowest astronomical tide"
"No correction" free text

2.3.2.2.2 Depth Distance Units -- units in which elevations are recorded.

Type: text

Domain: free text "meters" "feet"

2.3.3 Point/Vector Object Information -- means of encoding locations for, and types and numbers of, point or vector spatial objects in the data set.

Type: compound

2.3.3.1 Point/Vector Positional Representation -- means of encoding, and resolution of, horizontal and vertical coordinates of point of vector spatial objects.

Type: compound

2.3.3.1.1 Point/Vector Horizontal Position -- means of encoding, and the resolution of, horizontal coordinates of point or vector spatial objects.

Type: compound

2.3.3.1.1.1 Point/Vector Horizontal Encoding Method -- the means used to represent the horizontal position of point or vector spatial objects.

Type: text

Domain: "coordinate pair" "distance/bearing"

2.3.3.1.1.2 Coordinate Pair Representation -- the method of encoding the position of a point by measuring its distance from perpendicular reference axes (the "coordinate pair" method).
Type: compound

2.3.3.1.1.2.1 Abscissa Resolution -- the minimum distance between the "x" or longitude values of two adjacent points. expressed in (ground) meters or degrees.
Type: real
Domain: Abscissa Resolution > 0.0

2.3.3.1.1.2.2 Ordinate Resolution -- the minimum distance between the "y" or latitude values of two adjacent points. expressed in (ground) meters or degrees.
Type: real
Domain: Ordinate Resolution > 0.0

2.3.3.1.1.2.3 Coordinate Pair Resolution Units -- the units of measure in which the Abscissa Resolution and Ordinate Resolution data elements are expressed.
Type: text
Domain: "meters" "degrees"

2.3.3.1.1.3 Distance/Bearing Representation -- a method of encoding the position of a point by measuring its distance and direction (azimuth angle) from another point.
Type: compound

2.3.3.1.1.3.1 Distance Resolution -- the minimum distance measurable between two points, expressed in (ground) meters.
Type: real
Domain: Distance Resolution > 0.0

2.3.3.1.1.3.2 Bearing Resolution -- the minimum angle measurable between two points, expressed in degrees.
Type: real
Domain: Bearing Resolution > 0.0

2.3.3.1.1.3.3 Bearing Reference Direction -- direction from which the bearing is measured.
Type: text
Domain: "North" "South"

2.3.3.1.1.3.4 Bearing Reference Meridian -- axis from which the bearing is measured.
Type: text
Domain: "Assumed" "Grid" "Magnetic" "Astronomic" "Geodetic"

2.3.3.1.1.4 Point/Vector Vertical Position -- means of encoding, and the resolution of, elevations of point or vector spatial objects.
Type: compound

2.3.3.1.1.4.1 Point/Vector Vertical Encoding Method -- the means used to encode the elevation of point or vector spatial objects.
Type: text

Domain: "Vertical coordinate included with horizontal coordinates" "Attribute values"

2.3.3.1.1.4.2 Point/Vector Vertical Resolution -- the minimum distance between two adjacent elevation values, expressed in meters. Used when elevation is expressed as a coordinate.

Type: real
Domain: Point/Vector Vertical Resolution > 0.0

2.3.3.2 Point Object Information -- types and numbers of point spatial objects in the data set. This term is used when points are used exclusively in the data set.

Type: compound

2.3.3.2.1 Point Object Type -- name of point spatial objects used to locate zero-dimensional geometric locations in the data set.

Type: text
Domain: "Point" "Entity point" "Label point" "Area point"

2.3.3.2.2 Point Object Count -- number of each point object type used in the data set.

Type: integer
Domain: Point Object Count > 0

2.3.3.3 Vector Object Information -- means of encoding locations and types and number of vector spatial objects used in the data set.

Type: compound

2.3.3.3.1 Vector Object Type -- name of vector spatial objects used to locate zero-, one-, or two-dimensional geometric locations in the data set.

Type: text
Domain: "Point" "Entity point" "Label point" "Area point"
"Node, planar graph" "Node, network" "String"
"Link" "Complete chain" "Area chain"
"Network chain, planar graph"
"Network chain, nonplanar graph"
"Circular arc, three point center" "Elliptical arc"
"Uniform B-spline" "Piecewise Bezier"
"Ring with mixed composition"
"Ring composed of strings"
"Ring composed of chains"
"Ring composed of arcs" "G-polygon"
"GT-polygon composed of rings"
"GT-polygon composed of chains"
"Universe polygon composed of rings"
"Universe polygon composed of chains"
"Void polygon composed of rings"
"Void polygon composed of chains"

2.3.3.3.2 Vector Object Count -- number of each vector object type used in the data set

Type integer
Domain Vector Object Count > 0

2.3.4 670 Raster Object Information -- means of encoding locations for, and types and numbers, of raster spatial objects in the data set.
Type: compound

2.3.4.1 Raster Position Representation -- means of encoding, and resolution of, horizontal and vertical coordinates of raster spatial objects.
Type: compound

2.3.4.1.1 Raster Horizontal Position -- means of encoding, and the resolution of, horizontal coordinates of raster spatial objects.
Type: compound

2.3.4.1.1.1 Raster Horizontal Encoding Method -- the means used to represent the horizontal position of raster spatial objects.
Type: text
Domain: "explicit coordinate" "implicit coordinate"

2.3.4.1.1.2 Row Resolution -- the distance between adjacent rows, expressed in (ground) meters or degrees.
Type: real
Domain: Row Resolution > 0.0 "varies"

2.3.4.1.1.3 Column Resolution -- the distance between adjacent columns, expressed in (ground) meters or degrees.
Type: real
Domain: Column Resolution > 0.0 "varies"

2.3.4.2 Raster Horizontal Distance Units -- the units of measure in which the Row Resolution and Column Resolution data elements are expressed.
Type: text
Domain: "meters" "degrees"

2.3.4.3 Raster Vertical Position -- the means used to represent and the resolution of the elevation of raster spatial objects.
Type: compound

2.3.4.3.1 Raster Vertical Encoding Method -- the means used to represent the vertical position of raster spatial objects.
Type: text
Domain: "Explicit vertical coordinates" "Attribute values" "Implicit vertical coordinates"

2.3.4.3.2 Raster Vertical Resolution -- the minimum distance between two adjacent elevation values, expressed in meters. Used when elevation is expressed as a coordinate or index.
Type: real
Domain: Raster Vertical Resolution > 0.0

2.3.4.4 Raster Object Type -- raster spatial objects used to locate zero-or two-dimensional geometric locations in the data set.
Type: text
Domain: "Point" "Pixel" "Grid Cell" "Voxel"

2.3.4.5 Raster Object Count -- number of spatial objects of the raster object type used in the data set.

Type: integer

Domain: Raster Object Count > 0;

in planar cases,

Raster Object Count <= Row Count * Column Count;

in volumetric cases,

Raster Object Count <= Row Count * Column Count * Depth Count

2.3.4.6 Row Count -- the maximum number of raster objects along the ordinate (y) axis. For use with rectangular raster objects.

Type: Integer

Domain: Row Count > 0

2.3.4.7 Column Count -- the maximum number of raster objects along the abscissa (x) axis. For use with rectangular raster objects.

Type: Integer

Domain: Column Count > 0

2.3.4.8 Depth Count -- the maximum number of raster objects along the depth (z) axis. For use with rectangular volumetric raster objects (voxels).

Type: Integer

Domain: Depth Count > 0

2.4 Spatial Reference Element Context Syntax:

Spatial_Reference =

Native_Spatial_Data_Structure +
[Indirect_Spatial_Reference |
Direct_Spatial_Reference |
Indirect_Spatial_Reference +
Direct_Spatial_Reference]

Direct_Spatial_Reference =

Horizontal_Coordinate_System_Definition +
(Vertical_Coordinate_System_Definition) +
[Point/Vector_Object_Information |
Raster_Object_Information]

Horizontal_Coordinate_System_Definition =

[Geographic |
1{Planar}n |
Local]

Geographic =

Geographic_Coordinate_Units +
Geodetic_Model

Planar =

[Map_Projection |
Grid_Coordinate_System |
Local_Planar] +
Planar_Distance_Units

Map_Projection =

Map_Projection_Name +
[Albers_Conical_Equal_Area |
Azimuthal_Equidistant |
Equidistant_Conic |
Equirectangular |
General_Vertical_Near-sided_Perspective |
Gnomonic |
Lambert_Azimuthal_Equal_Area |
Lambert_Conformal_Conic |
Mercator |
Modified_Stereographic_for_Alaska |
Miller_Cylindrical |
Oblique_Mercator |
Orthographic |
Polar_Stereographic |
Polyconic |
Robinson |
Sinusoidal |
Space_Oblique_Mercator |
Stereographic |
Transverse_Mercator |
van_der_Grinten] +
Geodetic_Model

Albers_Conical_Equal_Area =

1{Standard_Parallel}2 +
Longitude_of_Central_Meridian +
Latitude_of_Projection_Origin +
False_Easting +
False_Northing

Azimuthal_Equidistant =

Longitude_of_Central_Meridian +
Latitude_of_Projection_Origin +
False_Easting +
False_Northing

Equidistant_Conic =

1{Standard_Parallel}2 +
Longitude_of_Central_Meridian +
Latitude_of_Projection_Origin +
False_Easting +
False_Northing

Equirectangular =

Standard_Parallel +
Longitude_of_Central_Meridian +
False_Easting +
False_Northing

General_Vertical_Near-sided_Perspective =

Height_of_Perspective_Point_Above_Surface +
Longitude_of_Projection_Center +
Latitude_of_Projection_Center +
False_Easting +
False_Northing

Gnomonic =
Longitude_of_Projection_Center +
Latitude_of_Projection_Center +
False_Easting +
False_Northing

Lambert_Azimuthal_Equal_Area =
Longitude_of_Projection_Center +
Latitude_of_Projection_Center +
False_Easting +
False_Northing

Lambert_Conformal_Conic =
1{Standard_Parallel}2 +
Longitude_of_Central_Meridian +
Latitude_of_Projection_Origin +
False_Easting +
False_Northing

Mercator =
[Standard_Parallel |
Scale_Factor_at_Equator] +
Longitude_of_Central_Meridian +
False_Easting +
False_Northing

Modified_Stereographic_for_Alaska =
False_Easting +
False_Northing

Miller_Cylindrical =
Longitude_of_Central_Meridian +
False_Easting +
False_Northing

Oblique_Mercator =
Scale_Factor_at_Center_Line +
Oblique_Line_Description +
Latitude_of_Projection_Origin +
False_Easting +
False_Northing

Oblique_Line_Description =
[Azimuthal_Description |
Two-Point_Description]

Azimuthal_Description =
Azimuthal_Angle +
Azimuth_Measure_Point_Longitude

Azimuth_Measure_Point_Longitude =
Longitude

Two-Point_Description =
2{Latitude +
Longitude}2

Orthographic =

Longitude_of_Projection_Center +
Latitude_of_Projection_Center +
False_Easting +
False_Northing

Polar_Stereographic =

Straight-Vertical_Longitude_from_Pole +
[Standard_Parallel |
Scale_Factor_at_Projection_Origin] +
False_Easting +
False_Northing

Straight-Vertical_Longitude_from_Pole =
Longitude

Polyconic =

Longitude_of_Central_Meridian +
Latitude_of_Projection_Origin +
False_Easting +
False_Northing

Robinson =

Longitude_of_Projection_Center +
False_Easting +
False_Northing

Sinusoidal =

Longitude_of_Central_Meridian +
False_Easting +
False_Northing

Space_Oblique_Mercator =
Landsat_Number +
Path_Number +
False_Easting +
False_Northing

Stereographic =

Longitude_of_Projection_Center +
Latitude_of_Projection_Center +
False_Easting +
False_Northing

Transverse_Mercator =
Scale_Factor_at_Central_Meridian +
Longitude_of_Central_Meridian +
Latitude_of_Projection_Origin +
False_Easting +
False_Northing

van_der_Grinten =
Longitude_of_Central_Meridian +
False_Easting +
False_Northing

Standard_Parallel =
Latitude

Longitude of Central Meridian =
Longitude

Latitude of Projection Origin =
Latitude

Longitude of Projection Center =
Longitude

Latitude of Projection Center =
Latitude

Grid_Coordinate_System =
Grid_Coordinate_System_Name +
[Universal_Transverse_Mercator |
Universal_Polar_Stereographic |
State_Plane_Coordinate_System] +
Geodetic_Model

Universal_Transverse_Mercator =
UTM_Zone_Number +
Transverse_Mercator

Universal_Polar_Stereographic =
UPS_Zone_Identifier +
Polar_Stereographic

State_Plane_Coordinate_System =
SPCS_Zone_Identifier +
[Lambert_Conformal_Conic |
Transverse_Mercator |
Oblique_Mercator |
Polyconic]

Geodetic_Model =
(Horizontal_Datum_Name) +
Ellipsoid

Ellipsoid =
Ellipsoid_Name +
Semi-major_Axis +
[Denominator_of_Flattening_Ratio |
Semi-minor_Axis]

Local_Planar =
Local_Planar_Description +
Planar_Georeference_Information

Local =
Local_Description +
Local_Georeference_Information

Vertical_Coordinate_System_Definition =
(Elevation_System_Definition) +

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(Depth_System_Definition)

Elevation_System_Definition =

Elevation_Datum_Name +
Elevation_Distance_Units

Depth_System_Definition =

Depth_Datum_Name +
Depth_Distance_Units

Point Vector_Object_Information =

Point/Vector_Position_Representation +
([Point_Object_Information |
Vector_Object_Information])

Point/Vector_Position_Representation =

Point/Vector_Horizontal_Position +
(Point/Vector_Vertical_Position)

Point/Vector_Horizontal_Position =

Point/Vector_Horizontal_Encoding_Method +
([Coordinate_Pair_Representation |
Distance/Bearing_Representation])

Coordinate_Pair_Representation =

Abscissa_Resolution +
Ordinate_Resolution +
Coordinate_Pair_Resolution_Units

Distance/Bearing_Representation =

Distance_Resolution +
Bearing_Resolution +
Bearing_Reference_Direction +
Bearing_Reference_Meridian

Point/Vector_Vertical_Position =

Point/Vector_Vertical_Encoding_Method +
(Point/Vector_Vertical_Resolution)

Point_Object_Information =

1{ Point_Object_Type +
(Point_Object_Count) }n

Vector_Object_Information =

1{ Vector_Object_Type +
(Vector_Object_Count) }n

Raster_Object_Information =

Raster_Position_Representation +
Raster_Object_Type +
(Raster_Object_Count) +
(Row_Count +
Column_Count +
(Depth_Count))

Raster_Position_Representation =

Raster_Horizontal_Position +

(Raster_Vertical_Position)

Raster_Horizontal_Position =
Raster_Horizontal_Encoding_Method +
(Row_Resolution +
Column_Resolution +
Raster_Horizontal_Distance_Units)

Raster_Vertical_Position =
Raster_Vertical_Encoding_Method +
(Raster_Vertical_Resolution)

Status Information

3 Status Information -- the state, release, and update information for the data set.
Type: compound

3.1 Data Set Status -- the state of the data set.
Type: text
Domain: "Available" "In work" "Planned"

3.2 Release Date -- the date by which the data set is available for release.
Type: date
Domain: free date "Unknown"

3.3 Maintenance and Update Frequency -- the frequency in days with which changes and additions are made to the data set after the initial data set.
Type: real
Domain: Maintenance and Update Frequency > 0.0 "Not applicable" "Unknown" "As needed" "Irregular"

3.4 Status Information Element Context Syntax:

Status_Information =
Data_Set_Status +
Release_Date +
Maintenance_and_Update_Frequency

Source Information

4 Source Information -- list of sources and a short discussion of the information contributed by each.

Type: compound

4.1 Source Identity -- identity of a source data set.

Type: compound

4.2 Source Contribution -- brief statement identifying the information contributed by the source to the data set.

Type: text
Domain: free text

4.3 Source Information Element Context Syntax:

Source_Information =

Source_Identity +
Source_Contribution

5 Processing History Information -- information about the events, parameters, and source data which constructed the data set, and information about the responsible parties
Type: compound

5.1 Process Step -- information about a single event.
Type: compound

5.1.1 Process Description -- an explanation of an event and related parameters or tolerances.
Type: text
Domain: free text

5.1.2 Process Date -- the date when the event was completed.
Type: date
Domain: free date "Unknown" "Not complete"

5.1.3 Process Time -- the time when the event was completed.
Type: time
Domain: free time

5.1.4 Source Identity -- identity of a source data set.
Type: compound

5.1.5 Process Contact -- the party responsible for the metadata information.
Type: compound

5.2 Processing History Information Element Context Syntax:

Processing_History_Information = 1{Process_Step}n

Process_Step = Process_Description + Process_Date + (Process_Time) + 0{Source_Identity}n + (Process_Contact)

Process_Contact = Contact_Information

6 Entity Attribute Information -- information about the entities types, their attributes, and the domains from which attribute values may be assigned that occur in the data set.
Type: compound

6.1 Entity Type -- The definition and description of a set into which similar entity instances are classified.
Type: compound

6.1.1 Entity Type Label -- the name of the entity type.
Type: text
Domain: free text

6.1.2 Entity Type Definition -- the description of the entity type.
Type: text
Domain: free text

6.1.3 Entity Type Definition Source -- the authority of the definition.
Type: text
Domain: free text

6.2 Attribute -- A defined characteristic.
Type: compound

6.2.1 Attribute Label -- the name of the attribute.
Type: text
Domain: free text

6.2.2 Attribute Definition -- the description of the attribute.
Type: text
Domain: free text

6.2.3 Attribute Definition Source -- the authority of the definition.
Type: text
Domain: free text

6.3 Attribute/Entity Association -- information about the values of the attribute of an entity type.
Type: compound

6.3.1 EA Domain Values -- the valid values.
Type: compound

6.3.1.1 Enumerated Domain -- the members of an established set of valid values.
Type: compound

6.3.1.1.1 Enumerated Domain Value -- the name or label of a member of the set.
Type. text
Domain free text

6.3.1.1.2 EDV Definition -- the description of the value.
Type. text
Domain free text

6.3.1.1.3 EDV Definition Source -- the authority of the definition
Type: text
Domain: free text

6.3.1.2 Range Domain -- the minimum and maximum values of a continuum of valid values.
Type: compound

6.3.1.2.1 Range Domain Minimum -- the least value that the attribute can be assigned.
Type: text
Domain: free text

6.3.1.2.2 Range Domain Maximum -- the greatest value that the attribute can be assigned.
Type: text
Domain: free text

6.3.1.3 Codeset Domain -- reference to a standard or list which contains the members of an established set of valid values.
Type: compound

6.3.1.3.1 Codeset Name -- the title of the codeset.
Type: text
Domain: free text

6.3.1.3.2 Codeset Source -- the authority for the codeset.
Type: text
Domain: free text

6.3.1.4 Unrepresentable Domain -- description of the values and reasons why they cannot be represented.
Type: text
Domain: free text

6.3.2 EA Units of Measurement -- the standard of measurement associated with an attribute value.
Type: text
Domain: free text

6.3.3 EA Measurement Precision -- the smallest unit increment to which an attribute value is measured.
Type: real
Domain: EA Measurement Precision > 0.0

6.3.4 EA Beginning Date -- earliest or only date for which the attribute values are valid. In cases when a range of dates are provided, this is the earliest date for which the information are valid.
Type: date
Domain: free date

6.3.5 EA Ending Date -- latest date for which the information are valid. Used in cases when a range of dates are provided.
Type: date
Domain: free date

6.3.6 EA Accuracy Information -- an assessment of the certainty of the assignment of attribute values.
Type: compound

6.3.6.1 EA Accuracy -- an estimate of the certainty of the assignment of attribute values.
Type: real

6.3.6.2 EA Accuracy Explanation -- the definition of the EA Accuracy measure and units, and a description of how the estimate was derived.
Type: text
Domain: free text

6.3.7 EA Measurement Frequency -- the frequency in days with which attribute values are added.
Type: real
Domain: Maintenance and Update Frequency> 0.0 "Unknown" "As needed" "Irregular"

6.4 Entity/Attribute Information Element Context Syntax:

```
Entity/Attribute_Information =
        1{Entity_Type +
            Attribute +
            Entity/Attribute_Association}n

    Entity_Type =
        Entity_Type_Label +
        Entity_Type_Definition +
        Entity_Type_Definition_Source

    Attribute =
        Attribute_Label +
        Attribute_Definition +
        Attribute_Definition_Source

    Entity/Attribute_Association =
        EA_Domain_Values +
        (EA_Units_of_Measure) +
        (EA_Measurement_Precision) +
        (EA_Beginning_Date +
            (EA_Ending_Date) ) +
        (EA_Accuracy_Information) +
        (EA_Measurement_Frequency)

        EA_Domain_Values =
            [Enumerated_Domain |
                Range_Domain |
                Codeset_Domain |
                Unrepresentable_Domain]

            Enumerated_Domain =
                1{Enumerated_Domain_Value +
                    EDV_Definition +
                    EDV_Definition_Source}n
```

Range_Domain =

Range_Domain_Minimum +
Range_Domain_Maximum

Codeset_Domain=

Codeset_Name +
Codeset_Source

EA_Accuracy_Information =

EA Accuracy +
EA_Accuracy_Explanation

7 Distribution Information -- information about the distributor of and options for obtaining the data set.

Type: compound

7.1 Distribution Contact -- the party from whom the data set may be obtained.

Type: compound

7.2 Distribution Liability -- statement of the liability assumed by the distributor

Type: text
Domain: free text

7.3 Transfer Options -- the ways in which the data set may be obtained or received, and related instructions and fee information.

Type: compound

7.3.1 Media -- the forms in which the data set may be obtained or received.

Type: compound

7.3.1.1 Non-digital media -- the description of option for obtaining or receiving the data set on non-computer-compatible media.

Type: text
Domain: free text

7.3.1.2 Digital media -- the description of options for obtaining or receiving the data set on computer-compatible media.

Type: compound

7.3.1.2.1 Transfer Format -- the name and version number of data transfer format.

Type: text
Domain:

Domain Value	Definition
"ADRG"	ARC Digitized Raster Graphic
"ADRI"	ARC Digitized Raster Imagery
"ARCE5"	ARC/INFO Export format, version 5
"ARCE6"	ARC/INFO Export format, version 6
"ASCII"	ASCII file, formatted for text attributes, declared format
"BIL"	Imagery, band interleaved by line
"BIP"	Imagery, band interleaved by pixel
"COORD"	User-created coordinate file, declared format
"DEM"	U.S. Geological Survey Digital Elevation Model format
"DFAD"	Digital Feature Analysis Data
"DGSTA"	Digital Geographic Information Exchange Standard (DIGEST) Annex A - ISO 8211 form
"DLGO"	U.S. Geological Survey Digital Line Graph-Optional format
"DLGS"	U.S. Geological Survey Digital Line Graph-Standard format

"DTED" Digital Terrain Elevation Data (MIL-D-89020)
"DXF9" AutoCAD Drawing Exchange Format, version 9
"DXF10" AutoCAD Drawing Exchange Format, version 10
"DXF11" AutoCAD Drawing Exchange Format, version 11
"ERD73" ERDAS image files, version 7.3
"ERD74" ERDAS image files, version 7.4
"GRAS3" Geographic Resources Analysis Support System, version 3
"GRAS4" Geographic Resources Analysis Support System, version 4
"IGDS" Interactive Graphic Design System format (Intergraph Corporation)
"IGES" Initial Graphics Exchange Standard
"MOSS" Multiple Overlay Statistical System export file
"NITF" National Imagery Transfer Format
"SDTSR" Spatial Data Transfer Standard raster profile
"SDTSV" Spatial Data Transfer Standard topological vector profile
"SIF" Standard Interchange Format (DOD Project 2851)
"SLF" Standard Linear Format
"TIFF" Tagged Image File Format
"TIGRP" Topologically Integrated Geographic Encoding and Referencing System, pre-census version
"TIGRC" Topologically Integrated Geographic Encoding and Referencing System, census version
"VPF" Vector Product Format (MIL-STD-600006) (also known as Digital Geographic Information Exchange Standard (DIGEST) Annex C - Vector Relational form, and Vector Relational Format)

7.3.1.2.2 Transfer Size Information -- information on file compression techniques applied to the transferred data set and the size of the resulting file sent from the distributor.
Type: compound

7.3.1.2.2.1 File Compression Technique -- information on algorithms or processes applied to the data set in its transfer format to reduce the size of the file.
Type: text
Domain: free text "None"

7.3.1.2.2.2 Transfer Size -- the size in megabytes of transferred data set.
Type: real
Domain: Transfer Size > 0.0

7.3.1.2.3 Digital Transfer Options -- the means and media by which a data set is sent from the distributor.
Type: compound

7.3.1.2.3.1 Online Options -- information required to obtain the data set electronically.

Type: compound

7.3.1.2.3.1.1 Computer Contact Information -- instructions for establishing communications with the distribution computer.

Type: compound

7.3.1.2.3.1.1.1 Network Address -- the electronic address of the distribution computer.

Type: text
Domain: free text

7.3.1.2.3.1.2 Dialup Instructions -- information required to access the distribution computer remotely through telephone lines.

Type: compound

7.3.1.2.3.1.2.1 Lowest BPS -- lowest or only speed for the connection's communication, expressed in bits per second.

Type: integer
Domain: Lowest BPS = [110 | 300 | 600 | 1200 | 2400 | 4800 | 9600 | 14400 | 19200 | 38400 | 57600 | 115200]

7.3.1.2.3.1.2.2 Highest BPS -- highest speed for the connection's communication, expressed in bits per second. Used in cases when a range of dates are provided.

Type: integer
Domain: Highest BPS = [300 | 600 | 1200 | 2400 | 4800 | 9600 | 14400 | 19200 | 38400 | 57600 | 115200];
Highest BPS > Lowest BPS

7.3.1.2.3.1.2.3 Number DataBits -- number of data bits in each character exchanged in the communication.

Type: integer
Domain: DataBits = [7 | 8]

7.3.1.2.3.1.2.4 Number StopBits -- number of stop bits in each character exchanged in the communication.

Type: integer
Domain: StopBits = [1 | 2]

7.3.1.2.3.1.2.5 Parity -- parity error checking used in each character exchanged in the communication

Type: text
Domain: "None" "Odd" "Even" "Mark" "Space"

7.3.1.2.3.1.2.6 Dialup Telephone -- the telephone number of the distribution computer.

Type: text

7.3.1.2.3.1.3 Access Instructions -- information on how to proceed once the connection to the distribution computer is established.

Type: compound

7.3.1.2.3.1.3.1 Access Instruction Text -- instructions on the steps required to access the data set.

Type: text

Domain: free text

7.3.1.2.3.1.3.2 Online File Name -- the identity of the computer file that contains all or part of the data set on the distribution computer.

Type: text

Domain: free text

7.3.1.2.3.1.3.3 Online Computer and Operating System -- the brand of distribution computer and its operating system.

Type: text

Domain: free text

7.3.1.2.3.1.4 Offline Options -- information about media-specific options for receiving the data set.

Type: compound

7.3.1.2.3.1.4.1 Cartridge Tape Options -- information describing options for data sets distributed on cartridge tape.

Type: compound

7.3.1.2.3.1.4.1.1 Cartridge Type -- identification about the physical characteristics of the cartridge.

Type: text

Domain:

Domain Value	Definition
"QIC"	quarter-inch
"4mm"	4 millimeter
"8mm"	8 millimeter

7.3.1.2.3.1.4.1.2 Cartridge Formatted Capacity -- the maximum amount of data, in megabytes, that can be written to the cartridge.

Type: real

Domain: Cartridge Formatted Capacity > 0.0

7.3.1.2.3.1.4.1.3 Cartridge Recording Format -- the method used to write the data set to the cartridge.

Type: text

Domain: free text "cpio" "tar"

7.3.1.2.3.1.4.1.4 Cartridge Computer and Operating System -- the brand of distribution computer and its operating system.
Type: text
Domain: free text

7.3.1.2.3.1.4.2 9-Track Reel Tape Options -- information describing options for data sets distributed on half-inch, 9-track tape reels.
Type: compound

7.3.1.2.3.1.4.2.1 9-Track Recording Density -- the density, in bytes or characters per inch, in which the data set can be recorded.
Type: integer
Domain: 9-Track Tape Reel Density = [800 1600 | 6250]

7.3.1.2.3.1.4.2.2 Record Length and Block Length Information -- information about the record length and options for block size in which the data set can be recorded.
Type: text
Domain: free text

7.3.1.2.3.1.4.2.3 9-Track Recording Format -- the method used to write the data set to the cartridge, including information about file labels.
Type: text
Domain: free text

7.3.1.2.3.1.4.2.4 9-Track Computer and Operating System -- the brand of distribution computer and its operating system.
Type: text
Domain: free text

7.3.1.2.3.1.4.3 Floppy Disk Tape Options -- information describing options for data sets distributed on floppy disk.
Type: compound

7.3.1.2.3.1.4.3.1 FD Type -- identification about the physical characteristics of the floppy disk.
Type: text
Domain:

Domain Value	Definition
"5.25"	Five and one-quarter inch
"3.5"	Three and one-half inch

7.3.1.2.3.1.4.3.2 FD Formatted Capacity -- the maximum amount of data, in megabytes, that can be written to the floppy disk.
Type: real
Domain: Floppy Disk Formatted Capacity = [0.36 | 0.72 | 1.2 | 1.44]

7.3.1.2.3.1.4.3.3 FD Recording Format -- the method used to write the data set to the floppy disk.
Type: text
Domain: free text

7.3.1.2.3.1.4.3.4 FD Computer and OS Compatibility -- the brand of computer(s) and operating system(s) with which the floppy disk is compatible.
Type: text
Domain: free text

7.3.1.2.3.1.4.4 CD-ROM Format -- the standard followed in recording the CD-ROM
Type: text
Domain: "High Sierra" "ISO 9660"
"ISO 9660 with Rock Ridge extensions"

7.4 Transfer Instructions -- general instructions and advise about, and special terms and services provided for, the data set by the distributor.
Type: text
Domain: free text

7.5 Fees -- the fees and terms for retrieving the data set.
Type: text
Domain: free text

7.6 Turnaround -- typical turnaround time, in days, for the filling of an order.
Type: integer
Domain: Turnaround >= 0

7.7 Distribution Information Element Context Syntax:

```
Distribution_Information =
        1{Distribution_Contact +
            Distribution_Liability +
            1{Transfer_Options}n }n

    Distribution_Contact =
        Contact_Information

    Transfer_Options =
        Media +
        Transfer_Instructions +
        Fees +
        (Turnaround)

        Media =
            [Non-digital_Media |
                Digital_Media]

            Digital_Media =
                Transfer_Format +
                1{Transfer_Size_Information}n +
                1{Digital_Transfer_Options}n
```

```
Transfer_Size_Information =
                    File_Compression_Information +
                    (Transfer_Size)

Digital_Transfer_Options =
                    [Online_Options ,
                        Offline_Options]

   Online_Options =
                    1{Computer_Contact_Information}n +
                    Access_Instructions +
                    Online_Computer_and_Operating_System

      Computer_Contact_Information =
                    [Network_Address |
                        Dialup_Instructions]

         Dialup_Instructions =
                    Lowest_BPS +
                    (Highest_BPS) +
                    Number_DataBits +
                    Number_StopBits +
                    Parity +
                    1{Dialup_Telephone}n

      Access_Instructions =
                    Access_Instructions_Text +
                    ( 1{Online_File_Name}n )

   Offline_Options =
                    [Cartridge_Tape_Options |
                        9-Track_Reel_Tape_Options |
                        Floppy_Disk_Options |
                        CD-ROM_Format]

      Cartridge_Tape_Options =
                    1{Cartridge_Type +
                        Cartridge_Formatted_Capacity}n +
                    Cartridge_Recording_Format +
                    Cartridge_Computer_and_Operating_System

      9-Track_Reel_Tape_Options =
                    1{9_Track_Recording_Density}3 +
                    Record_Length_and_Block_Length_Information +
                    9-Track_Recording_Format +
                    9-Track_Computer_and_Operating_System

      Floppy_Disk_Options =
                    1{FD_Type +
                        FD_Formatted_Capacity}n +
                    FD_Recording_Format +
                    FD_Computer_and_OS_Compatibility
```

8 Metadata Reference Information -- information on the currentness of the metadata information, and the responsible party.

8.1 Metadata Date -- the date that the metadata were created or last updated.
Type: date
Domain: free date

8.2 Metadata Review Date -- the date of the latest review of the metadata entry.
Type: date
Domain: free date; Metadata Review Date later than Metadata Date

8.3 Metadata Future Review Date -- the date by which the metadata entry should be reviewed.
Type: date
Domain: free date; Metadata Future Review Date later than Metadata Review Date

8.4 Metadata Contact -- the party responsible for the metadata information.
Type: compound

8.5 Metadata Reference Information Element Context Syntax:

```
Metadata_Reference_Information =
                        Metadata_Date +
                        ( Metadata_Review_Date +
                           (Metadata_Future_Review_Date) ) +
                        (Metadata_Contact)

Metadata_Contact =
                        Contact_Information
```

9 Contact Information -- Identity of, and means to communicate with, person(s) and/or organization(s) associated with the data set.
Type: compound

9.1 Contact Person Primary -- the person, and the affiliation of the person, associated with the data set. Used in cases where the association of the person with the data set is more significant than the association of the organization with the data set.
Type: compound

9.1.1 Contact Organization -- the name of the organization to which the contact type applies.
Type: text
Domain: free text

9.1.2 Contact Person -- the name of the individual to which the contact type applies.
Type: text
Domain: free text

9.2 Contact Organization Primary -- the organization, and the member of the organization, associated with the data set. Used in cases where the association of the organization with the data set is more significant than the association of the person with the data set.
Type: compound

9.3 Contact Position -- the title of individual to which the contact type applies.
Type: text
Domain: free text

9.4 Contact Mail Address -- the address of organization or individual to which the contact type applies.
Type: text
Domain: free text

9.5 Contact Voice Telephone -- the telephone number of the organization or individual to which the contact type applies
Type: text
Domain: free text

9.6 Contact Facsimile Telephone -- the telephone number of a facsimile machine of the organization or individual to which the contact type applies.
Type: text
Domain: free text

9.7 Contact Electronic Mail Address -- the address of the electronic mailbox of the organization or individual to which the contact type applies.
Type: text
Domain: free text

9.8 Contact Instructions -- text instructions to end user on how or when to make contact with an individual contact person.
Type: text
Domain: free text

99 Contact Information Element Context Syntax:

```
Contact_Information =
        [Contact_Person_Primary |
           Contact_Organization_Primary] +
        (Contact_Position) +
        Contact_Mail_Address +
        1{Contact_Voice_Telephone}n +
        (1{Contact_Facsimile_Telephone}n) +
        (1{Contact_Electronic_Mail_Address}n) +
        (Contact_Instructions)

Contact_Person_Primary =
        (Contact_Organization) +
        Contact_Person

Contact_Organization_Primary =
        Contact_Organization +
        (Contact_Person)
```

Reading the Metadata Content Syntax

Overview

The content syntax section describes the structure and relationships among the data elements. Each production rule has a left side (identifier) and right side (expression) connected by the symbol "=", meaning that the left side is replaced by or produces the right side. Making substitutions using matching symbols in the production rules leads to explaining the highest level identifier in terms of lower level symbols

The symbols used in the production rules have the following meaning:

Symbol	Meaning
=	Is replaced by, producers, consists of
+	And
[|]	Selection - select one term from the list of enclosed terms (exclusive or). Terms are separated by "|".
m{}n	Iteration - the term(s) enclosed is(are) repeated from "m" to "n" times
()	Optional - the term(s) enclosed is(are) optional

Examples:

```
a =
    b +
    c
```

a consists of b and c

```
a =
    [b |
        c]
```

a consists of one of b or c

```
a =
    4{b}6
```

a consists of four to six occurrences of b

```
a =
    b +
    (c)
```

a consists of b and optionally c

Default Theme Keyword Thesaurus[1]

Thesaurus Title: FGDC Content Standards for Spatial Metadata default thesaurus

Keywords:

ANTHROPOGENIC *

Administrative Units *
Cadastral *
Census Units *
Communication Lines *
Named Places *
Pipelines *
Political Units *
Populated Places *
Population *
Public Land Survey System *
Railroads *
Roads *
Structures *
Transmission Lines *
Transportation *
Waterways *

ATMOSPHERIC COMPOSITION

Aerosols
Air Quality
Ash
Carbon Dioxide
Chlorofluorocarbons
Clouds
Contaminants
Humidity
Methane
Nitric Acid
Nitrogen
Nitrogen Dioxide
Oxygen
Ozone
Trace Elements
Trace Gases
Tracers
Water Vapor

ATMOSPHERIC DYNAMICS

Altitude
Atmospheric Temperature
Climate *
Cloud Types
Evaporation
Evapotranspiration
Geopotential Height
Heat Flux
Humidity
Paleoclimate Indices
Precipitation
Pressure
Solar Radiation
Storms
Visibility
Winds

BIOLOGICAL ENTITIES

Birds
Domesticated Animals
Domesticated Plants
Endangered Species
Land Wildlife
Microorganisms
Minor Species
Ocean Vegetation
Ocean Wildlife
Surface Vegetation

[1] - Adapted from Directory Interchange Format (DIF) Manual, April 1993, version 4.1, section 2.11, "Parameter measured." Entries marked with an asterisk (*) are extensions to the DIF Manual.

DISEASES

Addiction
Bacterial
Cardiovascular
Chronic
Communicable
Dermatologic
Digestive System
Endocrine
Eye
Fungal
Immunologic
Infection
Injury
Musculoskeletal
Neonatal
Neoplasms
Nervous System
Nutritional and Metabolic
Occupational
Ophthalmic
Otorhinolaryngologic
Parasitic
Poisoning
Pregnancy Complications
Respiratory
Skin
Stomatognatic
Urologic
Virus

EARTH RADIATIVE PROCESSES

Albedo
Brightness Temperature
Heat Flux
Irradiance
Radiance
Solar Activity
Temperature
Thermal Inertia

GEODYNAMIC FEATURES

Earthquakes
Erosion
Geodesy
Geothermal
Gravity Fields
Magnetic Fields
Polar Motion
Seismic
Structures
Tectonophysics
Terrain Elevation
Volcanoes

GEOGRAPHY AND LAND COVER

Albedo
Cultural Features
Elevation
Fires
Glaciers
Ice
Lakes
Landforms
Rivers
Snow
Soils
Surface Vegetation
Surface Water
Topographic Data
Wetlands

GEOLOGICAL PARAMETERS

Age Determinations
Aquifer *
Coal
Economic Minerals
Geochemical Analysis
Igneous and Metamorphic Rocks
Lithology
Mineralogy and Crystallography
Paleontology
Petroleum
Petrology
Sedimentary rocks
Soils
Stratigraphy
Surficial Geology *

HEALTH CARE

Clinical Care
Community Care
Institutional Care

HYDROLOGIC PARAMETERS

Contamination
Deposition
Erosion
Evaporation
Glaciers
Ground Water
Infiltration
Oxygen Demand
Precipitation
Rivers
Runoff
Sedimentation
Solids
Surface Water
Temperature
Turbidity
Water Vapor
Wetlands

MAGNETIC AND ELECTRIC FIELDS

Activity Indices
Electric Fields (DC)
Electric Wave Spectra (AC)
Magnetic Fields (DC)
Magnetic Wave Spectra (AC)

OCEAN COMPOSITION

Alkalinity
Aquatic Plants
Biomass
Carbon Dioxide
Chemical Tracers
Chlorophyll
Conductivity
Dissolved Solids
Light Transmission
Major Elements
Minor Species
Nitrate
Nitric Acid
Nitrite
Nitrogen
Nitrogen Dioxide
Nutrients
Ocean Wildlife
Organic Matter
Oxygen
pH
Phosphates
Phytoplankton
Pigment Concentration
Pollutants
Salinity
Sea Ice
Sediments
Silicate
Suspended Solids
Trace Elements
Upwelling
Zooplankton

OCEAN DYNAMICS

Bathymetry
Brightness Temperature
Currents
Evaporation
Geopotential Height
Heat Flux
Pressure
Primary Production
Sea Ice
Sea Level
Sea Surface Height
Sedimentation
Swell
Temperature
Tides
Turbidity
Upwelling
Waves
Winds

PUBLIC HEALTH

Accidents
Behavior
Disease Outbreaks
Drug Contamination
Environmental Health
Epidemics
Epidemiologic Measurements
Food Poisoning
Nutrition

VITAL STATISTICS

Demography
Morbidity
Mortality

Appendix

C. COMPLEX DATA TASK FORCE MEETING BRIEFING CHARTS

Complex Data Definition

Definition: "Complex Data is that data which is not easily represented using existing data modeling methodologies."

- Current Data Models can be very complex
- IDEF1X Categories are complex to Chen Modelers
- Certain structures such as Hierarchies or Directed Graphs are called complex even though they can be represented (though with difficulty)
- Non-Standard data types (like graphics & sound) are called complex

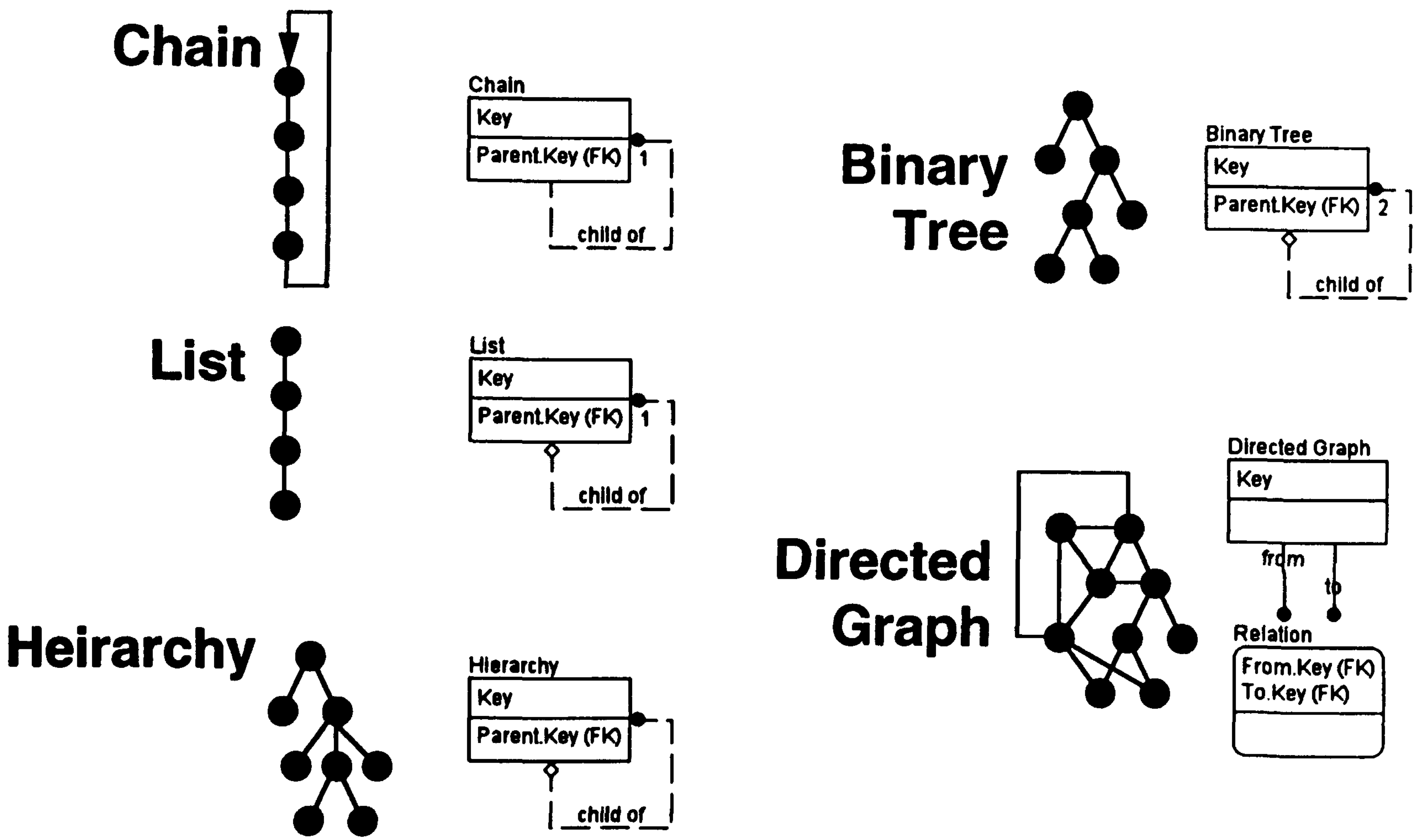
Complex Data & IDEF1X

- IDEF1X represents the existing modeling technique/language
- We can represent complex data as Shortfalls to IDEF1X
- Shortfalls come in to basic Groups
  - Addressable: Those shortfalls which can be addressed using IDEF1X through the use of "Tricks" of representation
  - Unaddressable: Those shortfalls which require the extension of the IDEF1X language or external supplementation of the model.

Addressable Shortfalls

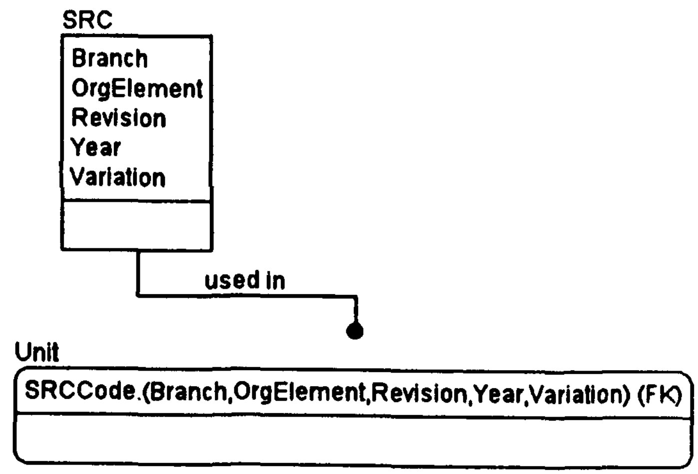
- Recursive Structures (Lists, Hierarchies, etc...)
- Composite Attributes (Groups)
- Complex Data Types(BLOBs, Arrays, Binary, etc...)
- Repeating groups (Multiple values)
- Multi-Purpose (Different Meanings)

Recursive Structures



Composite Attributes

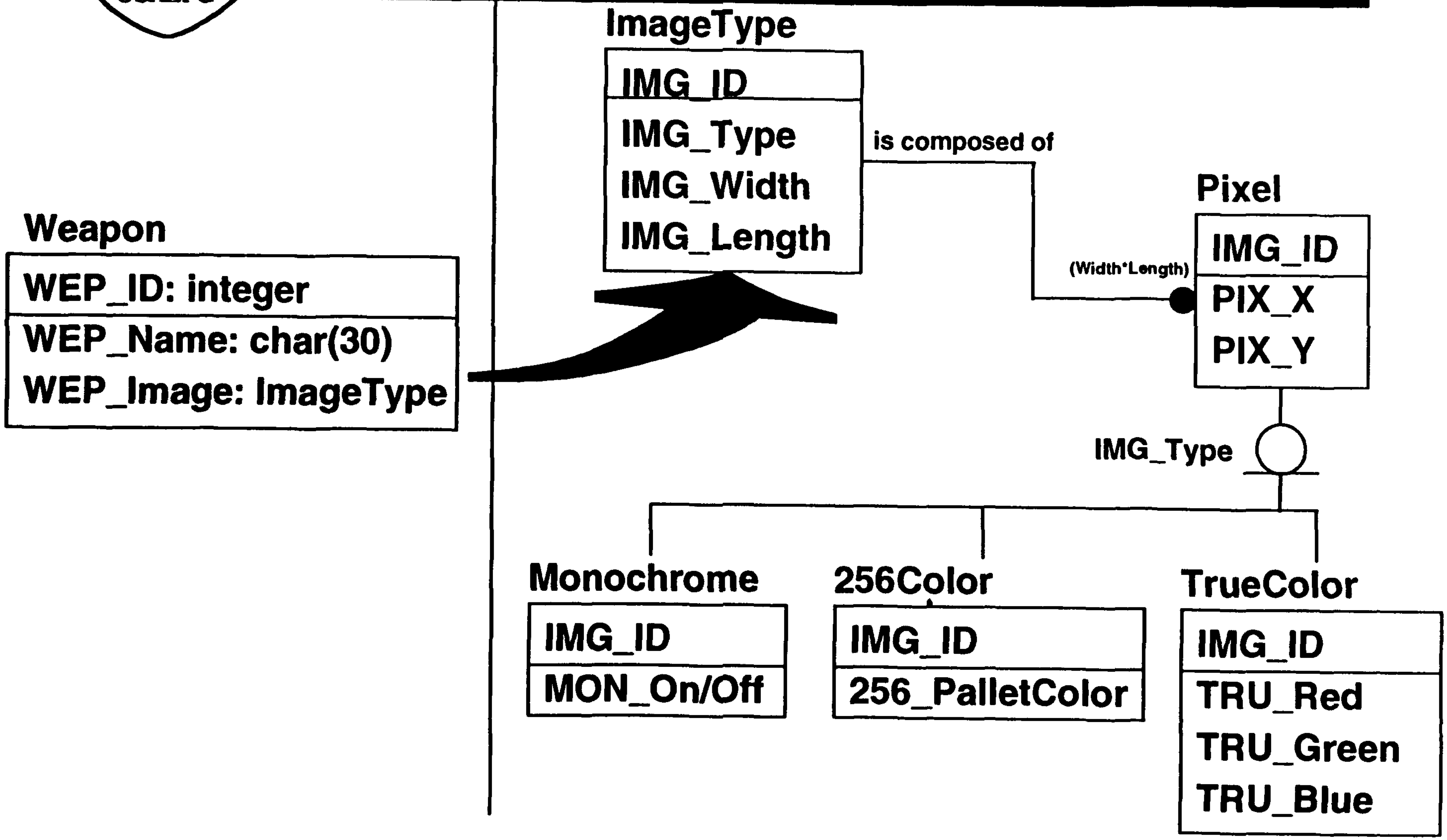
- Can be addressed using a state-of-practice feature available in some IDEF1X Tools
- Composite Attributes can be represented as "Group" attributes
- Issue on IEEE Working Group



Complex Data Types

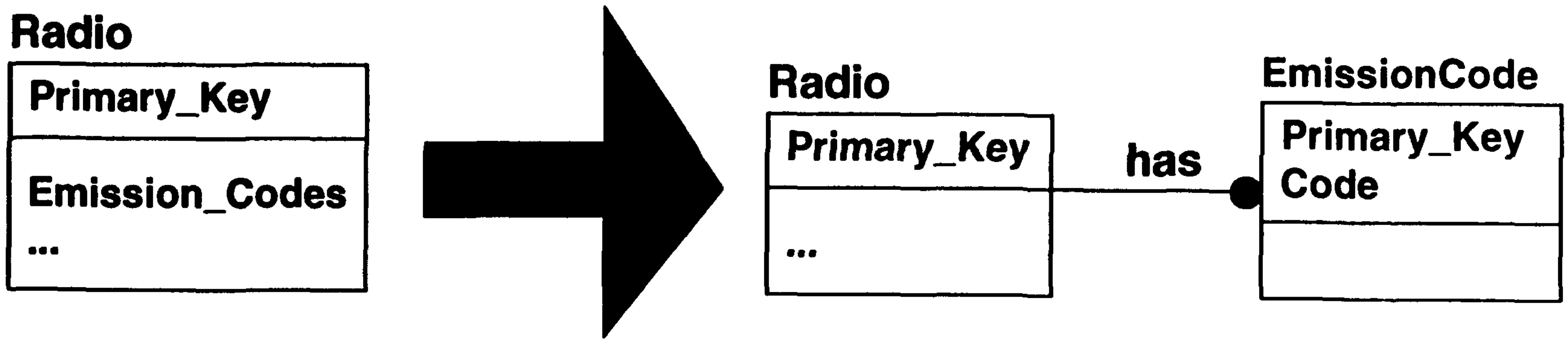
- Ecapsulates such things as:
  - Graphics, Sound Video
  - Compound Documents
  - Binary data & Binary Large Objects (bLOBS)
- Can be addressed by separately modeling the data type using IDEF1X or other technique such as Jackson Diagrams
- Physically represented in existing RDBMS's as BLOB, IMAGE or MEMO fields
- Use State-of-practice User defined data types

Complex Data Type Example



Repeating Groups

- Attributes which contain sets of values rather than a single value
- Not a valid IDEF1X construct
- Easily addressed by creating another entity to contain the repeating values



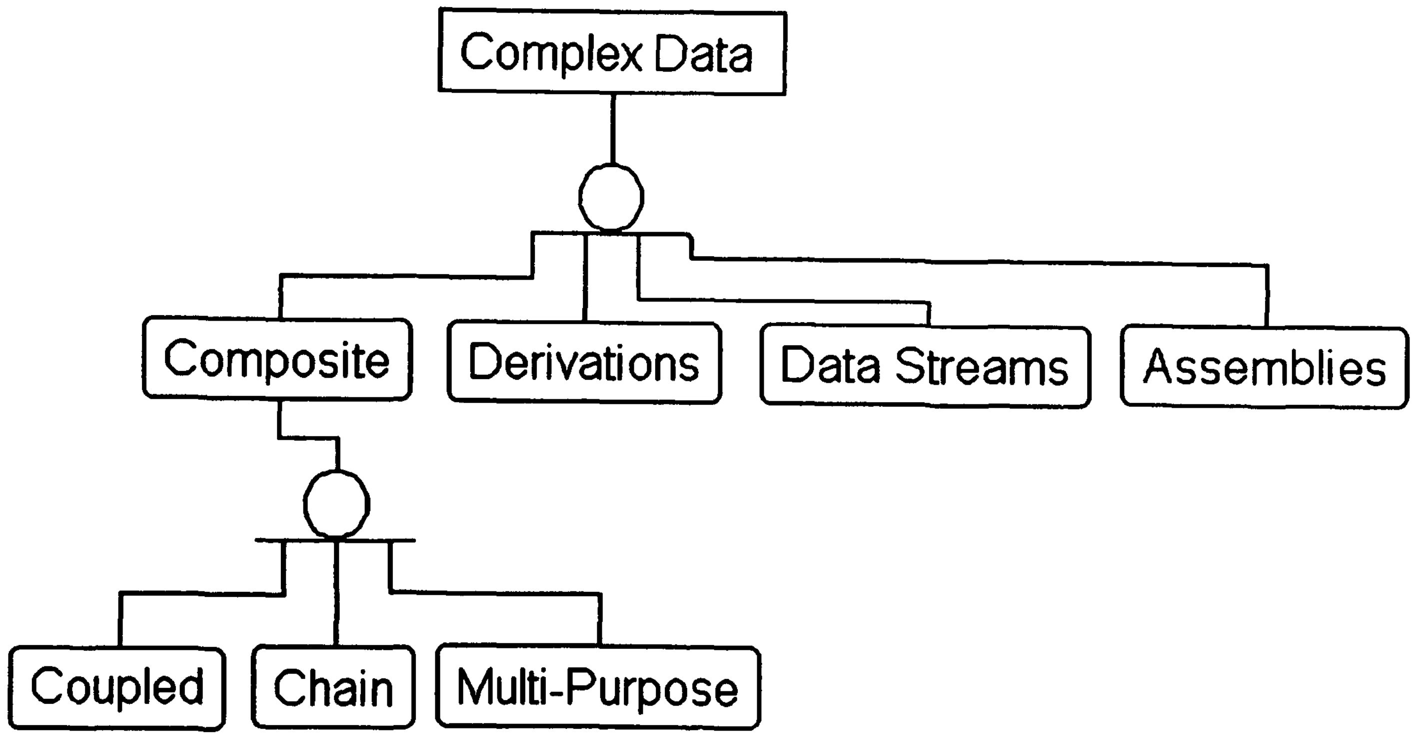
Multi-Purpose Attributes

- Attributes whose meaning changes based on changes in the instance values of other attributes.
- IDEF1X contains no language constructs to model this
- Violates data normalization rules
- Applicable in As-Is Models
- Documented in the Glossary description

Unaddressable Shortfalls

- Derrived Data
  - Algorithmic (Complex Calculations)
  - Aggregate (Summaries)
- Complex Business Rules
- Objects (Methods Included)
- Data Dependancies
  - Model Level
  - Instance Level
- Physical Representation (Bits & Bytes)

OASD C3I - Complex Data



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Interoperability, data exchange, and data translation/conversion

Miro Medek

18 February 1994

MITRE

Overview

- Heterogeneity in DMSO community
- Interoperability and data exchange
- Data translation/conversion
- Target architecture based on data standardization
- Evolutionary migration to target architecture
- Repository role in data translation

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Heterogeneity in DMSO community

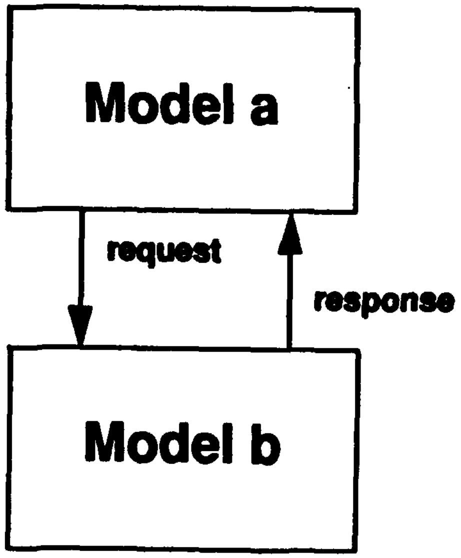
Data sharing in DMSO community must overcome heterogeneity in

- Models
- Data
- Hardware
- Software

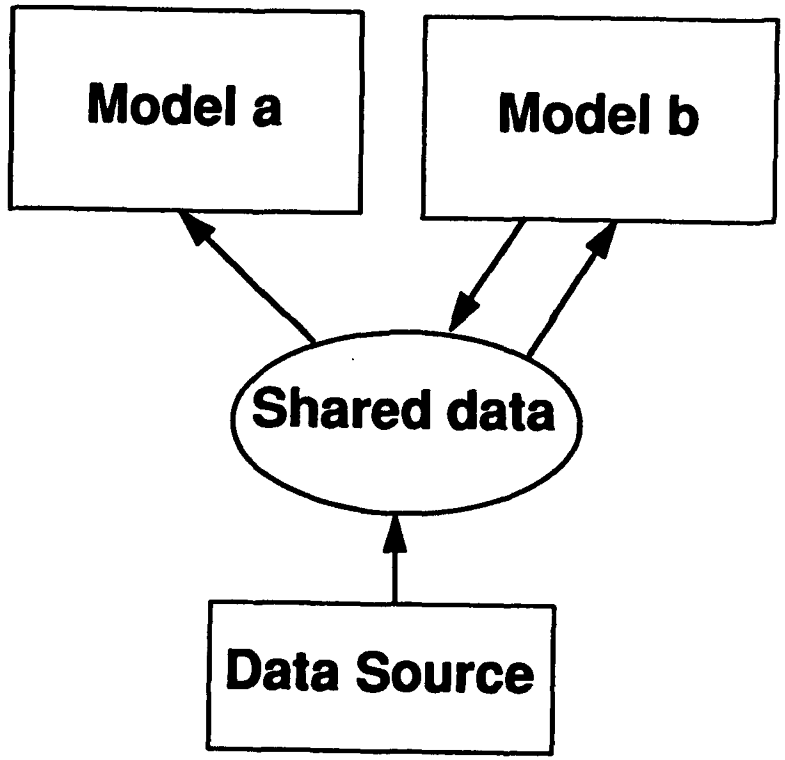
MITRE

Interoperability and data exchange

Interoperable models



Data exchange



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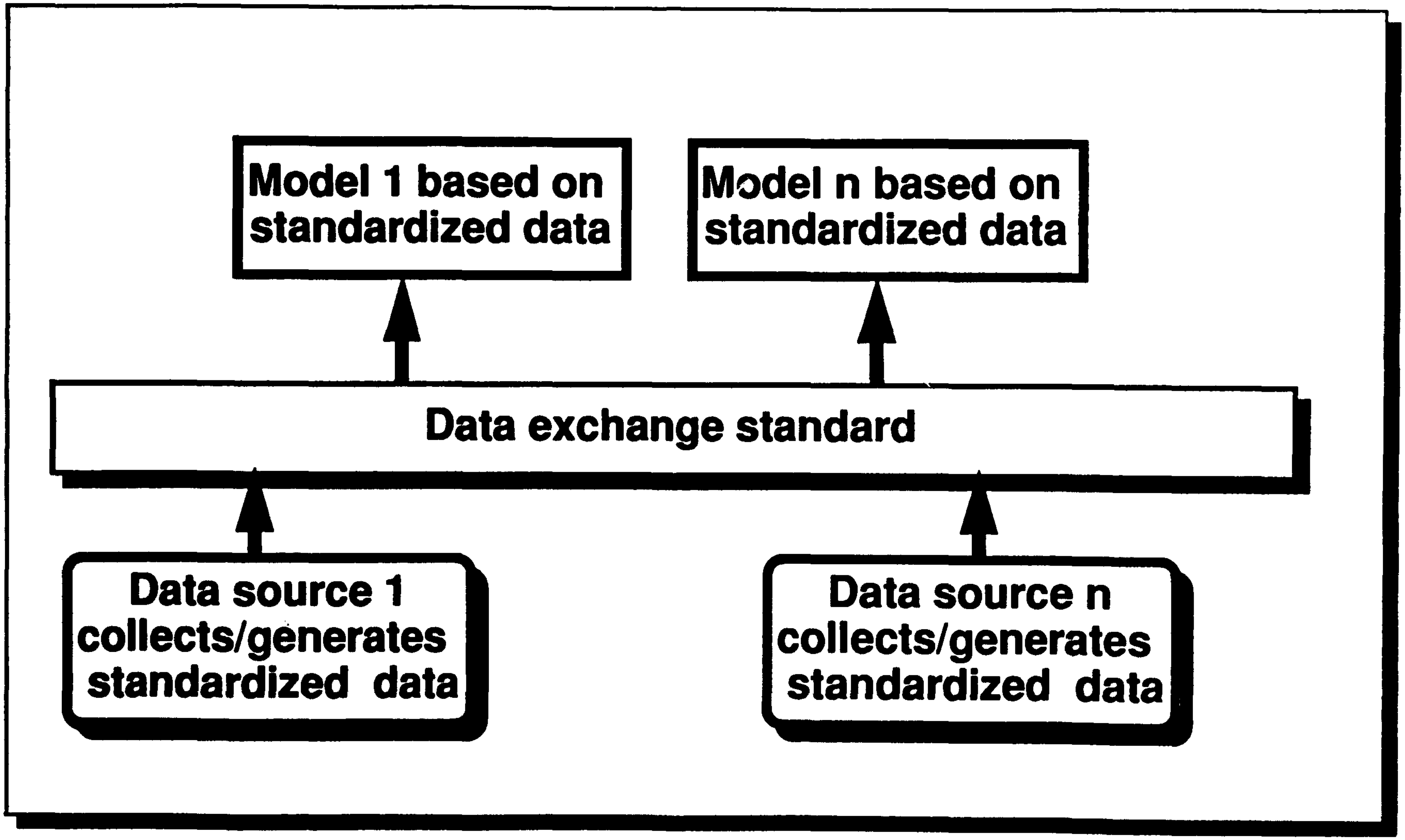
Data translation/conversion

- Data translation
  - data semantic
  - data representation
  - data types

- Data conversion
  - data organization and structure
  - data format

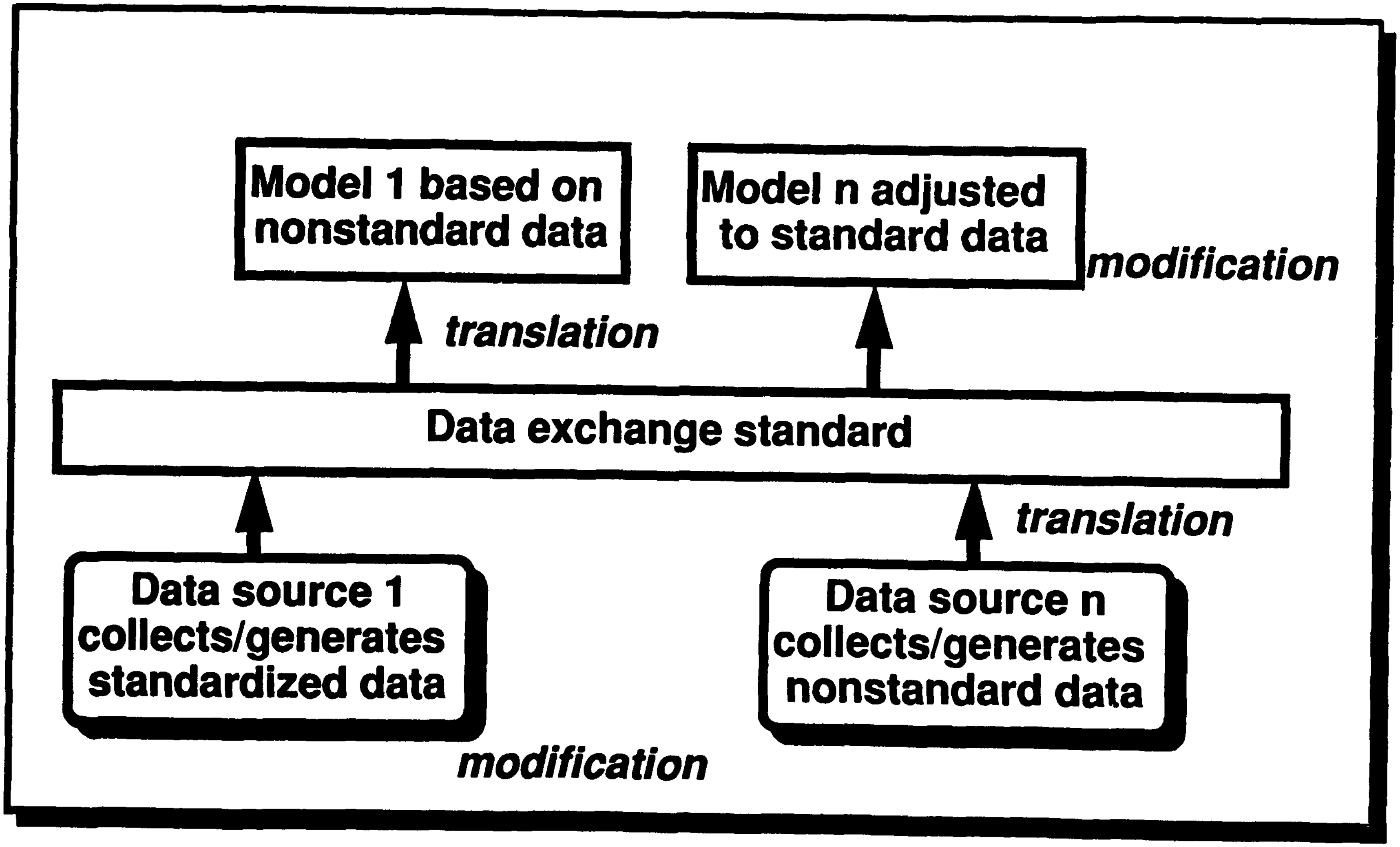
MITRE

Target architecture based on data standardization



MITRE

Evolutionary migration to target architecture



MITRE

Evolutionary migration to target architecture (concluded)

Migration approach must consider the following factors:

- Time
- Budget
- Resources
- Data ownership
- Technology insertion

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Repository role in data translation/conversion

Repository supporting data sharing must contain information about

- where to find required data (location of data)
- what is a format and representation of source data
- how to convert data from source to required format
- how to translate data from source to required representation (translation algorithm)

MITRE

Repository role in data translation/conversion (continue)

- Description of translation algorithm in repository should contain
  - definition of input
  - definition of translation output
  - description of translation algorithm
  - source code (if available)

Repository role in data translation/conversion (concluded)

Repository users:

- Data providers
  - in supporting translationof nonstandard data into standard data
- Data users
  - querying repository for possible data sources
  - translating data from source to required format

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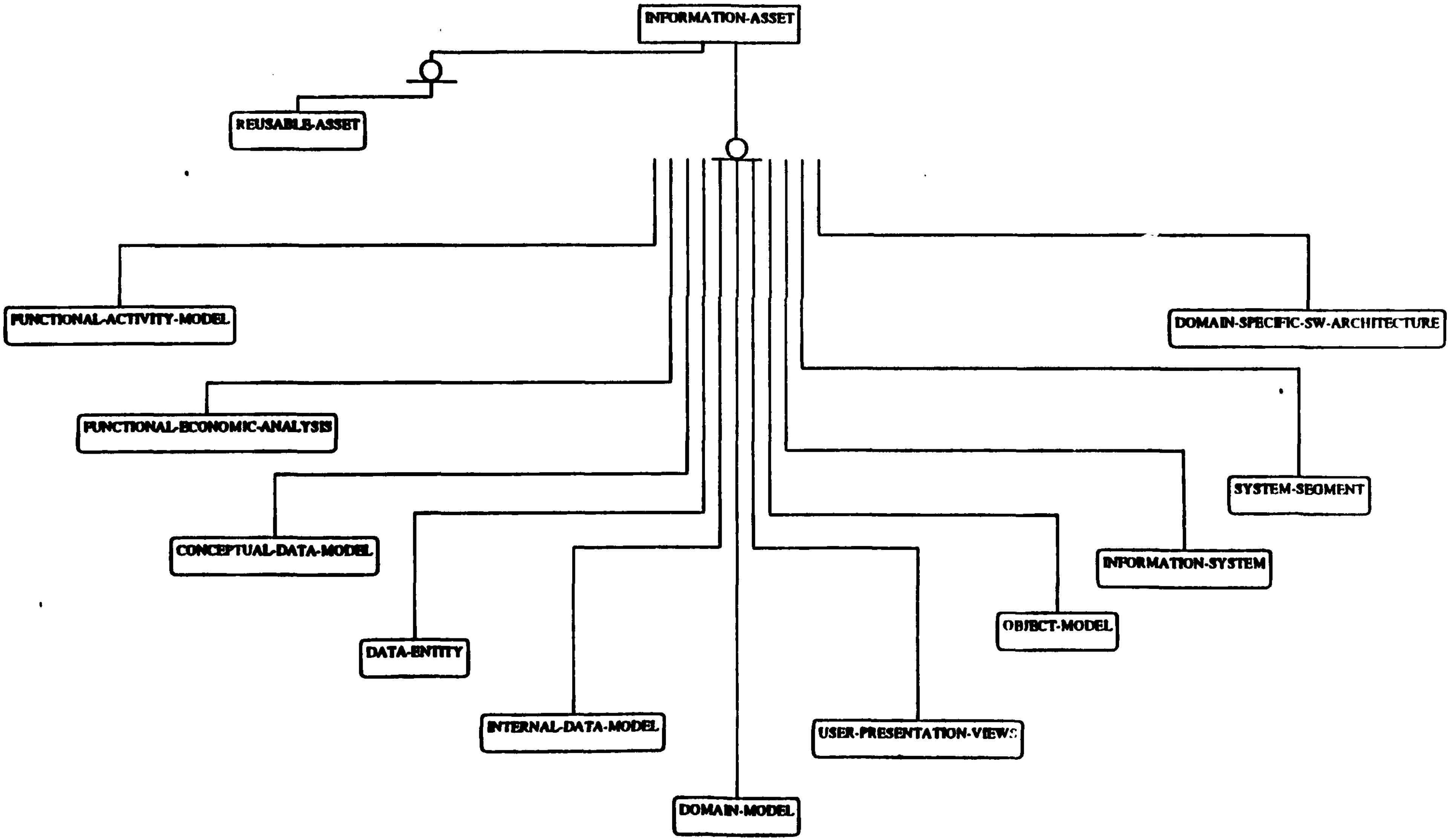
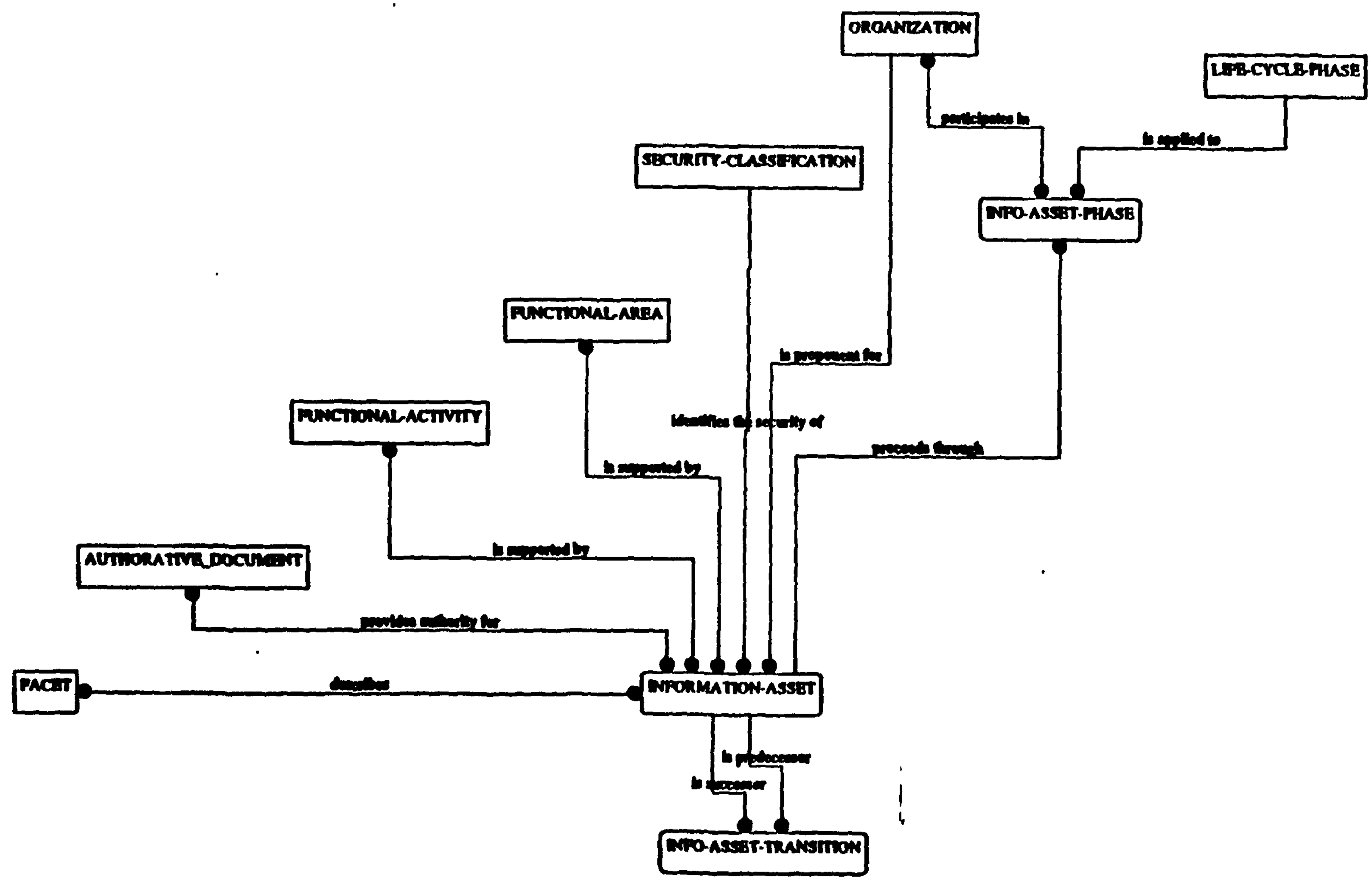
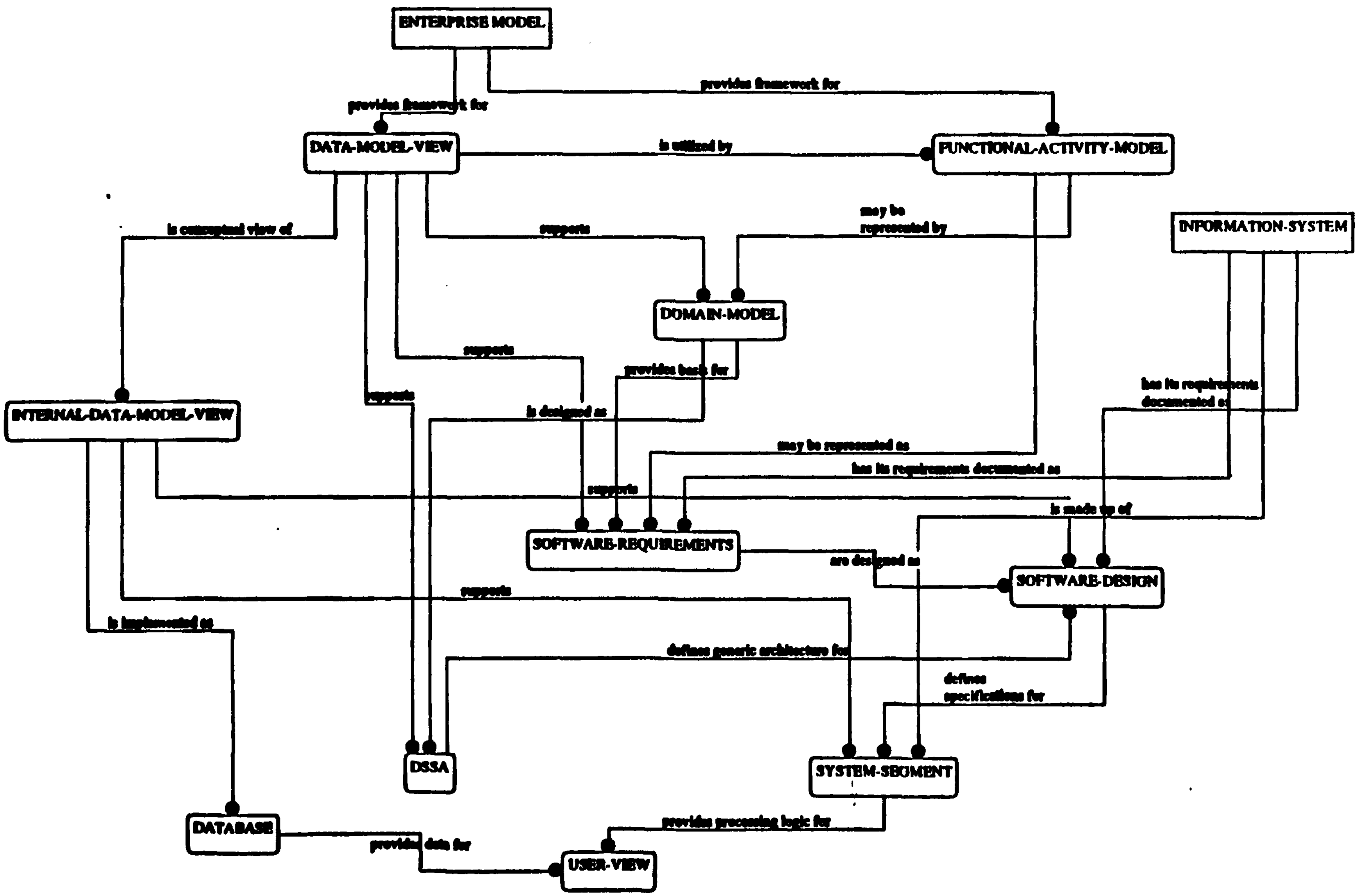
Information Asset Subtypes



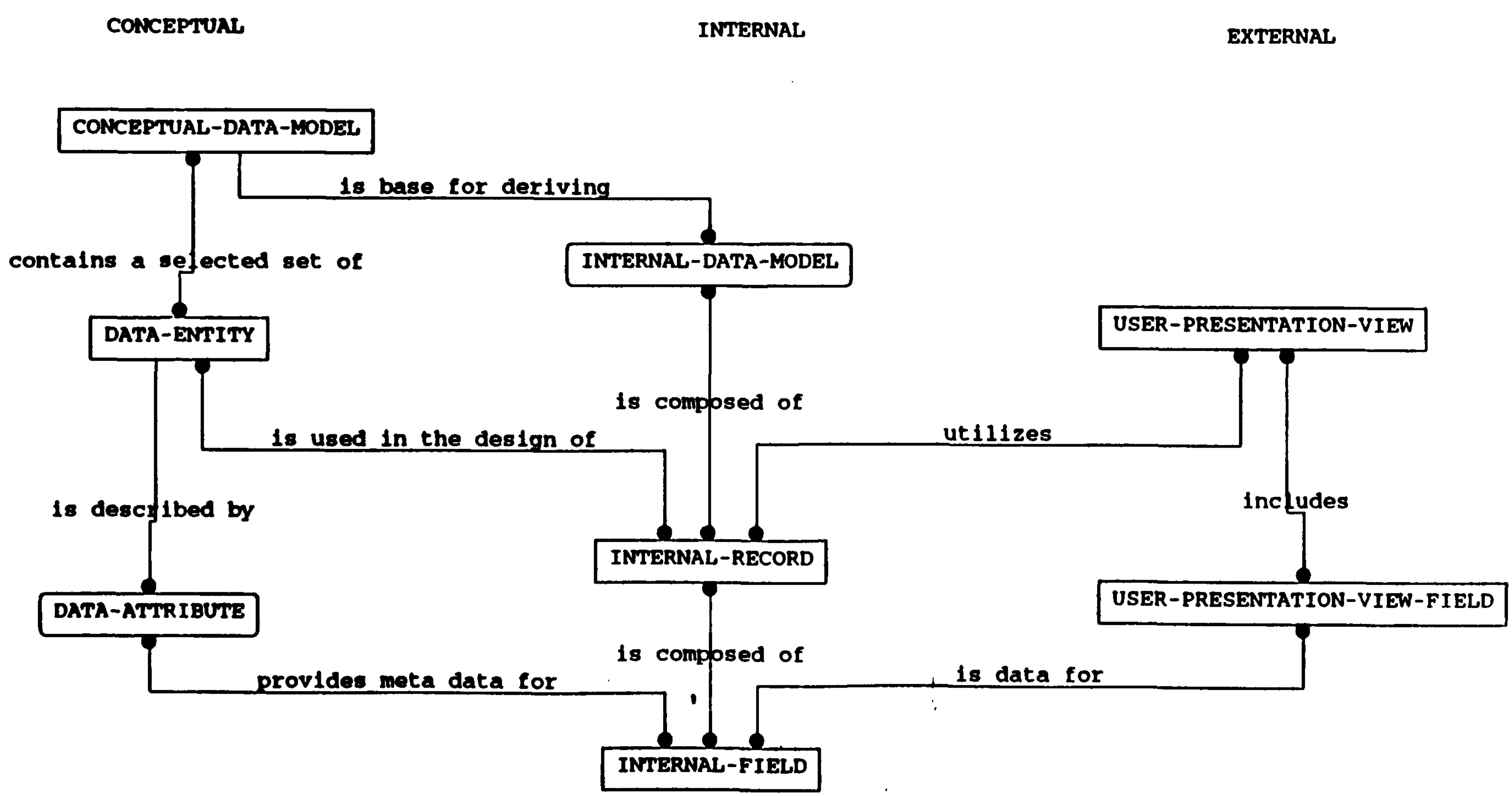
Information Asset and Its Managing Entities



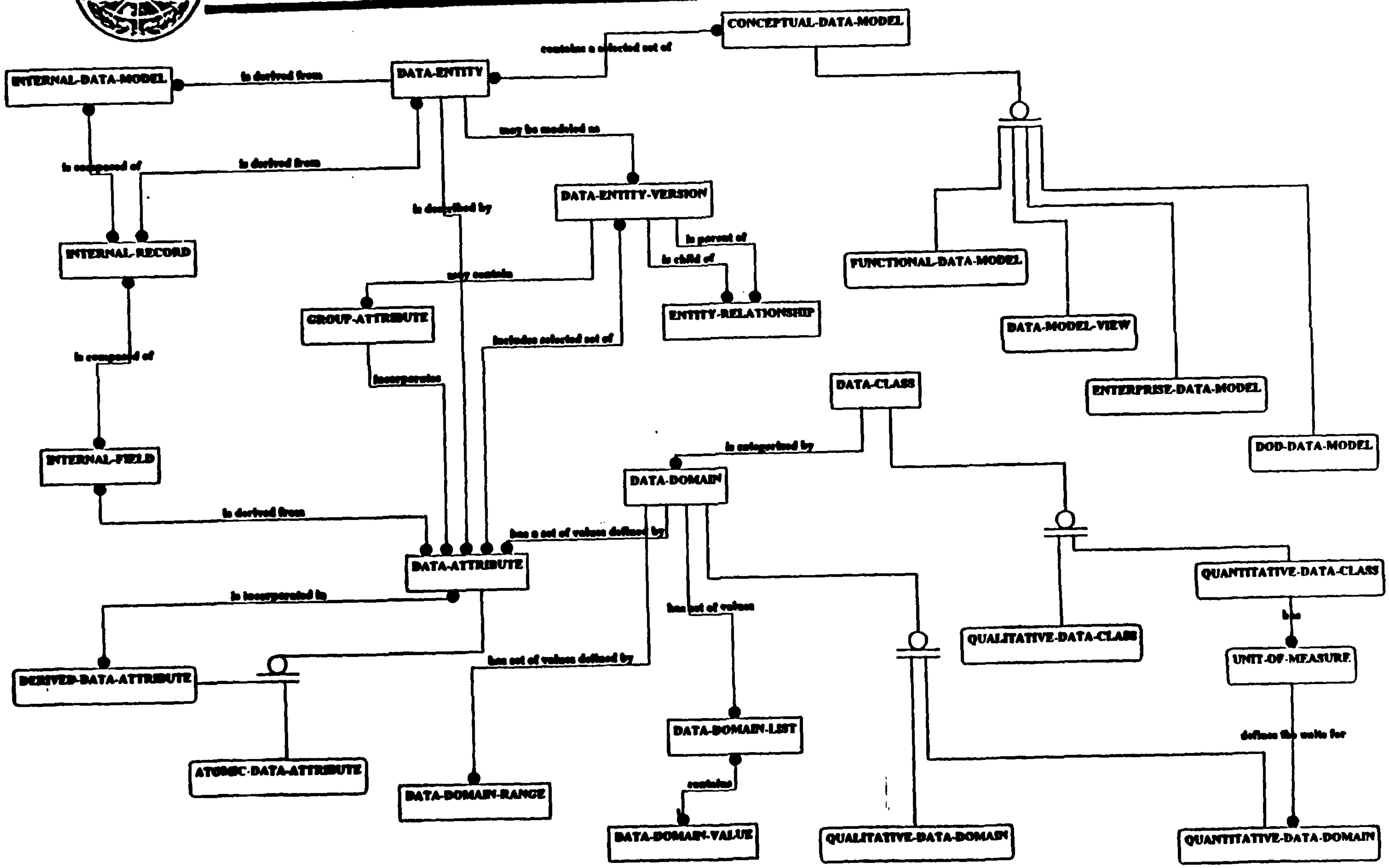
Abstract View of DIRS Data Model



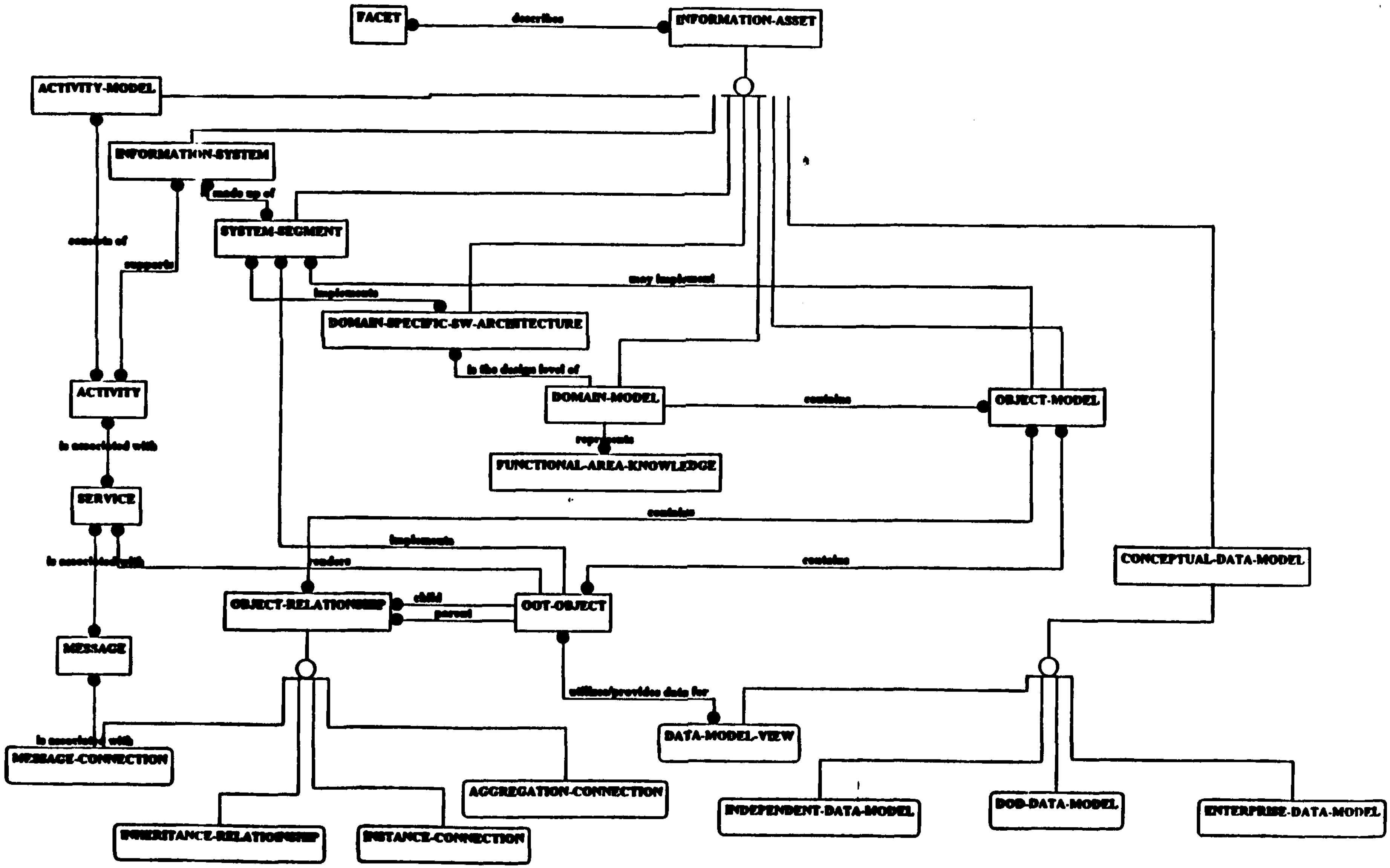
3-Schema View



Conceptual Data Standardization Data Model View



Software Reuse Data Model View



Complex Data Elements

Definitions of Complex Data:

- Embedded or inherited information contained within the data element

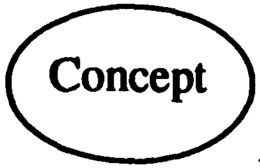
- From "Complex Data and the DoD Data Administration Program:" Any structure which requires order, any data structure which may be of variable length, or any data structures which requires a pointer.

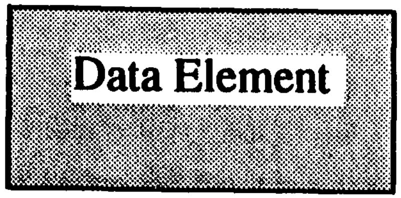
Complex Data Elements

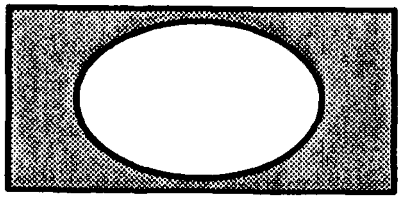
Types of Complex Data

- **Composite** - Data elements that embed intellignece about mulitple concepts in their names, definitions, and domains.
- **Derived** - Data elements representing concepts computed, aggregated, transformed, or inferred from the values of one or more other data elements.
- **Data Stream** - Ordered bits or characters formatted to represent information ina variety of forms
- **Assembly** - Data entities comprising instances fo data which relate to other instances of data within the same entity.

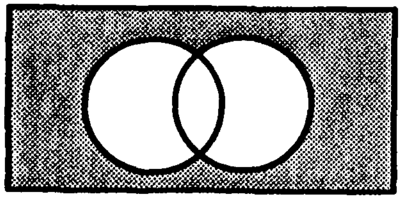
Diagramming Conventions







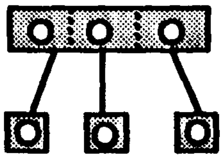
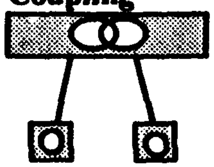
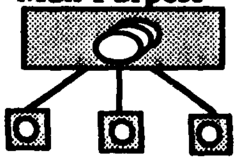
Formulation that Conforms with Formulation Guidelines



Formulation that Fails to Conform with Formulation Guidelines

8

Common Types of Associations Between Data Elements Leading to Partial Overlaps in Definition

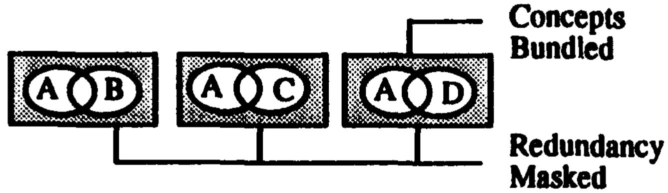
Association	Description
Chain 	**Standard is a member of In-Place Element Chain** An ordered set of data elements linked together (e.g., positions 1-3 => concept 'A', positions 4-5 => concept 'B', etc.).
Coupling 	**Standard Participates in In-Place Element Coupling** A data element describing more than a single concept (i.e., two or more concepts are bundled in a single data element).
Muli-Purpose 	**In-Place Element has Multiple Uses, Each Supporting a Different Standard** A data element with multiple uses or definitions (i.e., the meaning changes based on what is described by the record).

Legend	
- Data Element	- Concept

Coupled Concepts Within A Single Element

a. Coupled Data Elements

Principle	*Example*



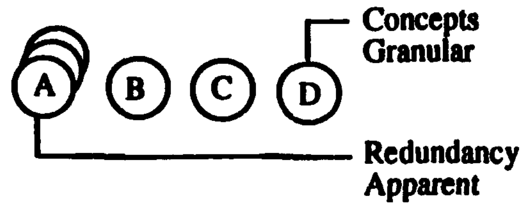
Authorized Officer Strength
Authorized Warrant Officer Strength
Authorized Enlisted Strength
Authorized Civilian U.S. Direct Hire Strength
Authorized Civilian Foreign National Strength
Authorized Civilian Indirect Hire

⋮

etc?

b. Cohesive Data Elements

Principle	*Example*



Strength Type Code
Resource Code
Strength Quantity

Three data elements - and only three data elements

Illustration: Influence Coupling vs Cohesion Can Have on Performance

Coupled Strength Data Elements: A single input operation can access all six authorizations

Key	Authorized Officer Strength	Authorized Warrant Officer Strength	Authorized Enlisted Strength	Authorized Civilian U.S. Direct Hire Strength	Authorized Civilian Foreign National Strength	Authorized Civilian Indirect Hire
WEAFAA	7	1	37	12	0	0

Uncoupled Strength Data Elements: Multiple input operations must be used to access all six authorizations

Key	Strength Type Code	Resource Code	Strength Quantity
WEAFAA	A	AAOF	7
WEAFAA	A	AAWO	1
WEAFAA	A	AAEN	37
WEAFAA	A	CUDH	12
WEAFAA	A	CFDH	0
WEAFAA	A	CFIH	0

Resource Code Values

AAOF	Officer,
AAWO	Warrant Officer
AAEN	Enlisted
CUDH	Civilian U.S. Direct Hire
CFDH	Civilian Foreign National
CFIH	Civilian Indirect Hire

Strength Type Code Values

A	Authorized
S	Structured

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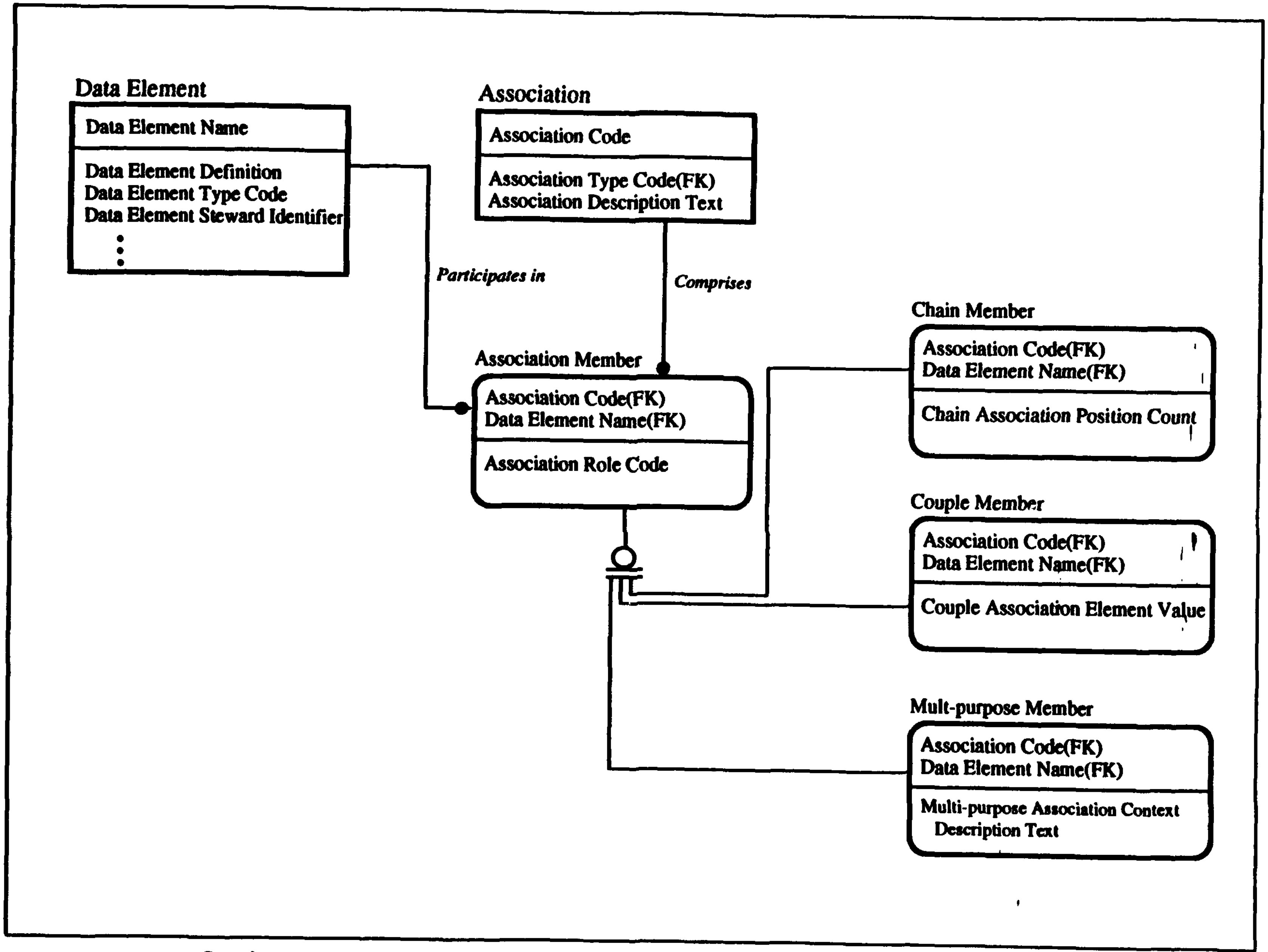


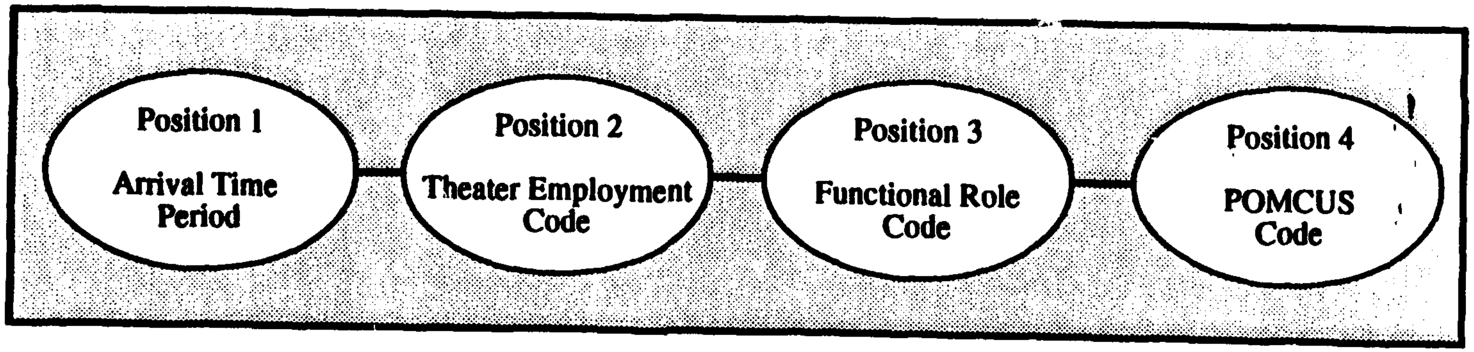
Logical Data Model for Documenting Composite Element Associations

Example Data Element

Readiness Objective Code (ROBCO)

Definition: Identifies a unit or activity as part of a specific force grouping based on a contingency plan assignment and/or current or programmed POMCUS.

Formulation:



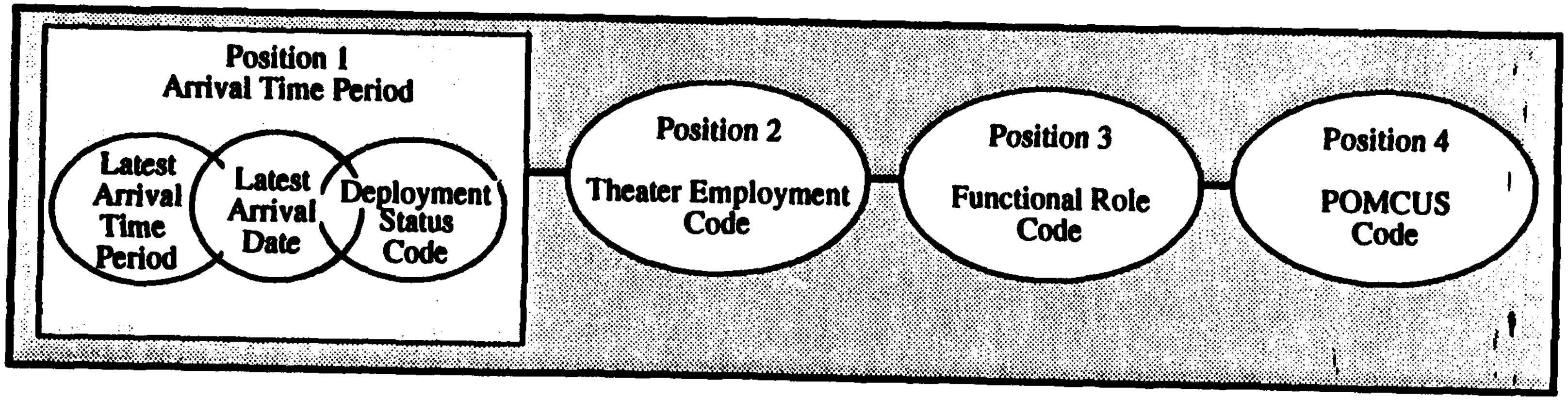
2

Example Data Element
(Continued)

Readiness Objective Code (ROBCO)

Definition: Identifies a unit or activity as part of a specific force grouping based on a contingency plan assignment and/or current or programmed POMCUS.

Formulation:



Coded Values

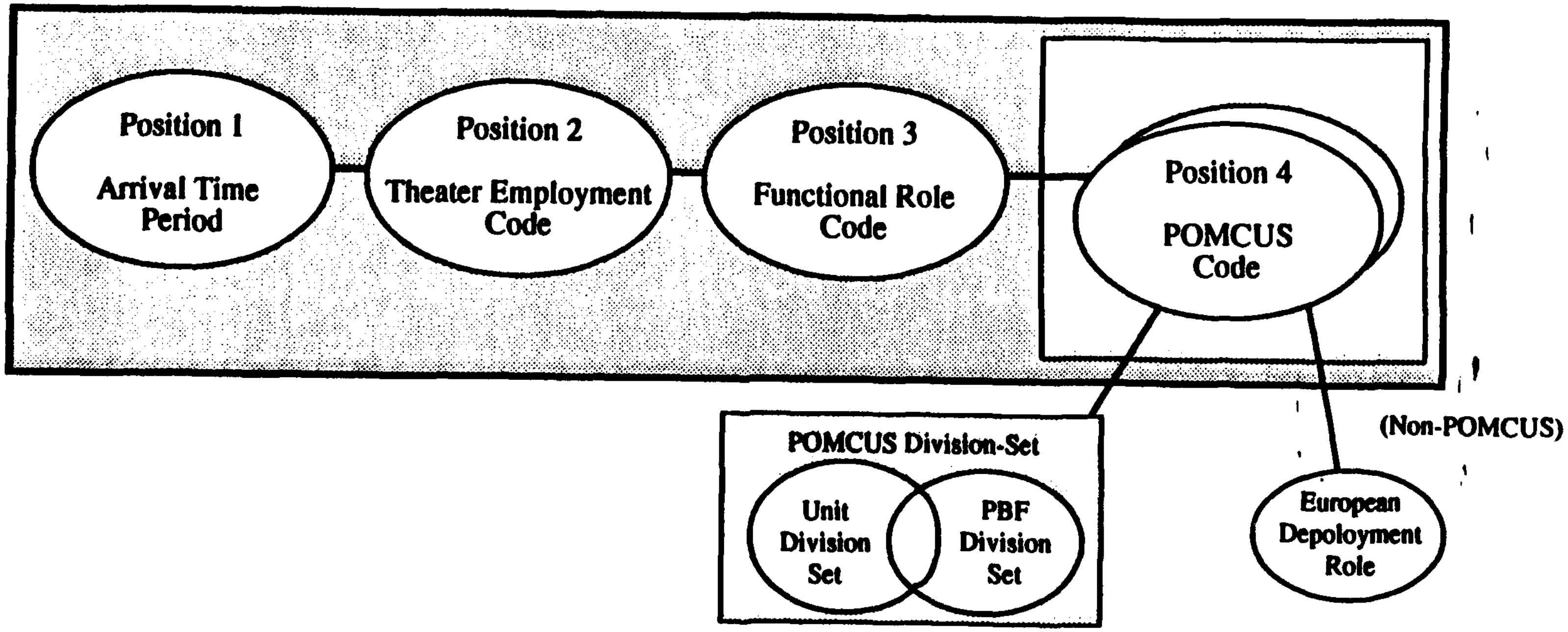
A	C-DAY TO C+4 (Combat and CS/CSS)
1	C-DAY TO C+4 (Non RDFA)
B	C+5 to C+ 15 (Combat)
C	C+5 to C+ 15 (CS/CSS)
2	C+5 to C+ 15 (Non RDFA)
D	C+16 to C+30 (Combat)
E	C+16 to C+30 (CS/CSS)
3	C+16 to C+30 (Non RDFA)
•	•
•	•
•	•

Example Data Element (Continued)

Readiness Objective Code (ROBCO)

Definition: Identifies a unit or activity as part of a specific force grouping based on a contingency plan assignment and/or current or programmed POMCUS.

Formulation:



Coded Values

1	Division Set 1 (Units)
A	Division Set 1 (PBF)
2	Division Set 2 (Units)
B	Division Set 2 (PBF)
3	Division Set 3 (Units)
C	Division Set 3 (PBF)
⋮	⋮

Coded Values

N	USAREUR Augmentation
R	EF Augmentation]
S	SACEUR Strategic Reserve
T	Other EF Units
⋮	⋮

Example of Table Population for ROBCO

Data Element

Data Element Name
Unit Readiness Objective Code
Arrival Time Period
Theater Employment Code
Function Role Code
Latest Arrival Time Period
Latest Arrival Date
Deployment Status Code
POMCUS Code
POMCUS Division Set Code
European Deployment Role

...

Associate Members

Assoc Code	Data Element Name	Elmnt Role Code *
111	Unit Readiness Objective Code	P
111	Arrival Time Period	S
111	Theater Employment Code	S
111	Function Role Code	S
111	POMCUS Code	S
112	Arrival Time Period	P
112	Latest Arrival Time Period	S
112	Latest Arrival Date	S
112	Deployment Status Code	S
113	POMCUS Code	P
113	POMCUS Division Set	S
113	European Deployment Role	S

...

Chain Assoc. Column Count
1
2
3
4

Associate Element Value
1 C 0:4 Non-RDFA
2 C 5:15 Non-RDFA
3 C 16:30 Non-RDFA
4 C 31:45 Non-RDFA
5 46:60

...

Element Associate

Assoc Code	Associate Description	Assoc Type Code
111	Unit Requirements Objective Code Data Element Formulation	CHAIN
112	Arrival Time PeriodFormulation	COUPL
113	POMCUS Code Formulation	MULTI

...

Assoc Element Context Text
Force Component Code = 9 Fórce Component Code \=9

* P = Primary Associate
S = Secondary Associate

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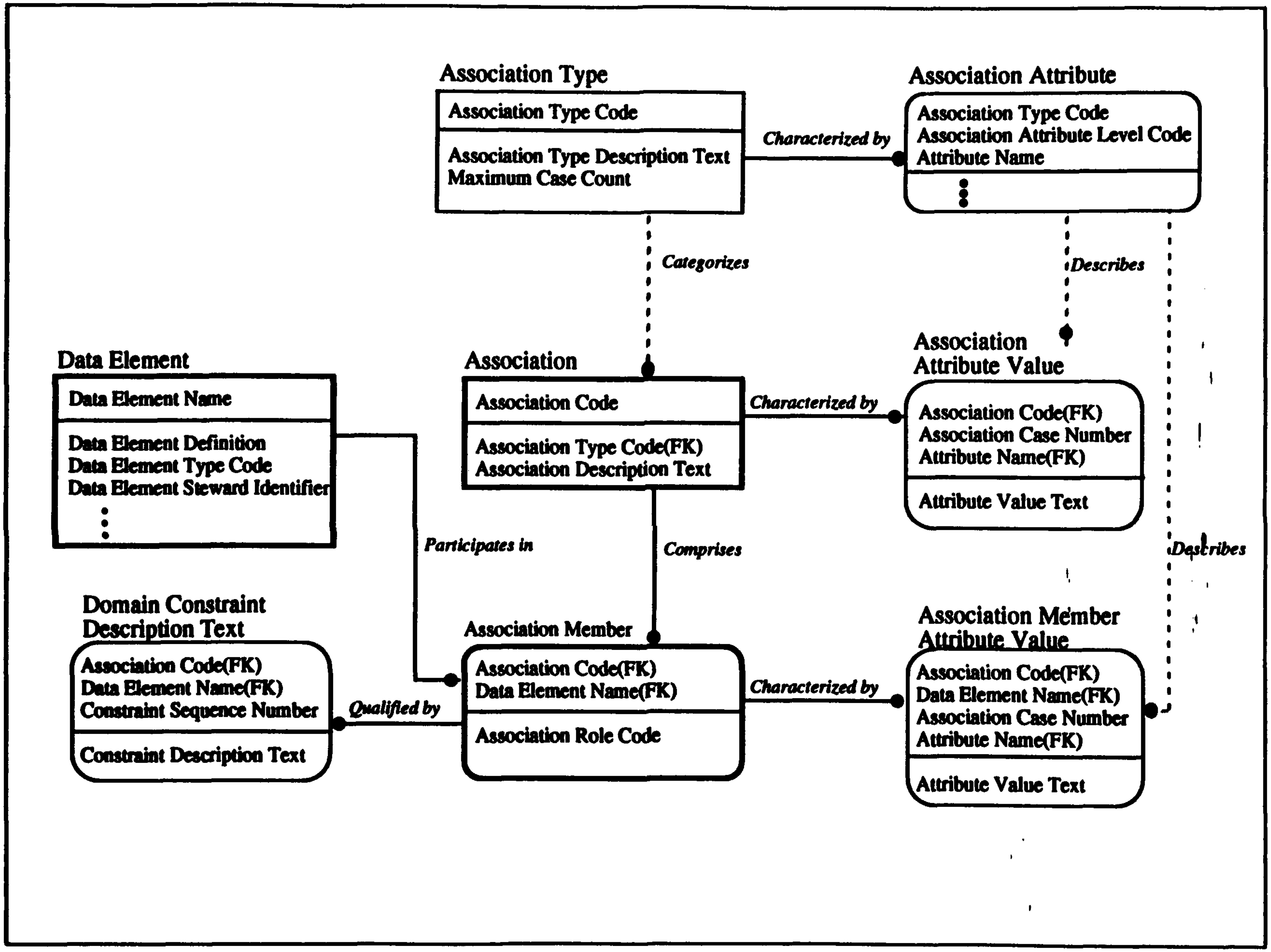
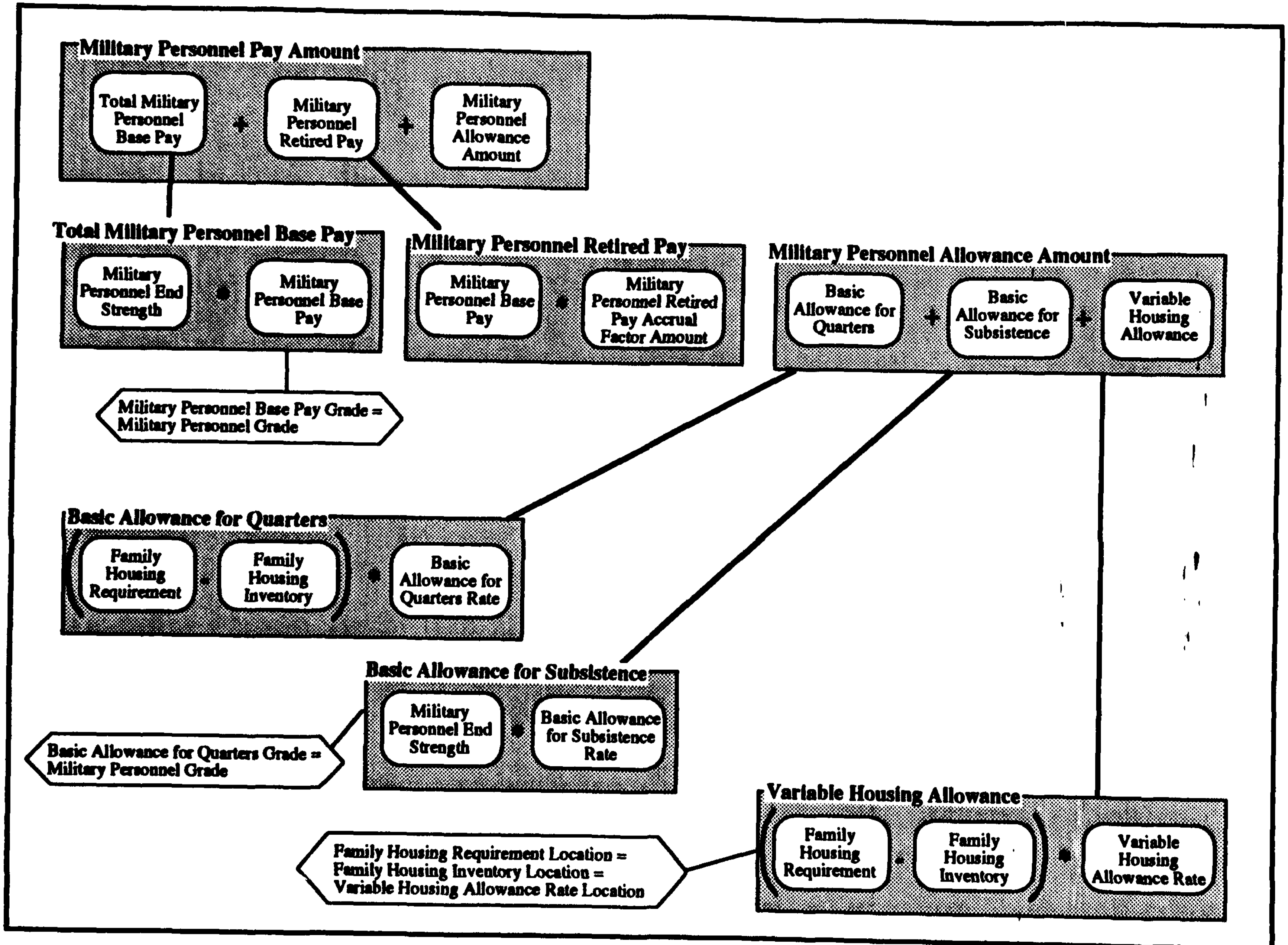
Primitive Versus Derived Data

Characteristic / Type of Data Element	Primitive	Derivative
Source of Value	Observed inputs	Generated from primitives (sum, ratio, average, etc.)
Volume	Finite	Potentially infinite
Definition	Static	Dynamic
Usage	Structured Widely Available Non-redundant	Unstructured Increasingly Private Redundant
Example	Equipment-Weight	Shipment-Weight
Responsibilitity	Data Administration	Software Configuration Manager /Functional User



Logical Data Model for Documenting Derivation Associations



Example Decomposition of a Derived Element

Data Element

Data Element Name
Military Personnel Pay Amount
Total Military Personnel Base Pay
Military Personnel Retired Pay ...
Military Personnel Allowance Amount
Military Personnel End Strength
Military Personnel Base Pay
Military Personnel Retired Pay accrual Factor Amount
Basic Allowance For Quarters
Basic Allowance for Subsistence
Variable Housing Allowance
Family Housing Requirement
Family Housing Inventory
Basic Allowance for Quarters Rate
Variable Housing Allowance Rate
⋮

Association Type

Assoc Type Code	Association Type Description Text	Max Case Count
DRVTN	Derived Data Element	1

Association Attribute

Assoc Type Code	Association Attribute Level	Attribute Name
DRVTN	Associate	Derivation Text
DRVTN	Associate	Reusable Software Module
DRVTN	Member	Argument Name

Association

Assoc Code	Assoc Type Code	Associate Description
511	DRVTN	Military Personnel Pay Amount Computation
512	DRVTN	Military Personnel Base Pay Computation
513	DRVTN	Military Personnel Retired Pay Computation
514	DRVTN	Military Personnel Allowance Amount Computation
515	DRVTN	Basic Allowance for Quarters Computation
516	DRVTN	Basic Allowance for Subsistence Computation
517	DRVTN	Variable Housing Allowance Computation

Association Attribute Value

Assoc Code	Assoc Case Nmbr	Attribute Name	Attribute Value Text
511	1	Derivation Text	MPPA = TMPBP + MPRP + MPAA
512	1	Derivation Text	TMPBP = MPES * MPBP
513	1	Derivation Text	MPRP = MPBP * MPRPAFA
514	1	Derivation Text	MPAA = BAQ + BAS + VHA
515	1	Derivation Text	BAQ = (FHR - FHI) * BAQR
516	1	Derivation Text	BAS = MPES * BASR
517	1	Derivation Text	VHA = (FHR - FHI) * VHAR
511	1	Reusable Software Module	MPPA_Cmptn

Association Member

Assoc Code	Data Element Name	Elmnt Role Code*
511	Military Personnel Pay Amount	P
511	Total Military Personnel Base Pay	S
511	Military Personnel Retired Pay	S
511	Military Personnel Allowance Amount	S
512	Total Military Personnel Base Pay	P
512	Military Personnel End Strength	S
512	Military Personnel Base Pay	S
513	Military Personnel Retired Pay	P
513	Military Personnel Base Pay	S
513	Military Personnel Retired Pay Accrual Factor Amount	S
514	Military Personnel Allowance Amount	P
514	Basic Allowance For Quarters	S
514	Basic Allowance for Subsistence	S
514	Variable Housing Allowance	S
515	Basic Allowance For Quarters	P
515	Family Housing Requirement	S
515	Family Housing Inventory	S
515	Basic Allowance for Quarters Rate	S
516	Basic Allowance for Subsistence	P
516	Basic Allowance for Subsistence Rate	S
516	Military Personnel End Strength	S
517	Variable Housing Allowance	P
517	Family Housing Requirement	S
517	Family Housing Inventory	S
517	Variable Housing Allowance Rate	S
⋮		

* P = Primary Associate
S = Secondary Associate

Association Member Attribute Value

Assoc Code	Data Element Name	Assoc Case Nmbr	Attribute Name	Attribute Value Text
511	Military Personnel Pay Amount	1	Argument Name	MPPA
511	Total Military Personnel Base Pay	1	Argument Name	TMPBP
511	Military Personnel Retired Pay	1	Argument Name	MPRP
511	Military Personnel Allowance Amount	1	Argument Name	MPAA
512	Total Military Personnel Base Pay		Argument Name	TMPBP
512	Military Personnel End Strength	1	Argument Name	MPES
512	Military Personnel Base Pay	1	Argument Name	MPBP
513	Military Personnel Retired Pay	1	Argument Name	MPRP
513	Military Personnel Base Pay	1	Argument Name	MPBP
513	Military Personnel Retired Pay Accrual Factor Amount	1	Argument Name	MPRPAFA
514	Military Personnel Allowance Amount	1	Argument Name	MPAA
514	Basic Allowance For Quarters	1	Argument Name	BAQ
514	Basic Allowance for Subsistence	1	Argument Name	BAS
514	Variable Housing Allowance	1	Argument Name	VHA
515	Basic Allowance For Quarters	1	Argument Name	BAQ
515	Family Housing Requirement	1	Argument Name	FHR
515	Family Housing Inventory	1	Argument Name	FHI
515	Basic Allowance for Quarters Rate	1	Argument Name	BAQR
516	Basic Allowance for Subsistence	1	Argument Name	BAS
516	Basic Allowance for Subsistence Rate	1	Argument Name	BASR
516	Military Personnel End Strength	1	Argument Name	MPES
517	Variable Housing Allowance	1	Argument Name	VHA
517	Family Housing Requirement	1	Argument Name	FHR
517	Family Housing Inventory	1	Argument Name	FHI
517	Variable Housing Allowance Rate	1	Argument Name	VHAR

Domain Constraint Description Text

Assoc Code	Data Element Name	Constraint Sequence Nmbr	Constraint Description Text
512	Total Military Personnel Base Pay	1	Military Personnel Base Pay Grade = Military Personnel Grade
516	Basic Allowance for Subsistence	1	Basic Allowance for Quarters Grade = Military Personnel Grade
517	Variable Housing Allowance	1	Family Housing Requirement Location = Family Housing Inventory Location
517	Variable Housing Allowance	2	Family Housing Requirement Location = Variable Housing Allowance Rate Location

Documentation of the Example Derived Element in the Model

Complex Data Elements

Complex Data Streams

Types of Complex Data Streams

- **Documents** - Text based files with formatting codes incorporated in the file
- **Spreadsheets** - Tables of two or more dimensions
- **Graphics** - Simple or complicated drawings such as CAD/ CAM systems and drawing packages.
- **Video and Sound** - Digitally recorded video and sound which can be manipulated by users with software programs
- **Hypertext** - Linked compilations of text, video, and sound

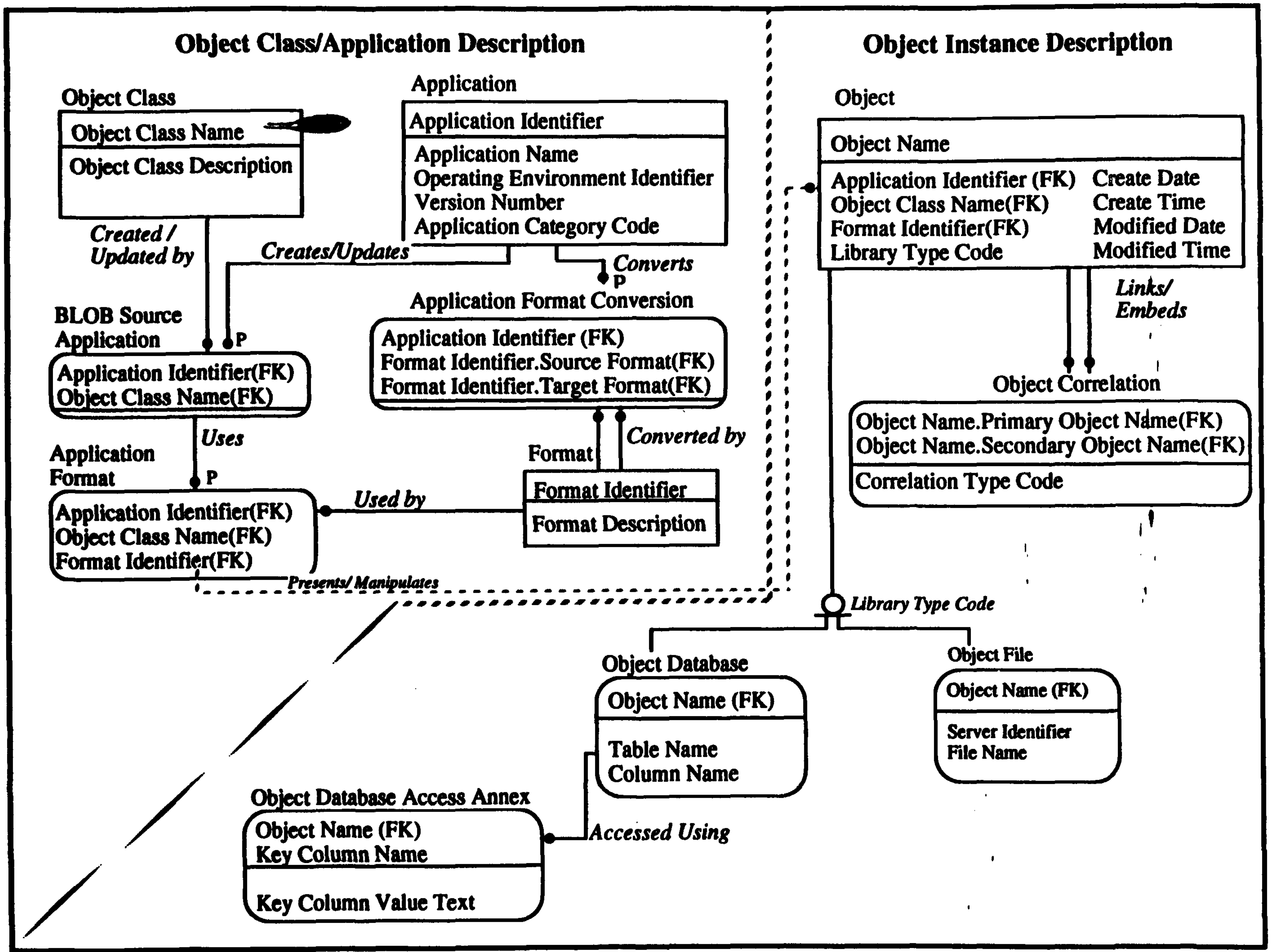
Complex Data Elements

Data Stream Standardization Issues:

- **Internal Storage Formats** - Standard formats to store types of data streams. SGML, PICT etc...
- **Common Definitions of Terminology** - Across the multiple object models, common terms to define needed data items. Object Identifier, Type etc...
- **Agreed Domains of Allowable Values** - For the common terms, common sets of allowable values. Types, Methods etc..

Today's Opportunity:

Focus of current research is on documenting complex data streams.
An opportunity exists to set standards to fulfill data sharing needs.
(Last two bullets)



Preliminary Logical Data Model for Administering Complex Data Streams as Reusable Assets

Complex Data Elements

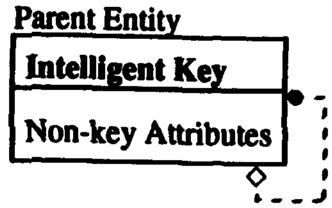
Assemblies, Definition:

- Entities which have relationships to themselves (i.e., instances within the entity relate recursively to other instances within the same entity).
- Dominant entities appearing across multiple functional data models

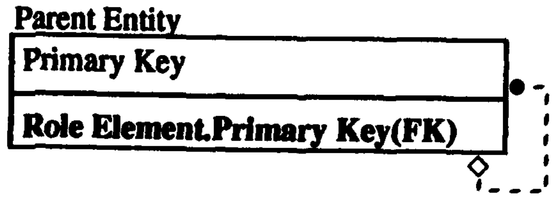
Examples:

- **Oganization structures**
- **Equipement assemblies and subassemblies**
- **Geographic terrain features such as roads, rivers and facilities.**

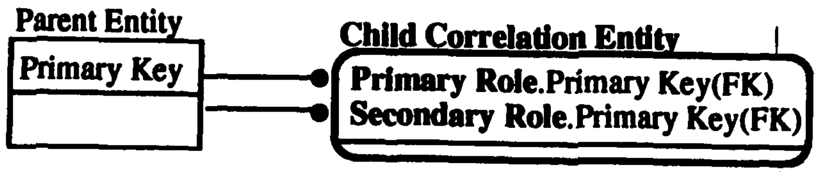
Intelligent Key: One-to-many recursive relationship based on intelligence embedded in the coded values of the key (e.g., 0.0, 1.0, 1.1, 1.1.1, 1.1.2, 1.1.2.1)



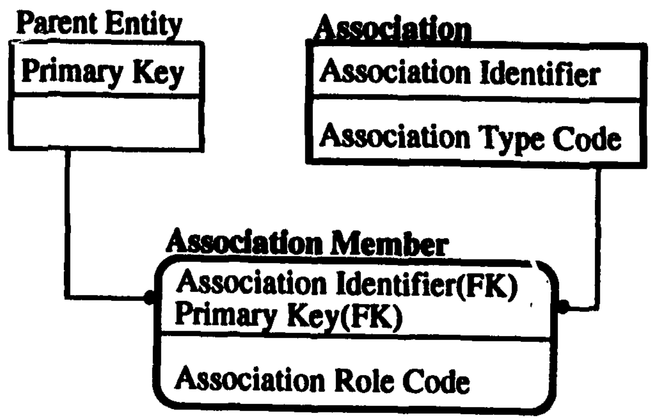
Foreign Key Role Element: One-to-many recursive relationship based on linking foreign key of a child entity instance to the primary key of another parent entity instance.



Child Correlation Entity: Many-to-many recursive relationship correlating a child entity having primary and secondary foreign key role elements. The names assigned to these foreign keys indicate the nature of the relationship between entity instances in the parent entity.



Association: Many-to-Many Recursive Relationship based on creation of an independently identified Association entity. The association entity is related to the parent entity using an Association Member correlation entity. The association identifier is a fabricated element which ultimately is system maintained. Roles are identified by assigning values to an Association Role Code in the Association Member entity.



Example Alternative Profiles for Modeling Recursion

Alternative / Evaluation Criteria	Intelligent Key	Foreign Key Role Element	Child Correlation Entity	Association
Simplicity of Syntax	••••	•••	••	•
Maintainability	•	•••	•••	•••
Flexibility	•	••	•••	•••
Extensibility	•	•	••	••••
Intellectual Complexity	••	•••	•••	••

Legend	• - Poor •• – Fair ••• - Good •••• - Excellent

Evaluation of Alternative Templates for Representing Recursive Relationships in Assemblies

Complex Data Elements

Relationship to the Modeling and Simulation Community:

- **Feedback on Classification** - Input to shape the DoD program for Complex Data Elements.
- **Inclusion in DoD Data Standardization** - Use of Data Standards and DDRS to define data requirements and improve data sharing.
- **Active Partner** - Stay involved with DISA CIM to work together on meeting common goals and needs about complex data elements.

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Executive Summary

This paper analyses four types of complex data that will impact the data administration program:

1. **Composite Elements** - formulations that bundle or embed multiple concepts within a single fixed format data element.

2. **Derived Elements** - calculations or aggregations assimilated from primitive observations.

3. **Complex Data Streams** - sequential arrangements of bits and/or bytes in varying lengths used to communicate information through, for example, word processing, graphics, voice, or multi-media applications.

4. **Assemblies** - entities which have relationships to themselves (i.e., instances within the entity relate recursively to other instances within the same entity). Organization structures, equipment assemblies and subassemblies, and geographic terrain features such as roads, rivers, and facilities all represent examples of assemblies.

The analysis is performed to:

1. Document evaluation criteria for deciding when composite data elements and derived data elements should be adopted and managed as standard data elements.

2. Develop relational models for documenting data element associations in composite data elements and derived data elements, and for supporting the reuse of complex data streams. These models provide a basis for updating data dictionaries designed to support reuse of these various types of complex data. Specifically, the models for composite and derived data elements will provide a basis for updating the DDRS. The model for complex data streams identifies data elements which are important for standardization at a national and international level to improve the interoperability of object oriented software packages being developed to support the reuse of complex data streams.

3. Outline approaches for improving the reuse management of entity groups which describe assembly type objects.

Recommendations developed for each of the types of complex data discussed in this paper are summarized in Table 1 below. The table lists the four types of complex data, specific recommendations for improving their management for reuse, and the rationale for these recommendations.

Type of Complex Data	Recommendation for Improving Management for Reuse	Rationale for Recommendation
Composite Elements	Document associations among data elements provide the basis for the composite element's formulation. A data model for documenting associations is provided in Chapter 2. Consider standardizing a composite it is institutionalized and does not contain components having independent uses outside the composite. Distinguish between logical and physical representations of data elements. Implementation issues concerning performance and storage may lead to situations where composite formulations are more desirable than single concept formulations. In these situations it is best to document the difference between the logical and physical, and the rationale for the choice made.	Capturing Association information promotes understanding of the data, improves its sharing, and supports efforts to migrate legacy elements to single concept elements. Costs for standardizing an institutionalized chain can exceed the benefits. Because institutionalized elements appear in numerous databases, numerous configuration management tasks would result from changing their formulation.
Derived Elements	Standardize derivatives used in transaction systems when support accounting, auditing, policy, or business rule enforcement. Manage data models for DSS functions separately from data models for transaction oriented systems. Consider adopting derived elements supporting DSS uses if their use is formalized in official DoD documents, used in multiple functional areas, or shared with external organizations. Map a standardized derived element to its constituent primitive source elements.	These elements are of 'corporate interest', and cataloging their specifications as standards improves corporate knowledge about the data, and the business. Documenting the association between a derived element and its primitive source elements improves coordination and communication about how commonly used derivations are to be calculated.
Complex Data Streams	Design and implement a standard architecture for cataloging and retrieving documents, graphics, voice, video and other complex data streams. This can be done using relational database technologies, but object oriented technologies provide a natural solution framework. Initiate a project to standardize elements critical identifying, categorizing and sharing complex data streams at a national or international level.	Application to catalog and retrieve complex data streams are just starting to emerge in the market place with primitive capabilities. Without central guidance, agencies within DoD will redundantly acquire and supplement these capabilities using a variety of incompatible solutions.
Assemblies	Develop guidelines for modeling assemblies using standard templates and extensions that communicate concepts not represented by entity-relationship models. Identify assembly type objects in data models and manage them for reuse independently of the functional models.	Guidelines will improve communication about the assembly. Reuse management will capitalize on past analysis and promote improvement of the assembly documentation over time.

Table 1 Summary of Recommendations

In formulating the recommendations, goals for improving data sharing, data quality, and data security were promoted. But requirements to achieve these goals in a cost effective and timely manner also require the standardization efforts be focused on data that are shared. All data within the department are of corporate interest, but the standardization program must be responsive to priorities; todays standardization efforts should focus on today's data sharing requirements. DoD's data standardization efforts would benefit its customers if it focused on standards and agreements that outline the formats used to exchange data between existing Automated Information Systems.

To support these recommendations, data administration tools need to be extended to capitalize on a synergism between data modeling techniques and data analysis techniques. The data analysis techniques include domain comparison, synonym and homonym checks, metadata audits, configuration management of data exchange needs, and analysis of existing data exchange formats. These data analyses techniques can be used to accelerate the discovery and definition of joint functional requirements. They can also be used to accelerate the standardization of look-up tables, reference tables, or domain tables (e.g., country code, pay plan code, location code, etc.); this would, in effect, jump start the extension of the DoD Data Model.

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Hardwired Data Hierarchies:
The Tyranny of End-Use Specific Representations

ARL/UT:

Jack Sheehan
Tom Dundon
Jim Hammond
Steve Unruh

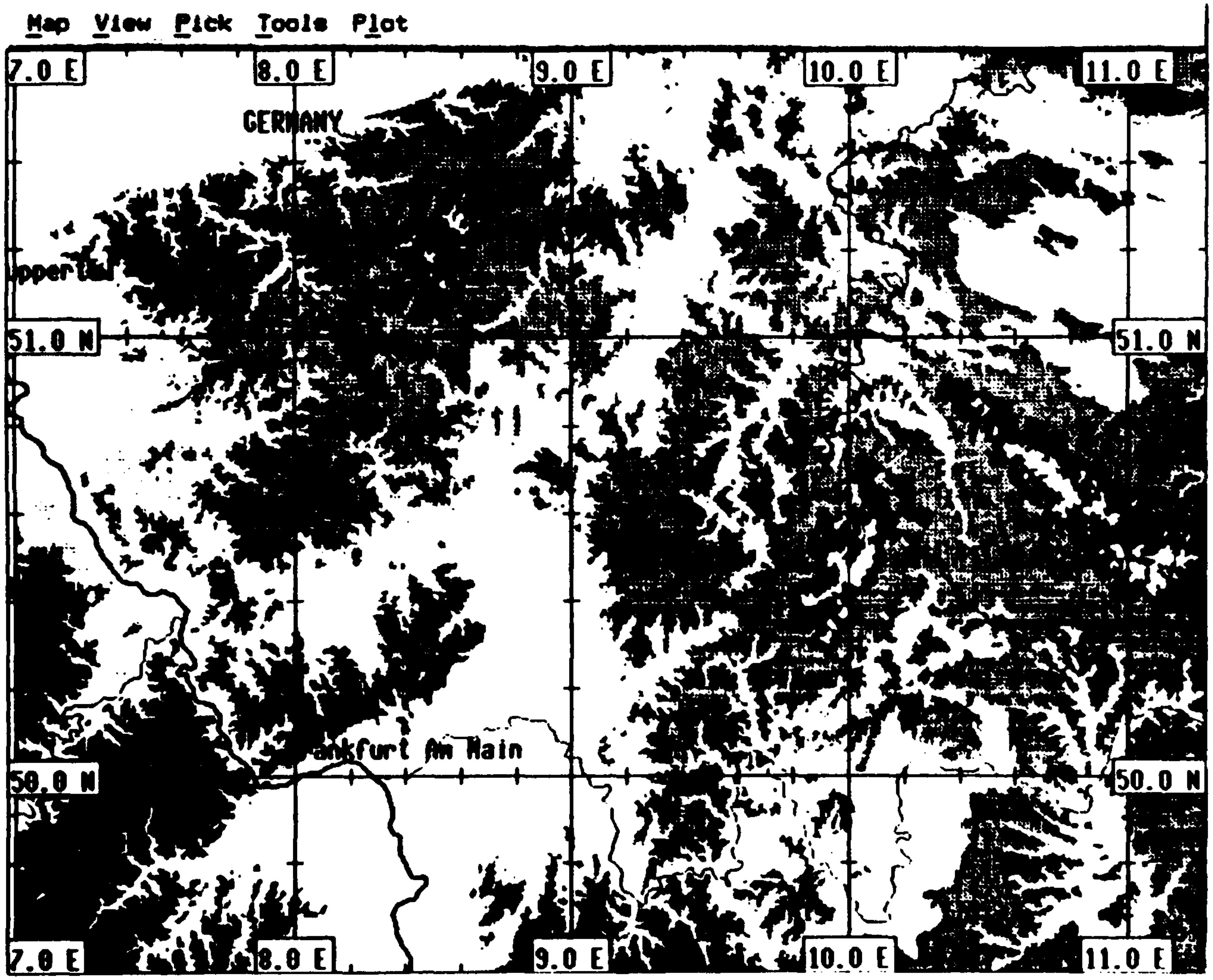
MSU/CAST:

Steve Foster

THE THREE HERESIES

- The Real World of Combat is <u>NOT</u> 2-D
- Hardwired Hierarchy is Reuse Hard-Kill
- Data Complexity is <u>NOT</u> an Intrinsic Property of a "Data Element"

Softcopy Mapping System

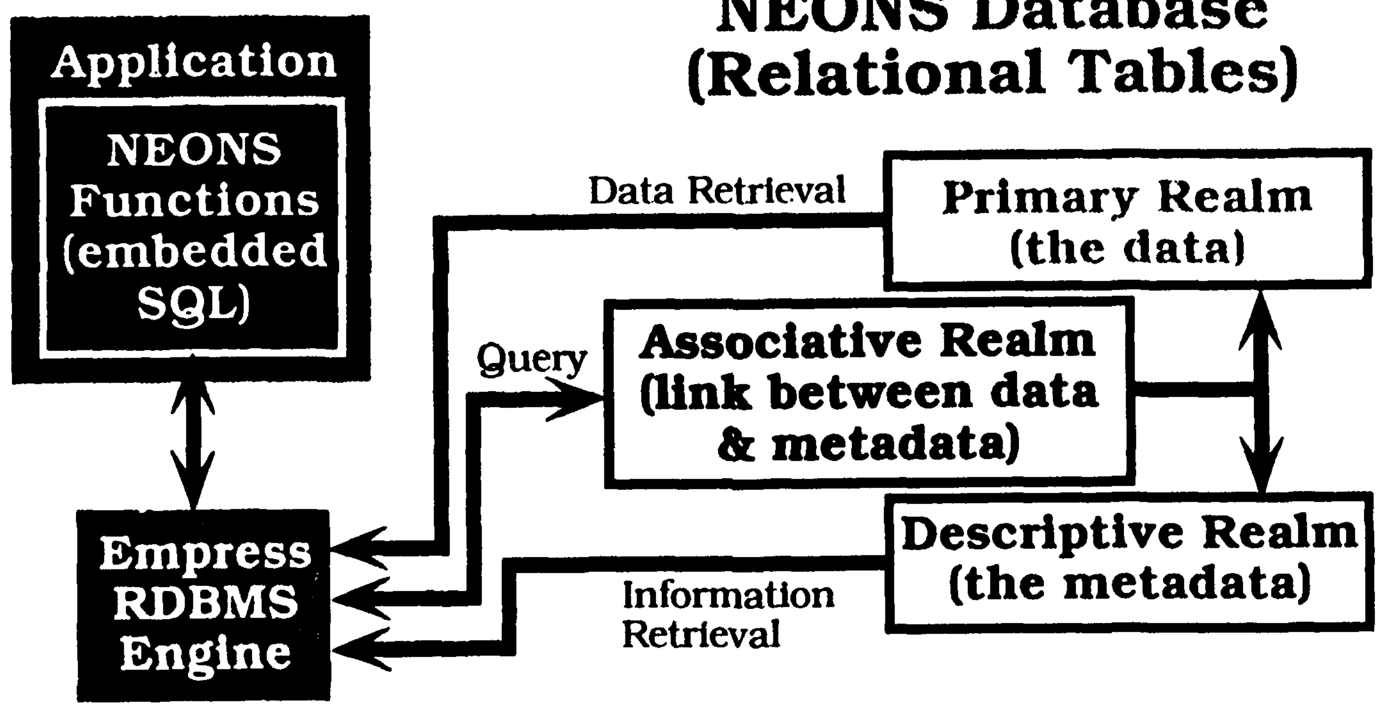


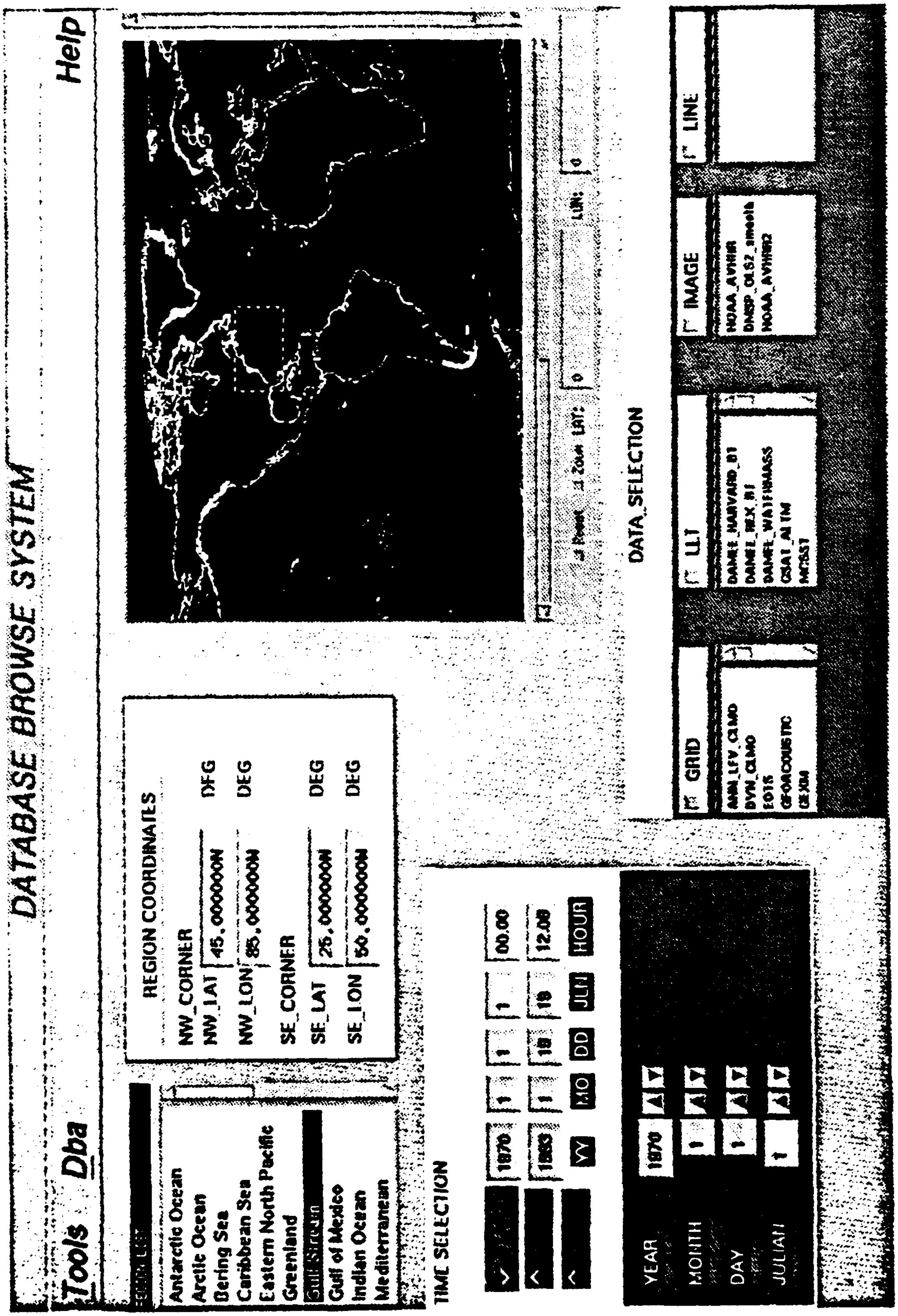
Lockheed
Missiles & Space Company, Inc.

Mississippi State
RESEARCH APPLICATIONS DEVELOPMENT
Center for Air Sea Technology

The Navy Environmental Operational Nowcast System NEONS

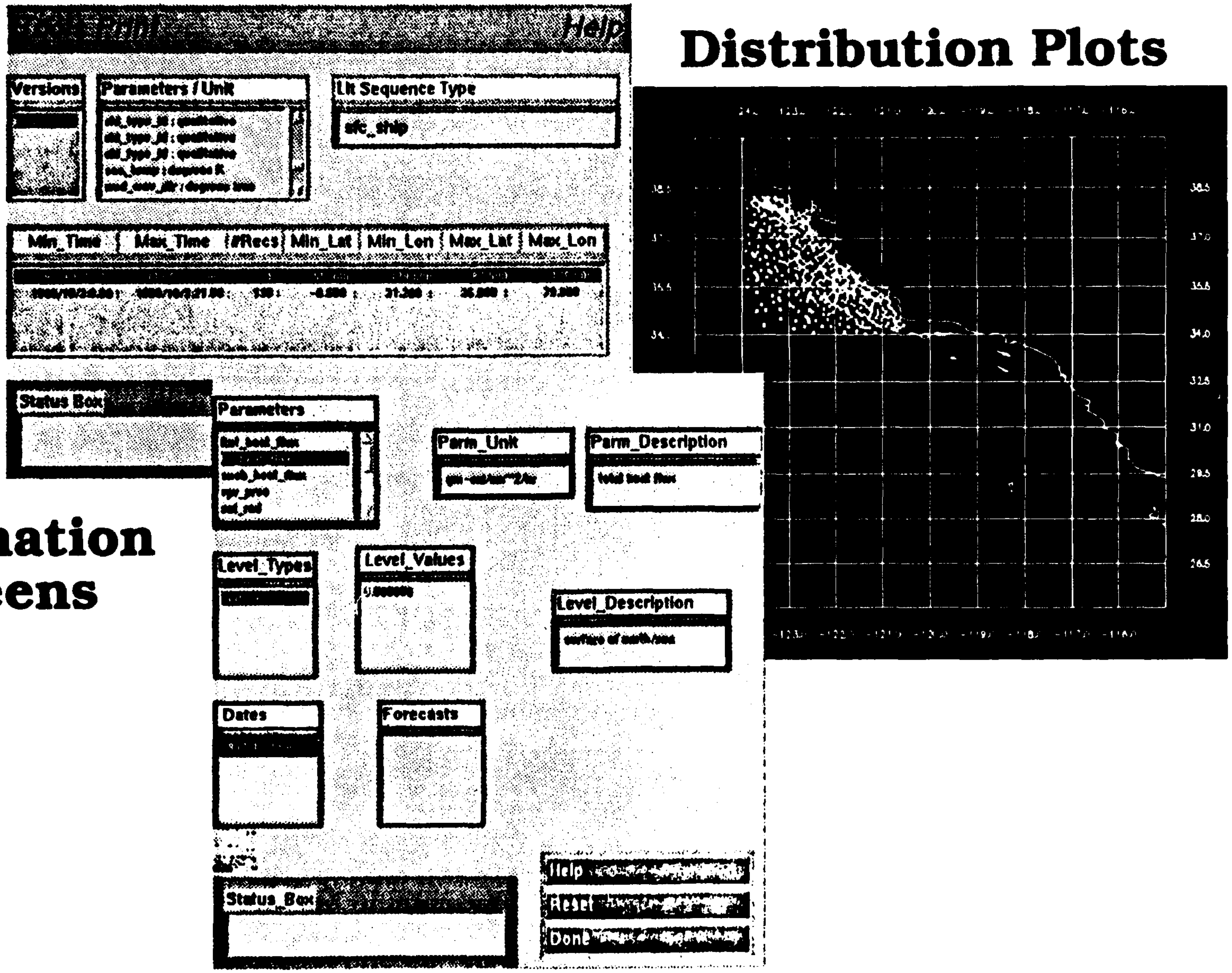
NEONS Database (Relational Tables)




DATABASE BROWSE SYSTEM
Tools
Dba
Help
Antarctic Ocean
Arctic Ocean
Bering Sea
Caribbean Sea
Eastern North Pacific
Greenland
Gulf Stream
Gulf of Mexico
Indian Ocean
Mediterranean
REGION COORDINATES
NW_CORNER
NW_LAT 45.000000N DEG
NW_LON 85.000000W DEG
SE_CORNER
SE_LAT 25.000000N DEG
SE_LON 50.000000W DEG
TIME SELECTION
YY
MO
DD
JLN
HOUR
YEAR
MONTH
DAY
JULIAN
DATA_SELECTION
GRID
LLT
IMAGE
LINE
NOAA_AVHRR
DAMEE_HARVARD_B1
DAMEE_WATERMASS
GEOACOUSTIC

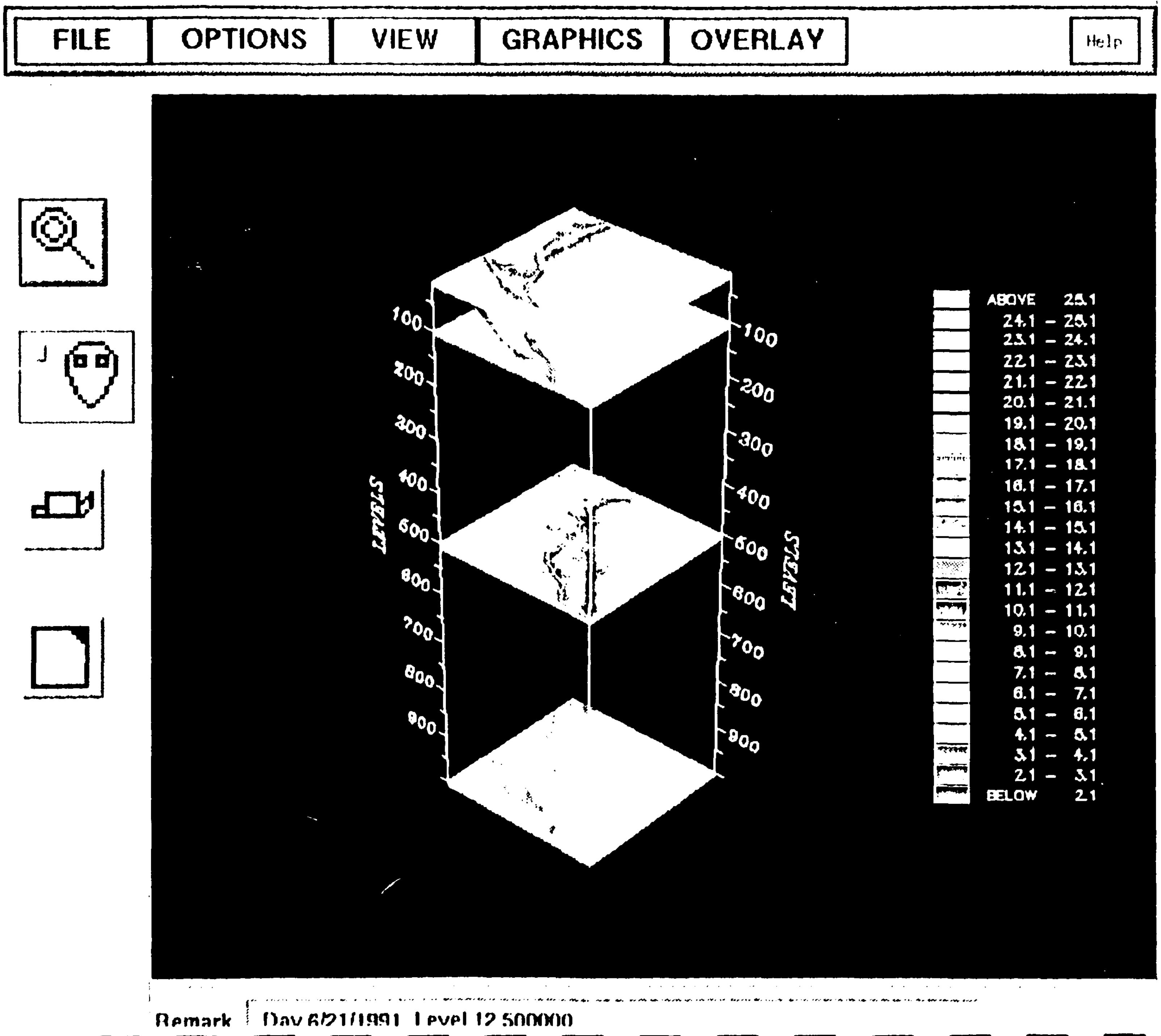
NEONS Browser Lat/Lon/Time (LLT) Data Display

Distribution Plots

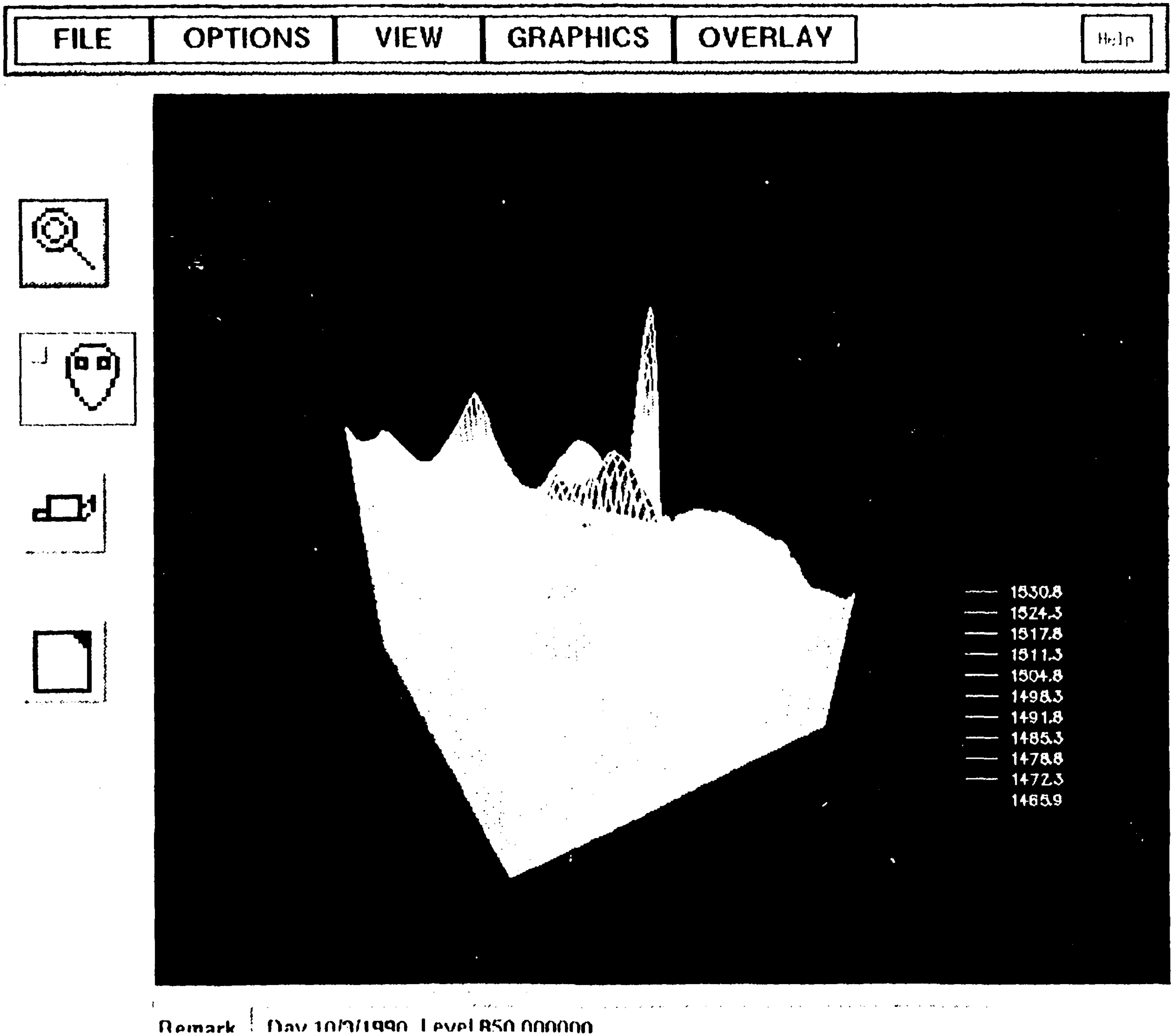


Information Screens

VISUALIZATION



VISUALIZATION



ENGINEERING UNITS

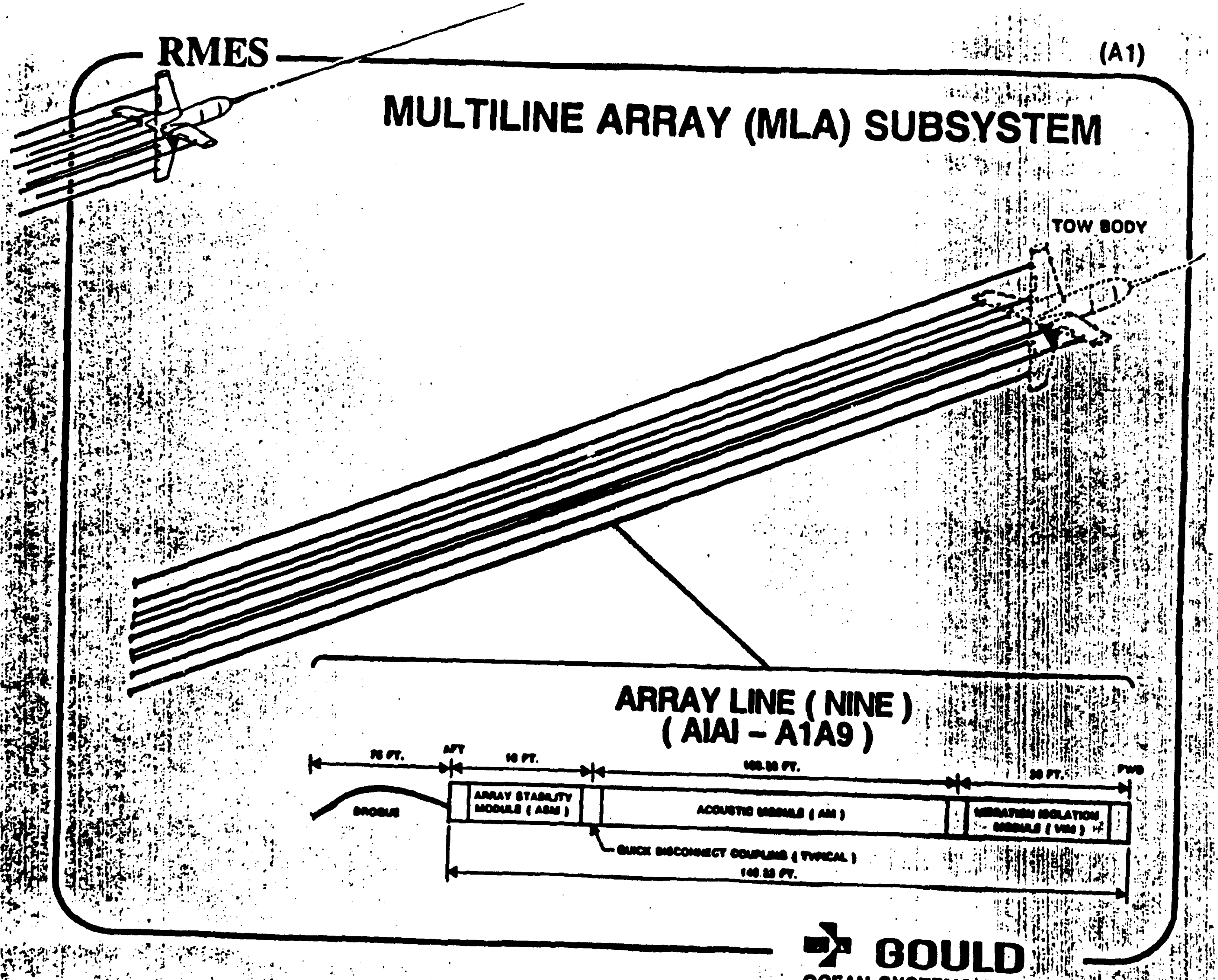
```
typedef struct {
        long int    history;
        long int    quantity;
        long int    norm_type;
        long int    norm_code;
        long int    unit_type;
        long int    unit_code;
        double      location;
        double      scale;
        } Engr_Unit;
```

ENGR_UNIT

- quantity → time
- norm_type → geometric
- norm_code → geometric
- unit_type → { linear, logarithmic }
- unit_code → { nsec, µsec, msec, sec, min, hour, day, month, year }

ENGR_UNIT

- quantity → velocity
- norm_type → geometric, Kinetic, Dynamic
- norm_code → geometric, {displacemnt, velocity, acceleration}, {Re, Gr, Cp, Nu, Fr, Pr, M, K, Wb, linear}
- unit_type → {linear, logarithmic}, linear
- unit_code → {um/sec, mm/sec, m/sec, km/hr}, in/sec, ft/sec, yd/sec, mph, knots


RMES
(A1)
MULTILINE ARRAY (MLA) SUBSYSTEM
TOW BODY
ARRAY LINE (NINE)
(AIAI – A1A9)
AFT
ARRAY STABILITY
MODULE (ASM)
ACOUSTIC MODULE (AM)
QUICK DISCONNECT COUPLING (TYPICAL)
GOULD
OCEAN SYSTEMS DIVISION

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- A Vertex ...
  - Conforms to a Standard Data Element
  - Provides Attributes for One Instance of an Entity, and
  - Contains NO Filial Information, and

  Is the "Data" at a Specific Level of Detail.

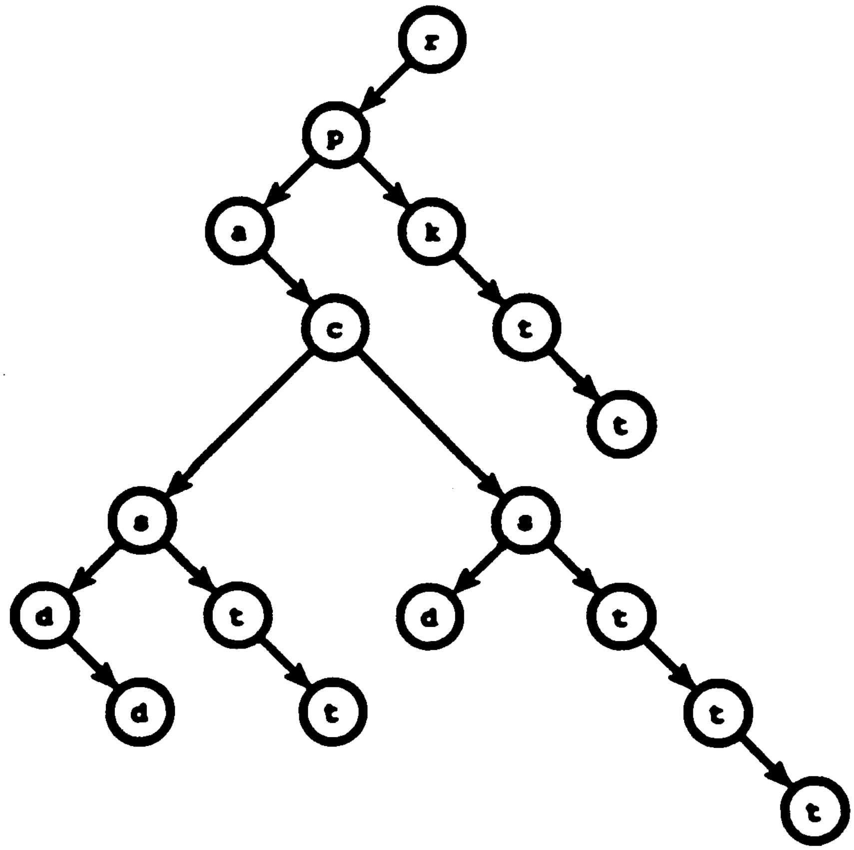
- An Edge...
  - Contains the Identification of Exactly 2 Vertices,
  - Asserts Superior-Subordinate Relationship, and
  - Contains NO Entity Attributes

  Is the Linkage between the "Data" at Differing Levels .

- The Grammar...
  - Evaluates Production Rules to Create the Data Model,
  - Captures the End-Use Specific Data Hierarchy, and
  - Associates Vertices by Edges, not Identities by Attributes

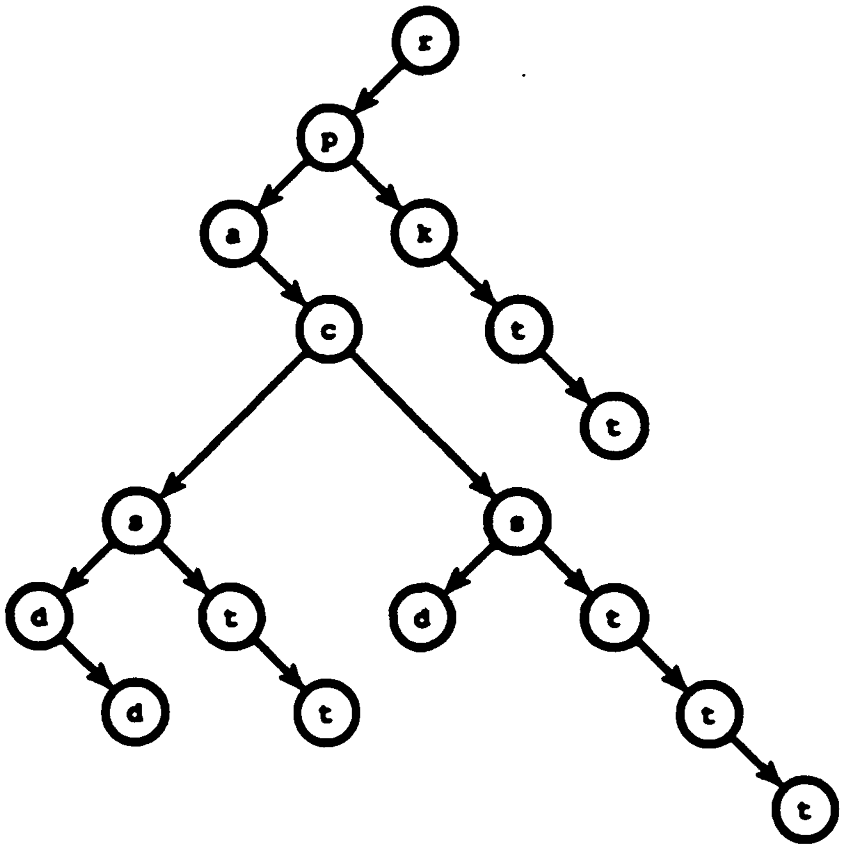
  Employs Superior Level "Data" as Subordinate Level "Meta-Data".

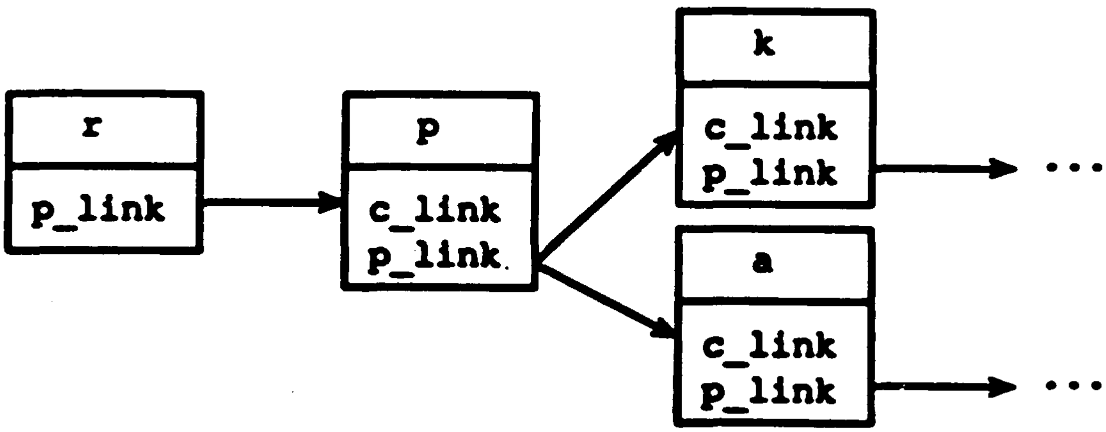
The DAS3 Relationship Model



Legend:
r - Run
p - Platform
a - Acoustic Sensor
k - Kinematic Sensor
c - Ping Cycle
s - Data Stream
t - Time-Series Data
d - Process Descriptor

DAS3 File Format





The Problem

- DAS3 data structures contain their own linkage information.
  - Requires a fixed model of relationships among data.
  - No provision for missing or unforeseen data structures.
  - Attempts to increase generality lead to a proliferation of linkage fields.

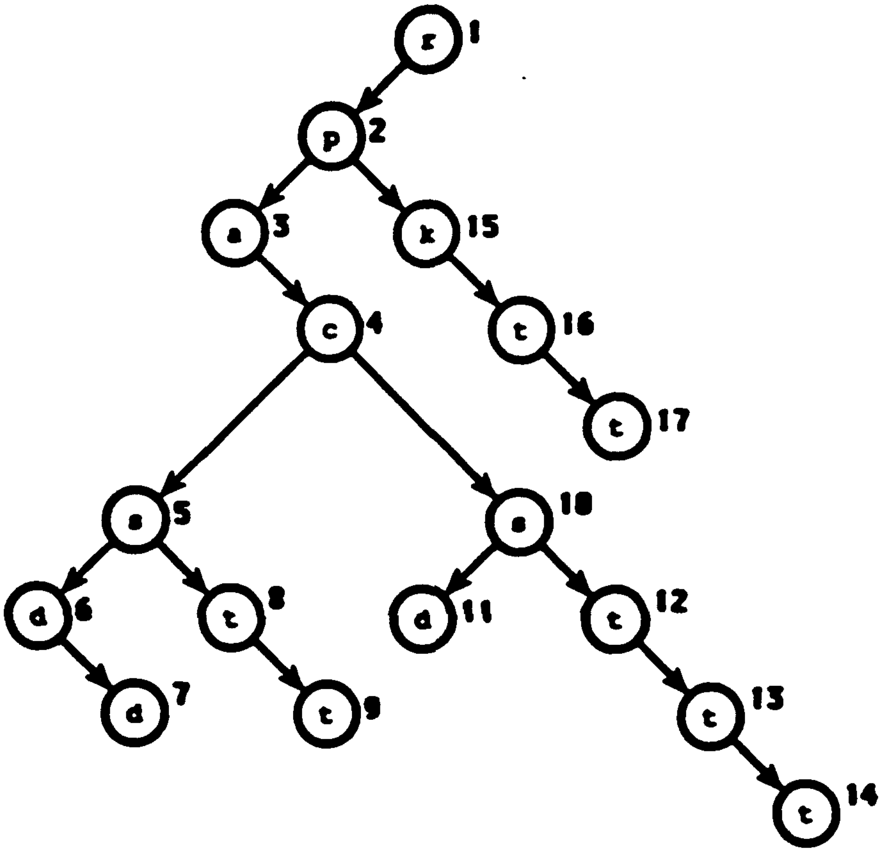
DAS4 Design Goals

- Compatible across all major computer architectures.
- Store data from a SONAR exercise of arbitrary complexity.
  - Permit multiple instances of any data type.
  - Express any level of detail that is appropriate.
- Allow users to apply alternate models to a common set of data.

The Solution

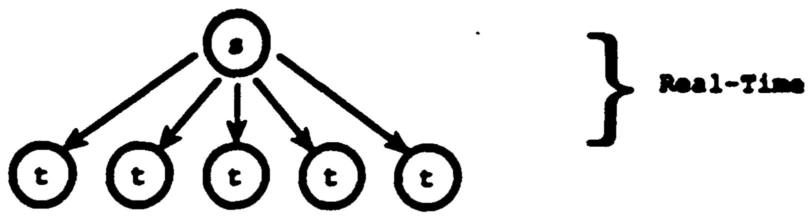
- Any given set of data and its relations can be expressed as a graph.
- Removing the linkage fields from the data structures produces a design with three components:
  - the data elements (vertices),
  - the relations among the data elements (edges),
  - the model to which the relations conform (production rules).

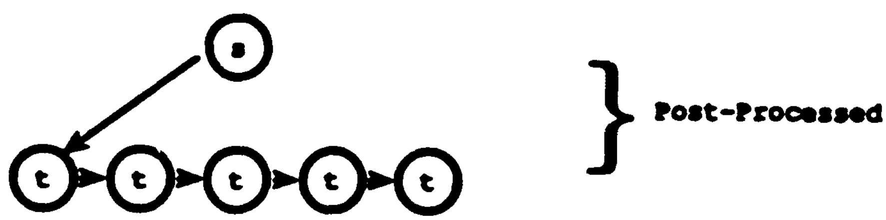
DAS4 File Format



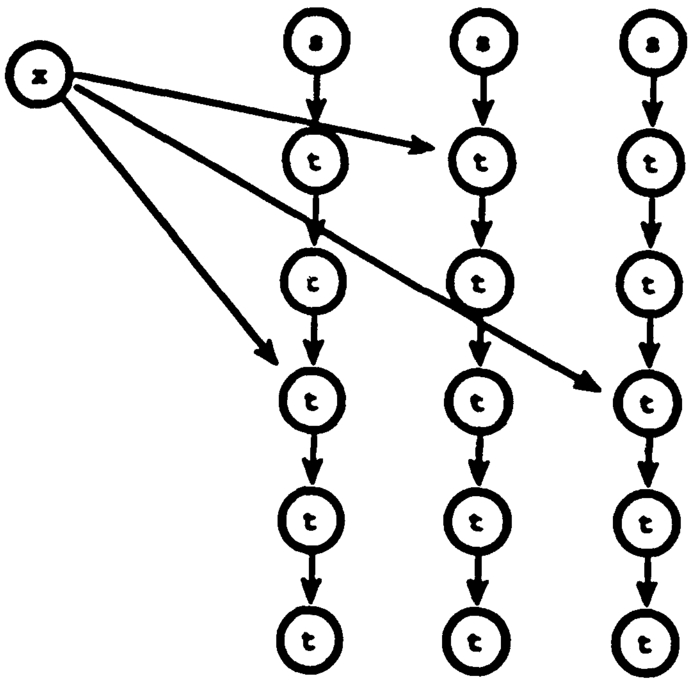
Vertices =	Edges =	Productions =
r, p, k,	{1,2},	r -> rp,
a, c, s,	{2,3},	p -> pa | pk,
...	{2,15},	a -> ac,
	...	...

DAS4 Real-Time Acquisition



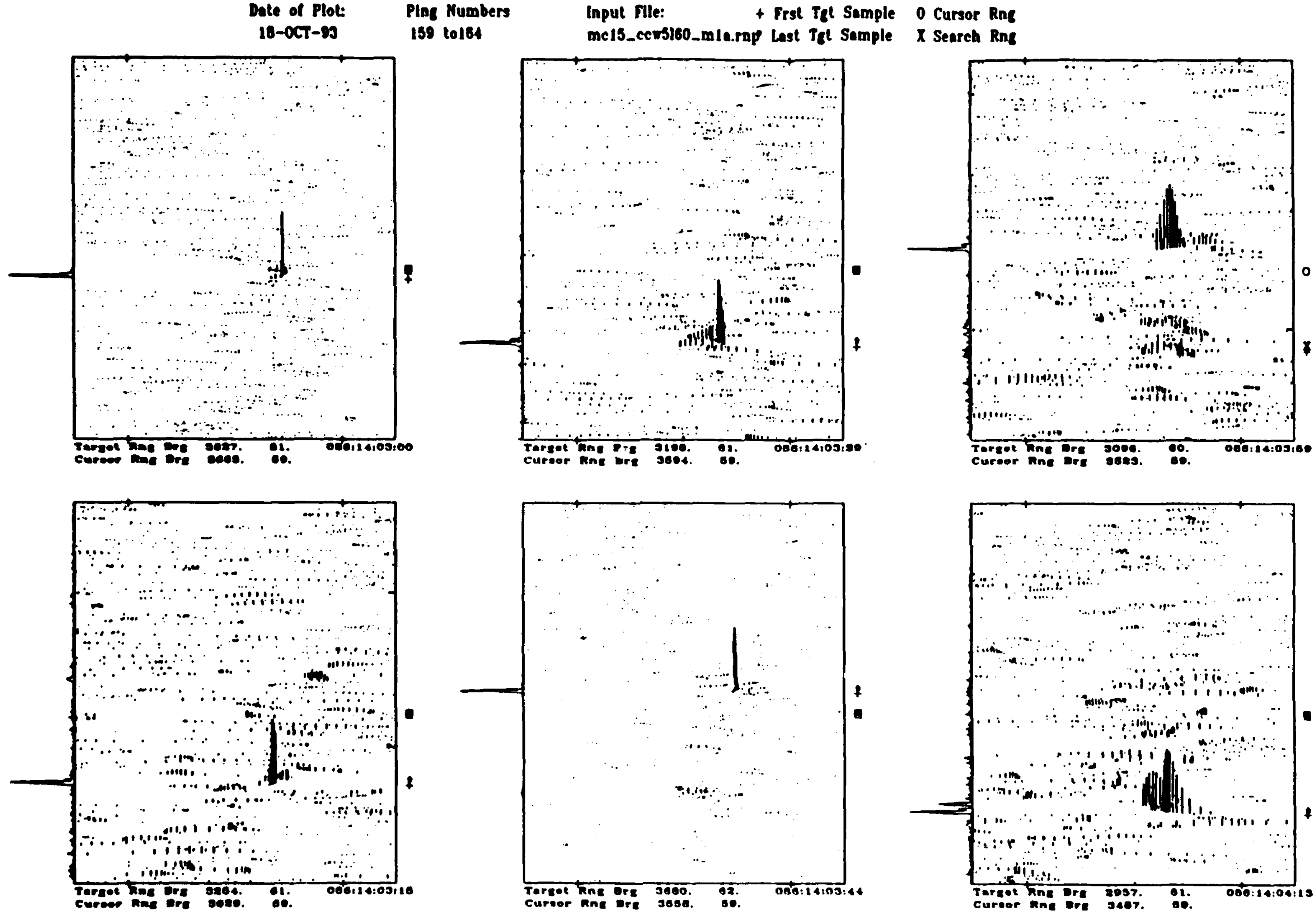


DAS4 Correlation Across Multiple Sensors



Benefits

- Treating components separately reduces overall complexity of the designer's problem.
- The set of DAS4 data structures may be expanded with no effect on existing files.
- An application's unique requirements are met by specifying an appropriate model of the relationships among DAS4 data elements.
- Porting of data between applications can be automated by a mechanism that transforms one model into another.
- A single pool of data may be shared by any number of applications.



McCandless 15 Whales Cut m1a
Correlation and Linking for 60ft Object

DMA
Data Modeling Project
for
MC&G Standardization

Dr. J Teller
DMA/TIM
2/18/94

BACKGROUND

- DoD Data Standardization Policy:
  - New initiatives to develop, modernize, or migrate an information system must use data elements registered in the DoD Data Repository System (DDRS)
- Why Standardize Data Elements?
  - Supports Interoperability
  - Application/Implementation Independence
  - Single <u>Name</u>- Single <u>Meaning</u>
- MC&G Data Elements must be Standardized

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REASONS FOR IDEF MODELING

- Federal Standard Vehicle for Documenting Business Processes
- Structures the Decision Process
  - Reveals Redundancies and Non-value Added Processes
  - Clearly Communicates Process and Data Relationships
- Provides a Framework for Functional Process Improvement

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PILOT PROJECT RATIONALE

- Standardize MC&G Data Elements:
  - Requires modeling with <u>I</u>ntegrated <u>DEF</u>inition Methodology
  - DMA lacked IDEF modeling expertise
  - ASD/C3I provided funding to cover training and facilitation of pilot modeling effort

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PILOT PROJECT AIMS

- Develop a DMA cadre with modeling and standard data element skills
- Develop models compatible with the Digital Geographic Information Exchange Standard (DIGEST) Feature Attribute Coding Catalog (FACC)

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PROJECT SCHEDULE

- One Week Training Session (Aug 23-27)
- Phase I: (8 Days, Aug 30-Sept 10)
  - Define Scope
  - Develop Preliminary Model
- Phase II: (12 Weeks, Sept 13- Nov 19)
  - Develop Data Model
  - Prepare Standard Data Element package

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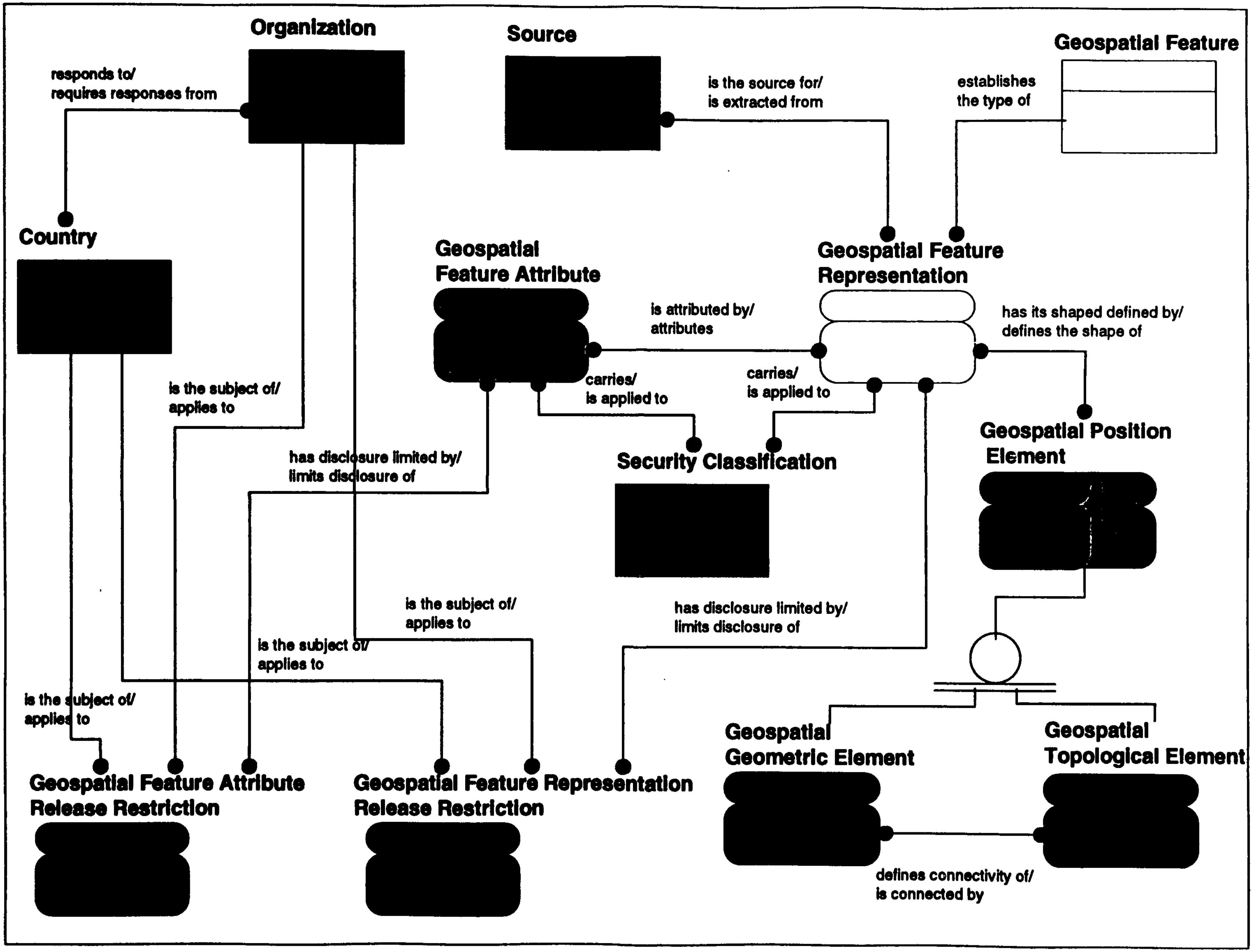
Organization
Source
Geospatial Feature
responds to/
requires responses from
is the source for/
is extracted from
establishes
the type of
Country
Geospatial
Feature Attribute
Geospatial Feature
Representation
is attributed by/
attributes
has its shaped defined by/
defines the shape of
is the subject of/
applies to
carries/
is applied to
carries/
is applied to
Geospatial Position
Element
has disclosure limited by/
limits disclosure of
Security Classification
is the subject of/
applies to
has disclosure limited by/
limits disclosure of
is the subject of/
applies to
is the subject of/
applies to
Geospatial
Geometric Element
Geospatial
Topological Element
Geospatial Feature Attribute
Release Restriction
Geospatial Feature Representation
Release Restriction
defines connectivity of/
is connected by

DDRS SUBMISSION

- Project Identified 75 potential Standard Data Elements
- Initial Package of 10 Elements Submitted
  - Dealt with basic ingredients of FEATURE
- Geometry and Topology Packages in Work

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WHAT NEXT?

- Modeling did not extend to individual features and attributes
- Modeling was from MC&G Perspective
- Other DoD Organizations have different uses for same objects:
  - Facilities
  - Command & Control
  - MOD/SIM, etc.
- Need to expand perspective to 'DoD-wide'
- DMA(TIM) Developed a Proposal for Joint Effort

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DoD Team Concept

- Create a multi-disciplinary team to Develop Standardized Data Elements:
  - Request Data Administrators from other DoD Elements to provide team members
  - Use DMA Data Model as starting point to integrate other Activity/ Data Models
- Objectives
  - DoD Enterprise Model Enhancements
  - Data Elements usable ‘DoD-wide’

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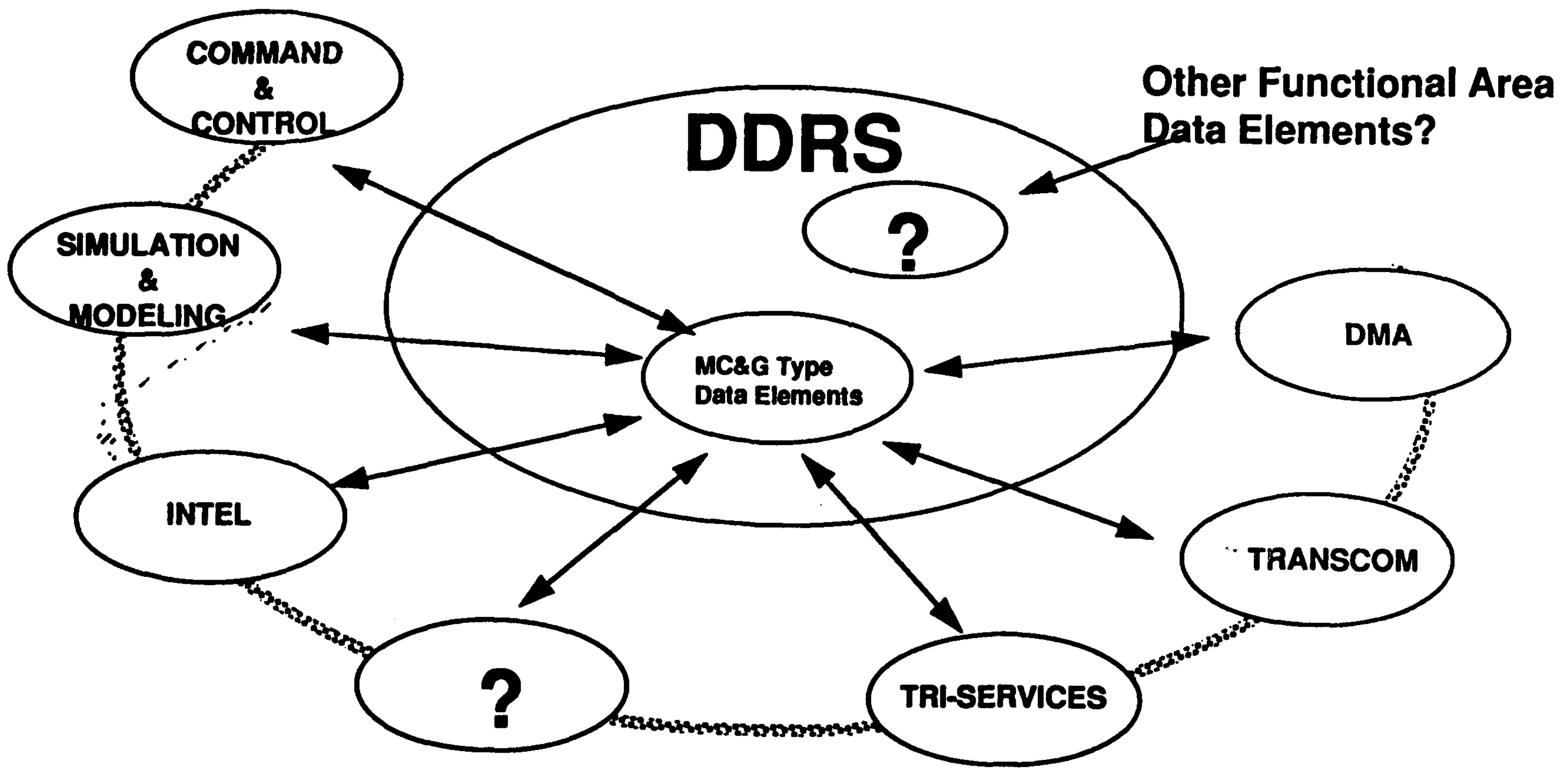
JOINT EFFORT TO STANDARDIZE MC&G DATA ELEMENTS



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ADVANTAGES

- Modeling from a DoD Enterprise perspective
- Eliminates redundancy
- Expedites Data Element Approval Process

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DISADVANTAGES

- Requires commitment from all participants
  - Not so easy to do!
  - Must get right functional areas to play
- Must have experienced players on team
  - Players must be empowered to speak for their organizations!

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DMA Data Model

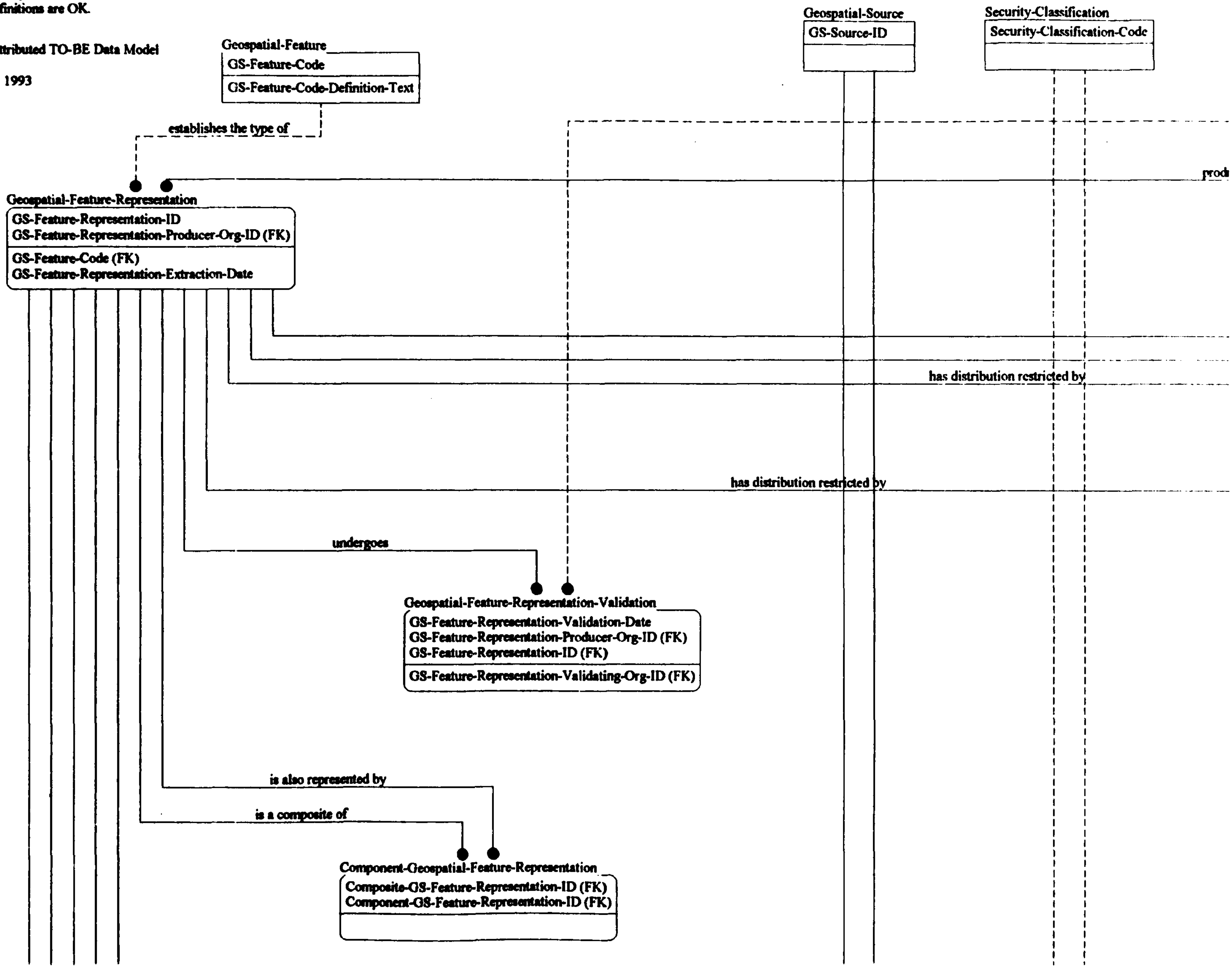
The DMA fully attributed, normalized model is on pages 4-13 through 4-31. The glossary begins on page 4-33 and is followed by the business rules on page 4-50. A guide to reading a data model is located in Appendix A.

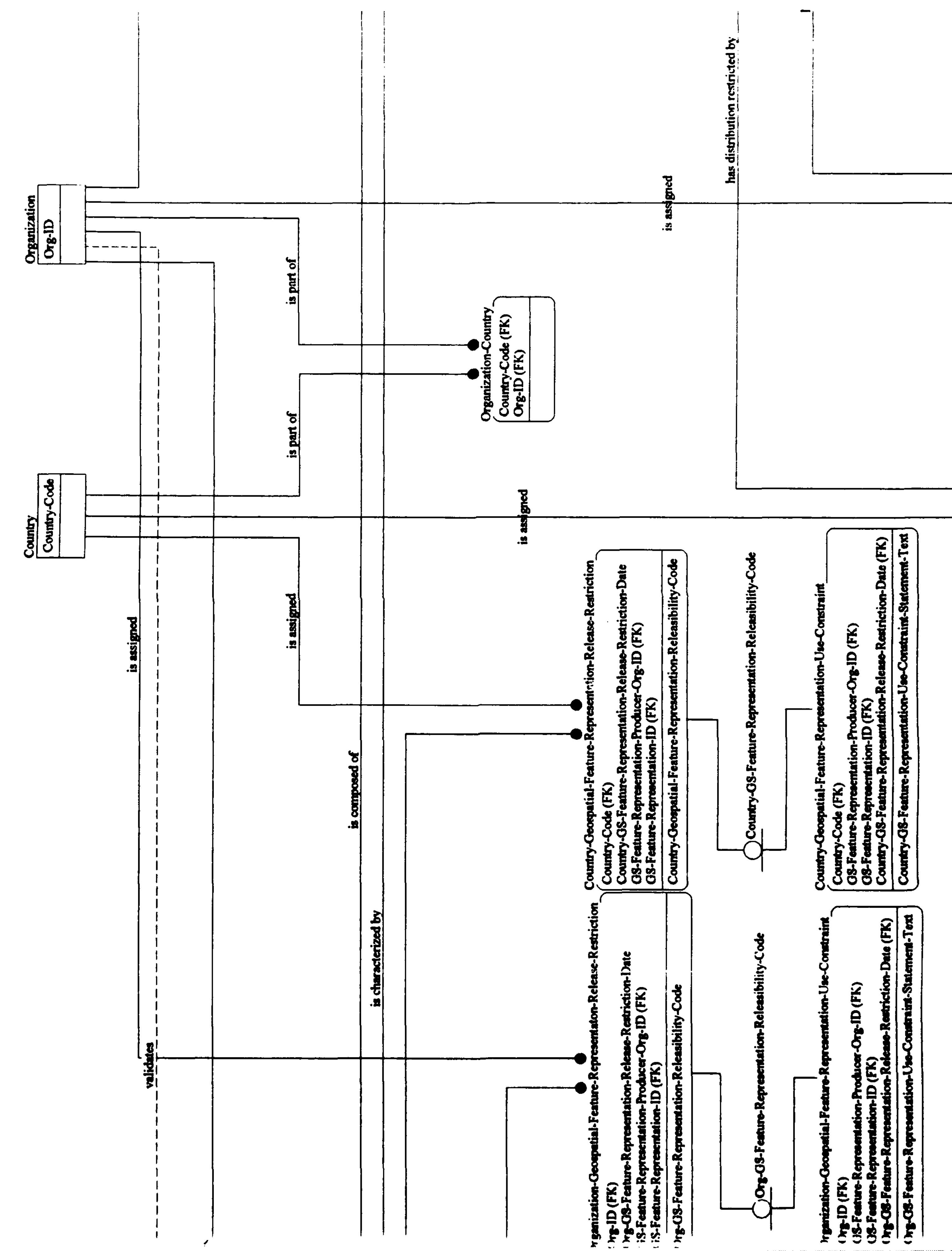
The DMA MC&G Standardization Pilot Project Data Model has the following page layout:

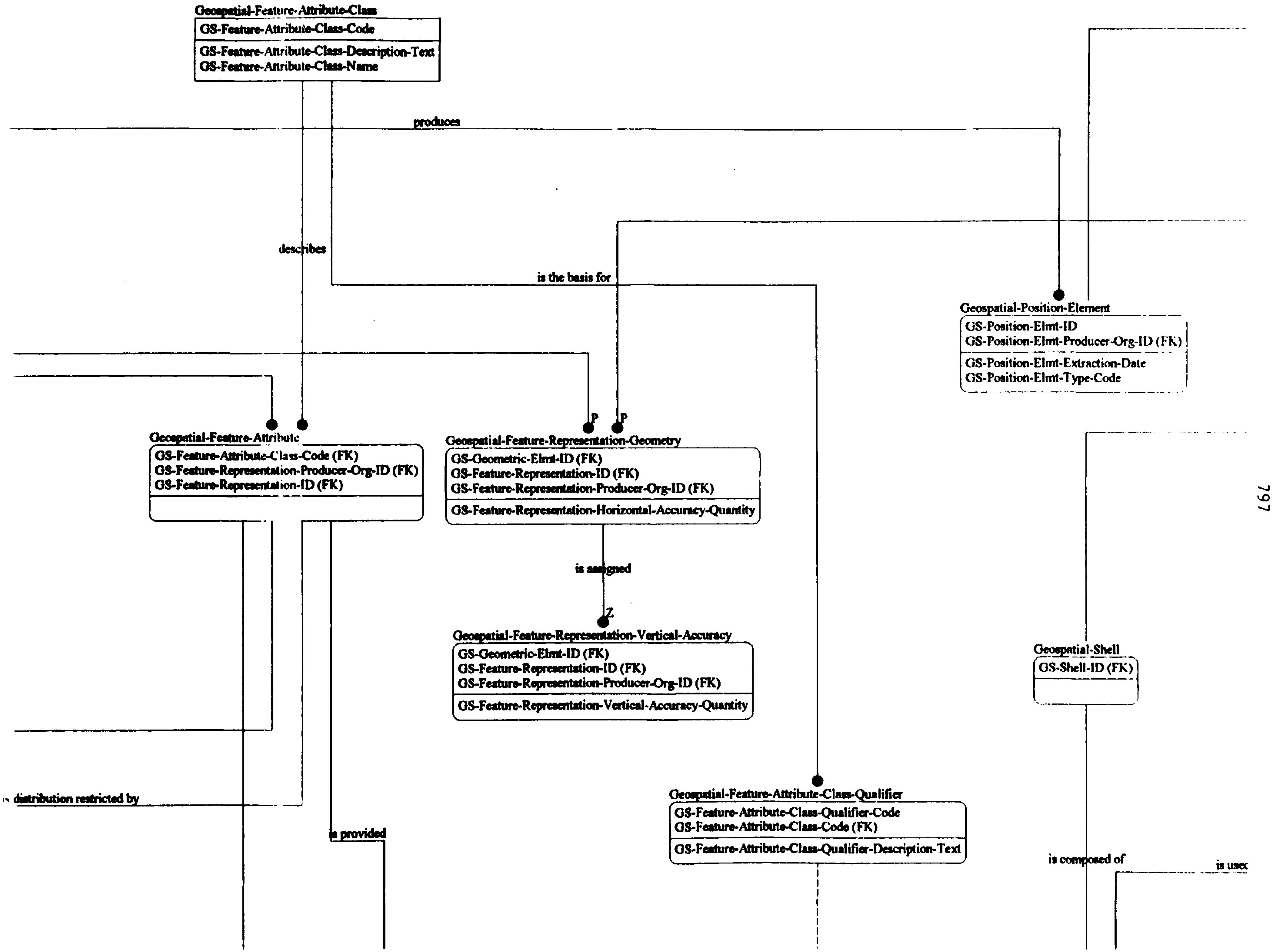
1	2	3	4	5
6	7	8	9	10

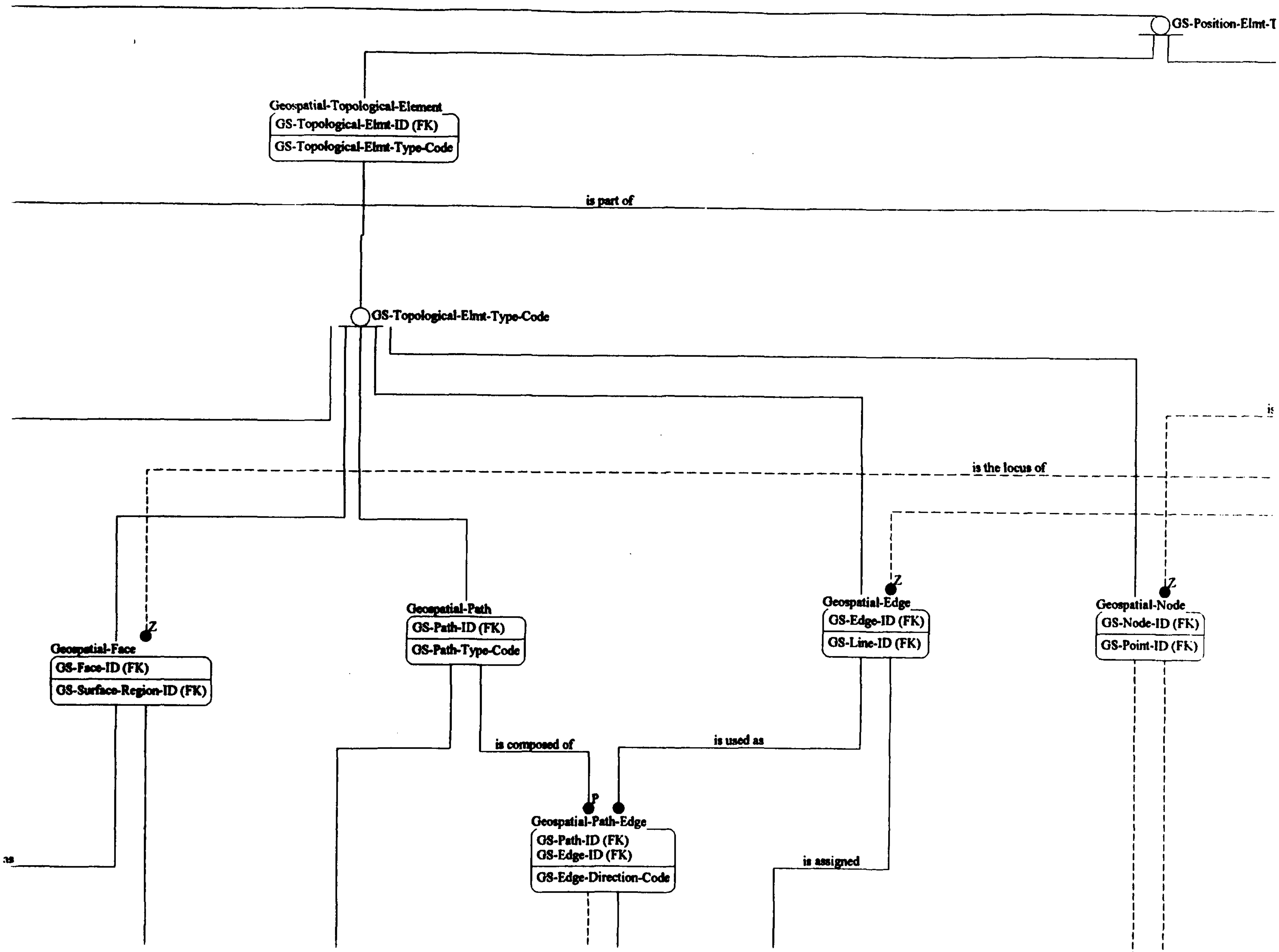
NOTE:
January 5, 1994
Diagram, Entity Definitions, and attribute definitions are OK.

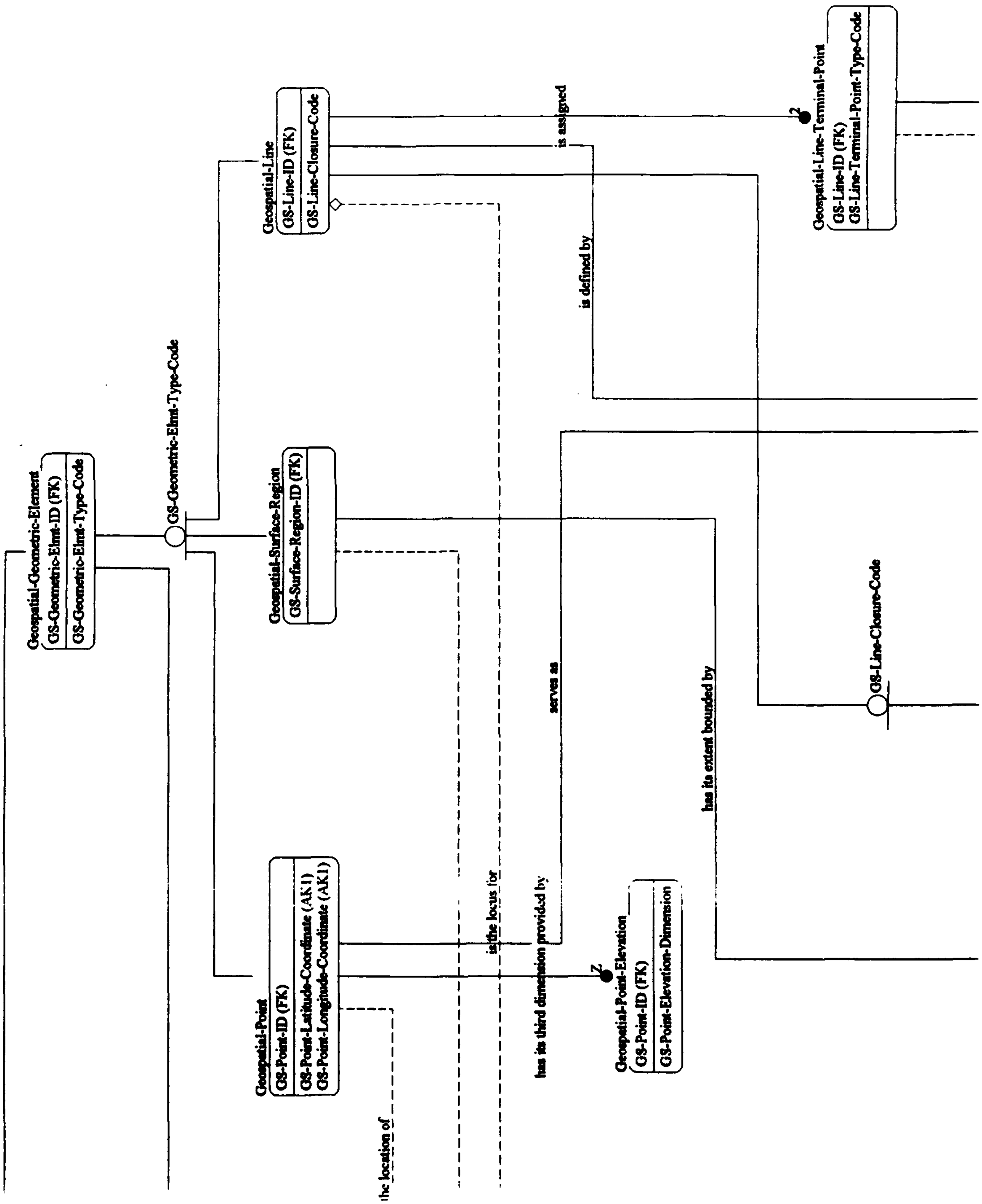
DMA Fully Attributed TO-BE Data Model
Version 1
November 19, 1993

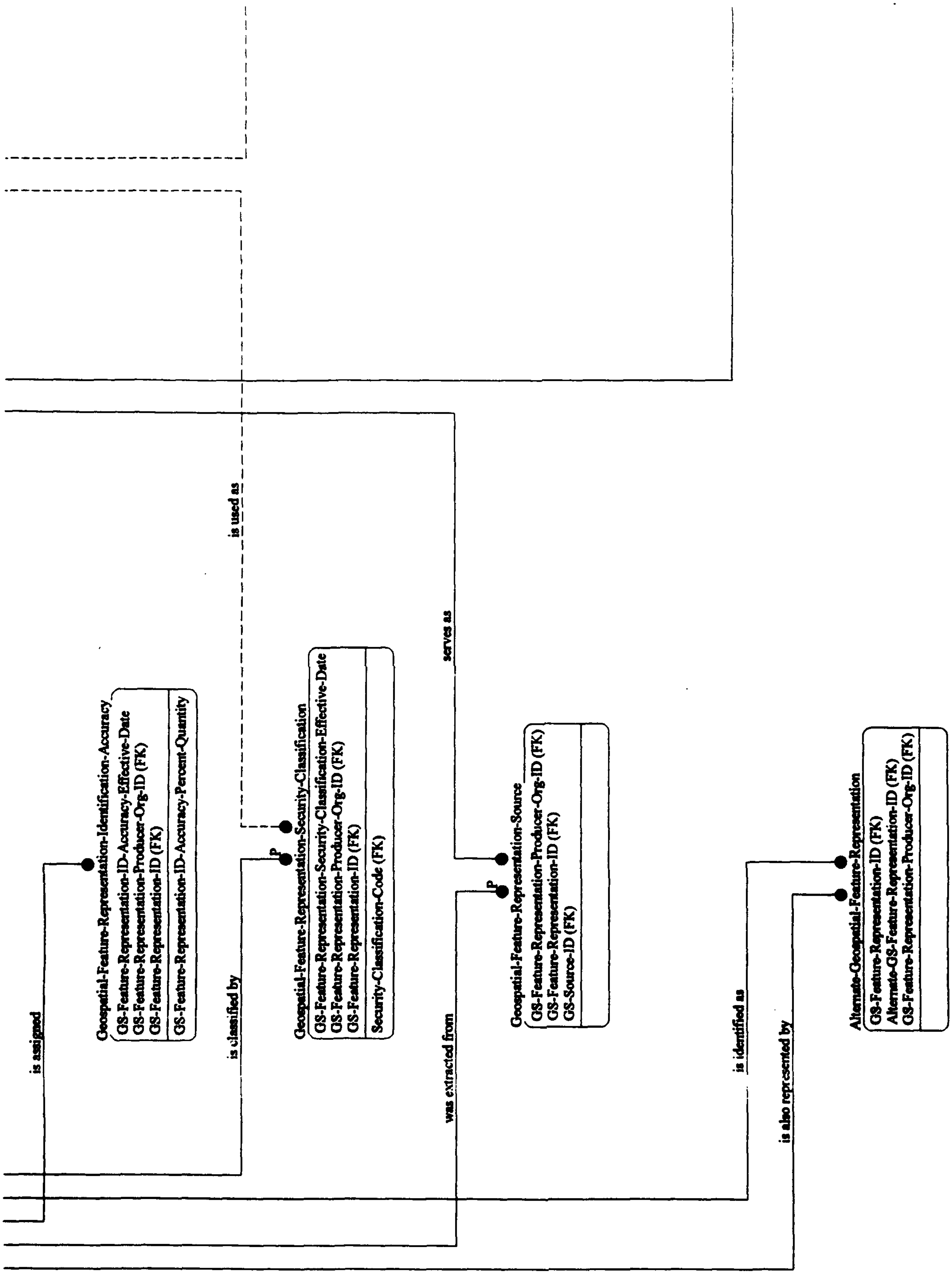


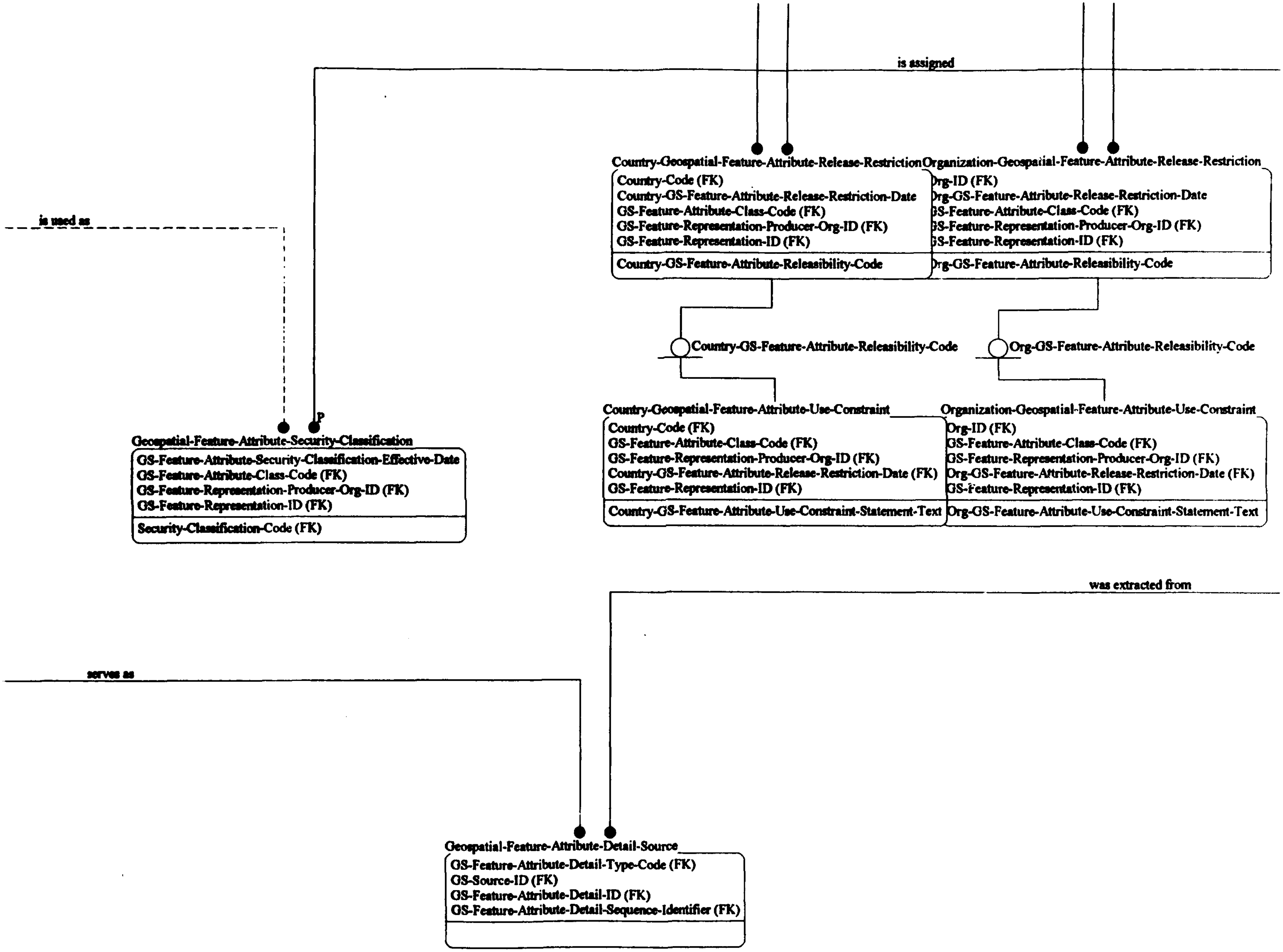

2
Organization
Org-ID
Country
Country-Code
Organization-Country
Country-Code (FK)
Org-ID (FK)
is part of
is part of
is assigned
is assigned
is assigned
is assigned
has distribution restricted by
is composed of
is characterized by
validates
Country-Geospatial-Feature-Representation-Release-Restriction
Country-Code (FK)
Country-GS-Feature-Representation-Release-Restriction-Date
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Country-Geospatial-Feature-Representation-Releasibility-Code
Country-GS-Feature-Representation-Releasibility-Code
Country-Geospatial-Feature-Representation-Use-Constraint
Country-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Country-GS-Feature-Representation-Release-Restriction-Date (FK)
Country-GS-Feature-Representation-Use-Constraint-Statement-Text
Org-GS-Feature-Representation-Release-Restriction-Date
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Org-GS-Feature-Representation-Releasibility-Code
Org-GS-Feature-Representation-Releasibility-Code
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Org-GS-Feature-Representation-Release-Restriction-Date (FK)
Org-GS-Feature-Representation-Use-Constraint-Statement-Text


Geospatial-Feature-Attribute-Class
GS-Feature-Attribute-Class-Code
GS-Feature-Attribute-Class-Description-Text
GS-Feature-Attribute-Class-Name
produces
describes
is the basis for
Geospatial-Position-Element
GS-Position-Elmt-ID
GS-Position-Elmt-Producer-Org-ID (FK)
GS-Position-Elmt-Extraction-Date
GS-Position-Elmt-Type-Code
Geospatial-Feature-Attribute
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
P
P
Geospatial-Feature-Representation-Geometry
GS-Geometric-Elmt-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-Horizontal-Accuracy-Quantity
is assigned
Z
Geospatial-Feature-Representation-Vertical-Accuracy
GS-Geometric-Elmt-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-Vertical-Accuracy-Quantity
Geospatial-Shell
GS-Shell-ID (FK)
is distribution restricted by
is provided
Geospatial-Feature-Attribute-Class-Qualifier
GS-Feature-Attribute-Class-Qualifier-Code
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Attribute-Class-Qualifier-Description-Text
is composed of
is usec

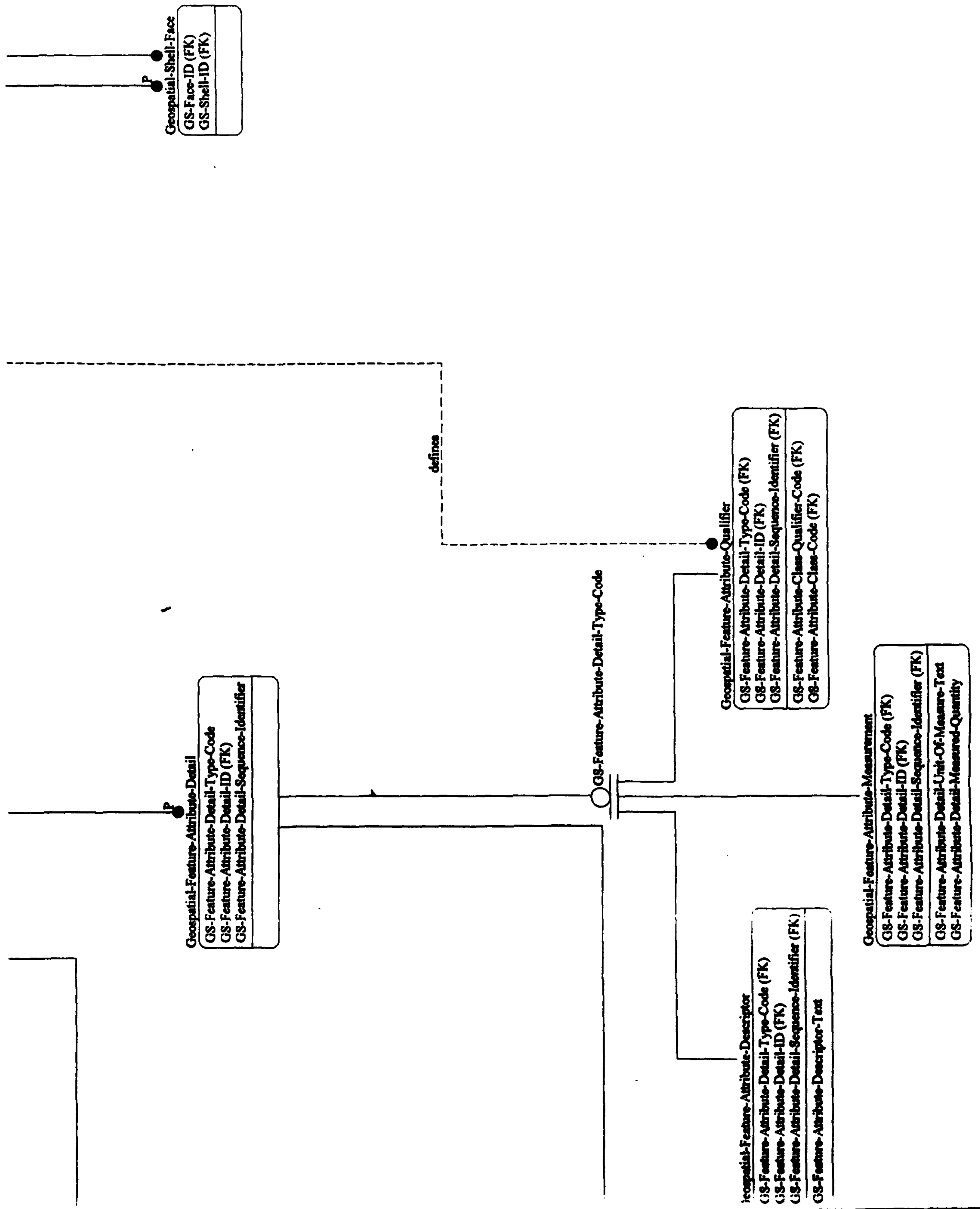

GS-Position-Elmt-T
Geospatial-Topological-Element
GS-Topological-Elmt-ID (FK)
GS-Topological-Elmt-Type-Code
is part of
GS-Topological-Elmt-Type-Code
is the locus of
Geospatial-Face
GS-Face-ID (FK)
GS-Surface-Region-ID (FK)
Geospatial-Path
GS-Path-ID (FK)
GS-Path-Type-Code
Geospatial-Edge
GS-Edge-ID (FK)
GS-Line-ID (FK)
Geospatial-Node
GS-Node-ID (FK)
GS-Point-ID (FK)
is composed of
is used as
Geospatial-Path-Edge
GS-Path-ID (FK)
GS-Edge-ID (FK)
GS-Edge-Direction-Code
is assigned

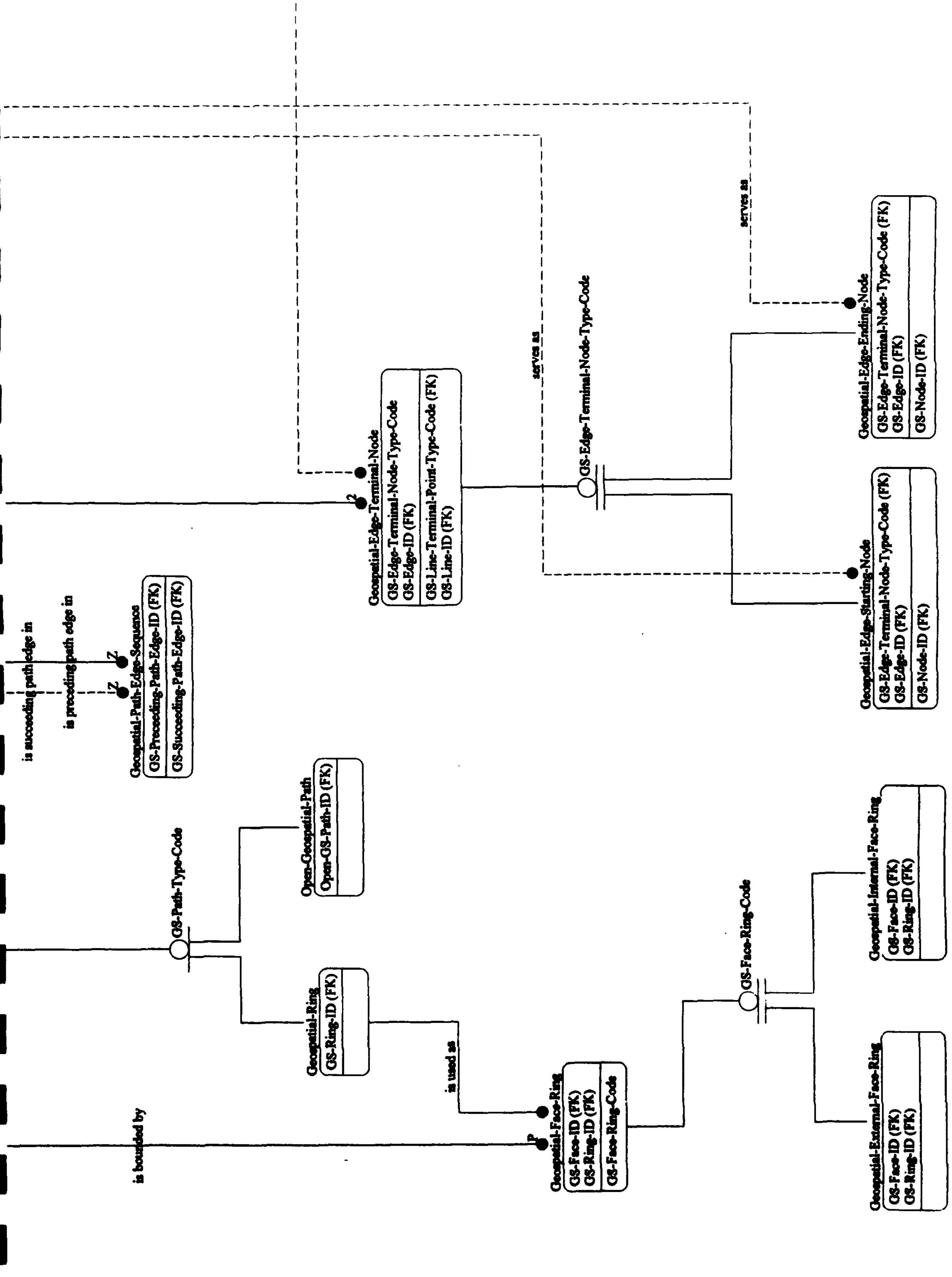

Geospatial-Geometric-Element
GS-Geometric-Elmt-ID (FK)
GS-Geometric-Elmt-Type-Code
GS-Geometric-Elmt-Type-Code
Geospatial-Line
GS-Line-ID (FK)
GS-Line-Closure-Code
Geospatial-Surface-Region
GS-Surface-Region-ID (FK)
Geospatial-Point
GS-Point-ID (FK)
GS-Point-Latitude-Coordinate (AK1)
GS-Point-Longitude-Coordinate (AK1)
Geospatial-Point-Elevation
GS-Point-ID (FK)
GS-Point-Elevation-Dimension
Geospatial-Line-Terminal-Point
GS-Line-ID (FK)
GS-Line-Terminal-Point-Type-Code
GS-Line-Closure-Code
is assigned
is defined by
serves as
has its extent bounded by
is the locus for
has its third dimension provided by
the location of
Z
Z


is assigned
Geospatial-Feature-Representation-Identification-Accuracy
GS-Feature-Representation-ID-Accuracy-Effective-Date
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Feature-Representation-ID-Accuracy-Percent-Quantity
is classified by
is used as
P
Geospatial-Feature-Representation-Security-Classification
GS-Feature-Representation-Security-Classification-Effective-Date
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Security-Classification-Code (FK)
serves as
was extracted from
P
Geospatial-Feature-Representation-Source
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Source-ID (FK)
is identified as
is also represented by
Alternate-Geospatial-Feature-Representation
GS-Feature-Representation-ID (FK)
Alternate-GS-Feature-Representation-ID (FK)
GS-Feature-Representation-Producer-Org-ID (FK)

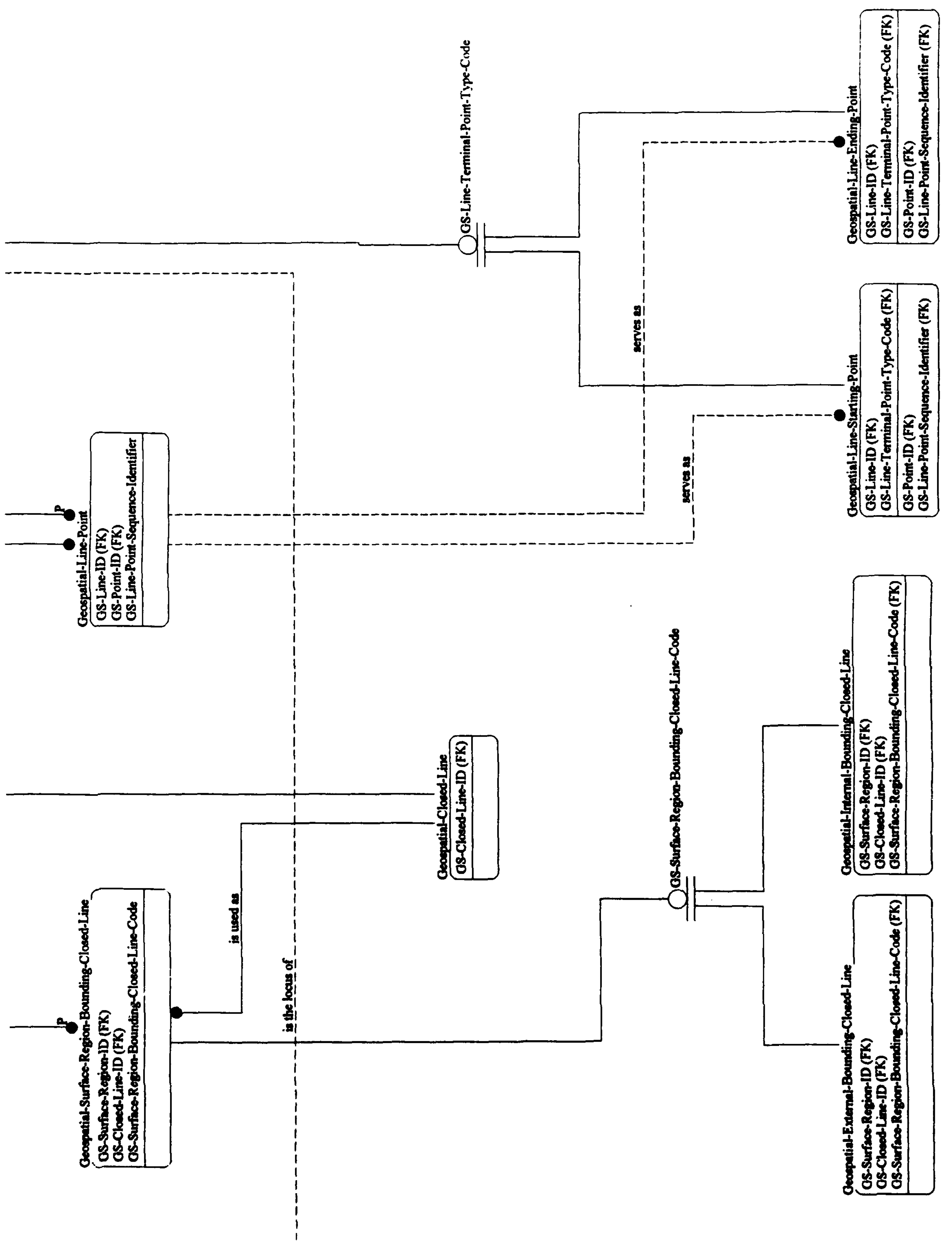


is assigned
is used as
Country-Geospatial-Feature-Attribute-Release-Restriction
Country-Code (FK)
Country-GS-Feature-Attribute-Release-Restriction-Date
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Country-GS-Feature-Attribute-Releasibility-Code
Organization-Geospatial-Feature-Attribute-Release-Restriction
Org-ID (FK)
Org-GS-Feature-Attribute-Release-Restriction-Date
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Org-GS-Feature-Attribute-Releasibility-Code
Country-GS-Feature-Attribute-Releasibility-Code
Org-GS-Feature-Attribute-Releasibility-Code
P
Geospatial-Feature-Attribute-Security-Classification
GS-Feature-Attribute-Security-Classification-Effective-Date
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Security-Classification-Code (FK)
Country-Geospatial-Feature-Attribute-Use-Constraint
Country-Code (FK)
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
Country-GS-Feature-Attribute-Release-Restriction-Date (FK)
GS-Feature-Representation-ID (FK)
Country-GS-Feature-Attribute-Use-Constraint-Statement-Text
Organization-Geospatial-Feature-Attribute-Use-Constraint
Org-ID (FK)
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
Org-GS-Feature-Attribute-Release-Restriction-Date (FK)
GS-Feature-Representation-ID (FK)
Org-GS-Feature-Attribute-Use-Constraint-Statement-Text
was extracted from
serves as
Geospatial-Feature-Attribute-Detail-Source
GS-Feature-Attribute-Detail-Type-Code (FK)
GS-Source-ID (FK)
GS-Feature-Attribute-Detail-ID (FK)
GS-Feature-Attribute-Detail-Sequence-Identifier (FK)


Geospatial-Shell-Face
GS-Face-ID (FK)
GS-Shell-ID (FK)
P
defines
Geospatial-Feature-Attribute-Qualifier
GS-Feature-Attribute-Detail-Type-Code (FK)
GS-Feature-Attribute-Detail-ID (FK)
GS-Feature-Attribute-Detail-Sequence-Identifier (FK)
GS-Feature-Attribute-Class-Qualifier-Code (FK)
GS-Feature-Attribute-Class-Code (FK)
P
Geospatial-Feature-Attribute-Detail
GS-Feature-Attribute-Detail-Type-Code
GS-Feature-Attribute-Detail-ID (FK)
GS-Feature-Attribute-Detail-Sequence-Identifier
GS-Feature-Attribute-Detail-Type-Code
Geospatial-Feature-Attribute-Measurement
GS-Feature-Attribute-Detail-Type-Code (FK)
GS-Feature-Attribute-Detail-ID (FK)
GS-Feature-Attribute-Detail-Sequence-Identifier (FK)
GS-Feature-Attribute-Detail-Unit-Of-Measure-Text
GS-Feature-Attribute-Detail-Measured-Quantity
eospatial-Feature-Attribute-Descriptor
GS-Feature-Attribute-Detail-Type-Code (FK)
GS-Feature-Attribute-Detail-ID (FK)
GS-Feature-Attribute-Detail-Sequence-Identifier (FK)
GS-Feature-Attribute-Descriptor-Text



Geospatial-Edge-Terminal-Node
GS-Edge-Terminal-Node-Type-Code
GS-Edge-ID (FK)
GS-Line-Terminal-Point-Type-Code (FK)
GS-Line-ID (FK)
serves as
serves as
GS-Edge-Terminal-Node-Type-Code
Geospatial-Edge-Ending-Node
GS-Edge-Terminal-Node-Type-Code (FK)
GS-Edge-ID (FK)
GS-Node-ID (FK)
Geospatial-Edge-Starting-Node
GS-Edge-Terminal-Node-Type-Code (FK)
GS-Edge-ID (FK)
GS-Node-ID (FK)
is succeeding path edge in
is preceding path edge in
Geospatial-Path-Edge-Sequence
GS-Preceding-Path-Edge-ID (FK)
GS-Succeeding-Path-Edge-ID (FK)
GS-Path-Type-Code
Open-Geospatial-Path
Open-GS-Path-ID (FK)
Geospatial-Ring
GS-Ring-ID (FK)
is used as
is bounded by
Geospatial-Face-Ring
GS-Face-ID (FK)
GS-Ring-ID (FK)
GS-Face-Ring-Code
GS-Face-Ring-Code
Geospatial-Internal-Face-Ring
GS-Face-ID (FK)
GS-Ring-ID (FK)
Geospatial-External-Face-Ring
GS-Face-ID (FK)
GS-Ring-ID (FK)


GS-Line-Terminal-Point-Type-Code
Geospatial-Line-Ending-Point
GS-Line-ID (FK)
GS-Line-Terminal-Point-Type-Code (FK)
GS-Point-ID (FK)
GS-Line-Point-Sequence-Identifier (FK)
serves as
serves as
Geospatial-Line-Starting-Point
GS-Line-ID (FK)
GS-Line-Terminal-Point-Type-Code (FK)
GS-Point-ID (FK)
GS-Line-Point-Sequence-Identifier (FK)
P
Geospatial-Line-Point
GS-Line-ID (FK)
GS-Point-ID (FK)
GS-Line-Point-Sequence-Identifier
Geospatial-Closed-Line
GS-Closed-Line-ID (FK)
GS-Surface-Region-Bounding-Closed-Line-Code
Geospatial-Internal-Bounding-Closed-Line
GS-Surface-Region-ID (FK)
GS-Closed-Line-ID (FK)
GS-Surface-Region-Bounding-Closed-Line-Code (FK)
is used as
is the locus of
P
Geospatial-Surface-Region-Bounding-Closed-Line
GS-Surface-Region-ID (FK)
GS-Closed-Line-ID (FK)
GS-Surface-Region-Bounding-Closed-Line-Code
Geospatial-External-Bounding-Closed-Line
GS-Surface-Region-ID (FK)
GS-Closed-Line-ID (FK)
GS-Surface-Region-Bounding-Closed-Line-Code (FK)

Fully Attributed Entity Definitions

ALTERNATE-GEOSPATIAL-FEATURE-REPRESENTATION

An independent model of a geospatial feature. The data extraction process permits capturing different representations of the same real world object. These representations are related to each other through this entity.

COMPONENT-GEOSPATIAL-FEATURE-REPRESENTATION

A geospatial feature representation that comprises an element of a complex geospatial feature representation.

COUNTRY

A sovereign state. Typically an autonomous political unit; also called a nation.

This entity is only a shadow entity in the DMA Data Model. DMA believes it is not responsible for defining and modeling the entity Country.

COUNTRY-GEOSPATIAL-FEATURE-ATTRIBUTE-RELEASE-RESTRICTION

A constraint controlling the release of specific data about a geospatial feature. The constraint may prohibit or permit said release to a country, as indicated by the country releasibility attribute.

COUNTRY-GEOSPATIAL-FEATURE-ATTRIBUTE-USE-CONSTRAINT

The limitations to the use a receiving country may make of specific information about a geospatial feature.

COUNTRY-GEOSPATIAL-FEATURE-REPRESENTATION-RELEASE-RESTRICTION

A constraint controlling the release of a geospatial feature representation. The constraint may prohibit or permit said release to a country, as indicated by the country releasibility attribute.

COUNTRY-GEOSPATIAL-FEATURE-REPRESENTATION-USE-CONSTRAINT

The limitation to the use a receiving country may make of a geospatial feature representation.

GEOSPATIAL-CLOSED-LINE

A non-self-intersecting geospatial line specified by at least four geospatial points in which the geospatial line starting point and the geospatial line ending point are the same.

GEOSPATIAL-EDGE

A one-dimensional topological element bounded by one geospatial starting node and one geospatial ending node and located by a geospatial line. A geosopatial edge is directed from start node to end node. When an edge is a part of a more complex structure, its directionality may be used as the basis for ideas such as "right" and "left".

GEOSPATIAL-EDGE-ENDING-NODE

A geospatial node identified as the ending node of a geospatial edge.

GEOSPATIAL-EDGE-STARTING-NODE

A geospatial node identified as the starting node of a geospatial edge.

GEOSPATIAL-EDGE-TERMINAL-NODE

A geospatial node which is either the starting or ending node for a specific geospatial edge.

GEOSPATIAL-EXTERNAL-BOUNDING-CLOSED-LINE

The geospatial surface region bounding closed line which defines the exterior boundary of a geospatial surface region.

GEOSPATIAL-EXTERNAL-FACE-RING

The geospatial face ring which defines the exterior boundary of a geospatial face.

GEOSPATIAL-FACE

A topological region enclosed by a geospatial ring. A geospatial facehas its locus defined by a geospatial surface region.

GEOSPATIAL-FACE-RING

The geospatial ring which is a boundary of a geospatial face. The ring may be an internal boundary. The ring may be the external boundary.

GEOSPATIAL-FEATURE

An identifiable object relative to the Earth's surface. A wide variety of identifiable objects exist on and sometimes above or below the Earth's surface. Included among these are moveable or temporal objects (trucks, command posts, etc.), and temporary structures (tents, shelters, etc.). While these are of interest or concern from many perspectives, the geospatial perspective considers only those features, natural and man-made, that remain stationary or recur in the same place over a significant length of time.

GEOSPATIAL-FEATURE-ATTRIBUTE

A characteristic of a geospatial feature.

GEOSPATIAL-FEATURE-ATTRIBUTE-CLASS

The generic description of a specific geospatial feature attribute. DIGEST provides a list of attribute classes, codes and descriptors in Part 4 Annex B. Refer to the instance tables provided on Page 4-6 in Section 4 for a fuller understanding of how the model employs these concepts.

GEOSPATIAL-FEATURE-ATTRIBUTE-CLASS-QUALIFIER

Information that provides further detail within a geospatial feature attribute class that may be used for geospatial feature characterization. DIGEST provides the lists of available qualifier (value) codes and descriptors in Part 4 Annex B. Refer to the instance tables provided on Page 4-6 in Section 4 for a fuller understanding of how the model employs these concepts.

GEOSPATIAL-FEATURE-ATTRIBUTE-DESCRIPTOR

The variable length text string providing descriptive detail to a geospatial feature attribute as required by the attribute class. For example, the feature attribute class "Name" requires that the name of the feature be provided as a text string. Refer to the instance tables provided on Page 4-7 in Section 4 for a fuller understanding of how the model employs these concepts.

GEOSPATIAL-FEATURE-ATTRIBUTE-DETAIL

Information about a specific geospatial feature that provides a more detailed description of a geospatial feature attribute. The detail is one of three types, which are geospatial feature attribute descriptor, geospatial feature attribute measurement, and geospatial feature attribute qualifier. DIGEST Part 4 Annex B provides a list of standard values for each attribute. Refer to the instance tables provided on Page 4-7 in Section 4 for a fuller understanding of how the model employs these concepts.

GEOSPATIAL-FEATURE-ATTRIBUTE-DETAIL-SOURCE

Information about a specific source for determining a geospatial feature attribute detail.

GEOSPATIAL-FEATURE-ATTRIBUTE-MEASUREMENT

The measured value of a specific geospatial feature attribute. Refer to the instance tables provided on Page 4-7 in Section 4 for a fuller understanding of how the model employs these concepts.

GEOSPATIAL-FEATURE-ATTRIBUTE-QUALIFIER

The specific geospatial feature attribute class qualifier used to provide the detail description of a specific geospatial feature attribute. Refer to the instance tables provided on Page 4-7 in Section 4 for a fuller understanding of how the model employs these concepts.

GEOSPATIAL-FEATURE-ATTRIBUTE-SECURITY-CLASSIFICATION

A security classification assigned to data about a geospatial feature attribute.

GEOSPATIAL-FEATURE-REPRESENTATION

A model of a geospatial feature. The model provides geometric and descriptive characteristics of the feature. The geometric portion of the model portrays the feature's size, shape, position and connectivity using geometric and topologic elements. The descriptive portion of the model contains attribute detail descriptions, attribute qualifiers, and attribute measurements.

GEOSPATIAL-FEATURE-REPRESENTATION-GEOMETRY

The association between a geospatial feature representation and its geospatial geometric element.

GEOSPATIAL-FEATURE-REPRESENTATION-IDENTIFICATION-ACCURACY

The probability that the geospatial feature code has been correctly assigned to a geospatial feature representation.

GEOSPATIAL-FEATURE-REPRESENTATION-SECURITY-CLASSIFICATION

The classification assigned to a geospatial feature representation.

GEOSPATIAL-FEATURE-REPRESENTATION-SOURCE

The geospatial source from which information about a geospatial feature was extracted.

GEOSPATIAL-FEATURE-REPRESENTATION-VALIDATION

The finding that a geospatial feature representation is complete.

GEOSPATIAL-FEATURE-REPRESENTATION-VERTICAL-ACCURACY

Information about the errors associated with the determination of the elevation of geospatial points used in the geospatial feature representation geometry.

GEOSPATIAL-GEOMETRIC-ELEMENT

A component of a geospatial feature representation which provides information about size, shape, and position. A geometric element may have a topologic element associated with it.

GEOSPATIAL-INTERNAL-BOUNDING-CLOSED-LINE

A geospatial surface region bounding closed line used as an interior boundary of a geospatial surface region.

GEOSPATIAL-INTERNAL-FACE-RING

A geospatial face ring used as an interior boundary of a geospatial face.

GEOSPATIAL-LINE

One of three types of geometric element, defined by a set of geospatial points in an ordered sequence. The defining points are connected by straight line segments.

GEOSPATIAL-LINE-ENDING-POINT

A geospatial line terminal point identified as the last point in a sequence of points that defines a geospatial line.

GEOSPATIAL-LINE-POINT

A geospatial point that is part of a set used in defining a geospatial line.

GEOSPATIAL-LINE-STARTING-POINT

A geospatial line terminal point identified as the first point in a sequence of points that defines a geospatial line.

GEOSPATIAL-LINE-TERMINAL-POINT

There are exactly two geospatial points designated terminal points for each line. One geospatial point is a terminal end point and one is a terminal start point.

GEOSPATIAL-NODE

A zero dimensional topological primitive used to define topologic relationships. A geospatial node is always associated with a geospatial point.

GEOSPATIAL-PATH

A set of edges connected at their terminal nodes, such that no node is shared by more than two edges of the set.

GEOSPATIAL-PATH-EDGE

A geospatial edge used as a component of a geospatial path.

GEOSPATIAL-PATH-EDGE-SEQUENCE

Information about the order of the assembly of a geospatial path. This entity associates a geospatial edge used as a geospatial path edge to the succeeding geospatial edge in the path.

GEOSPATIAL-POINT

The zero dimensional primitive that assigns the geodetic position. Latitude, longitude, and elevation, if available, are defined in WGS 84. (See DMA Technical Report 8350.2.)

GEOSPATIAL-POINT-ELEVATION

A geospatial point elevation assigns an elevation to a geospatial point. The elevation is referenced to mean sea level.

GEOSPATIAL-POSITION-ELEMENT

An element of geometry or topology used for real or conceptual delineations relative to the surface of the earth. Geometric elements include geospatial point, geospatial line, and geospatial surface region. Topologic elements include geospatial node, geospatial edge, geospatial face, geospatial shell, and geospatial path.

GEOSPATIAL-RING

A closed geospatial path. In a closed geospatial path, every geospatial terminal node in the path is shared by two of the edges that make up the path. A geospatial ring bounds a geospatial face.

GEOSPATIAL-SHELL

An open connected set of two or more geospatial faces.

GEOSPATIAL-SHELL-FACE

Information that a specific geospatial face is a member of a set that composes a geospatial shell.

GEOSPATIAL-SOURCE

Data of any type from which geospatial feature information can be extracted. Sources include, but are not limited to, ground control, aerial and terrestrial photographs, sketches, maps, and charts; topographic, hydrographic, hypsographic, magnetic, geodetic, oceanographic, and meteorological information; intelligence documents and written reports pertaining to natural and man-made features of the area to be mapped or charted.

This entity is only a shadow entity in the DMA Data Model. DMA believes that it does not fall within the scope of this project to define and model the entity Geospatial-Source.

GEOSPATIAL-SURFACE-REGION

A bounded segment of a specified surface. A geospatial surface region may be bounded by a geospatial surface region closed line. When a geospatial surface region is the location of a geospatial face, the loci of the geospatial edges which make up the geospatial face ring are the geospatial lines which bound the geospatial surface region.

GEOSPATIAL-SURFACE-REGION-BOUNDING-CLOSED-LINE

A geospatial surface region closed line that bounds a geospatial surface region.

GEOSPATIAL-TOPOLOGICAL-ELEMENT

A primitive that defines connectivity and relationship of the parts of the geospatial position elements. Every topological element has an appropriate association to a geometric element.

OPEN-GEOSPATIAL-PATH

A geospatial path in which all but two of the geospatial nodes are shared by two geospatial edges.

ORGANIZATION

An administrative structure constituted to accomplish a goal, purpose or mission. (Reference Working Draft of DoD Enterprise Model; February 1993.)

This entity is only a shadow entity in the DMA Data Model. DMA believes it is not responsible for defining and modeling the entity Organization.

ORGANIZATION-COUNTRY

The primary association between an organization and a country. The association is used to determine disclosures of information, limited by country.

ORGANIZATION-GEOSPATIAL-FEATURE-ATTRIBUTE-RELEASE-RESTRICTION

A constraint controlling the release of specific geospatial feature attribute data. The constraint may prohibit or permit said release to an organization, as indicated by the country releasibility attribute.

ORGANIZATION-GEOSPATIAL-FEATURE-ATTRIBUTE-USE-CONSTRAINT

The limitations to the use a receiving organization may make of specific information about a geospatial feature attribute.

ORGANIZATION-GEOSPATIAL-FEATURE-REPRESENTATION-RELEASE-RESTRICTION

A constraint controlling the release of a geospatial feature representation. The constraint may prohibit or permit said release to an organization, as indicated by the organization releasibility attribute.

ORGANIZATION-GEOSPATIAL-FEATURE-REPRESENTATION-USE-CONSTRAINT

The limitations to the use a receiving organization may make of a geospatial feature representation.

SECURITY-CLASSIFICATION

Information established by an authoritative body about a level of control of information disclosure.

Key Attribute Definitions

Alternate-Geospatial-Feature-Representation-Identifier

The identifier that denotes an alternate geospatial feature representation.

Component-Geospatial-Feature-Representation-Identifier

The identifier that denotes a geospatial feature that is a component of another geospatial feature representation.

Composite-Geospatial-Feature-Representation-Identifier

The identifier that denotes a geospatial feature representation that contains other geospatial feature representations as components.

Country-Code

The code that denotes a country as specified by FIPS PUB 10-3.

Country-Geospatial-Feature-Attribute-Release-Restriction-Date

The date on which a country geospatial feature attribute release restriction was established.

Country-Geospatial-Feature-Representation-Release-Restriction-Date

The date on which a country geospatial feature release restriction was established.

Geospatial-Closed-Line-Identifier

The geospatial line identifier that denotes a geospatial closed line.

Geospatial-Edge-Identifier

The geospatial topological element identifier that denotes a geospatial edge.

Geospatial-Edge-Terminal-Node-Type-Code

The code that denote a geospatial edge terminal node type. The type may be a geospatial edge starting node. The type may be a geospatial edge ending node.

Geospatial-Face-Identifier

The geospatial topological element identifier that denotes a geospatial face.

Geospatial-Feature-Attribute-Class-Code

The code that denotes a geospatial feature attribute class. DIGEST Part 4 Annex B provides a list of standard feature attribute codes.

Geospatial-Feature-Attribute-Class-Qualifier-Code

The code that denotes a qualifier of the selected geospatial feature attribute class. DIGEST Part 4 Annex B provides lists of standard feature attribute qualifier codes. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Attribute-Detail-Identifier

The identifier that denotes the role name for geospatial feature attribute class code, geospatial feature representation producer organization identifier, and geospatial feature representation identifier.

Geospatial-Feature-Attribute-Detail-Sequence-Identifier

The sequence identifier that distinguishes between several geospatial feature attribute descriptor texts that exist for the same geospatial feature attribute detail type code.

Geospatial-Feature-Attribute-Detail-Type-Code

A code that denotes a type of geospatial feature attribute detail. The code denotes one of three types of geospatial feature attribute detail, which are geospatial feature attribute descriptor, geospatial feature attribute measurement, and geospatial feature attribute qualifier.

Geospatial-Feature-Attribute-Security-Classification-Effective-Date

The date on which the geospatial feature attribute security classification was established.

Geospatial-Feature-Code

The code that denotes a specific geospatial feature type. Standard codes are listed in DIGEST Part 4 Annex A.

Geospatial-Feature-Representation-Identifier

The identifier that uniquely represents a geospatial feature representation produced by a specific geospatial feature representation producer organization.

Geospatial-Feature-Representation-Identification-Accuracy-Effective-Date

The date on which the geospatial feature representation identification accuracy was assigned.

Geospatial-Feature-Representation-Producer-Organization-Identifier

The identifier that denotes an organization as the producer of a geospatial feature representation.

Geospatial-Feature-Representation-Security-Classification-Effective-Date

The date on which the geospatial feature representation security classification was established.

Geospatial-Feature-Representation-Validation-Date

The date on which a geospatial feature representation validation is effective.

Geospatial-Geometric-Element-Identifier

The geospatial position element identifier that denotes a geospatial geometric element. It is the role name for geospatial position element producer organization identifier and geospatial position element identifier.

Geospatial-Line-Identifier

The geospatial geometric element identifier that denotes a geospatial line.

Geospatial-Line-Point-Sequence-Identifier

The identifier that denotes the position of a specific geospatial line point, ordering the set of geospatial line points that make up a geospatial line.

Geospatial-Line-Terminal-Point-Type-Code

The code that denotes a geospatial line terminal point type. The types are geospatial line starting point and geospatial line ending point.

Geospatial-Node-Identifier

The geospatial topological element identifier that denotes a geospatial node.

Geospatial-Path-Identifier

The geospatial topological element identifier that represents a geospatial path.

Geospatial-Point-Identifier

The geospatial geometric element identifier that denotes a geospatial point.

Geospatial-Position-Element-Identifier

The identifier that denotes a specific geospatial position element. The producer organization assigns a unique identifier to each instance of geospatial position element.

Geospatial-Position-Element-Producer-Organization-Identifier

The organization identifier that represents a geospatial position element producer organization. The organization identifier is used as part of the identification of a geospatial position element.

Geospatial-Preceding-Path-Edge-Identifier

The identifier that denotes a geospatial edge that immediately precedes another edge in the sequence of edges that make up a path.

Geospatial-Ring-Identifier

The geospatial topological element identifier that denotes a geospatial ring.

Geospatial-Shell-Identifier

The geospatial topological element identifier that denotes a geospatial shell.

Geospatial-Source-Identifier

The identifier that denotes data of any type from which geospatial feature information can be extracted. The identifier will be more clearly defined when Source is modeled more completely.

Geospatial-Surface-Region-Bounding-Closed-Line-Code

The code that denotes the type of geospatial surface region bounding closed line. There are two types: geospatial external bounding closed line and geospatial internal bounding closed line.

Geospatial-Surface-Region-Identifier

The geospatial geometric element identifier that denotes a geospatial surface region.

Geospatial-Topological-Element-Identifier

The geospatial position element identifier that denotes a geospatial topological element. It is the role name for geospatial position element producer organization identifier and geospatial position element identifier.

Open-Geospatial-Path-Identifier

The geospatial topological element identifier that denotes an open geospatial path.

Organization-Identifier

The identifier that denotes an organization.

Organization-Geospatial-Feature-Attribute-Release-Restriction-Date

The date on which an organization geospatial feature attribute release restriction was established.

Organization-Geospatial-Feature-Representation-Release-Restriction-Date

The date on which an organization geospatial feature representation release restriction was established.

Security-Classification-Code

The code that denotes a level of a classification.

Non-Key Attribute Definitions

Country-Geospatial-Feature-Attribute-Releasibility-Code

The code that denotes whether a country can receive information about a geospatial feature attribute. If the value is yes, the geospatial feature attribute may be given to persons or organizations representing that country, but it may be subject to constraints expressed by the organization geospatial feature attribute release restriction and country geospatial feature attribute use constraint. If the value is no, the geospatial feature attribute may not be given to any person or organization representing the country.

Country Geospatial-Feature-Attribute-Use-Constraint-Statement-Text

The text identifying the limits to the uses a receiving country may make concerning the geospatial feature attribute.

Country-Geospatial-Feature-Representation-Releasibility-Code

The code that denotes whether a country can receive a geospatial feature representation. If the value is yes, the geospatial feature representation may be given to persons or organizations representing that country, but it may be subject to constraints expressed by the organization geospatial feature representation release restriction and country geospatial feature representation use constraint. If the value is no, the geospatial feature representation may not be given to any person or organization representing the country.

Country Geospatial-Feature-Representation-Use-Constraint-Statement-Text

The text identifying the limits to the uses a receiving country may make concerning the geospatial feature representation.

Geospatial-Edge-Direction-Code

The code that denotes the direction in which an edge is traversed when that edge is a component of a geospatial path. Normal traversal of a geospatial edge is from geospatial edge starting node to geospatial edge ending node. When an edge is part of a path, it may be traversed in the opposite direction.

Geospatial-Face-Ring-Code

The code that denotes the type of a geospatial face ring. There are two types: geospatial external face ring and geospatial internal face ring.

Geospatial-Feature-Attribute-Class-Description-Text

The text that describes the geospatial feature attribute class. These descriptions are provided in DIGEST Part 4 Annex B. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Attribute-Class-Name

The name of a geospatial feature attribute class. A list of these names is provided in DIGEST Part 4 Annex B. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Attribute-Class-Qualifier-Description-Text

The text that describes a geospatial feature attribute class qualifier. These descriptions are provided in DIGEST Part 4 Annex B. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Attribute-Descriptor-Text

The text of the geospatial feature attribute descriptor as required by DIGEST Part 4 Annex B. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Attribute-Detail-Measured-Quantity

The quantity of the measured value for the geospatial feature attribute detail. The required units of measure are stated in DIGEST Part 4 Annex B. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Attribute-Detail-Unit-Of-Measure-Text

The text describing the value of a geospatial feature attribute detail. These descriptions are provided in DIGEST Part 4 Annex B. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Code-Definition-Text

The text describing the distinguishing characteristics of a geospatial feature.

Geospatial-Feature-Representation-Extraction-Date

The date on which a geospatial feature representation was produced by a compilation from source data.

Geospatial-Feature-Representation-Horizontal-Accuracy-Quantity

The quantity providing circular error bounds at the 90% confidence level for the geospatial point horizontal position.

When the horizontal position of an identified object is stated in latitude-longitude measurements (phi-lambda), this places the object horizontally with respect to the Earth's surface in an Earth-centered fixed coordinate system. The error associated with this process expresses the uncertainty with which the phi-lambda values provided are correct.

DMA states this error as a circular error (Δ phi = Δ lambda) at the 90% confidence level indicating that 90% of the placement measurements in a set of measurements with the same circular error will be correct to within the radius of the error circle.

Geospatial-Feature-Representation-Identification-Accuracy-Percent-Quantity

The quantity expressing the probability that the geospatial feature code has been correctly assigned to a geospatial feature representation; the probability is expressed as a percentage.

Geospatial-Feature-Representation-Validating-Organization-Identifier

The identifier that denotes the organization that validated a geospatial feature representation.

Geospatial-Feature-Representation-Vertical-Accuracy-Quantity

The quantity providing linear error bounds at the 90% confidence level for geospatial point elevations.

When DMA provides a vertical measurement positioning an object with respect to its height, above or below mean sea level, the measurement is accompanied by an error bound, $\pm \Delta h$.

The interpretation of Δh is: In a set of vertical measurements, DMA is confident that 90% of the stated values will be within $\pm \Delta h$ of the true value.

Geospatial-Geometric-Element-Type-Code

The code that denotes a geospatial geometric element type. There are three types: point, surface region, and line.

Geospatial-Line-Closure-Code

The code that denotes that a geospatial line is a geospatial closed line.

Geospatial-Path-Type-Code

The code that denotes the type of a geospatial path. There are two types: geospatial ring and open geospatial path.

Geospatial-Point-Elevation-Dimension

The elevation of a geospatial point in meters above or below mean sea level.

Geospatial-Point-Latitude-Coordinate

One of the coordinates that identifies the location of a geospatial point. The latitude is the angle between the plane of the geodetic equator and the normal to the ellipsoid at a point (measured positive north from the geodetic equator, negative south). [DMA Technical Report 8350.2 - WGS 84]

Geospatial-Point-Longitude-Coordinate

One of the coordinates that identifies the location of a geospatial point. The longitude is the angle between the plane of the Zero Meridian and the plane of the geodetic meridian of the point (measured in the plane of the geodetic equator, positive from 0° to 180° E, and negative from 0° to 180° W). [DMA Technical Report 8350.2 - WGS 84]

Geospatial-Position-Element-Extraction-Date

The date on which a geospatial position element was produced by a compilation from source data.

Geospatial-Position-Element-Type-Code

The code that denotes a type of geospatial position element. The type may be a geospatial topological element. The type may be a geospatial geometric element.

Geospatial-Succeeding-Path-Edge-Identifier

The geospatial edge identifier that denotes a geospatial edge that immediately succeeds another geospatial edge in the sequence of geospatial edges that make up a geospatial path.

Geospatial-Topological-Element-Type-Code

The code that denotes a geospatial topological element type. The five types are: shell, face, path, edge, and node.

Organization-Geospatial-Feature-Attribute-Releasibility-Code

The code that denotes whether an organization can receive information about a geospatial feature attribute. If the value is yes, the geospatial feature attribute may be given to organizations or persons representing those organizations, but it may be subject to constraints expressed by the organization geospatial feature attribute release restriction and country geospatial feature attribute use constraint. If the value is no, the geospatial feature attribute may not be given to any organizations or persons representing those organizations.

Organization-Geospatial-Feature-Attribute-Use-Constraint-Statement-Text

A text that describes the limits to the uses a receiving organization may make concerning the geospatial feature attribute.

Organization-Geospatial-Feature-Representation-Releasibility-Code

The code that denotes whether an organization can receive a geospatial feature representation. If the value is yes, the geospatial feature may be given to organizations or persons representing those organizations, but it may be subject to constraints expressed by the organization geospatial feature representation release restriction and country geospatial feature representation use constraint. If the value is no, the geospatial feature representation may not be given to any organizations or persons representing those organizations.

Organization-Geospatial-Feature-Representation-Use Constraint-Statement-Text

The text that describes the limits to the uses a receiving organization may make concerning the geospatial feature representation.

<u>Business Rules</u>

Every Alternate-Geospatial-Feature-Representation
  always has a Geospatial-Feature-Representation.
  always has a Geospatial-Feature-Representation.

Every Component-Geospatial-Feature-Representation
  always has a Geospatial-Feature-Representation.
  always has a Geospatial-Feature-Representation.

Every Country
  always is assigned zero, one or many Country-Geospatial-Feature-Attribute-Release-Restriction(s).
  always is assigned zero, one or many Country-Geospatial-Feature-Representation-Release-Restriction(s).
  always is part of zero, one or many Organization-Country(s).

Every Country-Geospatial-Feature-Attribute-Release-Restriction
  may be a Country-Geospatial-Feature-Attribute-Use-Constraint,
    depending on Country-Geospatial-Feature-Attribute-Releasibility-Code.
  always has a Country.
  always has a Geospatial-Feature-Attribute.

Every Country-Geospatial-Feature-Attribute-Use-Constraint
  is a Country-Geospatial-Feature-Attribute-Release-Restriction.

Every Country-Geospatial-Feature-Representation-Release-Restriction
  may be a Country-Geospatial-Feature-Representation-Use-Constraint,
    depending on Country-Geospatial-Feature-Representation-Releasibility-Code.
  always has a Country.
  always has a Geospatial-Feature-Representation.

Every Country-Geospatial-Feature-Representation-Use-Constraint
  is a Country-Geospatial-Feature-Representation-Release-Restriction.

Every Geospatial-Closed-Line
  is a Geospatial-Line.
  always is used as zero, one or many Geospatial-Surface-Region-Bounding-Closed-Line(s).

Every Geospatial-Edge
  is a Geospatial-Topological-Element.
  always has a Geospatial-Line.
  always is assigned 2 Geospatial-Edge-Terminal-Node(s).
  always is used as zero, one or many Geospatial-Path-Edge(s).

Every Geospatial-Edge-Ending-Node
  is a Geospatial-Edge-Terminal-Node.
  always has a Geospatial-Node.

Every Geospatial-Edge-Starting-Node
is a Geospatial-Edge-Terminal-Node.
always has a Geospatial-Node.

Every Geospatial-Edge-Terminal-Node
may be either
a Geospatial-Edge-Ending-Node,
or a Geospatial-Edge-Starting-Node,
depending on Geospatial-Edge-Terminal-Node-Type-Code.
always has a Geospatial-Edge.
always has a Geospatial-Line-Terminal-Point.

Every Geospatial-External-Bounding-Closed-Line
is a Geospatial-Surface-Region-Bounding-Closed-Line.

Every Geospatial-External-Face-Ring
is a Geospatial-Face-Ring.

Every Geospatial-Face
is a Geospatial-Topological-Element.
always has a Geospatial-Surface-Region.
always is bounded by one or more Geospatial-Face-Ring(s).
always is used as zero, one or many Geospatial-Shell-Face(s).

Every Geospatial-Face-Ring
may be either
a Geospatial-External-Face-Ring,
or a Geospatial-Internal-Face-Ring,
depending on Geospatial-Face-Ring-Code.
always has a Geospatial-Face.
always has a Geospatial-Ring.

Every Geospatial-Feature
always establishes the type of zero, one or many Geospatial-Feature-Representation(s).

Every Geospatial-Feature-Attribute
always has a Geospatial-Feature-Attribute-Class.
always has a Geospatial-Feature-Representation.
always has distribution restricted by zero, one or many Country-Geospatial-Feature-Attribute-Release-Restriction(s).
always is provided one or more Geospatial-Feature-Attribute-Detail(s).
always is assigned one or more Geospatial-Feature-Attribute-Security-Classification(s).
always has distribution restricted by zero, one or many Organization-Geospatial-Feature-Attribute-Release-Restriction(s).

Every Geospatial-Feature-Attribute-Class
always describes zero, one or many Geospatial-Feature-Attribute(s).
always is the basis for zero, one or many Geospatial-Feature-Attribute-Class-Qualifier(s).

Every Geospatial-Feature-Attribute-Class-Qualifier
always has a Geospatial-Feature-Attribute-Class.
always defines zero, one or many Geospatial-Feature-Attribute-Qualifier(s).

Every Geospatial-Feature-Attribute-Descriptor
is a Geospatial-Feature-Attribute-Detail.

Every Geospatial-Feature-Attribute-Detail
may be either
a Geospatial-Feature-Attribute-Descriptor,
or a Geospatial-Feature-Attribute-Measurement,
or a Geospatial-Feature-Attribute-Qualifier,
depending on Geospatial-Feature-Attribute-Detail-Type-Code.
always has a Geospatial-Feature-Attribute.
always was extracted from zero, one or many Geospatial-Feature-Attribute-Detail-Source(s).

Every Geospatial-Feature-Attribute-Detail-Source
always has a Geospatial-Feature-Attribute-Detail.
always has a Geospatial-Source.

Every Geospatial-Feature-Attribute-Measurement
is a Geospatial-Feature-Attribute-Detail.

Every Geospatial-Feature-Attribute-Qualifier
is a Geospatial-Feature-Attribute-Detail.
always has a Geospatial-Feature-Attribute-Class-Qualifier.

Every Geospatial-Feature-Attribute-Security-Classification
always has a Geospatial-Feature-Attribute.
always has a Security-Classification.

Every Geospatial-Feature-Representation
always has an Organization.
always has a Geospatial-Feature.
always is also represented by zero, one or many Alternate-Geospatial-Feature-Representation(s).
always is identified as zero, one or many Alternate-Geospatial-Feature-Representation(s).
always is a composite of zero, one or many Component-Geospatial-Feature-Representation(s).
always is also represented by zero, one or many Component-Geospatial-Feature-Representation(s).
always has distribution restricted by zero, one or many Country-Geospatial-Feature-Representation-Release-Restriction(s).
always is characterized by zero, one or many Geospatial-Feature-Attribute(s).
always is composed of zero or one Geospatial-Feature-Representation-Geometry(s).
always is assigned zero, one or many Geospatial-Feature-Representation-Identification-Accuracy(s).
always is classified by one or more Geospatial-Feature-Representation-Security-Classification(s).
always was extracted from one or more Geospatial-Feature-Representation-Source(s).
always undergoes zero, one or many Geospatial-Feature-Representation-Validation(s).
always has distribution restricted by zero, one or many Organization-Geospatial-Feature-Representation-Release-Restriction(s).

Every Geospatial-Feature-Representation-Geometry
always has a Geospatial-Feature-Representation.
always has a Geospatial-Geometric-Element.
always is assigned zero or one Geospatial-Feature-Representation-Vertical-Accuracy(s).

Every Geospatial-Feature-Representation-Identification-Accuracy
always has a Geospatial-Feature-Representation.

Every Geospatial-Feature-Representation-Security-Classification
always has a Geospatial-Feature-Representation.
always has a Security-Classification.

Every Geospatial-Feature-Representation-Source
always has a Geospatial-Feature-Representation.
always has a Geospatial-Source.

Every Geospatial-Feature-Representation-Validation
always has a Geospatial-Feature-Representation.
always has an Organization.

Every Geospatial-Feature-Representation-Vertical-Accuracy
always has a Geospatial-Feature-Representation-Geometry.

Every Geospatial-Geometric-Element
is a Geospatial-Position-Element.
may be either
a Geospatial-Line,
or a Geospatial-Point,
or a Geospatial-Surface-Region,
depending on Geospatial-Geometric-Element-Type-Code.
always is part of zero, one or many Geospatial-Feature-Representation-Geometry(s).

Every Geospatial-Internal-Bounding-Closed-Line
is a Geospatial-Surface-Region-Bounding-Closed-Line.

Every Geospatial-Internal-Face-Ring
is a Geospatial-Face-Ring.

Every Geospatial-Line
is a Geospatial-Geometric-Element.
may be a Geospatial-Closed-Line,
depending on Geospatial-Line-Closure-Code.
always is the locus for zero or one Geospatial-Edge(s).
always is defined by one or more Geospatial-Line-Point(s).
always is assigned 2 Geospatial-Line-Terminal-Point(s).

Every Geospatial-Line-Ending-Point
is a Geospatial-Line-Terminal-Point.
always has a Geospatial-Line-Point.

Every Geospatial-Line-Point
always has a Geospatial-Line.
always has a Geospatial-Point.
always serves as zero, one or many Geospatial-Line-Ending-Point(s).
always serves as zero, one or many Geospatial-Line-Starting-Point(s).

Every Geospatial-Line-Starting-Point
is a Geospatial-Line-Terminal-Point.
always has a Geospatial-Line-Point.

Every Geospatial-Line-Terminal-Point
may be either
a Geospatial-Line-Ending-Point,
or a Geospatial-Line-Starting-Point,
depending on Geospatial-Line-Terminal-Point-Type-Code.
always has a Geospatial-Line.
always is the locus of zero, one or many Geospatial-Edge-Terminal-Node(s).

Every Geospatial-Node
is a Geospatial-Topological-Element.
always has a Geospatial-Point.
always serves as zero, one or many Geospatial-Edge-Ending-Node(s).
always serves as zero, one or many Geospatial-Edge-Starting-Node(s).

Every Geospatial-Open-Path
is a Geospatial-Path.

Every Geospatial-Path
is a Geospatial-Topological-Element.
may be either
a Geospatial-Open-Path,
or a Geospatial-Ring,
depending on Geospatial-Path-Type-Code.
always is composed of one or more Geospatial-Path-Edge(s).

Every Geospatial-Path-Edge
always has a Geospatial-Edge.
always has a Geospatial-Path.
always is preceding ring edge in zero or one Geospatial-Path-Edge-Sequence(s).
always is succeeding ring edge in zero or one Geospatial-Path-Edge-Sequence(s).

Every Geospatial-Path-Edge-Sequence
always has a Geospatial-Path-Edge.
always has a Geospatial-Path-Edge.

Every Geospatial-Point
is a Geospatial-Geometric-Element.
always serves as zero, one or many Geospatial-Line-Point(s).
always is the location of zero or one Geospatial-Node(s).
always has its third dimension provided by zero or one Geospatial-Point-Elevation(s).

Every Geospatial-Point-Elevation
always has a Geospatial-Point.

Every Geospatial-Position-Element
may be either
a Geospatial-Geometric-Element,
or a Geospatial-Topological-Element,
depending on Geospatial-Position-Element-Type-Code.
always has an Organization.

Every Geospatial-Ring
is a Geospatial-Path.
always is used as zero, one or many Geospatial-Face-Ring(s).

Every Geospatial-Shell
is a Geospatial-Topological-Element.
always is composed of one or more Geospatial-Shell-Face(s).

Every Geospatial-Shell-Face
always has a Geospatial-Face.
always has a Geospatial-Shell.

Every Geospatial-Source
always serves as zero, one or many Geospatial-Feature-Attribute-Detail-Source(s).
always serves as zero, one or many Geospatial-Feature-Representation-Source(s).

Every Geospatial-Surface-Region
is a Geospatial-Geometric-Element.
always is the locus of zero or one Geospatial-Face(s).
always has its extent bounded by one or more Geospatial-Surface-Region-Bounding-Closed-Line(s).

Every Geospatial-Surface-Region-Bounding-Closed-Line
may be either
a Geospatial-External-Bounding-Closed-Line,
or a Geospatial-Internal-Bounding-Closed-Line,
depending on Geospatial-Surface-Region-Bounding-Closed-Line-Code.
always has a Geospatial-Closed-Line.
always has a Geospatial-Surface-Region.

Every Geospatial-Topological-Element
  is a Geospatial-Position-Element.
  may be either
    a Geospatial-Edge,
    or a Geospatial-Face,
    or a Geospatial-Node,
    or a Geospatial-Path,
    or a Geospatial-Shell,
      depending on Geospatial-Topological-Element-Type-Code.

Every Organization
  always produces zero, one or many Geospatial-Feature-Representation(s).
  always validates zero, one or many Geospatial-Feature-Representation-Validation(s).
  always produces zero, one or many Geospatial-Position-Element(s).
  always is part of zero, one or many Organization-Country(s).
  always is assigned zero, one or many Organization-Geospatial-Feature-Attribute-Release-Restriction(s).
  always is assigned zero, one or many Organization-Geospatial-Feature-Representation-Release-Restriction(s).

Every Organization-Country
  always has a Country.
  always has an Organization.

Every Organization-Geospatial-Feature-Attribute-Release-Restriction
  may be an Organization-Geospatial-Feature-Attribute-Use-Constraint,
    depending on Organization-Geospatial-Feature-Attribute-Releasibility-Code.
  always has a Geospatial-Feature-Attribute.
  always has an Organization.

Every Organization-Geospatial-Feature-Attribute-Use-Constraint
  is an Organization-Geospatial-Feature-Attribute-Release-Restriction.

Every Organization-Geospatial-Feature-Representation-Release-Restriction
  may be an Organization-Geospatial-Feature-Representation-Use-Constraint,
    depending on Organization-Geospatial-Feature-Representation-Releasibility-Code.
  always has a Geospatial-Feature-Representation.
  always has an Organization.

Every Organization-Geospatial-Feature-Representation-Use-Constraint
  is an Organization-Geospatial-Feature-Representation-Release-Restriction.

Every Security-Classification
  always is used as zero, one or many Geospatial-Feature-Attribute-Security-Classification(s).
  always is used as zero, one or many Geospatial-Feature-Representation-Security-Classification(s).

DMA Data Model

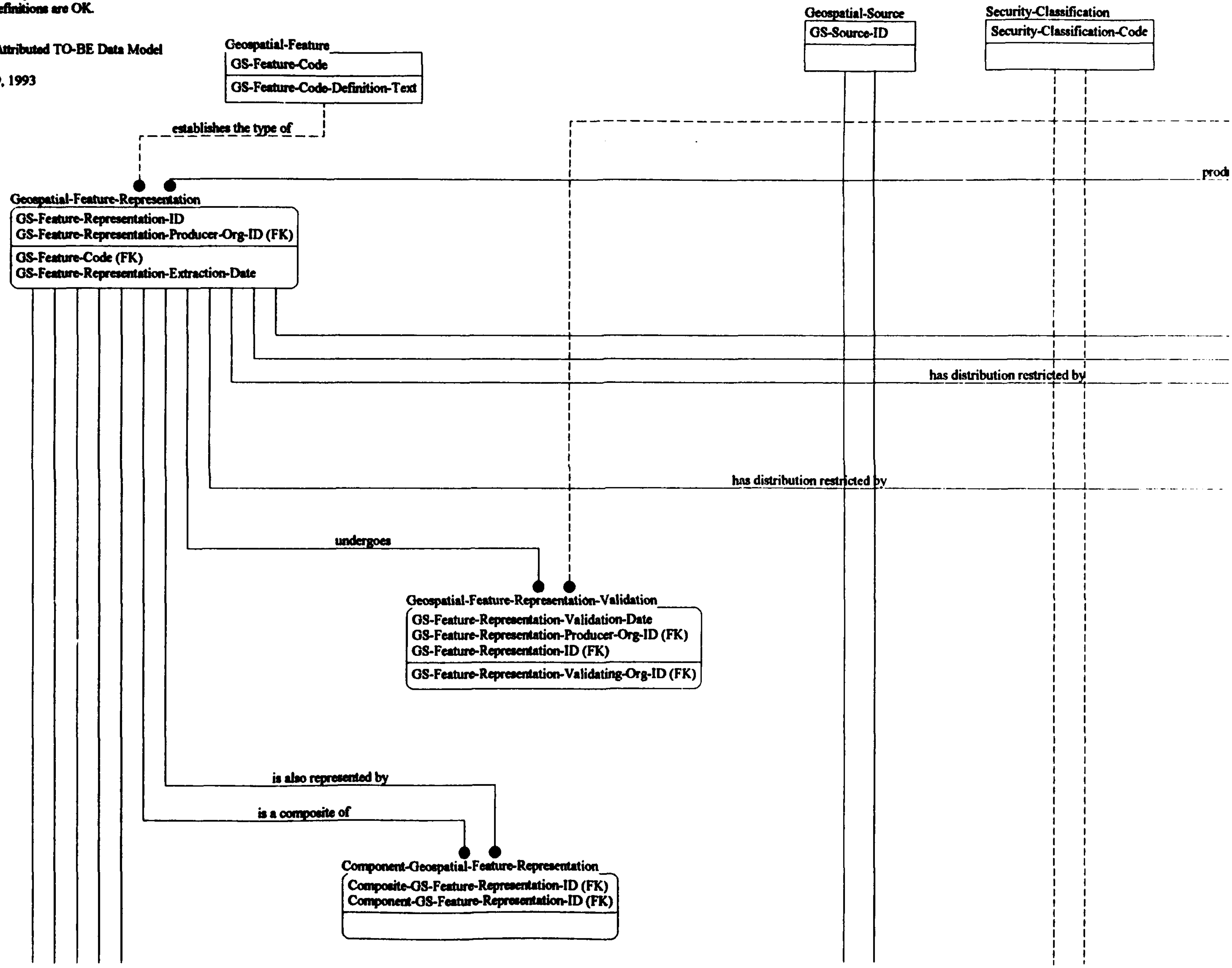
The DMA fully attributed, normalized model is on pages 4-13 through 4-31. The glossary begins on page 4-33 and is followed by the business rules on page 4-50. A guide to reading a data model is located in Appendix A.

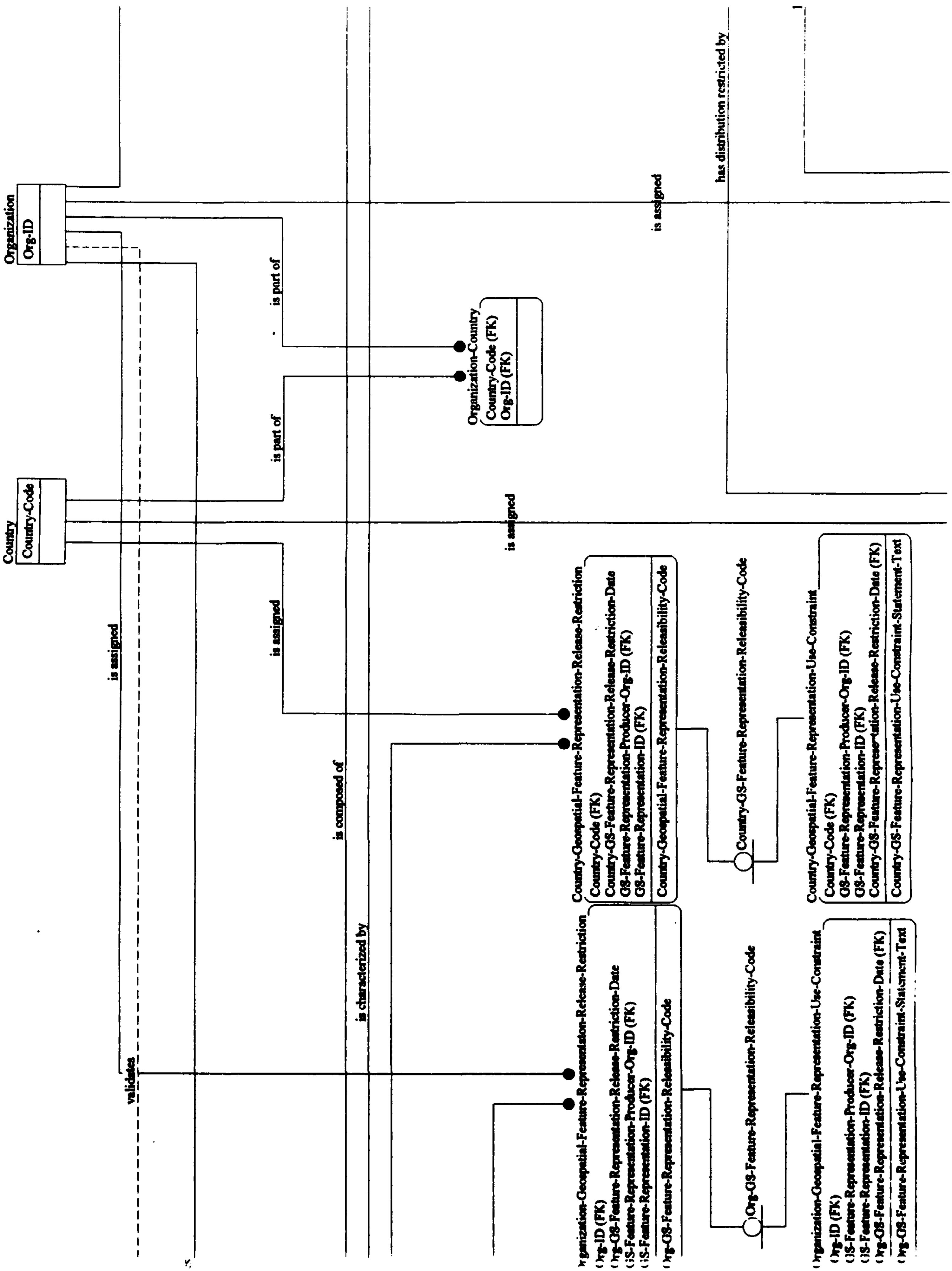
The DMA MC&G Standardization Pilot Project Data Model has the following page layout:

1	2	3	4	5
6	7	8	9	10

NOTE:
January 5, 1994
Diagram, Entity Definitions, and attribute definitions are OK.

DMA Fully Attributed TO-BE Data Model
Version 1
November 19, 1993




Organization
Org-ID
Country
Country-Code
Organization-Country
Country-Code (FK)
Org-ID (FK)
is part of
is part of
is assigned
is assigned
is assigned
is assigned
has distribution restricted by
is composed of
is characterized by
validates
Country-Geospatial-Feature-Representation-Release-Restriction
Country-Code (FK)
Country-GS-Feature-Representation-Release-Restriction-Date
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Country-Geospatial-Feature-Representation-Releasibility-Code
Country-GS-Feature-Representation-Releasibility-Code
Country-Geospatial-Feature-Representation-Use-Constraint
Country-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Country-GS-Feature-Representation-Release-Restriction-Date (FK)
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Org-GS-Feature-Representation-Release-Restriction-Date
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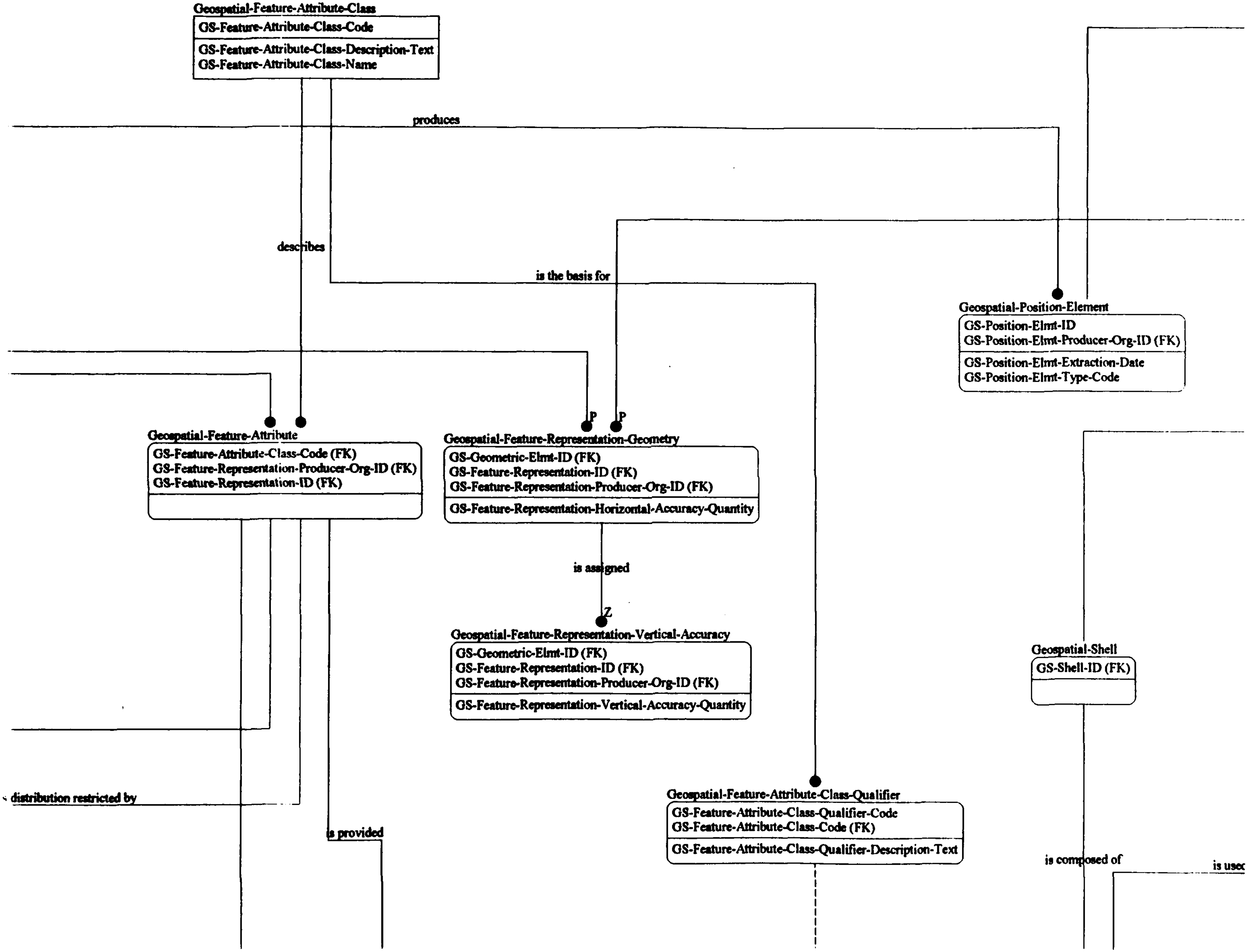
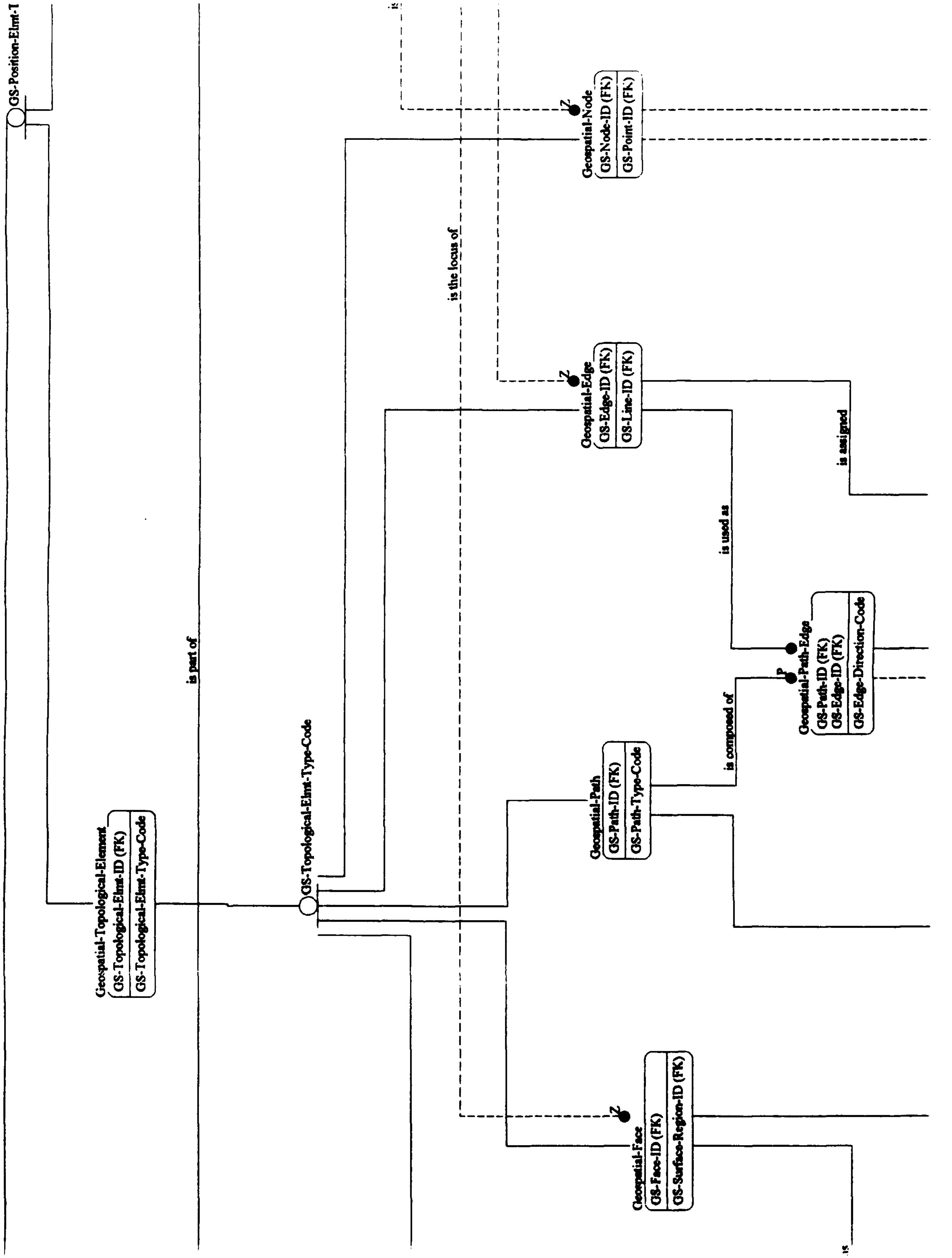
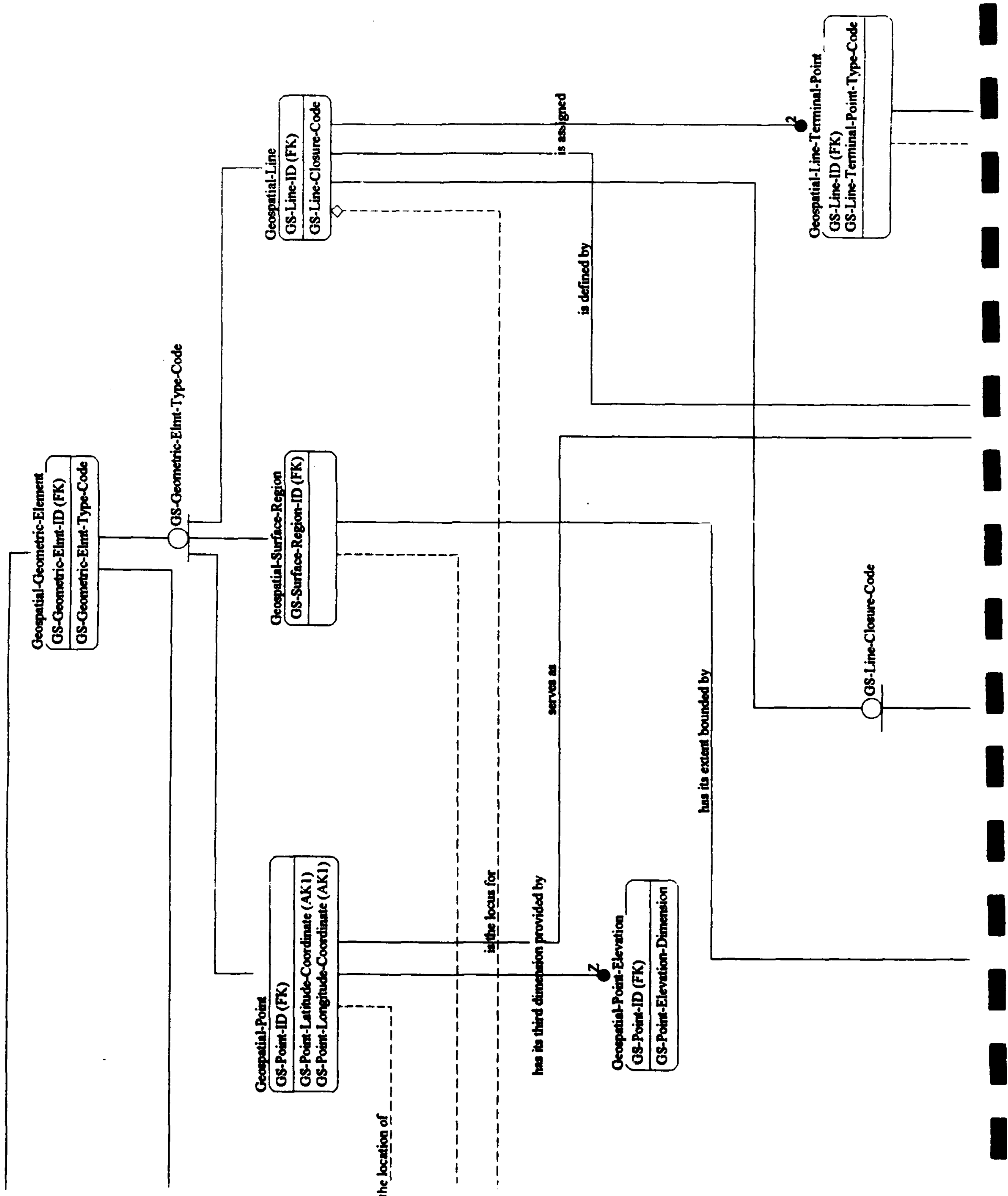
Org-GS-Feature-Representation-Use-Constraint-Statement-Text


Geospatial-Feature-Attribute-Class
GS-Feature-Attribute-Class-Code
GS-Feature-Attribute-Class-Description-Text
GS-Feature-Attribute-Class-Name
produces
describes
is the basis for
Geospatial-Position-Element
GS-Position-Elmt-ID
GS-Position-Elmt-Producer-Org-ID (FK)
GS-Position-Elmt-Extraction-Date
GS-Position-Elmt-Type-Code
Geospatial-Feature-Attribute
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
P
P
Geospatial-Feature-Representation-Geometry
GS-Geometric-Elmt-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-Horizontal-Accuracy-Quantity
is assigned
Z
Geospatial-Feature-Representation-Vertical-Accuracy
GS-Geometric-Elmt-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-Vertical-Accuracy-Quantity
Geospatial-Shell
GS-Shell-ID (FK)
distribution restricted by
is provided
Geospatial-Feature-Attribute-Class-Qualifier
GS-Feature-Attribute-Class-Qualifier-Code
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Attribute-Class-Qualifier-Description-Text
is composed of
is usec


GS-Position-Elmt-T
Geospatial-Topological-Element
GS-Topological-Elmt-ID (FK)
GS-Topological-Elmt-Type-Code
is part of
GS-Topological-Elmt-Type-Code
is the locus of
Geospatial-Node
GS-Node-ID (FK)
GS-Point-ID (FK)
Geospatial-Edge
GS-Edge-ID (FK)
GS-Line-ID (FK)
is assigned
is used as
Geospatial-Path-Edge
GS-Path-ID (FK)
GS-Edge-ID (FK)
GS-Edge-Direction-Code
is composed of
Geospatial-Path
GS-Path-ID (FK)
GS-Path-Type-Code
Geospatial-Face
GS-Face-ID (FK)
GS-Surface-Region-ID (FK)


Geospatial-Geometric-Element
GS-Geometric-Elmt-ID (FK)
GS-Geometric-Elmt-Type-Code
GS-Geometric-Elmt-Type-Code
Geospatial-Line
GS-Line-ID (FK)
GS-Line-Closure-Code
Geospatial-Surface-Region
GS-Surface-Region-ID (FK)
Geospatial-Point
GS-Point-ID (FK)
GS-Point-Latitude-Coordinate (AK1)
GS-Point-Longitude-Coordinate (AK1)
Geospatial-Point-Elevation
GS-Point-ID (FK)
GS-Point-Elevation-Dimension
Geospatial-Line-Terminal-Point
GS-Line-ID (FK)
GS-Line-Terminal-Point-Type-Code
GS-Line-Closure-Code
is assigned
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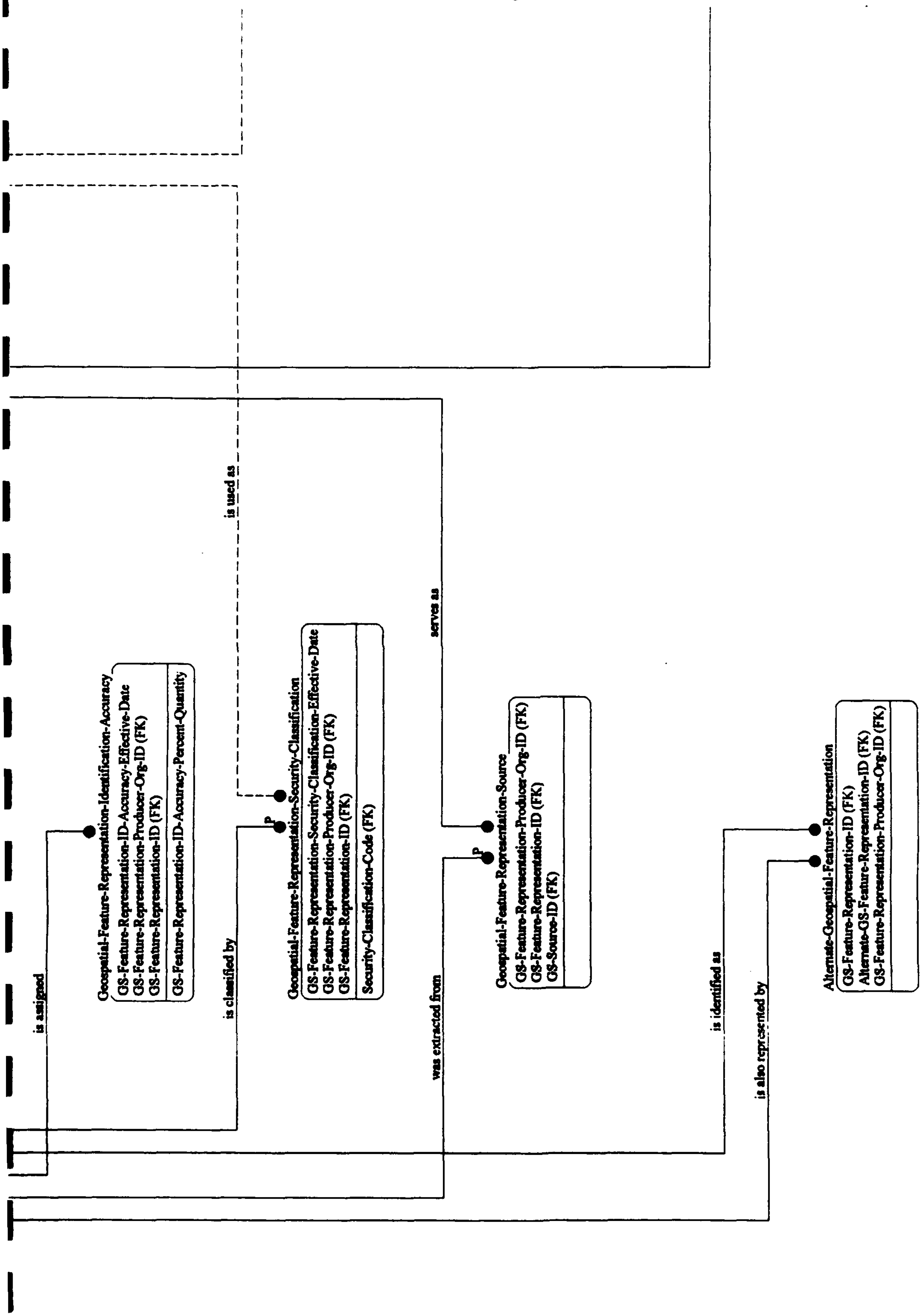
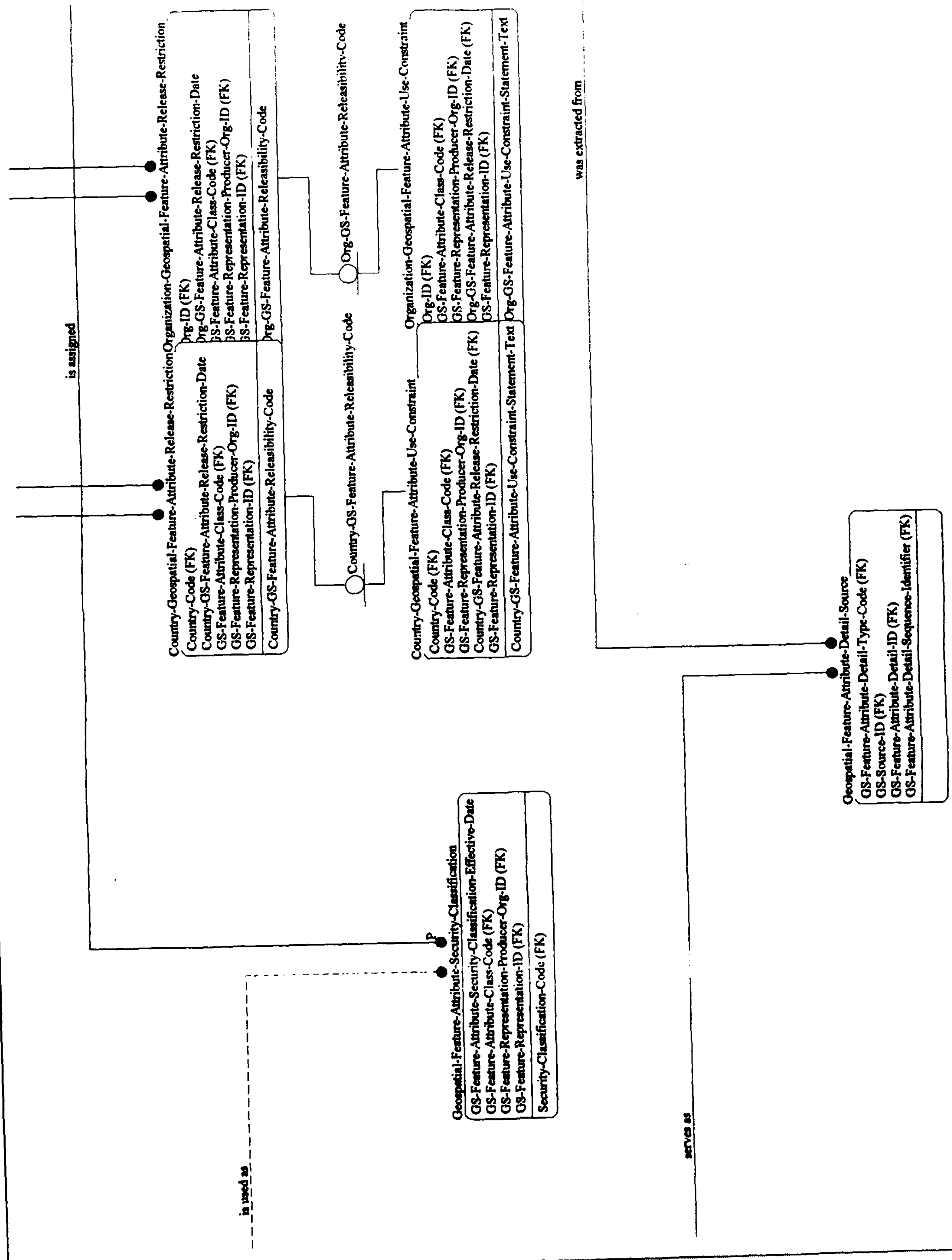
has its extent bounded by
is the locus for
has its third dimension provided by
the location of
2
Z



is used as
serves as
is assigned
is classified by
was extracted from
is identified as
is also represented by
Geospatial-Feature-Representation-Identification-Accuracy
GS-Feature-Representation-ID-Accuracy-Effective-Date
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Feature-Representation-ID-Accuracy-Percent-Quantity
Geospatial-Feature-Representation-Security-Classification
GS-Feature-Representation-Security-Classification-Effective-Date
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Security-Classification-Code (FK)
Geospatial-Feature-Representation-Source
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Source-ID (FK)
Alternate-Geospatial-Feature-Representation
GS-Feature-Representation-ID (FK)
Alternate-GS-Feature-Representation-ID (FK)
GS-Feature-Representation-Producer-Org-ID (FK)


Organization-Geospatial-Feature-Attribute-Release-Restriction
Org-ID (FK)
Org-GS-Feature-Attribute-Release-Restriction-Date
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Org-GS-Feature-Attribute-Releasability-Code
Org-GS-Feature-Attribute-Releasability-Code
Organization-Geospatial-Feature-Attribute-Use-Constraint
Org-ID (FK)
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
Org-GS-Feature-Attribute-Release-Restriction-Date (FK)
GS-Feature-Representation-ID (FK)
Org-GS-Feature-Attribute-Use-Constraint-Statement-Text
was extracted from
is assigned
Country-Geospatial-Feature-Attribute-Release-Restriction
Country-Code (FK)
Country-GS-Feature-Attribute-Release-Restriction-Date
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Country-GS-Feature-Attribute-Releasability-Code
Country-GS-Feature-Attribute-Releasability-Code
Country-Geospatial-Feature-Attribute-Use-Constraint
Country-Code (FK)
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
Country-GS-Feature-Attribute-Release-Restriction-Date (FK)
GS-Feature-Representation-ID (FK)
Country-GS-Feature-Attribute-Use-Constraint-Statement-Text
Geospatial-Feature-Attribute-Detail-Source
GS-Feature-Attribute-Detail-Type-Code (FK)
GS-Source-ID (FK)
GS-Feature-Attribute-Detail-ID (FK)
GS-Feature-Attribute-Detail-Sequence-Identifier (FK)
P
Geospatial-Feature-Attribute-Security-Classification
GS-Feature-Attribute-Security-Classification-Effective-Date
GS-Feature-Attribute-Class-Code (FK)
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GS-Feature-Representation-ID (FK)
Security-Classification-Code (FK)
is used as
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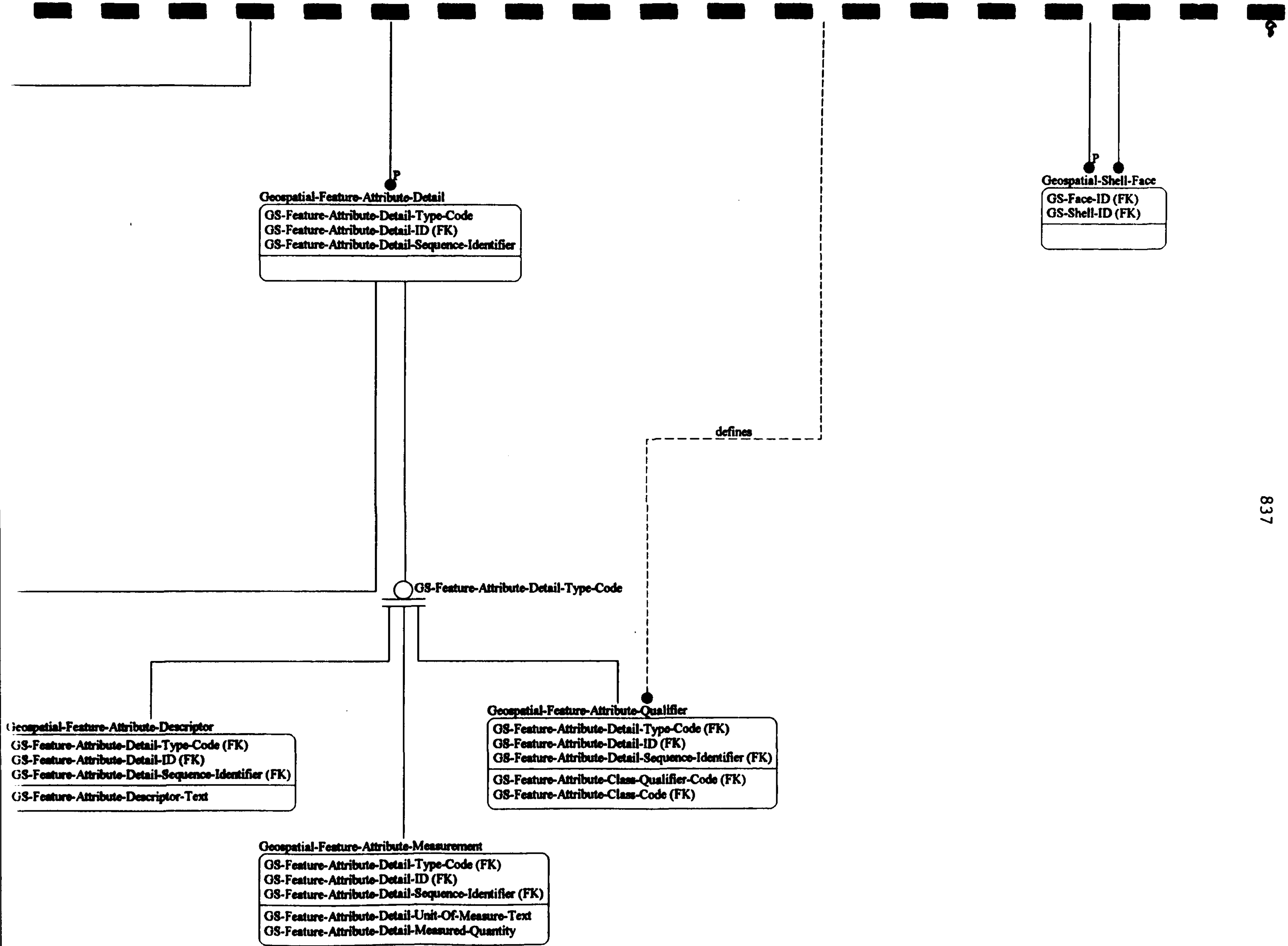
Geospatial-Feature-Attribute-Detail
GS-Feature-Attribute-Detail-Type-Code
GS-Feature-Attribute-Detail-ID (FK)
GS-Feature-Attribute-Detail-Sequence-Identifier
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Geospatial-Shell-Face
GS-Face-ID (FK)
GS-Shell-ID (FK)
P
defines
GS-Feature-Attribute-Detail-Type-Code
Geospatial-Feature-Attribute-Descriptor
GS-Feature-Attribute-Detail-Type-Code (FK)
GS-Feature-Attribute-Detail-ID (FK)
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GS-Feature-Attribute-Descriptor-Text
Geospatial-Feature-Attribute-Qualifier
GS-Feature-Attribute-Detail-Type-Code (FK)
GS-Feature-Attribute-Detail-ID (FK)
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GS-Feature-Attribute-Class-Qualifier-Code (FK)
GS-Feature-Attribute-Class-Code (FK)
Geospatial-Feature-Attribute-Measurement
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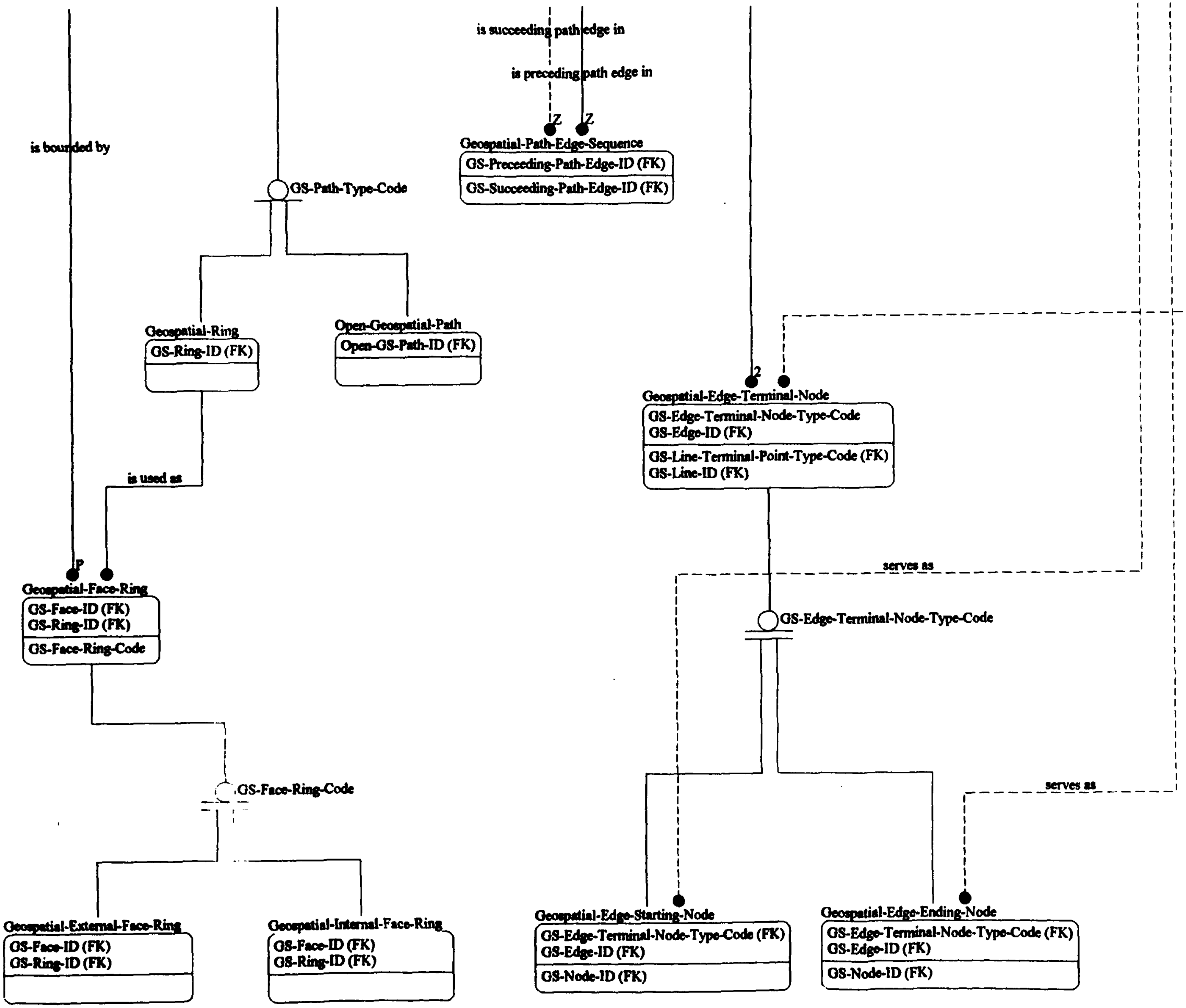
GS-Feature-Attribute-Detail-Measured-Quantity


is bounded by
GS-Path-Type-Code
is succeeding path edge in
is preceding path edge in
Z
Z
Geospatial-Path-Edge-Sequence
GS-Preceding-Path-Edge-ID (FK)
GS-Succeeding-Path-Edge-ID (FK)
Geospatial-Ring
GS-Ring-ID (FK)
Open-Geospatial-Path
Open-GS-Path-ID (FK)
2
Geospatial-Edge-Terminal-Node
GS-Edge-Terminal-Node-Type-Code
GS-Edge-ID (FK)
GS-Line-Terminal-Point-Type-Code (FK)
GS-Line-ID (FK)
is used as
P
Geospatial-Face-Ring
GS-Face-ID (FK)
GS-Ring-ID (FK)
GS-Face-Ring-Code
serves as
GS-Edge-Terminal-Node-Type-Code
GS-Face-Ring-Code
serves as
Geospatial-External-Face-Ring
GS-Face-ID (FK)
GS-Ring-ID (FK)
Geospatial-Internal-Face-Ring
GS-Face-ID (FK)
GS-Ring-ID (FK)
Geospatial-Edge-Starting-Node
GS-Edge-Terminal-Node-Type-Code (FK)
GS-Edge-ID (FK)
GS-Node-ID (FK)
Geospatial-Edge-Ending-Node
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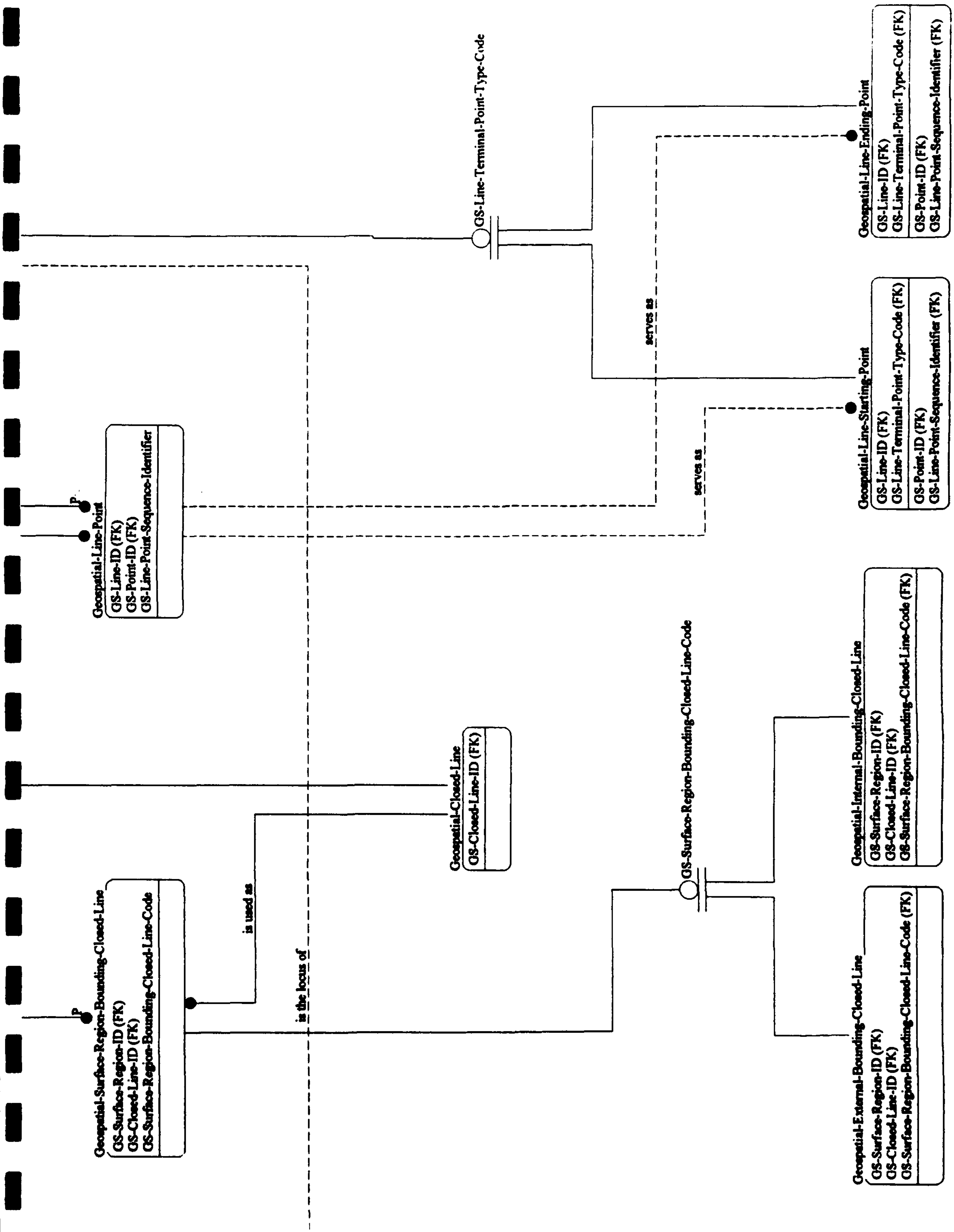
GS-Node-ID (FK)


GS-Line-Terminal-Point-Type-Code
Geospatial-Line-Ending-Point
GS-Line-ID (FK)
GS-Line-Terminal-Point-Type-Code (FK)
GS-Point-ID (FK)
GS-Line-Point-Sequence-Identifier (FK)
serves as
Geospatial-Line-Starting-Point
GS-Line-ID (FK)
GS-Line-Terminal-Point-Type-Code (FK)
GS-Point-ID (FK)
GS-Line-Point-Sequence-Identifier (FK)
serves as
Geospatial-Line-Point
GS-Line-ID (FK)
GS-Point-ID (FK)
GS-Line-Point-Sequence-Identifier
P
GS-Surface-Region-Bounding-Closed-Line-Code
Geospatial-Internal-Bounding-Closed-Line
GS-Surface-Region-ID (FK)
GS-Closed-Line-ID (FK)
GS-Surface-Region-Bounding-Closed-Line-Code (FK)
Geospatial-Closed-Line
GS-Closed-Line-ID (FK)
is used as
is the locus of
Geospatial-Surface-Region-Bounding-Closed-Line
GS-Surface-Region-ID (FK)
GS-Closed-Line-ID (FK)
GS-Surface-Region-Bounding-Closed-Line-Code
P
Geospatial-External-Bounding-Closed-Line
GS-Surface-Region-ID (FK)
GS-Closed-Line-ID (FK)
GS-Surface-Region-Bounding-Closed-Line-Code (FK)

Fully Attributed Entity Definitions

ALTERNATE-GEOSPATIAL-FEATURE-REPRESENTATION

An independent model of a geospatial feature. The data extraction process permits capturing different representations of the same real world object. These representations are related to each other through this entity.

COMPONENT-GEOSPATIAL-FEATURE-REPRESENTATION

A geospatial feature representation that comprises an element of a complex geospatial feature representation.

COUNTRY

A sovereign state. Typically an autonomous political unit; also called a nation.

This entity is only a shadow entity in the DMA Data Model. DMA believes it is not responsible for defining and modeling the entity Country.

COUNTRY-GEOSPATIAL-FEATURE-ATTRIBUTE-RELEASE-RESTRICTION

A constraint controlling the release of specific data about a geospatial feature. The constraint may prohibit or permit said release to a country, as indicated by the country releasibility attribute.

COUNTRY-GEOSPATIAL-FEATURE-ATTRIBUTE-USE-CONSTRAINT

The limitations to the use a receiving country may make of specific information about a geospatial feature.

COUNTRY-GEOSPATIAL-FEATURE-REPRESENTATION-RELEASE-RESTRICTION

A constraint controlling the release of a geospatial feature representation. The constraint may prohibit or permit said release to a country, as indicated by the country releasibility attribute.

COUNTRY-GEOSPATIAL-FEATURE-REPRESENTATION-USE-CONSTRAINT

The limitation to the use a receiving country may make of a geospatial feature representation.

GEOSPATIAL-CLOSED-LINE

A non-self-intersecting geospatial line specified by at least four geospatial points in which the geospatial line starting point and the geospatial line ending point are the same.

GEOSPATIAL-EDGE

A one-dimensional topological element bounded by one geospatial starting node and one geospatial ending node and located by a geospatial line. A geosopatial edge is directed from start node to end node. When an edge is a part of a more complex structure, its directionality may be used as the basis for ideas such as "right" and "left".

GEOSPATIAL-EDGE-ENDING-NODE

A geospatial node identified as the ending node of a geospatial edge.

GEOSPATIAL-EDGE-STARTING-NODE

A geospatial node identified as the starting node of a geospatial edge.

GEOSPATIAL-EDGE-TERMINAL-NODE

A geospatial node which is either the starting or ending node for a specific geospatial edge.

GEOSPATIAL-EXTERNAL-BOUNDING-CLOSED-LINE

The geospatial surface region bounding closed line which defines the exterior boundary of a geospatial surface region.

GEOSPATIAL-EXTERNAL-FACE-RING

The geospatial face ring which defines the exterior boundary of a geospatial face.

GEOSPATIAL-FACE

A topological region enclosed by a geospatial ring. A geospatial facehas its locus defined by a geospatial surface region.

GEOSPATIAL-FACE-RING

The geospatial ring which is a boundary of a geospatial face. The ring may be an internal boundary. The ring may be the external boundary.

GEOSPATIAL-FEATURE

An identifiable object relative to the Earth's surface. A wide variety of identifiable objects exist on and sometimes above or below the Earth's surface. Included among these are moveable or temporal objects (trucks, command posts, etc.), and temporary structures (tents, shelters, etc.). While these are of interest or concern from many perspectives, the geospatial perspective considers only those features, natural and man-made, that remain stationary or recur in the same place over a significant length of time.

GEOSPATIAL-FEATURE-ATTRIBUTE

A characteristic of a geospatial feature.

GEOSPATIAL-FEATURE-ATTRIBUTE-CLASS

The generic description of a specific geospatial feature attribute. DIGEST provides a list of attribute classes, codes and descriptors in Part 4 Annex B. Refer to the instance tables provided on Page 4-6 in Section 4 for a fuller understanding of how the model employs these concepts.

GEOSPATIAL-FEATURE-ATTRIBUTE-CLASS-QUALIFIER

Information that provides further detail within a geospatial feature attribute class that may be used for geospatial feature characterization. DIGEST provides the lists of available qualifier (value) codes and descriptors in Part 4 Annex B. Refer to the instance tables provided on Page 4-6 in Section 4 for a fuller understanding of how the model employs these concepts.

GEOSPATIAL-FEATURE-ATTRIBUTE-DESCRIPTOR

The variable length text string providing descriptive detail to a geospatial feature attribute as required by the attribute class. For example, the feature attribute class "Name" requires that the name of the feature be provided as a text string. Refer to the instance tables provided on Page 4-7 in Section 4 for a fuller understanding of how the model employs these concepts.

GEOSPATIAL-FEATURE-ATTRIBUTE-DETAIL

Information about a specific geospatial feature that provides a more detailed description of a geospatial feature attribute. The detail is one of three types, which are geospatial feature attribute descriptor, geospatial feature attribute measurement, and geospatial feature attribute qualifier. DIGEST Part 4 Annex B provides a list of standard values for each attribute. Refer to the instance tables provided on Page 4-7 in Section 4 for a fuller understanding of how the model employs these concepts.

GEOSPATIAL-FEATURE-ATTRIBUTE-DETAIL-SOURCE

Information about a specific source for determining a geospatial feature attribute detail.

GEOSPATIAL-FEATURE-ATTRIBUTE-MEASUREMENT

The measured value of a specific geospatial feature attribute. Refer to the instance tables provided on Page 4-7 in Section 4 for a fuller understanding of how the model employs these concepts.

GEOSPATIAL-FEATURE-ATTRIBUTE-QUALIFIER

The specific geospatial feature attribute class qualifier used to provide the detail description of a specific geospatial feature attribute. Refer to the instance tables provided on Page 4-7 in Section 4 for a fuller understanding of how the model employs these concepts.

GEOSPATIAL-FEATURE-ATTRIBUTE-SECURITY-CLASSIFICATION

A security classification assigned to data about a geospatial feature attribute.

GEOSPATIAL-FEATURE-REPRESENTATION

A model of a geospatial feature. The model provides geometric and descriptive characteristics of the feature. The geometric portion of the model portrays the feature's size, shape, position and connectivity using geometric and topologic elements. The descriptive portion of the model contains attribute detail descriptions, attribute qualifiers, and attribute measurements.

GEOSPATIAL-FEATURE-REPRESENTATION-GEOMETRY

The association between a geospatial feature representation and its geospatial geometric element.

GEOSPATIAL-FEATURE-REPRESENTATION-IDENTIFICATION-ACCURACY

The probability that the geospatial feature code has been correctly assigned to a geospatial feature representation.

GEOSPATIAL-FEATURE-REPRESENTATION-SECURITY-CLASSIFICATION

The classification assigned to a geospatial feature representation.

GEOSPATIAL-FEATURE-REPRESENTATION-SOURCE

The geospatial source from which information about a geospatial feature was extracted.

GEOSPATIAL-FEATURE-REPRESENTATION-VALIDATION

The finding that a geospatial feature representation is complete.

GEOSPATIAL-FEATURE-REPRESENTATION-VERTICAL-ACCURACY

Information about the errors associated with the determination of the elevation of geospatial points used in the geospatial feature representation geometry.

GEOSPATIAL-GEOMETRIC-ELEMENT

A component of a geospatial feature representation which provides information about size, shape, and position. A geometric element may have a topologic element associated with it.

GEOSPATIAL-INTERNAL-BOUNDING-CLOSED-LINE

A geospatial surface region bounding closed line used as an interior boundary of a geospatial surface region.

GEOSPATIAL-INTERNAL-FACE-RING

A geospatial face ring used as an interior boundary of a geospatial face.

GEOSPATIAL-LINE

One of three types of geometric element, defined by a set of geospatial points in an ordered sequence. The defining points are connected by straight line segments.

GEOSPATIAL-LINE-ENDING-POINT

A geospatial line terminal point identified as the last point in a sequence of points that defines a geospatial line.

GEOSPATIAL-LINE-POINT

A geospatial point that is part of a set used in defining a geospatial line.

GEOSPATIAL-LINE-STARTING-POINT

A geospatial line terminal point identified as the first point in a sequence of points that defines a geospatial line.

GEOSPATIAL-LINE-TERMINAL-POINT

There are exactly two geospatial points designated terminal points for each line. One geospatial point is a terminal end point and one is a terminal start point.

GEOSPATIAL-NODE

A zero dimensional topological primitive used to define topologic relationships. A geospatial node is always associated with a geospatial point.

GEOSPATIAL-PATH

A set of edges connected at their terminal nodes, such that no node is shared by more than two edges of the set.

GEOSPATIAL-PATH-EDGE

A geospatial edge used as a component of a geospatial path.

GEOSPATIAL-PATH-EDGE-SEQUENCE

Information about the order of the assembly of a geospatial path. This entity associates a geospatial edge used as a geospatial path edge to the succeeding geospatial edge in the path.

GEOSPATIAL-POINT

The zero dimensional primitive that assigns the geodetic position. Latitude, longitude, and elevation, if available, are defined in WGS 84. (See DMA Technical Report 8350.2.)

GEOSPATIAL-POINT-ELEVATION

A geospatial point elevation assigns an elevation to a geospatial point. The elevation is referenced to mean sea level.

GEOSPATIAL-POSITION-ELEMENT

An element of geometry or topology used for real or conceptual delineations relative to the surface of the earth. Geometric elements include geospatial point, geospatial line, and geospatial surface region. Topologic elements include geospatial node, geospatial edge, geospatial face, geospatial shell, and geospatial path.

GEOSPATIAL-RING

A closed geospatial path. In a closed geospatial path, every geospatial terminal node in the path is shared by two of the edges that make up the path. A geospatial ring bounds a geospatial face.

GEOSPATIAL-SHELL

An open connected set of two or more geospatial faces.

GEOSPATIAL-SHELL-FACE

Information that a specific geospatial face is a member of a set that composes a geospatial shell.

GEOSPATIAL-SOURCE

Data of any type from which geospatial feature information can be extracted. Sources include, but are not limited to, ground control, aerial and terrestrial photographs, sketches, maps, and charts; topographic, hydrographic, hypsographic, magnetic, geodetic, oceanographic, and meteorological information; intelligence documents and written reports pertaining to natural and man-made features of the area to be mapped or charted.

This entity is only a shadow entity in the DMA Data Model. DMA believes that it does not fall within the scope of this project to define and model the entity Geospatial-Source.

GEOSPATIAL-SURFACE-REGION

A bounded segment of a specified surface. A geospatial surface region may be bounded by a geospatial surface region closed line. When a geospatial surface region is the location of a geospatial face, the loci of the geospatial edges which make up the geospatial face ring are the geospatial lines which bound the geospatial surface region.

GEOSPATIAL-SURFACE-REGION-BOUNDING-CLOSED-LINE

A geospatial surface region closed line that bounds a geospatial surface region.

GEOSPATIAL-TOPOLOGICAL-ELEMENT

A primitive that defines connectivity and relationship of the parts of the geospatial position elements. Every topological element has an appropriate association to a geometric element.

OPEN-GEOSPATIAL-PATH

A geospatial path in which all but two of the geospatial nodes are shared by two geospatial edges.

ORGANIZATION

An administrative structure constituted to accomplish a goal, purpose or mission. (Reference Working Draft of DoD Enterprise Model; February 1993.)

This entity is only a shadow entity in the DMA Data Model. DMA believes it is not responsible for defining and modeling the entity Organization.

ORGANIZATION-COUNTRY

The primary association between an organization and a country. The association is used to determine disclosures of information, limited by country.

ORGANIZATION-GEOSPATIAL-FEATURE-ATTRIBUTE-RELEASE-RESTRICTION

A constraint controlling the release of specific geospatial feature attribute data. The constraint may prohibit or permit said release to an organization, as indicated by the country releasibility attribute.

ORGANIZATION-GEOSPATIAL-FEATURE-ATTRIBUTE-USE-CONSTRAINT

The limitations to the use a receiving organization may make of specific information about a geospatial feature attribute.

ORGANIZATION-GEOSPATIAL-FEATURE-REPRESENTATION-RELEASE-RESTRICTION

A constraint controlling the release of a geospatial feature representation. The constraint may prohibit or permit said release to an organization, as indicated by the organization releasibility attribute.

ORGANIZATION-GEOSPATIAL-FEATURE-REPRESENTATION-USE-CONSTRAINT

The limitations to the use a receiving organization may make of a geospatial feature representation.

SECURITY-CLASSIFICATION

Information established by an authoritative body about a level of control of information disclosure.

Key Attribute Definitions

Alternate-Geospatial-Feature-Representation-Identifier

The identifier that denotes an alternate geospatial feature representation.

Component-Geospatial-Feature-Representation-Identifier

The identifier that denotes a geospatial feature that is a component of another geospatial feature representation.

Composite-Geospatial-Feature-Representation-Identifier

The identifier that denotes a geospatial feature representation that contains other geospatial feature representations as components.

Country-Code

The code that denotes a country as specified by FIPS PUB 10-3.

Country-Geospatial-Feature-Attribute-Release-Restriction-Date

The date on which a country geospatial feature attribute release restriction was established.

Country-Geospatial-Feature-Representation-Release-Restriction-Date

The date on which a country geospatial feature release restriction was established.

Geospatial-Closed-Line-Identifier

The geospatial line identifier that denotes a geospatial closed line.

Geospatial-Edge-Identifier

The geospatial topological element identifier that denotes a geospatial edge.

Geospatial-Edge-Terminal-Node-Type-Code

The code that denote a geospatial edge terminal node type. The type may be a geospatial edge starting node. The type may be a geospatial edge ending node.

Geospatial-Face-Identifier

The geospatial topological element identifier that denotes a geospatial face.

Geospatial-Feature-Attribute-Class-Code

The code that denotes a geospatial feature attribute class. DIGEST Part 4 Annex B provides a list of standard feature attribute codes.

Geospatial-Feature-Attribute-Class-Qualifier-Code

The code that denotes a qualifier of the selected geospatial feature attribute class. DIGEST Part 4 Annex B provides lists of standard feature attribute qualifier codes. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Attribute-Detail-Identifier

The identifier that denotes the role name for geospatial feature attribute class code, geospatial feature representation producer organization identifier, and geospatial feature representation identifier.

Geospatial-Feature-Attribute-Detail-Sequence-Identifier

The sequence identifier that distinguishes between several geospatial feature attribute descriptor texts that exist for the same geospatial feature attribute detail type code.

Geospatial-Feature-Attribute-Detail-Type-Code

A code that denotes a type of geospatial feature attribute detail. The code denotes one of three types of geospatial feature attribute detail, which are geospatial feature attribute descriptor, geospatial feature attribute measurement, and geospatial feature attribute qualifier.

Geospatial-Feature-Attribute-Security-Classification-Effective-Date

The date on which the geospatial feature attribute security classification was established.

Geospatial-Feature-Code

The code that denotes a specific geospatial feature type. Standard codes are listed in DIGEST Part 4 Annex A.

Geospatial-Feature-Representation-Identifier

The identifier that uniquely represents a geospatial feature representation produced by a specific geospatial feature representation producer organization.

Geospatial-Feature-Representation-Identification-Accuracy-Effective-Date

The date on which the geospatial feature representation identification accuracy was assigned.

Geospatial-Feature-Representation-Producer-Organization-Identifier

The identifier that denotes an organization as the producer of a geospatial feature representation.

Geospatial-Feature-Representation-Security-Classification-Effective-Date

The date on which the geospatial feature representation security classification was established.

Geospatial-Feature-Representation-Validation-Date

The date on which a geospatial feature representation validation is effective.

Geospatial-Geometric-Element-Identifier

The geospatial position element identifier that denotes a geospatial geometric element. It is the role name for geospatial position element producer organization identifier and geospatial position element identifier.

Geospatial-Line-Identifier

The geospatial geometric element identifier that denotes a geospatial line.

Geospatial-Line-Point-Sequence-Identifier

The identifier that denotes the position of a specific geospatial line point, ordering the set of geospatial line points that make up a geospatial line.

Geospatial-Line-Terminal-Point-Type-Code

The code that denotes a geospatial line terminal point type. The types are geospatial line starting point and geospatial line ending point.

Geospatial-Node-Identifier

The geospatial topological element identifier that denotes a geospatial node.

Geospatial-Path-Identifier

The geospatial topological element identifier that represents a geospatial path.

Geospatial-Point-Identifier

The geospatial geometric element identifier that denotes a geospatial point.

Geospatial-Position-Element-Identifier

The identifier that denotes a specific geospatial position element. The producer organization assigns a unique identifier to each instance of geospatial position element.

Geospatial-Position-Element-Producer-Organization-Identifier

The organization identifier that represents a geospatial position element producer organization. The organization identifier is used as part of the identification of a geospatial position element.

Geospatial-Preceding-Path-Edge-Identifier

The identifier that denotes a geospatial edge that immediately precedes another edge in the sequence of edges that make up a path.

Geospatial-Ring-Identifier

The geospatial topological element identifier that denotes a geospatial ring.

Geospatial-Shell-Identifier

The geospatial topological element identifier that denotes a geospatial shell.

Geospatial-Source-Identifier

The identifier that denotes data of any type from which geospatial feature information can be extracted. The identifier will be more clearly defined when Source is modeled more completely.

Geospatial-Surface-Region-Bounding-Closed-Line-Code

The code that denotes the type of geospatial surface region bounding closed line. There are two types: geospatial external bounding closed line and geospatial internal bounding closed line.

Geospatial-Surface-Region-Identifier

The geospatial geometric element identifier that denotes a geospatial surface region.

Geospatial-Topological-Element-Identifier

The geospatial position element identifier that denotes a geospatial topological element. It is the role name for geospatial position element producer organization identifier and geospatial position element identifier.

Open-Geospatial-Path-Identifier

The geospatial topological element identifier that denotes an open geospatial path.

Organization-Identifier

The identifier that denotes an organization.

Organization-Geospatial-Feature-Attribute-Release-Restriction-Date

The date on which an organization geospatial feature attribute release restriction was established.

Organization-Geospatial-Feature-Representation-Release-Restriction-Date

The date on which an organization geospatial feature representation release restriction was established.

Security-Classification-Code

The code that denotes a level of a classification.

Non-Key Attribute Definitions

Country-Geospatial-Feature-Attribute-Releasibility-Code

The code that denotes whether a country can receive information about a geospatial feature attribute. If the value is yes, the geospatial feature attribute may be given to persons or organizations representing that country, but it may be subject to constraints expressed by the organization geospatial feature attribute release restriction and country geospatial feature attribute use constraint. If the value is no, the geospatial feature attribute may not be given to any person or organization representing the country.

Country Geospatial-Feature-Attribute-Use-Constraint-Statement-Text

The text identifying the limits to the uses a receiving country may make concerning the geospatial feature attribute.

Country-Geospatial-Feature-Representation-Releasibility-Code

The code that denotes whether a country can receive a geospatial feature representation. If the value is yes, the geospatial feature representation may be given to persons or organizations representing that country, but it may be subject to constraints expressed by the organization geospatial feature representation release restriction and country geospatial feature representation use constraint. If the value is no, the geospatial feature representation may not be given to any person or organization representing the country.

Country Geospatial-Feature-Representation-Use-Constraint-Statement-Text

The text identifying the limits to the uses a receiving country may make concerning the geospatial feature representation.

Geospatial-Edge-Direction-Code

The code that denotes the direction in which an edge is traversed when that edge is a component of a geospatial path. Normal traversal of a geospatial edge is from geospatial edge starting node to geospatial edge ending node. When an edge is part of a path, it may be traversed in the opposite direction.

Geospatial-Face-Ring-Code

The code that denotes the type of a geospatial face ring. There are two types: geospatial external face ring and geospatial internal face ring.

Geospatial-Feature-Attribute-Class-Description-Text

The text that describes the geospatial feature attribute class. These descriptions are provided in DIGEST Part 4 Annex B. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Attribute-Class-Name

The name of a geospatial feature attribute class. A list of these names is provided in DIGEST Part 4 Annex B. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Attribute-Class-Qualifier-Description-Text

The text that describes a geospatial feature attribute class qualifier. These descriptions are provided in DIGEST Part 4 Annex B. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Attribute-Descriptor-Text

The text of the geospatial feature attribute descriptor as required by DIGEST Part 4 Annex B. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Attribute-Detail-Measured-Quantity

The quantity of the measured value for the geospatial feature attribute detail. The required units of measure are stated in DIGEST Part 4 Annex B. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Attribute-Détail-Unit-Of-Measure-Text

The text describing the value of a geospatial feature attribute detail. These descriptions are provided in DIGEST Part 4 Annex B. Refer to the instance tables provided elsewhere in Section 4 for a fuller understanding of how the model employs these concepts.

Geospatial-Feature-Code-Definition-Text

The text describing the distinguishing characteristics of a geospatial feature.

Geospatial-Feature-Representation-Extraction-Date

The date on which a geospatial feature representation was produced by a compilation from source data.

Geospatial-Feature-Representation-Horizontal-Accuracy-Quantity

The quantity providing circular error bounds at the 90% confidence level for the geospatial point horizontal position.

When the horizontal position of an identified object is stated in latitude-longitude measurements (phi-lambda), this places the object horizontally with respect to the Earth's surface in an Earth-centered fixed coordinate system. The error associated with this process expresses the uncertainty with which the phi-lambda values provided are correct.

DMA states this error as a circular error (Δ phi = Δ lambda) at the 90% confidence level indicating that 90% of the placement measurements in a set of measurements with the same circular error will be correct to within the radius of the error circle.

Geospatial-Feature-Representation-Identification-Accuracy-Percent-Quantity

The quantity expressing the probability that the geospatial feature code has been correctly assigned to a geospatial feature representation; the probability is expressed as a percentage.

Geospatial-Feature-Representation-Validating-Organization-Identifier

The identifier that denotes the organization that validated a geospatial feature representation.

Geospatial-Feature-Representation-Vertical-Accuracy-Quantity

The quantity providing linear error bounds at the 90% confidence level for geospatial point elevations.

When DMA provides a vertical measurement positioning an object with respect to its height, above or below mean sea level, the measurement is accompanied by an error bound, $\pm \Delta h$.

The interpretation of Δh is: In a set of vertical measurements, DMA is confident that 90% of the stated values will be within $\pm \Delta h$ of the true value.

Geospatial-Geometric-Element-Type-Code

The code that denotes a geospatial geometric element type. There are three types: point, surface region, and line.

Geospatial-Line-Closure-Code

The code that denotes that a geospatial line is a geospatial closed line.

Geospatial-Path-Type-Code

The code that denotes the type of a geospatial path. There are two types: geospatial ring and open geospatial path.

Geospatial-Point-Elevation-Dimension

The elevation of a geospatial point in meters above or below mean sea level.

Geospatial-Point-Latitude-Coordinate

One of the coordinates that identifies the location of a geospatial point. The latitude is the angle between the plane of the geodetic equator and the normal to the ellipsoid at a point (measured positive north from the geodetic equator, negative south). [DMA Technical Report 8350.2 - WGS 84]

Geospatial-Point-Longitude-Coordinate

One of the coordinates that identifies the location of a geospatial point. The longitude is the angle between the plane of the Zero Meridian and the plane of the geodetic meridian of the point (measured in the plane of the geodetic equator, positive from 0° to 180° E, and negative from 0° to 180° W). [DMA Technical Report 8350.2 - WGS 84]

Geospatial-Position-Element-Extraction-Date

The date on which a geospatial position element was produced by a compilation from source data.

Geospatial-Position-Element-Type-Code

The code that denotes a type of geospatial position element. The type may be a geospatial topological element. The type may be a geospatial geometric element.

Geospatial-Succeeding-Path-Edge-Identifier

The geospatial edge identifier that denotes a geospatial edge that immediately succeeds another geospatial edge in the sequence of geospatial edges that make up a geospatial path.

Geospatial-Topological-Element-Type-Code

The code that denotes a geospatial topological element type. The five types are: shell, face, path, edge, and node.

Organization-Geospatial-Feature-Attribute-Releasibility-Code

The code that denotes whether an organization can receive information about a geospatial feature attribute. If the value is yes, the geospatial feature attribute may be given to organizations or persons representing those organizations, but it may be subject to constraints expressed by the organization geospatial feature attribute release restriction and country geospatial feature attribute use constraint. If the value is no, the geospatial feature attribute may not be given to any organizations or persons representing those organizations.

Organization-Geospatial-Feature-Attribute-Use-Constraint-Statement-Text

A text that describes the limits to the uses a receiving organization may make concerning the geospatial feature attribute.

Organization-Geospatial-Feature-Representation-Releasibility-Code

The code that denotes whether an organization can receive a geospatial feature representation. If the value is yes, the geospatial feature may be given to organizations or persons representing those organizations, but it may be subject to constraints expressed by the organization geospatial feature representation release restriction and country geospatial feature representation use constraint. If the value is no, the geospatial feature representation may not be given to any organizations or persons representing those organizations.

Organization-Geospatial-Feature-Representation-Use Constraint-Statement-Text

The text that describes the limits to the uses a receiving organization may make concerning the geospatial feature representation.

<u>Business Rules</u>

Every Alternate-Geospatial-Feature-Representation
  always has a Geospatial-Feature-Representation.
  always has a Geospatial-Feature-Representation.

Every Component-Geospatial-Feature-Representation
  always has a Geospatial-Feature-Representation.
  always has a Geospatial-Feature-Representation.

Every Country
  always is assigned zero, one or many Country-Geospatial-Feature-Attribute-Release-Restriction(s).
  always is assigned zero, one or many Country-Geospatial-Feature-Representation-Release-Restriction(s).
  always is part of zero, one or many Organization-Country(s).

Every Country-Geospatial-Feature-Attribute-Release-Restriction
  may be a Country-Geospatial-Feature-Attribute-Use-Constraint,
    depending on Country-Geospatial-Feature-Attribute-Releasibility-Code.
  always has a Country.
  always has a Geospatial-Feature-Attribute.

Every Country-Geospatial-Feature-Attribute-Use-Constraint
  is a Country-Geospatial-Feature-Attribute-Release-Restriction.

Every Country-Geospatial-Feature-Representation-Release-Restriction
  may be a Country-Geospatial-Feature-Representation-Use-Constraint,
    depending on Country-Geospatial-Feature-Representation-Releasibility-Code.
  always has a Country.
  always has a Geospatial-Feature-Representation.

Every Country-Geospatial-Feature-Representation-Use-Constraint
  is a Country-Geospatial-Feature-Representation-Release-Restriction.

Every Geospatial-Closed-Line
  is a Geospatial-Line.
  always is used as zero, one or many Geospatial-Surface-Region-Bounding-Closed-Line(s).

Every Geospatial-Edge
  is a Geospatial-Topological-Element.
  always has a Geospatial-Line.
  always is assigned 2 Geospatial-Edge-Terminal-Node(s).
  always is used as zero, one or many Geospatial-Path-Edge(s).

Every Geospatial-Edge-Ending-Node
  is a Geospatial-Edge-Terminal-Node.
  always has a Geospatial-Node.

Every Geospatial-Edge-Starting-Node
  is a Geospatial-Edge-Terminal-Node.
  always has a Geospatial-Node.

Every Geospatial-Edge-Terminal-Node
  may be either
    a Geospatial-Edge-Ending-Node,
    or a Geospatial-Edge-Starting-Node,
      depending on Geospatial-Edge-Terminal-Node-Type-Code.
  always has a Geospatial-Edge.
  always has a Geospatial-Line-Terminal-Point.

Every Geospatial-External-Bounding-Closed-Line
  is a Geospatial-Surface-Region-Bounding-Closed-Line.

Every Geospatial-External-Face-Ring
  is a Geospatial-Face-Ring.

Every Geospatial-Face
  is a Geospatial-Topological-Element.
  always has a Geospatial-Surface-Region.
  always is bounded by one or more Geospatial-Face-Ring(s).
  always is used as zero, one or many Geospatial-Shell-Face(s).

Every Geospatial-Face-Ring
  may be either
    a Geospatial-External-Face-Ring,
    or a Geospatial-Internal-Face-Ring,
      depending on Geospatial-Face-Ring-Code.
  always has a Geospatial-Face.
  always has a Geospatial-Ring.

Every Geospatial-Feature
  always establishes the type of zero, one or many Geospatial-Feature-Representation(s).

Every Geospatial-Feature-Attribute
  always has a Geospatial-Feature-Attribute-Class.
  always has a Geospatial-Feature-Representation.
  always has distribution restricted by zero, one or many Country-Geospatial-Feature-Attribute-Release-Restriction(s).
  always is provided one or more Geospatial-Feature-Attribute-Detail(s).
  always is assigned one or more Geospatial-Feature-Attribute-Security-Classification(s).
  always has distribution restricted by zero, one or many Organization-Geospatial-Feature-Attribute-Release-Restriction(s).

Every Geospatial-Feature-Attribute-Class
  always describes zero, one or many Geospatial-Feature-Attribute(s).
  always is the basis for zero, one or many Geospatial-Feature-Attribute-Class-Qualifier(s).

Every Geospatial-Feature-Attribute-Class-Qualifier
always has a Geospatial-Feature-Attribute-Class.
always defines zero, one or many Geospatial-Feature-Attribute-Qualifier(s).

Every Geospatial-Feature-Attribute-Descriptor
is a Geospatial-Feature-Attribute-Detail.

Every Geospatial-Feature-Attribute-Detail
may be either
a Geospatial-Feature-Attribute-Descriptor,
or a Geospatial-Feature-Attribute-Measurement,
or a Geospatial-Feature-Attribute-Qualifier,
depending on Geospatial-Feature-Attribute-Detail-Type-Code.
always has a Geospatial-Feature-Attribute.
always was extracted from zero, one or many Geospatial-Feature-Attribute-Detail-Source(s).

Every Geospatial-Feature-Attribute-Detail-Source
always has a Geospatial-Feature-Attribute-Detail.
always has a Geospatial-Source.

Every Geospatial-Feature-Attribute-Measurement
is a Geospatial-Feature-Attribute-Detail.

Every Geospatial-Feature-Attribute-Qualifier
is a Geospatial-Feature-Attribute-Detail.
always has a Geospatial-Feature-Attribute-Class-Qualifier.

Every Geospatial-Feature-Attribute-Security-Classification
always has a Geospatial-Feature-Attribute.
always has a Security-Classification.

Every Geospatial-Feature-Representation
always has an Organization.
always has a Geospatial-Feature.
always is also represented by zero, one or many Alternate-Geospatial-Feature-Representation(s).
always is identified as zero, one or many Alternate-Geospatial-Feature-Representation(s).
always is a composite of zero, one or many Component-Geospatial-Feature-Representation(s).
always is also represented by zero, one or many Component-Geospatial-Feature-Representation(s).
always has distribution restricted by zero, one or many Country-Geospatial-Feature-Representation-Release-Restriction(s).
always is characterized by zero, one or many Geospatial-Feature-Attribute(s).
always is composed of zero or one Geospatial-Feature-Representation-Geometry(s).
always is assigned zero, one or many Geospatial-Feature-Representation-Identification-Accuracy(s).
always is classified by one or more Geospatial-Feature-Representation-Security-Classification(s).
always was extracted from one or more Geospatial-Feature-Representation-Source(s).
always undergoes zero, one or many Geospatial-Feature-Representation-Validation(s).
always has distribution restricted by zero, one or many Organization-Geospatial-Feature-Representation-Release-Restriction(s).

Every Geospatial-Feature-Representation-Geometry
always has a Geospatial-Feature-Representation.
always has a Geospatial-Geometric-Element.
always is assigned zero or one Geospatial-Feature-Representation-Vertical-Accuracy(s).

Every Geospatial-Feature-Representation-Identification-Accuracy
always has a Geospatial-Feature-Representation.

Every Geospatial-Feature-Representation-Security-Classification
always has a Geospatial-Feature-Representation.
always has a Security-Classification.

Every Geospatial-Feature-Representation-Source
always has a Geospatial-Feature-Representation.
always has a Geospatial-Source.

Every Geospatial-Feature-Representation-Validation
always has a Geospatial-Feature-Representation.
always has an Organization.

Every Geospatial-Feature-Representation-Vertical-Accuracy
always has a Geospatial-Feature-Representation-Geometry.

Every Geospatial-Geometric-Element
is a Geospatial-Position-Element.
may be either
a Geospatial-Line,
or a Geospatial-Point,
or a Geospatial-Surface-Region,
depending on Geospatial-Geometric-Element-Type-Code.
always is part of zero, one or many Geospatial-Feature-Representation-Geometry(s).

Every Geospatial-Internal-Bounding-Closed-Line
is a Geospatial-Surface-Region-Bounding-Closed-Line.

Every Geospatial-Internal-Face-Ring
is a Geospatial-Face-Ring.

Every Geospatial-Line
is a Geospatial-Geometric-Element.
may be a Geospatial-Closed-Line,
depending on Geospatial-Line-Closure-Code.
always is the locus for zero or one Geospatial-Edge(s).
always is defined by one or more Geospatial-Line-Point(s).
always is assigned 2 Geospatial-Line-Terminal-Point(s).

Every Geospatial-Line-Ending-Point
is a Geospatial-Line-Terminal-Point.
always has a Geospatial-Line-Point.

Every Geospatial-Line-Point
always has a Geospatial-Line.
always has a Geospatial-Point.
always serves as zero, one or many Geospatial-Line-Ending-Point(s).
always serves as zero, one or many Geospatial-Line-Starting-Point(s).

Every Geospatial-Line-Starting-Point
is a Geospatial-Line-Terminal-Point.
always has a Geospatial-Line-Point.

Every Geospatial-Line-Terminal-Point
may be either
a Geospatial-Line-Ending-Point,
or a Geospatial-Line-Starting-Point,
depending on Geospatial-Line-Terminal-Point-Type-Code.
always has a Geospatial-Line.
always is the locus of zero, one or many Geospatial-Edge-Terminal-Node(s).

Every Geospatial-Node
is a Geospatial-Topological-Element.
always has a Geospatial-Point.
always serves as zero, one or many Geospatial-Edge-Ending-Node(s).
always serves as zero, one or many Geospatial-Edge-Starting-Node(s).

Every Geospatial-Open-Path
is a Geospatial-Path.

Every Geospatial-Path
is a Geospatial-Topological-Element.
may be either
a Geospatial-Open-Path,
or a Geospatial-Ring,
depending on Geospatial-Path-Type-Code.
always is composed of one or more Geospatial-Path-Edge(s).

Every Geospatial-Path-Edge
always has a Geospatial-Edge.
always has a Geospatial-Path.
always is preceding ring edge in zero or one Geospatial-Path-Edge-Sequence(s).
always is succeeding ring edge in zero or one Geospatial-Path-Edge-Sequence(s).

Every Geospatial-Path-Edge-Sequence
always has a Geospatial-Path-Edge.
always has a Geospatial-Path-Edge.

Every Geospatial-Point
is a Geospatial-Geometric-Element.
always serves as zero, one or many Geospatial-Line-Point(s).
always is the location of zero or one Geospatial-Node(s).
always has its third dimension provided by zero or one Geospatial-Point-Elevation(s).

Every Geospatial-Point-Elevation
always has a Geospatial-Point.

Every Geospatial-Position-Element
may be either
a Geospatial-Geometric-Element,
or a Geospatial-Topological-Element,
depending on Geospatial-Position-Element-Type-Code.
always has an Organization.

Every Geospatial-Ring
is a Geospatial-Path.
always is used as zero, one or many Geospatial-Face-Ring(s).

Every Geospatial-Shell
is a Geospatial-Topological-Element.
always is composed of one or more Geospatial-Shell-Face(s).

Every Geospatial-Shell-Face
always has a Geospatial-Face.
always has a Geospatial-Shell.

Every Geospatial-Source
always serves as zero, one or many Geospatial-Feature-Attribute-Detail-Source(s).
always serves as zero, one or many Geospatial-Feature-Representation-Source(s).

Every Geospatial-Surface-Region
is a Geospatial-Geometric-Element.
always is the locus of zero or one Geospatial-Face(s).
always has its extent bounded by one or more Geospatial-Surface-Region-Bounding-Closed-Line(s).

Every Geospatial-Surface-Region-Bounding-Closed-Line
may be either
a Geospatial-External-Bounding-Closed-Line,
or a Geospatial-Internal-Bounding-Closed-Line,
depending on Geospatial-Surface-Region-Bounding-Closed-Line-Code.
always has a Geospatial-Closed-Line.
always has a Geospatial-Surface-Region.

Every Geospatial-Topological-Element
is a Geospatial-Position-Element.
may be either
a Geospatial-Edge,
or a Geospatial-Face,
or a Geospatial-Node,
or a Geospatial-Path,
or a Geospatial-Shell,
depending on Geospatial-Topological-Element-Type-Code.

Every Organization
always produces zero, one or many Geospatial-Feature-Representation(s).
always validates zero, one or many Geospatial-Feature-Representation-Validation(s).
always produces zero, one or many Geospatial-Position-Element(s).
always is part of zero, one or many Organization-Country(s).
always is assigned zero, one or many Organization-Geospatial-Feature-Attribute-Release-Restriction(s).
always is assigned zero, one or many Organization-Geospatial-Feature-Representation-Release-Restriction(s).

Every Organization-Country
always has a Country.
always has an Organization.

Every Organization-Geospatial-Feature-Attribute-Release-Restriction
may be an Organization-Geospatial-Feature-Attribute-Use-Constraint,
depending on Organization-Geospatial-Feature-Attribute-Releasibility-Code.
always has a Geospatial-Feature-Attribute.
always has an Organization.

Every Organization-Geospatial-Feature-Attribute-Use-Constraint
is an Organization-Geospatial-Feature-Attribute-Release-Restriction.

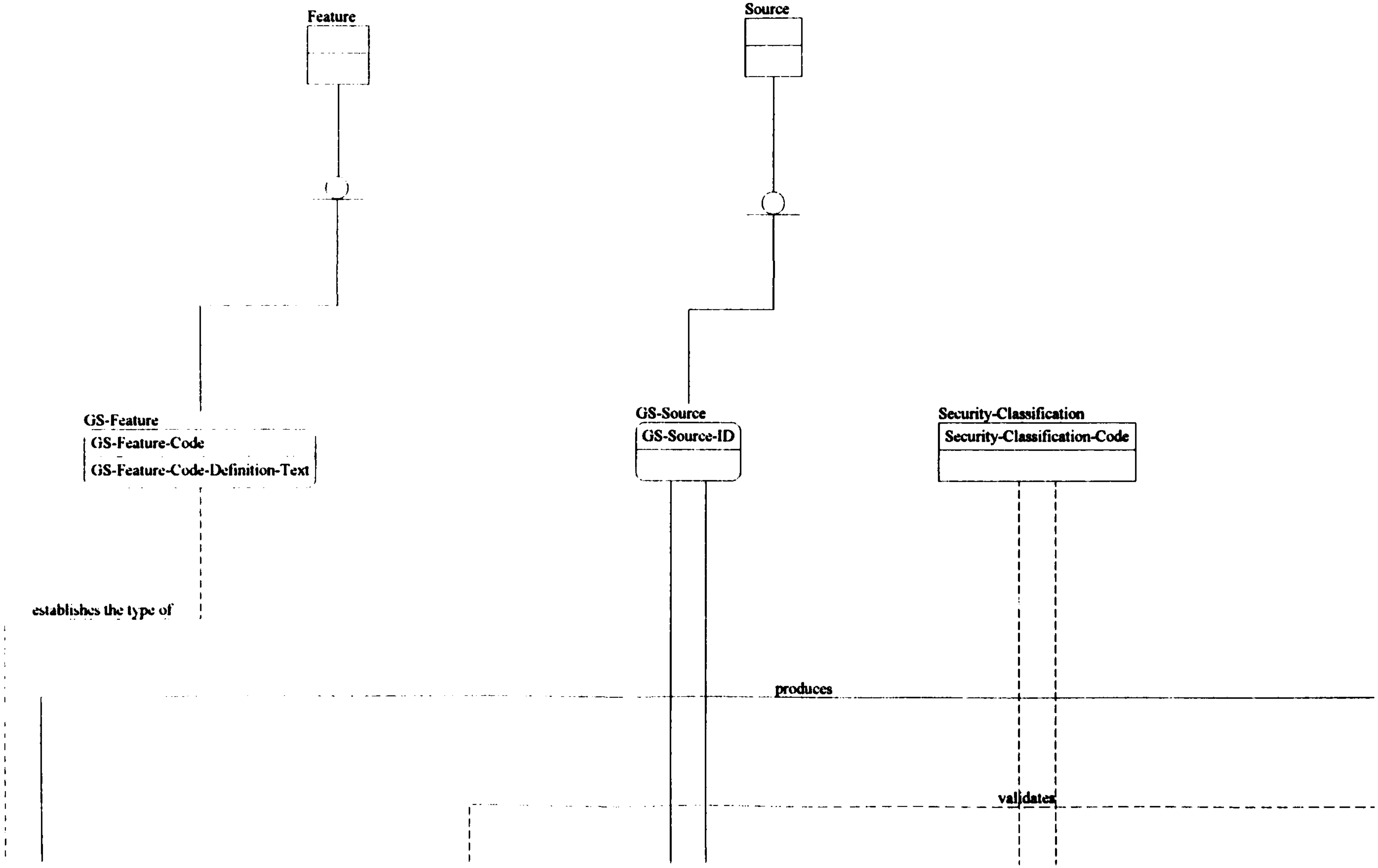
Every Organization-Geospatial-Feature-Representation-Release-Restriction
may be an Organization-Geospatial-Feature-Representation-Use-Constraint,
depending on Organization-Geospatial-Feature-Representation-Releasibility-Code.
always has a Geospatial-Feature-Representation.
always has an Organization.

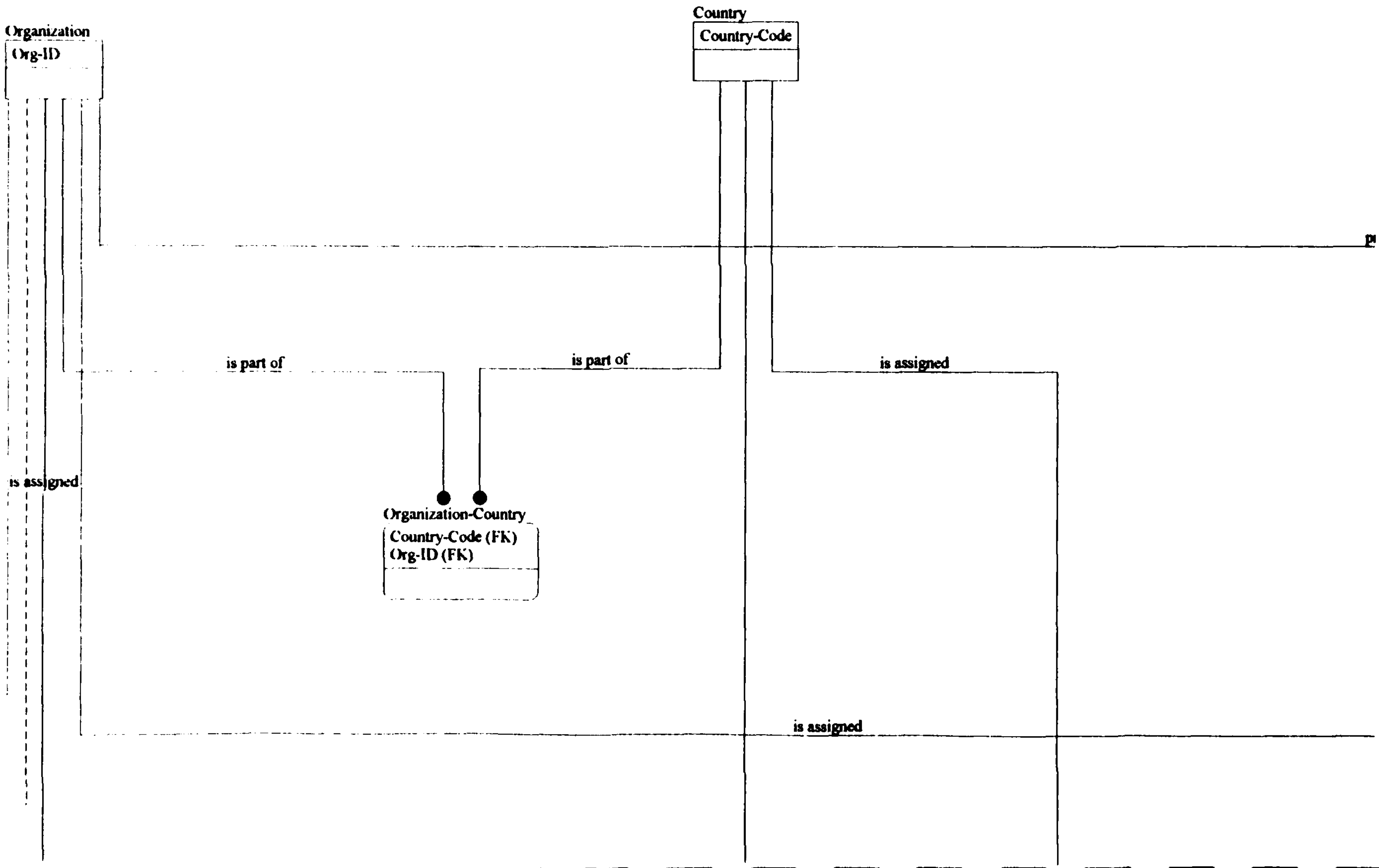
Every Organization-Geospatial-Feature-Representation-Use-Constraint
is an Organization-Geospatial-Feature-Representation-Release-Restriction.

Every Security-Classification
always is used as zero, one or many Geospatial-Feature-Attribute-Security-Classification(s).
always is used as zero, one or many Geospatial-Feature-Representation-Security-Classification(s).

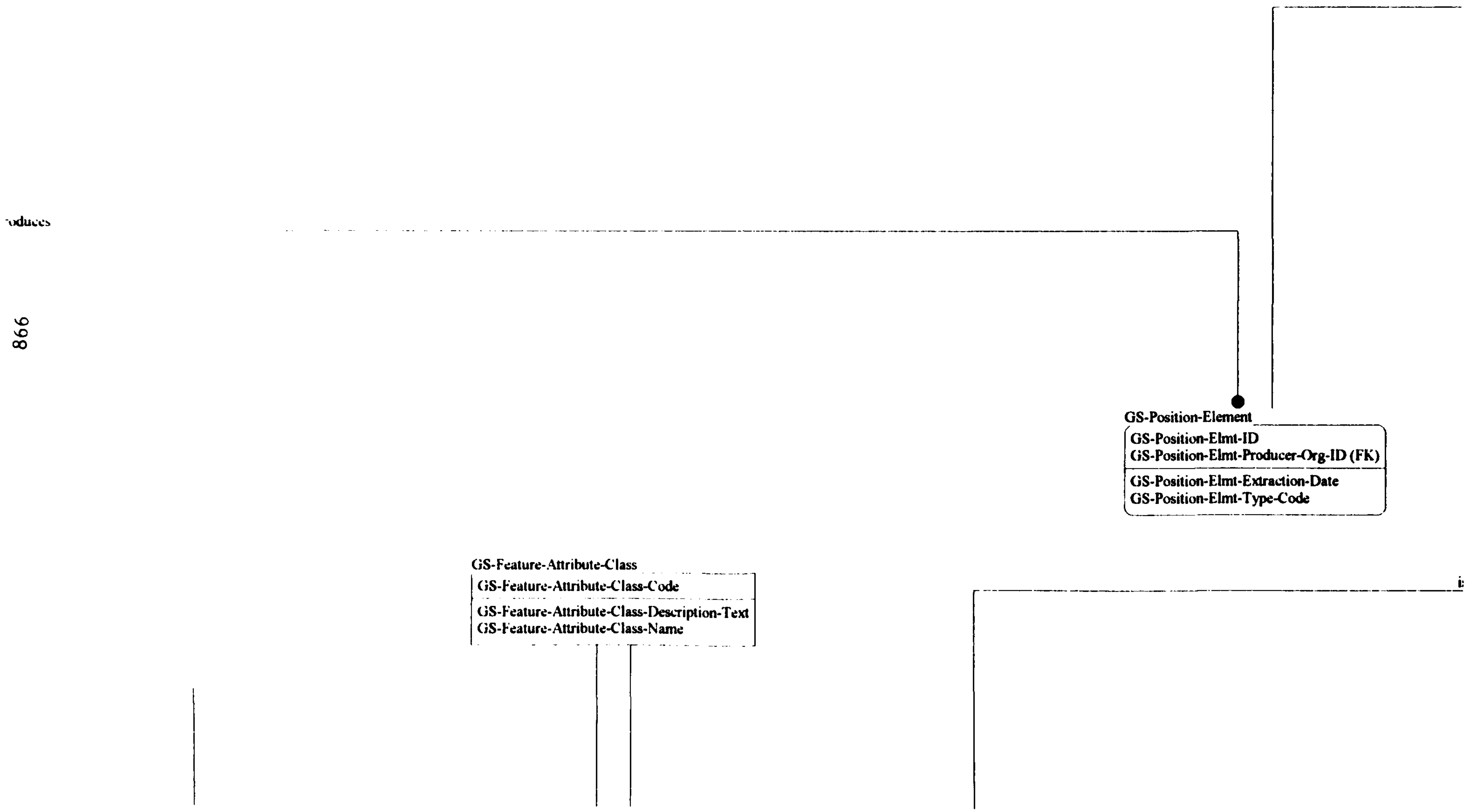
NOTE:
January 5, 1994
Diagram, Entity Definitions, and
attribute definitions are OK.

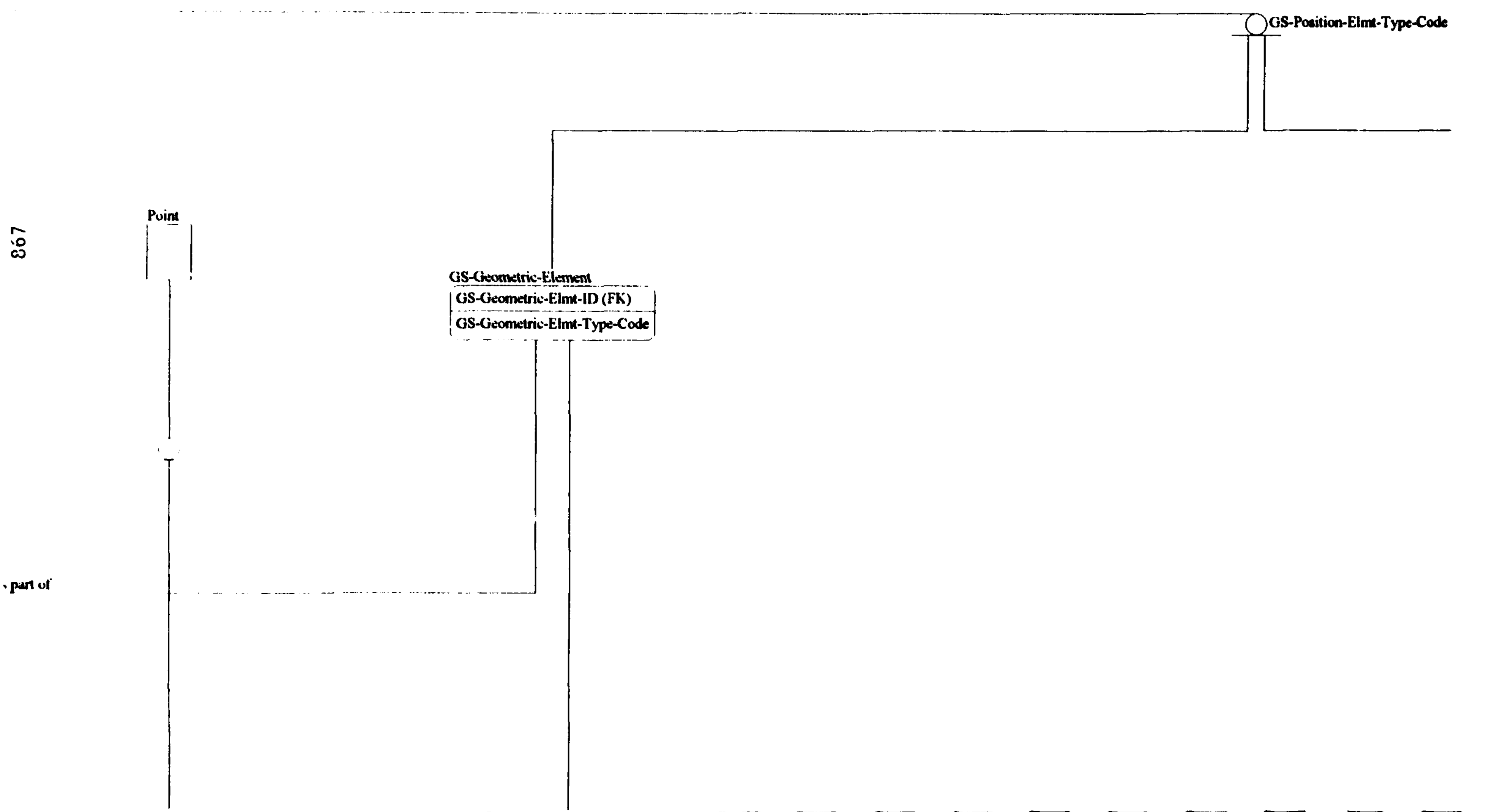
)MA Fully Attributed TO-BE Data Model
'ersion 3
ebruary 17, 1994

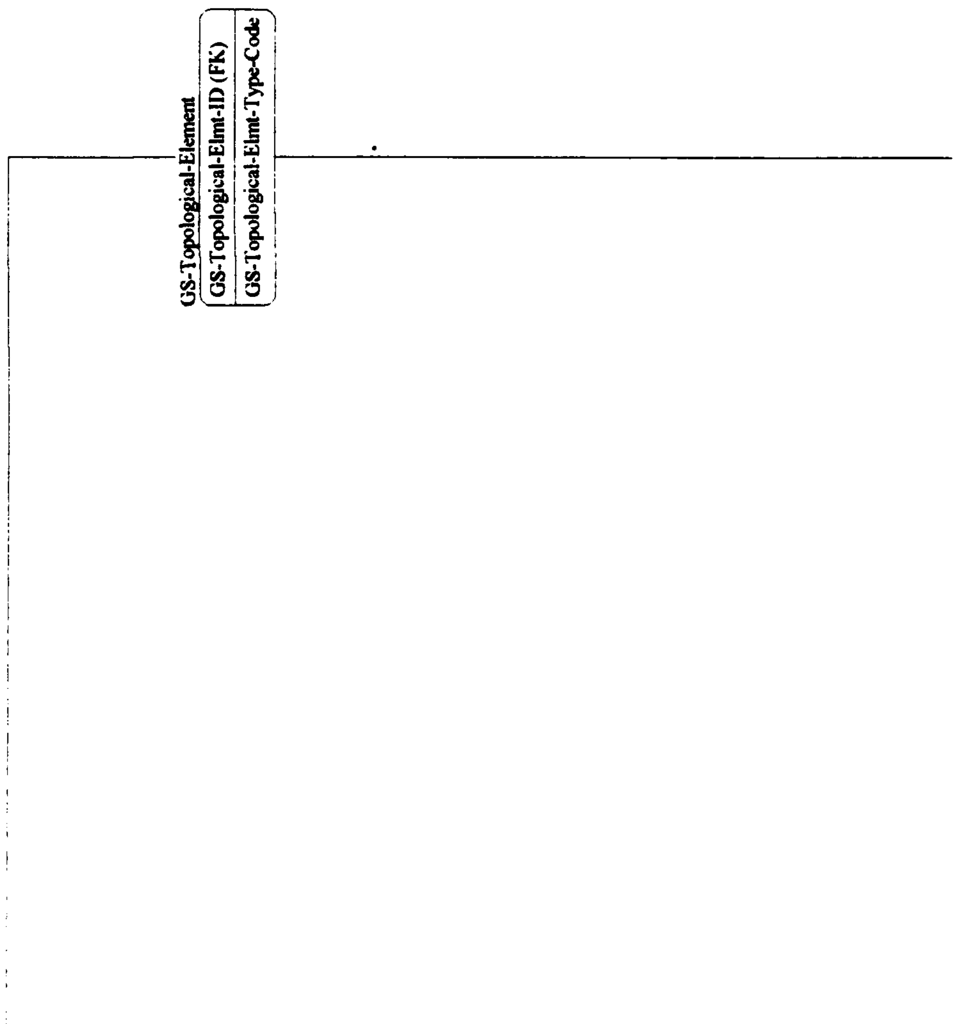


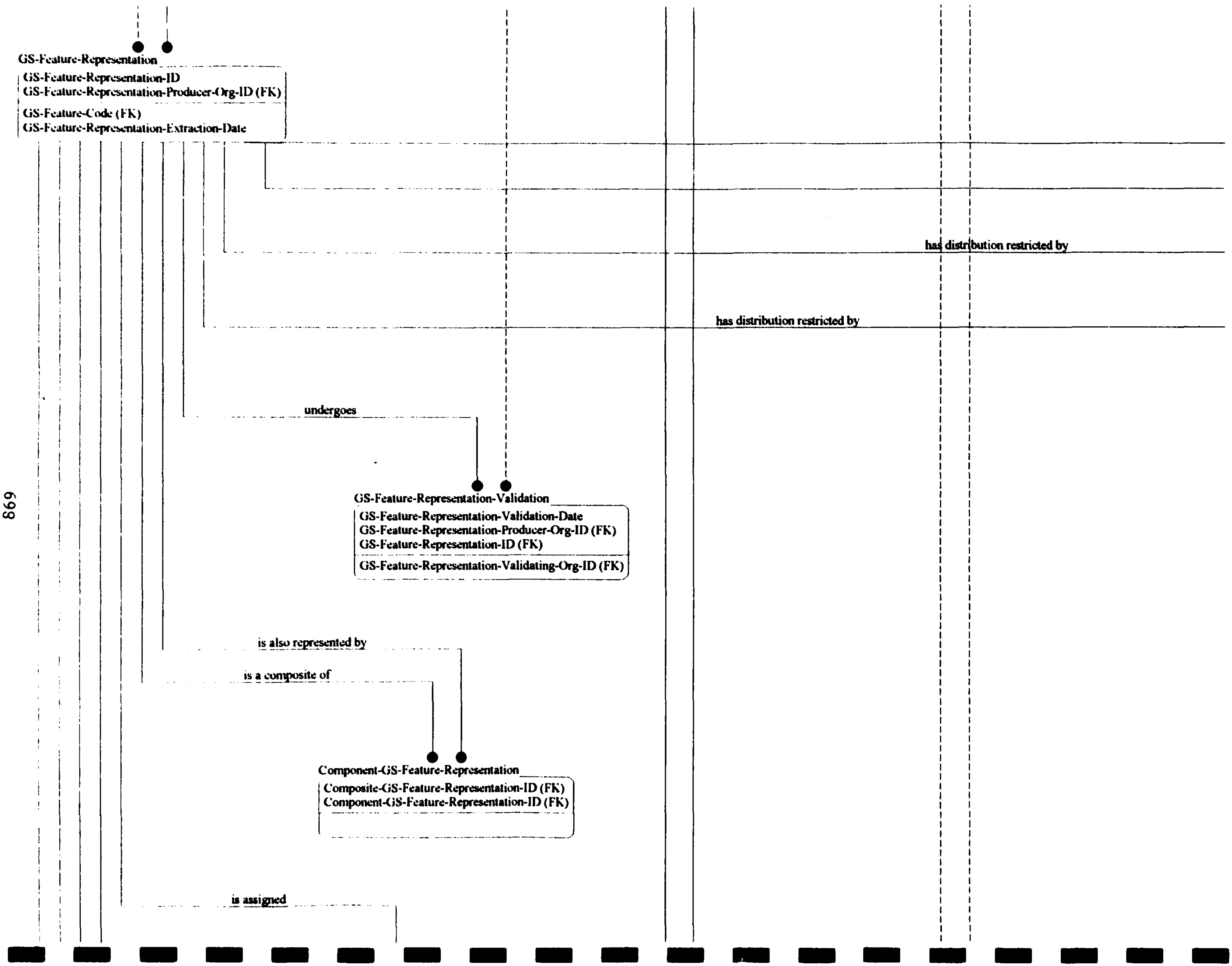


Organization
Org-ID
Country
Country-Code
is part of
is part of
is assigned
is assigned
is assigned
Organization-Country
Country-Code (FK)
Org-ID (FK)

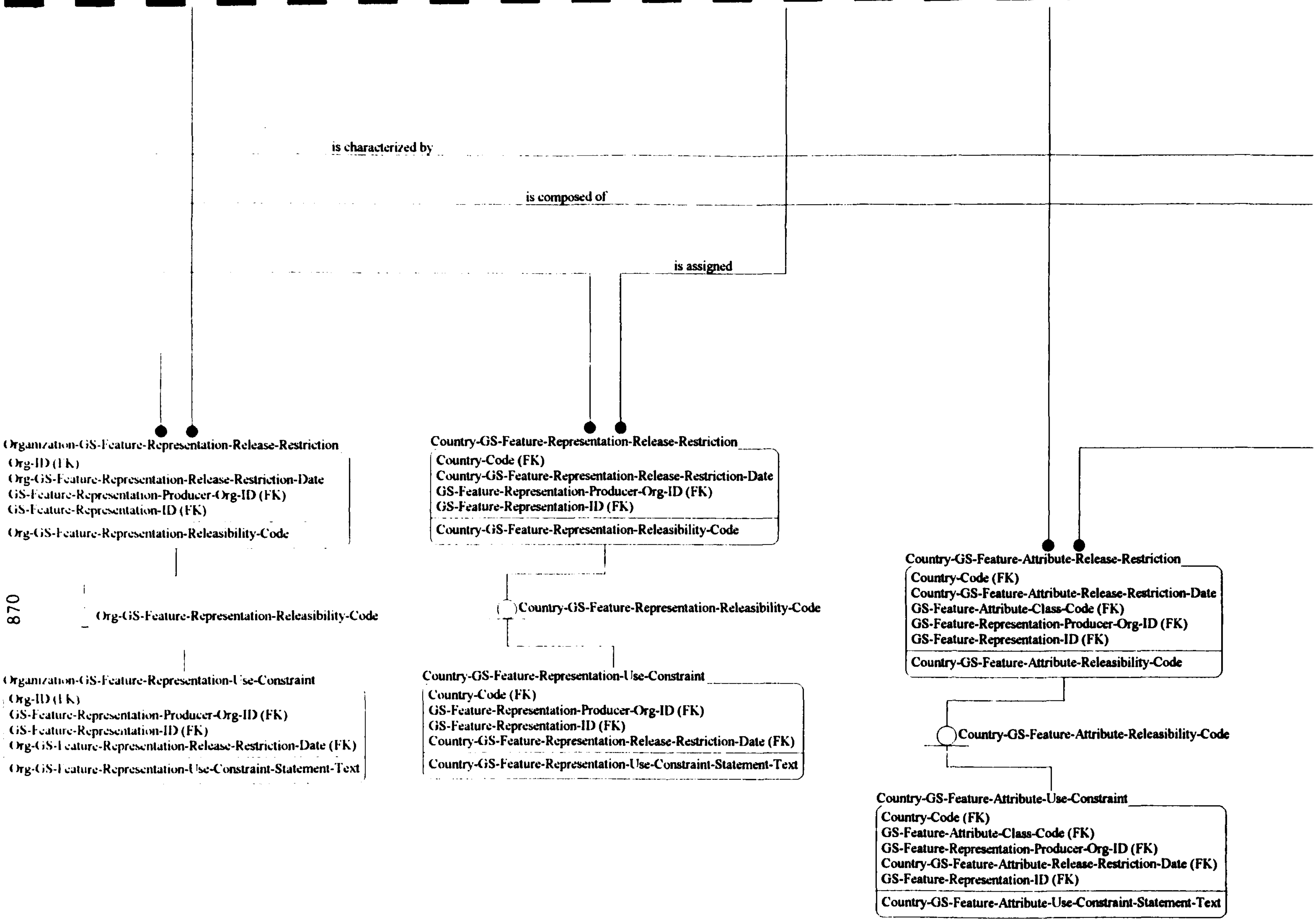

GS-Position-Element
GS-Position-Elmt-ID
GS-Position-Elmt-Producer-Org-ID (FK)
GS-Position-Elmt-Extraction-Date
GS-Position-Elmt-Type-Code
GS-Feature-Attribute-Class
GS-Feature-Attribute-Class-Code
GS-Feature-Attribute-Class-Description-Text
GS-Feature-Attribute-Class-Name

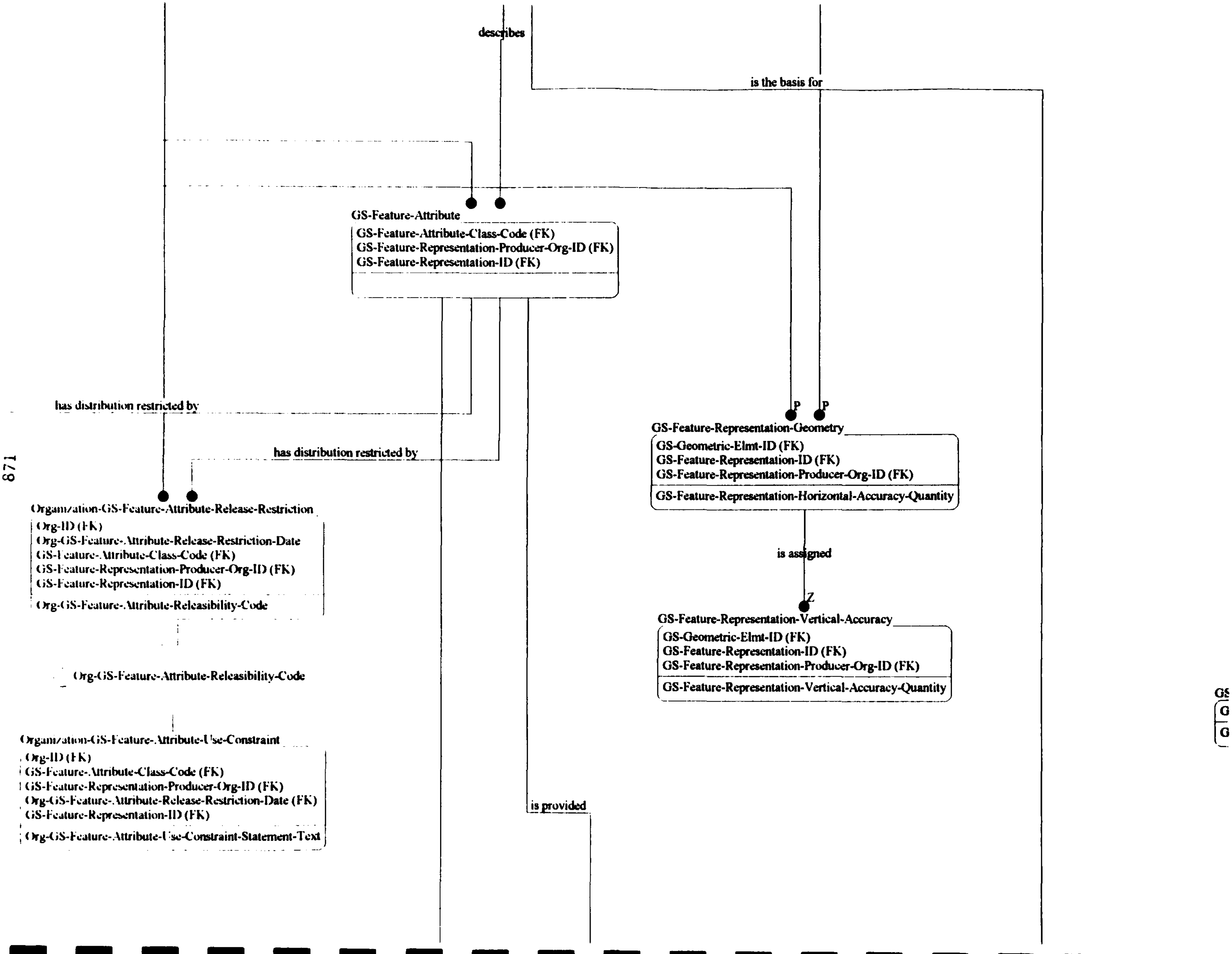

GS-Position-Elmt-Type-Code
Point
GS-Geometric-Element
GS-Geometric-Elmt-ID (FK)
GS-Geometric-Elmt-Type-Code
part of

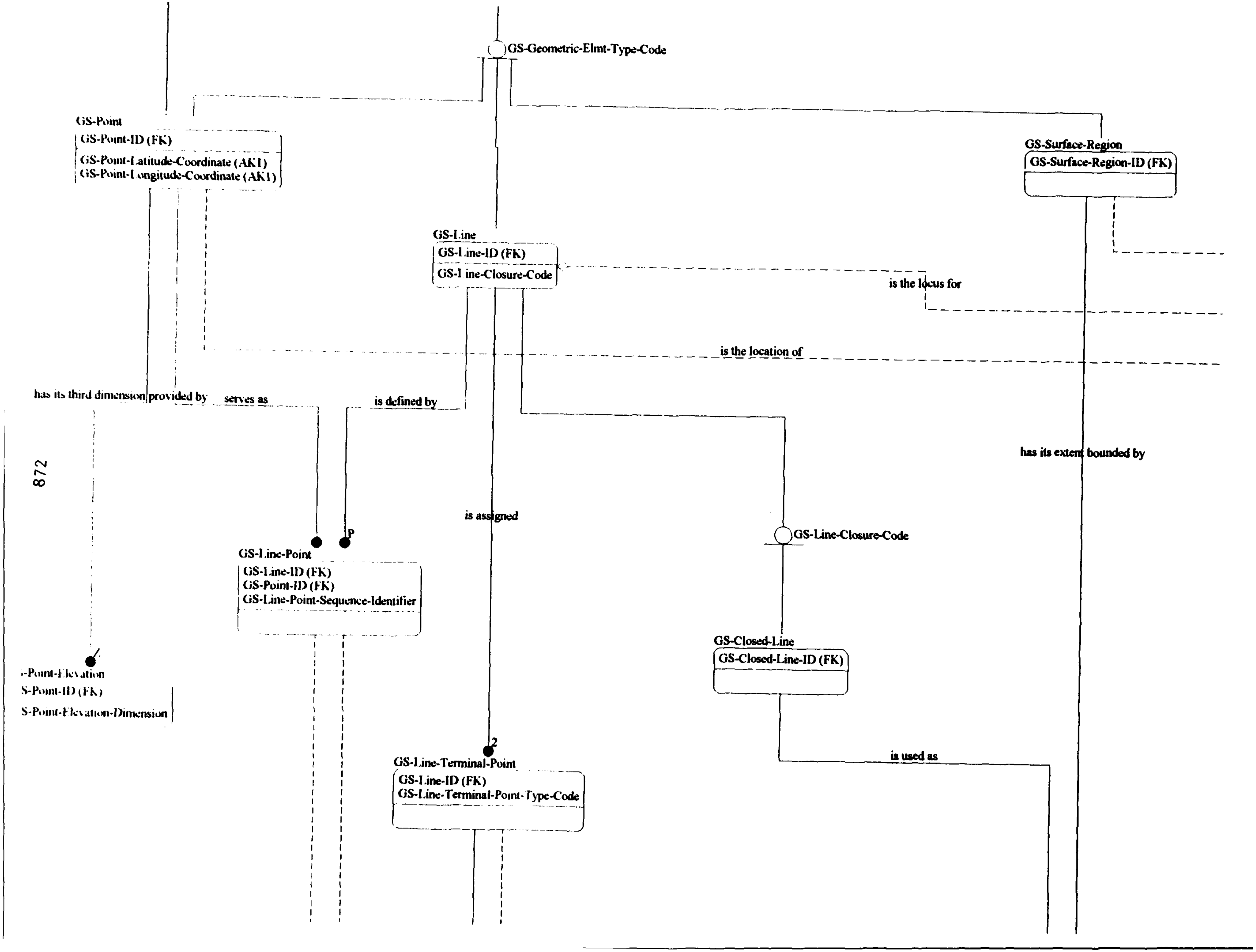

GS-Topological-Element
GS-Topological-Elmt-ID (FK)
GS-Topological-Elmt-Type-Code

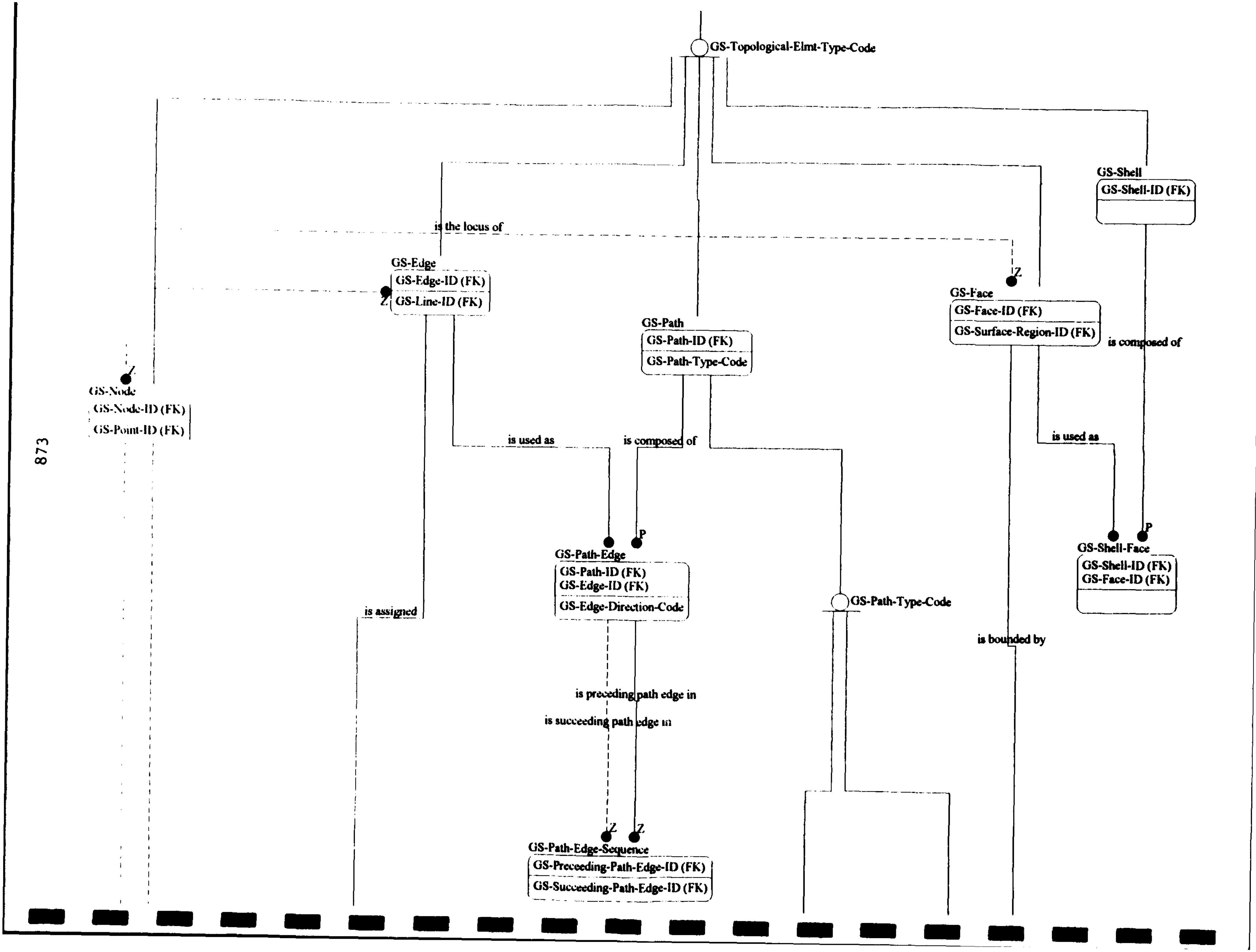


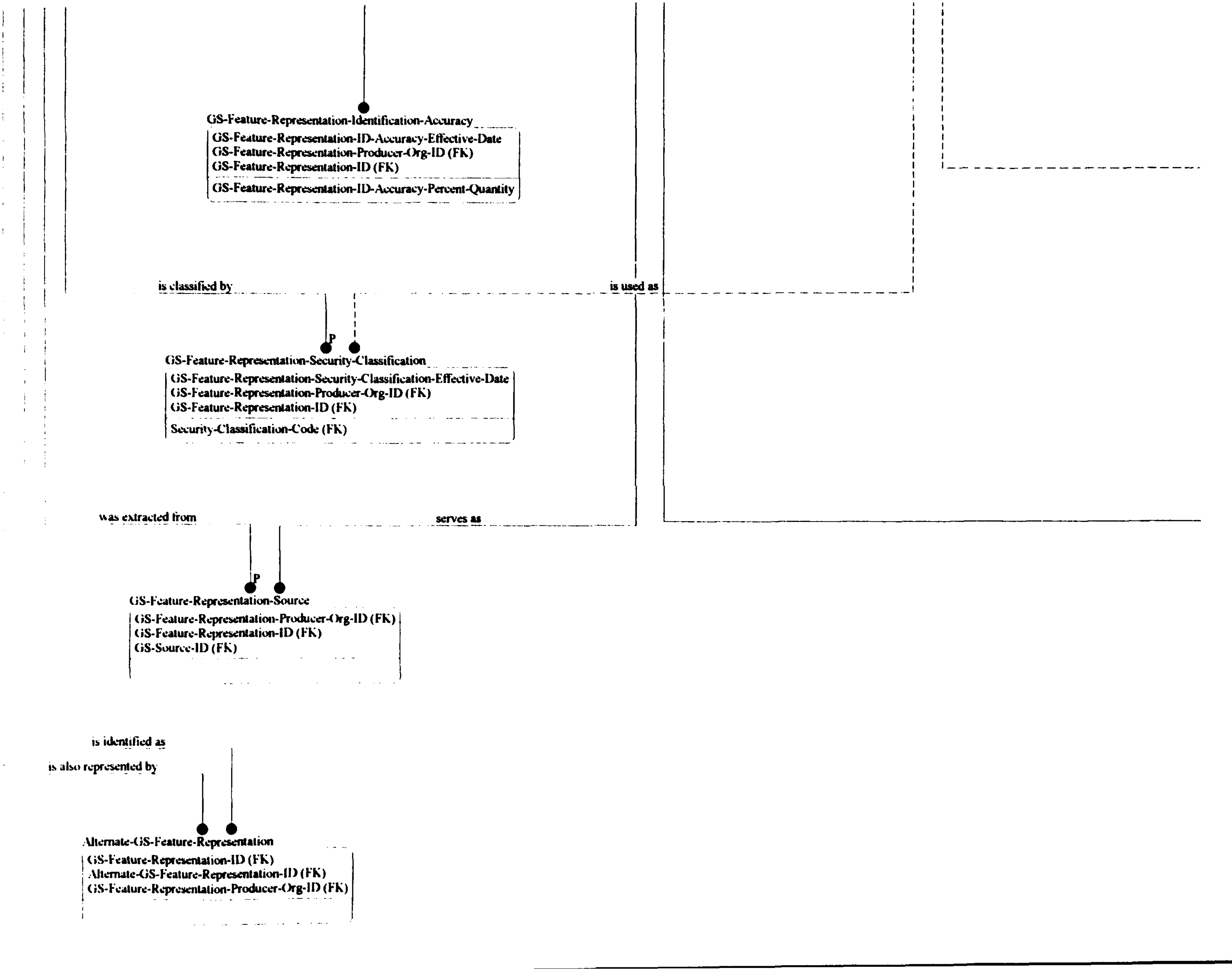
GS-Feature-Representation
GS-Feature-Representation-ID
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Code (FK)
GS-Feature-Representation-Extraction-Date
has distribution restricted by
has distribution restricted by
undergoes
GS-Feature-Representation-Validation
GS-Feature-Representation-Validation-Date
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Feature-Representation-Validating-Org-ID (FK)
is also represented by
is a composite of
Component-GS-Feature-Representation
Composite-GS-Feature-Representation-ID (FK)
Component-GS-Feature-Representation-ID (FK)
is assigned

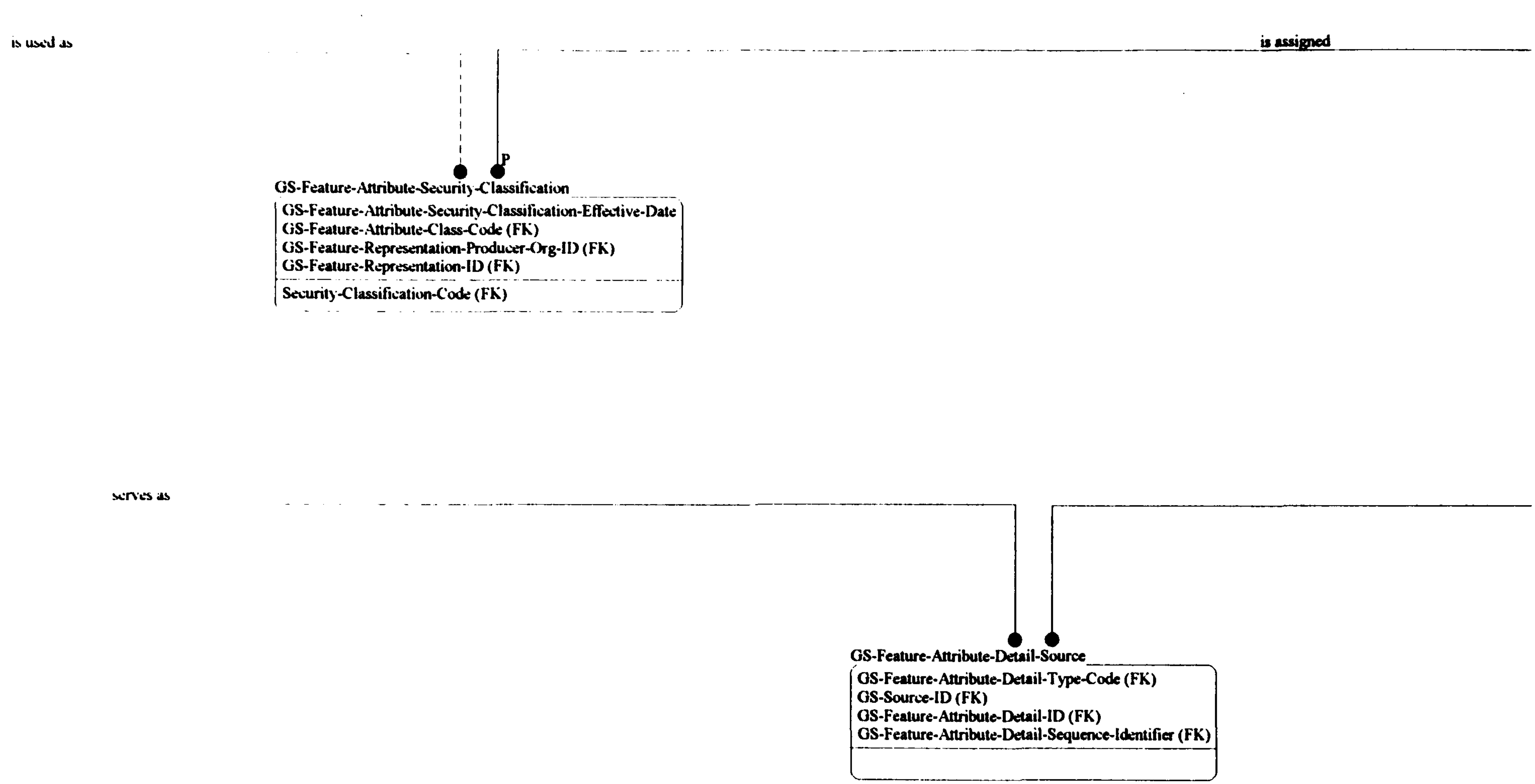

is characterized by
is composed of
is assigned
Organization-GS-Feature-Representation-Release-Restriction
Org-ID (FK)
Org-GS-Feature-Representation-Release-Restriction-Date
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Org-GS-Feature-Representation-Releasibility-Code
Org-GS-Feature-Representation-Releasibility-Code
Organization-GS-Feature-Representation-Use-Constraint
Org-ID (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Org-GS-Feature-Representation-Release-Restriction-Date (FK)
Org-GS-Feature-Representation-Use-Constraint-Statement-Text
Country-GS-Feature-Representation-Release-Restriction
Country-Code (FK)
Country-GS-Feature-Representation-Release-Restriction-Date
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Country-GS-Feature-Representation-Releasibility-Code
Country-GS-Feature-Representation-Releasibility-Code
Country-GS-Feature-Representation-Use-Constraint
Country-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Country-GS-Feature-Representation-Release-Restriction-Date (FK)
Country-GS-Feature-Representation-Use-Constraint-Statement-Text
Country-GS-Feature-Attribute-Release-Restriction
Country-Code (FK)
Country-GS-Feature-Attribute-Release-Restriction-Date
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Country-GS-Feature-Attribute-Releasibility-Code
Country-GS-Feature-Attribute-Releasibility-Code
Country-GS-Feature-Attribute-Use-Constraint
Country-Code (FK)
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
Country-GS-Feature-Attribute-Release-Restriction-Date (FK)
GS-Feature-Representation-ID (FK)
Country-GS-Feature-Attribute-Use-Constraint-Statement-Text

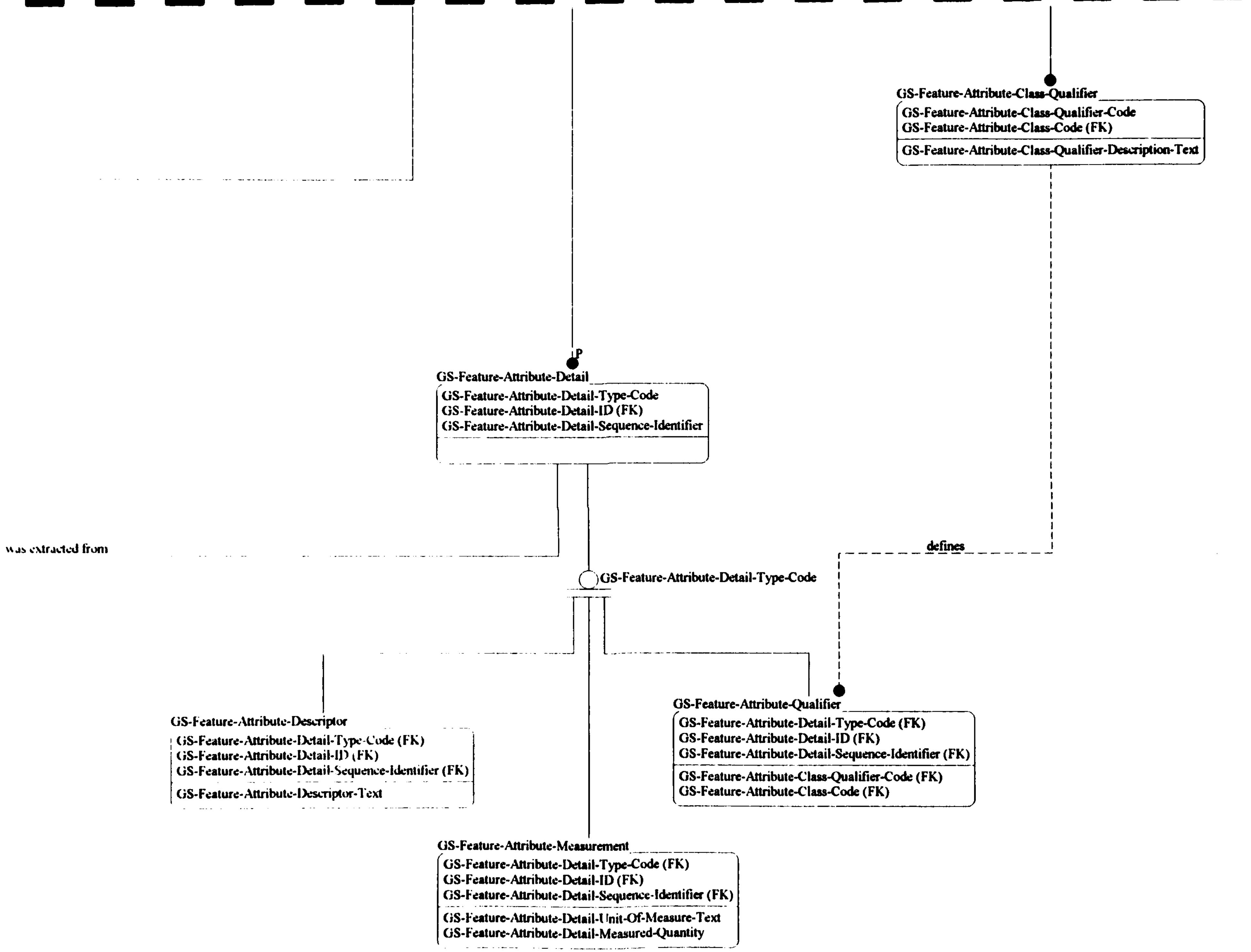

describes
is the basis for
GS-Feature-Attribute
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
has distribution restricted by
has distribution restricted by
P
P
GS-Feature-Representation-Geometry
GS-Geometric-Elmt-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-Horizontal-Accuracy-Quantity
is assigned
Z
GS-Feature-Representation-Vertical-Accuracy
GS-Geometric-Elmt-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-Vertical-Accuracy-Quantity
Organization-GS-Feature-Attribute-Release-Restriction
Org-ID (FK)
Org-GS-Feature-Attribute-Release-Restriction-Date
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Org-GS-Feature-Attribute-Releasibility-Code
Org-GS-Feature-Attribute-Releasibility-Code
Organization-GS-Feature-Attribute-Use-Constraint
Org-ID (FK)
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
Org-GS-Feature-Attribute-Release-Restriction-Date (FK)
GS-Feature-Representation-ID (FK)
Org-GS-Feature-Attribute-Use-Constraint-Statement-Text
is provided

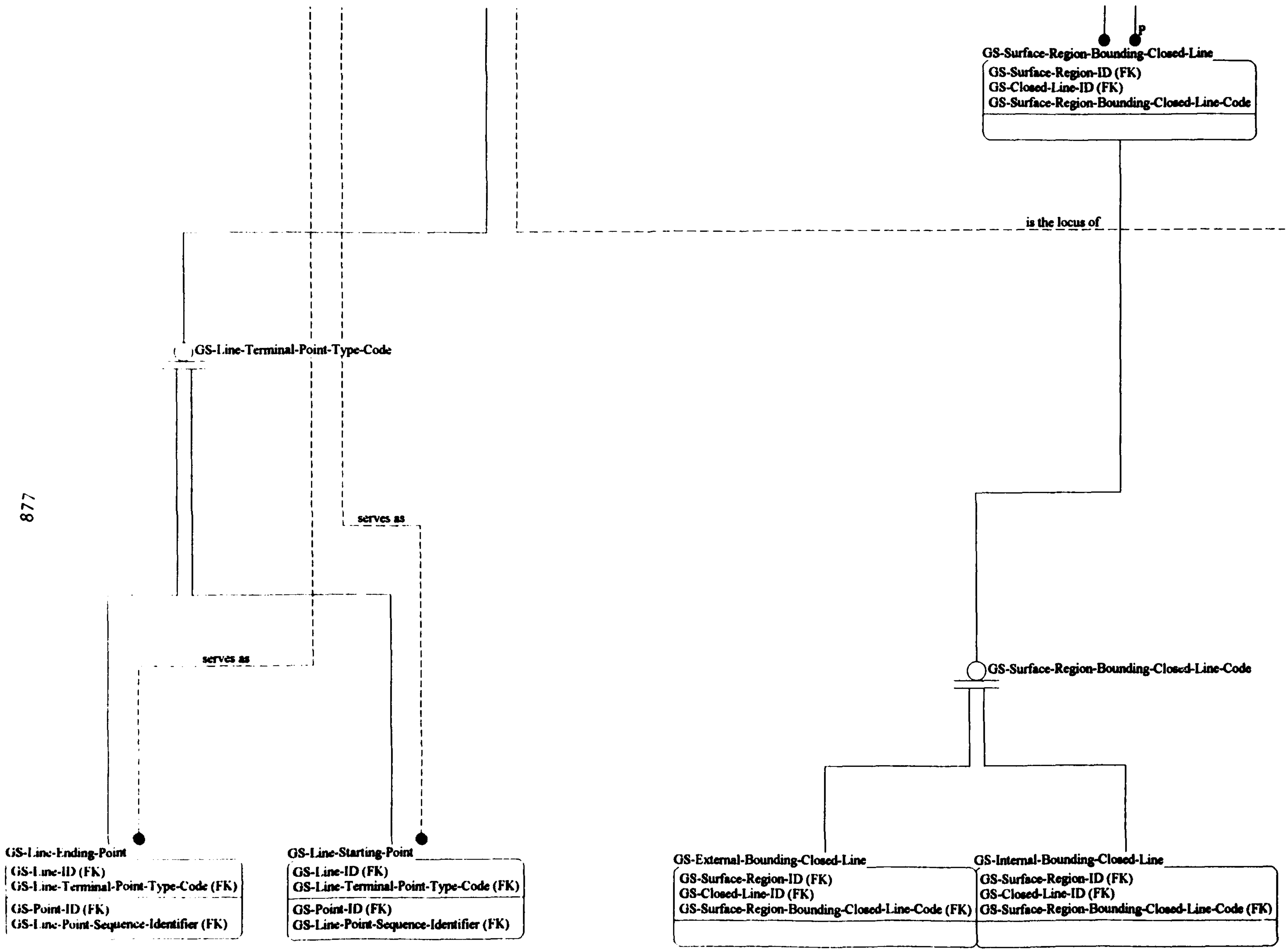

GS-Geometric-Elmt-Type-Code
GS-Point
GS-Point-ID (FK)
GS-Point-Latitude-Coordinate (AK1)
GS-Point-Longitude-Coordinate (AK1)
GS-Surface-Region
GS-Surface-Region-ID (FK)
GS-Line
GS-Line-ID (FK)
GS-Line-Closure-Code
is the locus for
is the location of
has its third dimension provided by
serves as
is defined by
has its extent bounded by
is assigned
GS-Line-Closure-Code
GS-Line-Point
GS-Line-ID (FK)
GS-Point-ID (FK)
GS-Line-Point-Sequence-Identifier
GS-Closed-Line
GS-Closed-Line-ID (FK)
GS-Line-Terminal-Point
GS-Line-ID (FK)
GS-Line-Terminal-Point-Type-Code
is used as

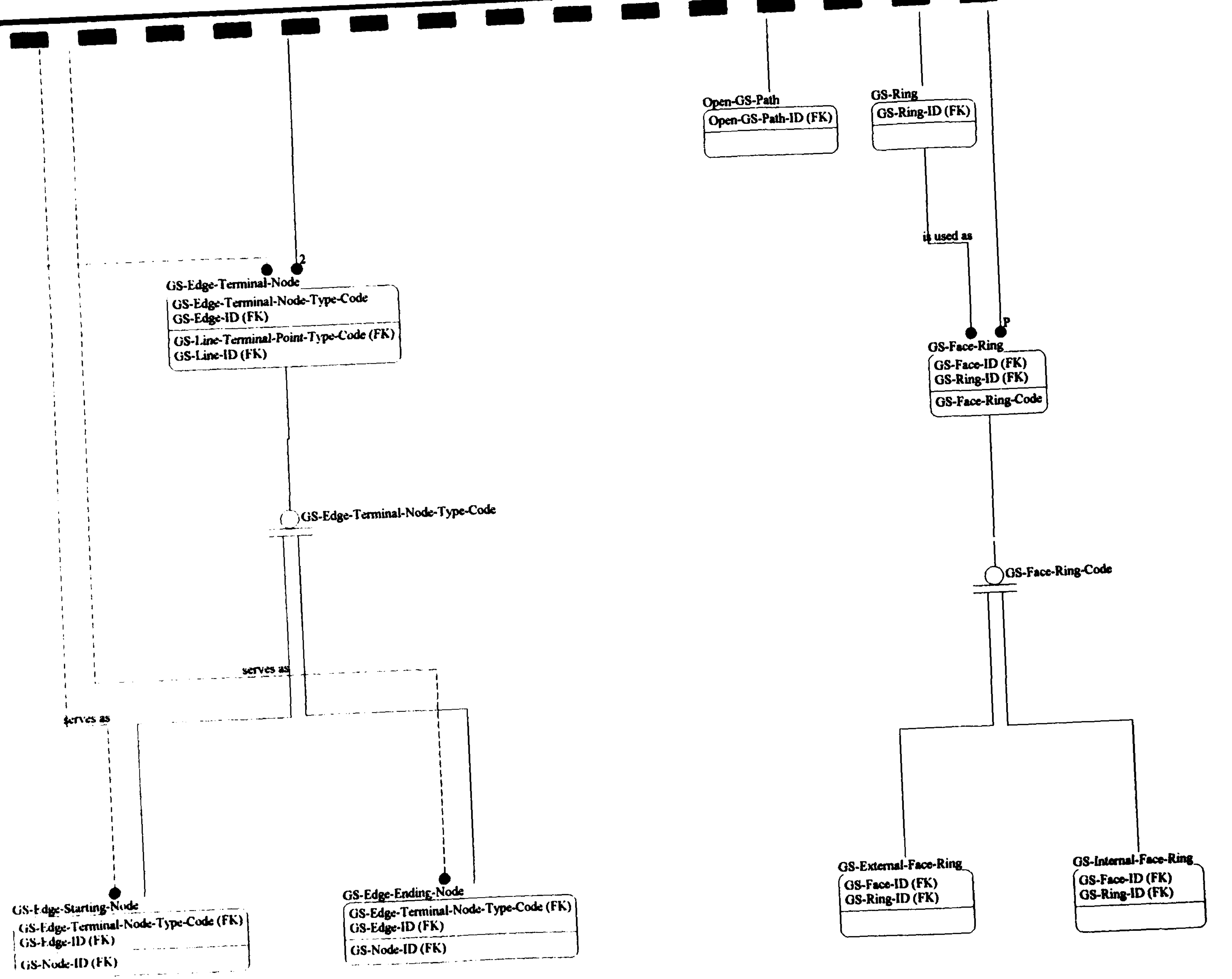

GS-Topological-Elmt-Type-Code
GS-Shell
GS-Shell-ID (FK)
is the locus of
GS-Edge
GS-Edge-ID (FK)
GS-Line-ID (FK)
GS-Face
GS-Face-ID (FK)
GS-Surface-Region-ID (FK)
is composed of
GS-Path
GS-Path-ID (FK)
GS-Path-Type-Code
GS-Node
GS-Node-ID (FK)
GS-Point-ID (FK)
is used as
is composed of
is used as
GS-Path-Edge
GS-Path-ID (FK)
GS-Edge-ID (FK)
GS-Edge-Direction-Code
GS-Shell-Face
GS-Shell-ID (FK)
GS-Face-ID (FK)
is assigned
GS-Path-Type-Code
is bounded by
is preceding path edge in
is succeeding path edge in
GS-Path-Edge-Sequence
GS-Preceeding-Path-Edge-ID (FK)
GS-Succeeding-Path-Edge-ID (FK)


GS-Feature-Representation-Identification-Accuracy
GS-Feature-Representation-ID-Accuracy-Effective-Date
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Feature-Representation-ID-Accuracy-Percent-Quantity
is classified by
is used as
P
GS-Feature-Representation-Security-Classification
GS-Feature-Representation-Security-Classification-Effective-Date
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Security-Classification-Code (FK)
was extracted from
serves as
P
GS-Feature-Representation-Source
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
GS-Source-ID (FK)
is identified as
is also represented by
Alternate-GS-Feature-Representation
GS-Feature-Representation-ID (FK)
Alternate-GS-Feature-Representation-ID (FK)
GS-Feature-Representation-Producer-Org-ID (FK)


is used as
is assigned
P
GS-Feature-Attribute-Security-Classification
GS-Feature-Attribute-Security-Classification-Effective-Date
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Representation-Producer-Org-ID (FK)
GS-Feature-Representation-ID (FK)
Security-Classification-Code (FK)
serves as
GS-Feature-Attribute-Detail-Source
GS-Feature-Attribute-Detail-Type-Code (FK)
GS-Source-ID (FK)
GS-Feature-Attribute-Detail-ID (FK)
GS-Feature-Attribute-Detail-Sequence-Identifier (FK)


GS-Feature-Attribute-Class-Qualifier
GS-Feature-Attribute-Class-Qualifier-Code
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Attribute-Class-Qualifier-Description-Text
P
GS-Feature-Attribute-Detail
GS-Feature-Attribute-Detail-Type-Code
GS-Feature-Attribute-Detail-ID (FK)
GS-Feature-Attribute-Detail-Sequence-Identifier
was extracted from
defines
GS-Feature-Attribute-Detail-Type-Code
GS-Feature-Attribute-Descriptor
GS-Feature-Attribute-Detail-Type-Code (FK)
GS-Feature-Attribute-Detail-ID (FK)
GS-Feature-Attribute-Detail-Sequence-Identifier (FK)
GS-Feature-Attribute-Descriptor-Text
GS-Feature-Attribute-Qualifier
GS-Feature-Attribute-Detail-Type-Code (FK)
GS-Feature-Attribute-Detail-ID (FK)
GS-Feature-Attribute-Detail-Sequence-Identifier (FK)
GS-Feature-Attribute-Class-Qualifier-Code (FK)
GS-Feature-Attribute-Class-Code (FK)
GS-Feature-Attribute-Measurement
GS-Feature-Attribute-Detail-Type-Code (FK)
GS-Feature-Attribute-Detail-ID (FK)
GS-Feature-Attribute-Detail-Sequence-Identifier (FK)
GS-Feature-Attribute-Detail-Unit-Of-Measure-Text
GS-Feature-Attribute-Detail-Measured-Quantity


GS-Surface-Region-Bounding-Closed-Line
P
GS-Surface-Region-ID (FK)
GS-Closed-Line-ID (FK)
GS-Surface-Region-Bounding-Closed-Line-Code
is the locus of
GS-Surface-Region-Bounding-Closed-Line-Code
GS-External-Bounding-Closed-Line
GS-Surface-Region-ID (FK)
GS-Closed-Line-ID (FK)
GS-Surface-Region-Bounding-Closed-Line-Code (FK)
GS-Internal-Bounding-Closed-Line
GS-Surface-Region-ID (FK)
GS-Closed-Line-ID (FK)
GS-Surface-Region-Bounding-Closed-Line-Code (FK)
GS-Line-Terminal-Point-Type-Code
serves as
serves as
GS-Line-Ending-Point
GS-Line-ID (FK)
GS-Line-Terminal-Point-Type-Code (FK)
GS-Point-ID (FK)
GS-Line-Point-Sequence-Identifier (FK)
GS-Line-Starting-Point
GS-Line-ID (FK)
GS-Line-Terminal-Point-Type-Code (FK)
GS-Point-ID (FK)
GS-Line-Point-Sequence-Identifier (FK)



Open-GS-Path
Open-GS-Path-ID (FK)
GS-Ring
GS-Ring-ID (FK)
is used as
P
GS-Face-Ring
GS-Face-ID (FK)
GS-Ring-ID (FK)
GS-Face-Ring-Code
GS-Face-Ring-Code
GS-External-Face-Ring
GS-Face-ID (FK)
GS-Ring-ID (FK)
GS-Internal-Face-Ring
GS-Face-ID (FK)
GS-Ring-ID (FK)
2
GS-Edge-Terminal-Node
GS-Edge-Terminal-Node-Type-Code
GS-Edge-ID (FK)
GS-Line-Terminal-Point-Type-Code (FK)
GS-Line-ID (FK)
GS-Edge-Terminal-Node-Type-Code
serves as
serves as
GS-Edge-Starting-Node
GS-Edge-Terminal-Node-Type-Code (FK)
GS-Edge-ID (FK)
GS-Node-ID (FK)
GS-Edge-Ending-Node
GS-Edge-Terminal-Node-Type-Code (FK)
GS-Edge-ID (FK)
GS-Node-ID (FK)

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FAX

TO: Iris Kameny
FAX 310 393-4818

4 Feb 94

FROM: Beth Driver
FAX 703 285 -9396
Voice 703 285-9222

SUBJECT: Discussion topics for Complex Data Task Force

Iris--

Here are a couple topics I'd be interested in having the Complex Data Task Force discuss. I gather from our discussion that the group may have already identified them.

- What is the relationship between meta-data for "instance data" (as I think you are using the term--things like specific features or attributes) and that for "wholes" that represent a larger picture, not merely an aggregate of features. I have used the example of a map or digital data set that purports to be a picture of selected aspects of a geographic area. One reason for concern: we draw conclusions about the absence of data and the relationships between features from the whole, not from the individual features. For example, if I see no accesses to a limited access highway between two locations, I would conclude they don't exist. I would suggest that "completeness" measures, for example, (often considered a part of currency evaluations of MC&G data) need a well-defined footprint, as do any "truth in packaging" items that are based on sampling or statistical analysis.
- How can we verify the usefulness of metadata definitions; for example, how will applications software use the data provided in metadata fields? Perhaps generating sample values would help us understand and organize this.
- How much (at what level of granularity) metadata can M&S systems process? What are the priorities? Is there a need for selected attributes at high degrees of granularity (e.g., attribute level for some attributes) and other attributes only at a more generalized level, *even though it would be possible to provide them at the instance level.*

DEPARTMENT OF DEFENSE

Data Standardization and Data Reuse Guidance

for

Complex Data Elements

Draft

9 February 1994

Office of the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence

Duane Hufford
Amer. Mgt. Sys.

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REFERENCES

Refer to Appendix A for a list of references related to this document.

DEFINITIONS

Refer to Appendix B for a list of definitions of words used with special context in this document.

CHAPTER 1

INTRODUCTION

A. PURPOSE

1. This document describes management guidelines and logical data models for capturing and sharing information about four categories of complex data elements and data concepts:

a. Composite Data Elements. Data elements that embed intelligence about multiple concepts in their names, definitions, and domains.

b. Derivations. Data elements representing concepts computed, aggregated, transformed, or inferred from the values of one or more other data elements.

c. Data Streams. Ordered bits or characters formatted to represent information in a variety of forms (e.g., graphic, voice, text document, and spreadsheet).

d. Assemblies. Data entities comprising instances of data which relate to other instances of data within the same entity (e.g., roads, buildings, equipment part assemblies, and organizations).

2. The models presented can capture information needed to:

a. Improve organizational awareness of how data elements in these categories are related.

b. Reduce the amount of time it takes new people to become aware of relationships among complex data.

c. Enhance communications across functional boundaries sharing complex data.

d. Foster the use of 'standard information parts' for the assembly of databases, information systems, and information sharing transactions.

e. Support migration of legacy systems and information sharing made possible by new applications, hardware platforms, and design methodologies.

3. Relational data models are used to depict the models. These are not endorsed as the 'best' diagramming techniques for representing complex data, but are used here because the majority of the audience is familiar with relational modeling semantics and syntax. The relational models can also be used to design repositories for capturing facts about complex data using currently prevalent relational database technology.

B. DOCUMENT ORGANIZATION

This document can be read sequentially, or be used as a quick reference for:

1. Composite Data Elements (Chapter 2).

2. Derivations (Chapter 3).

3. Data Streams (Chapter 4).

4. Assemblies (Chapter 5).

CHAPTER 2

COMPOSITE DATA ELEMENTS

A. DEFINITION

1. Composite data elements describe multiple concepts by coding intelligence into the individual data element values, embedding domain values among words used to name the data element, and/or making the definition or meaning of the data element dependent on the value(s) contained in other related data element(s).

2. When elements are formulated as composites, associations develop among data elements supporting different requirements. A data element association is a relationship among two or more data elements due to a partial overlap in definition, or due to important characteristics or business rules concerning the group (e.g., when considered individually, each element in a group may be unclassified, but taken as a whole, the group may carry classified information).

B. CLASSIFICATION OF COMPOSITE ELEMENTS

The National Institute of Standards and Technology Special Publication 500-208, Manual for Data Administration (reference (g)) defines three types of composite data processing elements identified in Figure 2-1:

1. Chain. An ordered set of data elements linked together (e.g., positions 1-3 describe concept "A", positions 4-5 describe concept "B", etc.). For example, consider a 'Policy Identifier' formulation where positions 1 through 7 identify a customer, positions 8 through 10 identify the type of policy, positions 11 and 12 identify the year the policy started, and positions 13 and 14 identify the expiration date.

2. Coupled. A data element carrying multiple concepts through its assigned name, or its allowable set of coded values. For example, the data element 'Four Passenger Automobile Count' not only describes the number of cars, but also describes the type of car (passenger) and the seating capacity (four).

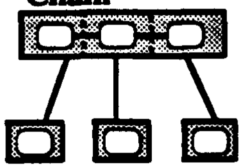
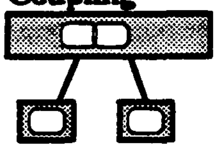
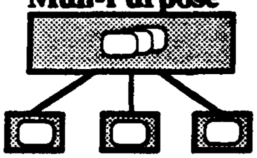
Association	Description
Chain 	**Standard is a member of Chain Composite** An ordered set of data elements linked together (e.g., positions 1-3 => concept 'A', positions 4-5 => concept 'B', etc.).
Coupling 	**Standard Participates in Coupling Composite** A data element describing more than a single concept (i.e., two or more concepts are bundled in a single data element).
Muli-Purpose 	**Implemented Element has Multiple Uses, Each Supporting a Different Standard** A data element with multiple uses or definitions (i.e., the meaning changes based on what is described by the record).
Legend	- Data Element - Concept Formulation Conforms with Guidelines for One Concept and One Use Formulations That Fail to Conform with Guidelines for One Concept and One Use

Figure 2-1 Common Types of Associations Between Data Elements

3. Multi-purpose. A data element with multiple uses or definitions. The context of the value contained in the data element changes based on what is described by the record. For example, the value "5" in the data element 'Vehicle Capacity' might mean "five passengers" for a passenger car, but mean "five tons" for a delivery truck.

C. CHAINED DATA ELEMENTS

1. A data element chain is formed by physically concatenating two or more data elements, and then naming, implementing, and managing the collective group as a single data element. This happens, as suggested in Figure 2-2, when a values for a data element are coded so that different types of information are carried in different positions of the code. Partial redundancy occurs across chains when a single concept data element is carried in two or more chains.

2. There are times when the order of concepts concatenated into a chain represents an institutionalized standard for exchanging data, or for identifying individual records in a table containing data that are widely shared. For example, National Stock Number (NSN) is a chain which can be decomposed into three primitive elements shown in Figure 2-3. NSN is a concatenation of Federal Supply Classification and National Item Identification Number. The Federal Supply Classification can be further decomposed into Federal supply Group and Federal Supply Subgroup. If all systems treat NSN as the same concatenation of these concepts for accessing or exchanging data, then chain should be documented and coordinated as a standard for improving data sharing/data exchange.

3. Concepts concatenated into a chain must be modeled as single concept elements. A chained data element can easily be decomposed into its smaller components, and when this is done, the redundancy is easier to detect.

4. Chains are allowed in databases, but the decision on whether or not to develop and implement a chain for a specific combination must be managed as a coordinated implementation issue. If the components of the chain do not have independent uses outside of the chain, then there is a strong business case for implementing the chain.

5. Chains are allowed in data exchange transactions (e.g., Electronic Data Interchange (EDI) transactions, and Message Text Formats (MTFs)); However, responsibility must be assigned for developing, maintaining, and operating software for producing the agreed upon exchange transaction in the memorandum of agreement. The

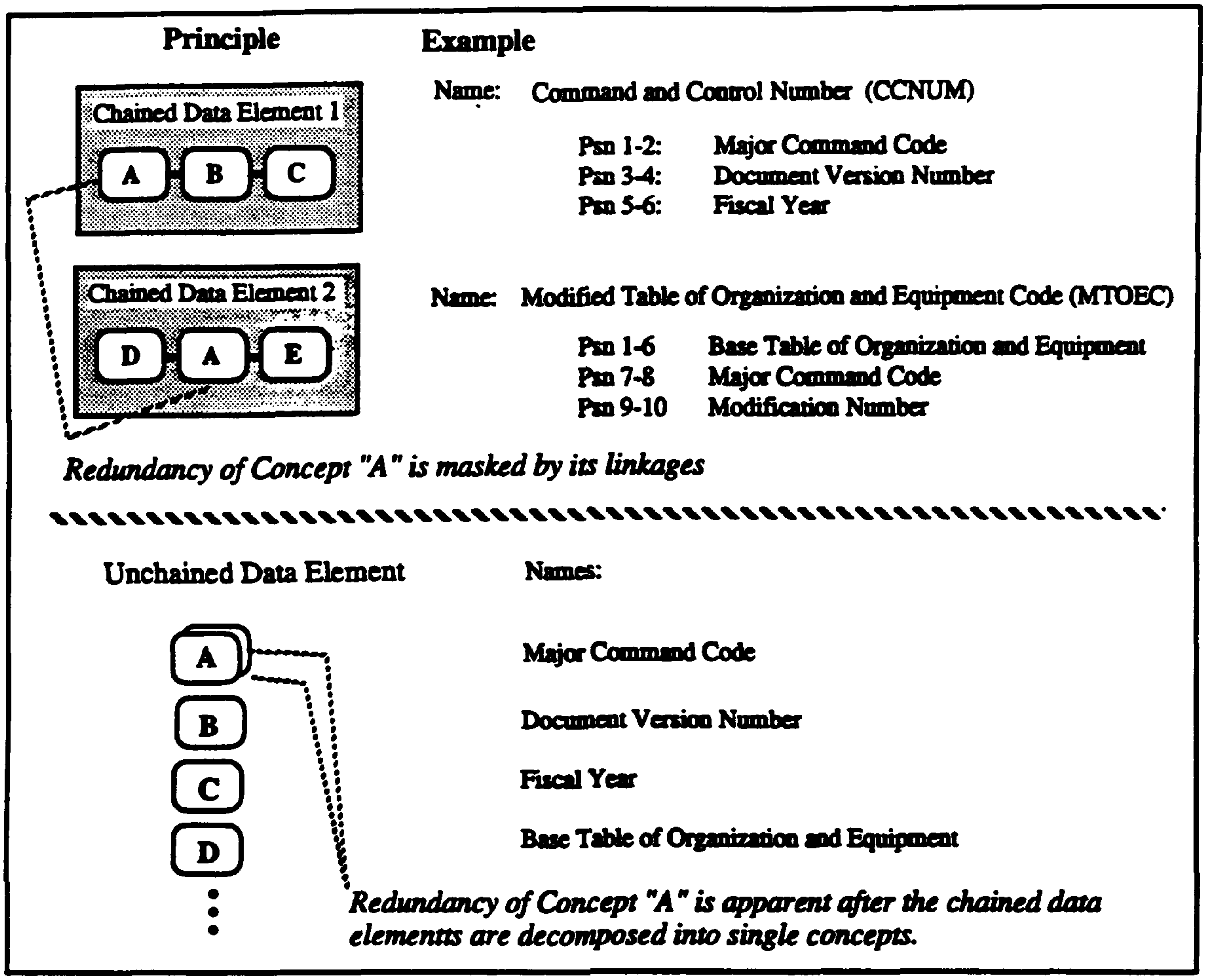


Figure 2-2 Partially Overlapping Data Element Chains

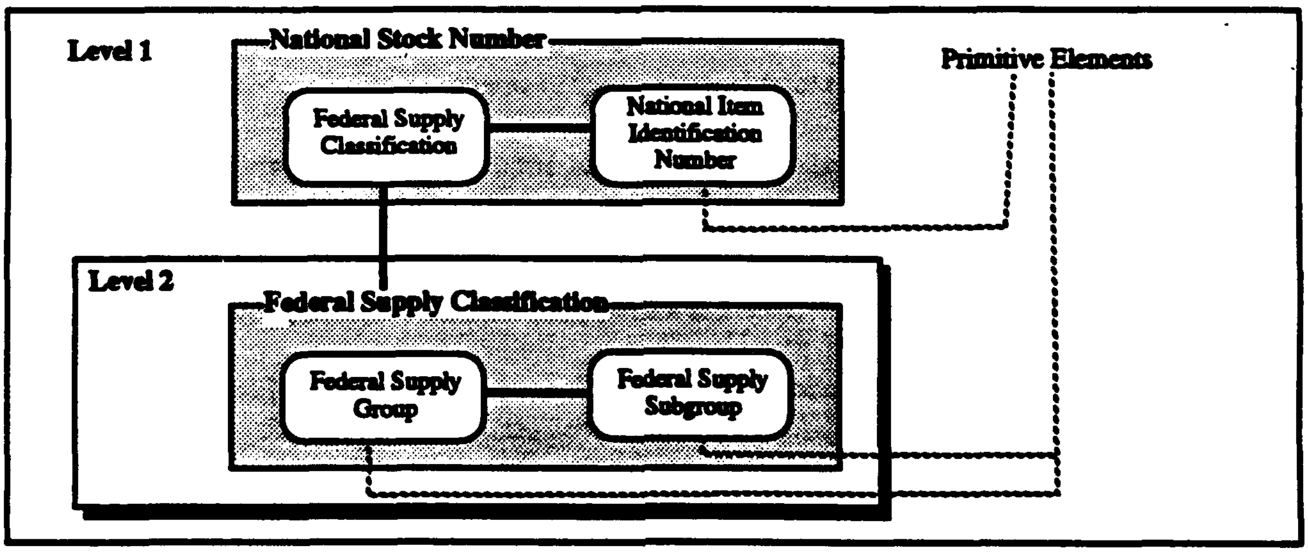


Figure 2-3 National Stock Number (NSN) Chain Decomposition

organization assuming these cost responsibilities must consent to the terms of the agreement.

6. Chains will be documented in the DDRS, to include the association of the individual elements participating in the chain. This documentation will:

a. Allow requirements for individual elements participating in the chain to be easily registered.

b. Support efforts to migrate legacy chains to single concept elements.

7. If a requirement is registered for an individual element participating in a chain documented for database implementation, the implementation decision must then be revisited.

D. COUPLED DATA ELEMENTS

1. Data elements are often constructed to carry intelligence in their names or in their coded values. When a data element carries information about more than one thing, it is a coupled data element. A coupled data element's definition can partially overlap with the definition of another data element by sharing only some of the concepts it characterizes. Because the overlap is partial, redundancy across the elements is masked.

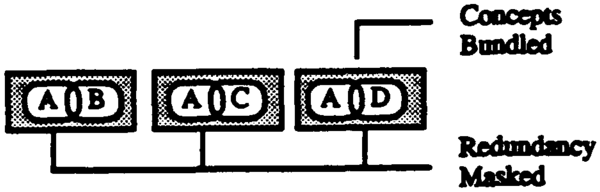
2. A trivial example association of coupled data elements is shown in Figure 2-4 to illustrate data coupling. Coupled data elements in the upper half of this Figure are from a system designed to support force structuring. They all share the concept 'strength count', but differ in the resource code (i.e., types of personnel such as officer, warrant officer, enlisted, etc.) to which the strength count applies, and the type of strength (i.e., structured or authorized). Many new entries can be made into this list of partially overlapping data elements simply by defining new resource codes and/or new types of strength and plugging them into the data element names.

3. The resource code, and its values, shown in the lower half of Figure 2-4 also exist in the budgeting system. It is not intuitively clear how data relate across the two systems until the coupled data elements in the force structuring system are broken down to single concept formulations (i.e., they are cohesive) used in the budgeting system.

4. The example in Figure 2-4 is a trivial example used to illustrate coupling and its attendant problems. Coupling two concepts into an element does not necessarily

a. Coupled Data Elements

Principle

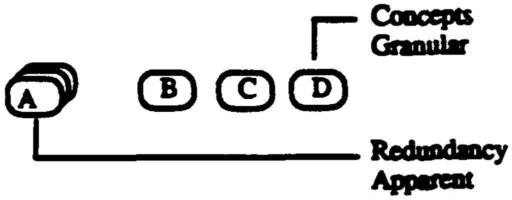


Example

Authorized Officer Strength
Authorized Warrant Officer Strength
Authorized Enlisted Strength
Authorized Civilian U.S. Direct Hire Strength
Authorized Civilian Foreign National Strength
Authorized Civilian Indirect Hire
etc?

b. Cohesive Data Elements

Principle



Example

Budget Status Code
Resource Code
Strength Quantity

Three data elements - and only three data elements

Figure 2-4 Coupled Concepts Within A Single Element

result in a poor formulation. There is a risk for problems occurring that increases as the number of concepts bundled into the element increase. The risk for problems occurring also increases when the data element is to support new or unstable requirements.

5. The DoD data standardization program focuses on encouraging database designs to adopt data elements that describe singular concepts (e.g., establishing data element naming conventions that require a single prime word for the concept described, and single class word for the use). A data element that describes a single concept is more familiar to the users because it is easier to name and describe what values should be put into the element. A single-concept data element is also more stable than its multi-concept counterpart because it is not impacted by changes to other data elements. When a single-concept element needs to be changed, it's own modularity makes the scope of the change smaller; the change encompasses only one element rather than cascading to other data elements with partially overlapping definitions. The single-concept data element is more flexible than its multi-purpose counterpart because it supports a wide range of usage across functional boundaries.

6. Some of the rationale for physically implementing composite elements lie in tradeoffs that sometimes emerge for storage efficiency, disk I/O efficiency, and alignment with what has already been defined in existing systems. A comparison of two data storage structures, shown in Figure 2-5, illustrates how some of these tradeoffs work using the example of coupled data elements discussed earlier. Using a data structure assembled from the coupled data elements (part a), a single input operation can access all six strength authorizations. The record (without indexes) requires a total of 18 bytes of storage. The same data in a data structure assembled from the uncoupled data elements requires six input operations to retrieve the same data, and the record structure (without indexes) requires a total of 78 bytes of storage.

7. Modularity and maintainability promoted by single concept formulations minimize changes that would be required to split authorized enlisted strength into authorized senior enlisted strength and authorized junior enlisted strength. Notice that the record layout must change for the structure using coupled data elements, but stands unchanged for the structure using single-concept elements. For the structure using coupled elements, the Authorized Enlisted Strength element would be dropped, and two new elements -- Authorized Senior Enlisted Strength and Authorized Junior Enlisted Strength -- would be added. For the structure using single-concept elements the current resource code

Coupled Strength Data Elements: A single input operation can access all six authorizations
The amount of storage used is 6 + (6 x 2) = 18.

Key	Authorized Officer Strength	Authorized Warrant Officer Strength	Authorized Enlisted Strength	Authorized Civilian U.S. Direct Hire Strength	Authorized Civilian Foreign National Strength	Authorized Civilian Indirect Hire
WEAFAA	7	1	37	12	0	0

Uncoupled Strength Data Elements: Multiple input operations needed to access all authorizations.
The amount of storage used is 13 x 6 = 78

Key	Strength Type Code	Resource Code	Strength Quantity
WEAFAA	A	AAOF	7
WEAFAA	A	AAWO	1
WEAFAA	A	AAEN	37
WEAFAA	A	CUDH	12
WEAFAA	A	CFDH	0
WEAFAA	A	CFIH	0

Resource Code Values

AAOF	Officer
AAWO	Warrant Officer
AAEN	Enlisted
CUDH	Civilian U.S. Direct Hire
CFDH	Civilian Foreign National
CFIH	Civilian Indirect Hire

Strength Type Code Values

A	Authorized
S	Structured

Figure 2-5 Illustration of the Influence Coupling vs. Cohesion Alternatives Can Have on Storage and Performance

for *Enlisted* would be dropped and two new codes for *Senior Enlisted* and *Junior Enlisted* would be added.

8. Implementation tradeoffs must be evaluated to properly decide whether data elements will be formulated as couplings. This must not, however, become an excuse for not formulating the single concept element. A logical database design should always fully normalize the data and formulate the data elements as single-concept elements. Just as data structures must sometimes deviate from rules of full normalization for the physical database design to accommodate an application's storage requirements or data access/update performance, physical data element designs must sometimes deviate from the single concept formulation. But these implementation decisions should be made based on a full understanding of how data are lo···ally ·…ated.

9. Adhering to single-concept elements in the logical database design and allowing multi-concept elements in the physical database design creates a requirement to map the logical database design to the physical database design at both an entity/record level and a data element level. The logical database should be consulted whenever alternative approaches are being evaluated for upgrading the database design. Evaluating upgrade alternatives against the logical model ensures that impacts are weighed against the full set of data relationships. An evaluation of upgrade alternatives against the physical database design is likely to miss relationships diminished or hidden by steps taken to denormalize the data and bundle multiple concepts within single data elements.

E. MULTI-PURPOSE DATA ELEMENTS

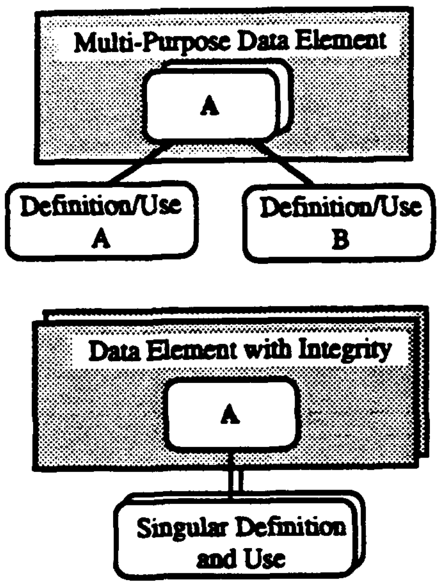
1. A multi-purpose data element is a single storage space that is used to store data values describing a variety of different concepts. Although the storage area is named and managed as a single data element, it is doing the job of several data elements. Typically the analyst formulating the multi-purpose element takes advantage of a mutual exclusivity that often exists for the attributes collected on different entity subtypes. There are, for example, different types of people in the Army - Military Officers, Military Enlisted, Civilians, etc. These are different subtypes for the 'personnel' entity. Some attributes are shared by all three subtypes (e.g., Name, Social Security Number, Birth Date, etc.), but there are other attributes that only apply to the different types (e.g., Area of Concentration (AOC) for Military Officers, Military Occupation Specialty (MOS) for Enlisted, and Occupational Code for Civilians). Elements that apply only to the different subtypes of the entity become candidates for multi-purpose formulations. The context of

the multi-purpose data element's value change based on what type of entity is described by a specific record.

2. Data elements formulated for multiple uses are difficult to interpret because the meaning of their values depends on the context in which the data values appear. Figure 2-6 shows an example of a multi-purpose data element. The existence of a multi-purpose data element can often be detected by the different categories of allowable values that appear in domain value lists for the data element. Over time, as new data requirements are continuously introduced, and as business rules mature, the protocol for determining the context for the values for a multi-purpose element tends to collapse; it becomes possible that the element could have two legitimate values.

3. Multi-purpose elements are sometimes used to accommodate varying formulations for an element by different systems and/or organizations. Different organizations may have assembled varying legacy elements that, from a global 'integration' perspective, should be treated as having identical meaning. This case is illustrated for technical manual (TM) numbers in Figure 2-7. Technical manual numbers are formatted differently across the Army, Navy, and Air Force. Under current standards (MIL-STD-1388-2B) on the transmittal and delivery of automated Logistics Support Analysis Records (LSAR) the technical manual number is transmitted as a composite data item. Technical manual number is made up of many elements having different embedded meaning from both a semantic and syntactical points of view across the Army, Navy, and Air Force. Nevertheless, in the exchange format, the TM number is treated as a single information concept with identical meaning. This single information concept transmittal is also followed under the DoD standards (e.g., MIL-STD-1840).

Principle



Example

UNPID Unit Package Identifier

1. **Force Grouping - when component code(COMPO) = 1**

Code	Description
AA	- HQ USAREUR 7A
AB	- HQ Staff Act (200 MMC)
50	- HQ V Corps/Associated Units
⋮	⋮

2. **HNS and LOG Civil Augmentation Program Offset Accumulation Indicator -when COMPO = 4,7,8, or 9)**

Code	Description
SH	Recognized Unit Shortfall
HD	HNS Direct Offset
HI	HNS Indirect Offset
CC	LOG Civil Augmentation Program Offset

Figure 2-6 Multi-Purpose Storage Space

Army Technical Manual (TM) Number: TM 5-5420-210-20P-2

TM	Indicates this Publication is a Technical Manual
5-	Series Number (Engineers)
5420-	Federal Supply Class for Equipment (Bridges)
210-	Sequence Number
20P-	Indicates TMS is RPSTI for unit maintenance
2	Second Volume

Navy Technical Manual (TM) Number: AE-172A0-720-100

A	Indicates Publication is NATSF Controlled NAVAIR TM
E-172	Shows that TM is for Electronic Navigation Equipment
A0-	Serial Number designating Stewart Warner Models
720-	Work Unit Code for Radar Navigation Systems
10	Indicates Volume Number in Set
0	Change/Revision Number

Air Force Technical Order (TO) Number: 12R5-2ARN24-2

12	Indicates Publication is for Airborne Electronic Equipment
R	Shows that TM is for Radio System
5	Equipment Series for Navigational Equipment
2	Indicates that JETDS Nomenclature Applies
ARN	JETDS Nomenclature: A = Airborne, R = Radio, N = Navigator
24	Model Number
2	Indicates TO to be a Maintenance Manual

MIL-STD-1388-2B

Technical Manual Number: The technical manual, technical order, or manual controlling number assigned by the requiring authority.

Field Length: 20
Type: AN
Justification: Left

Figure 2-7 Different Chain Syntax Exchanged as Single Composite Semantic

F. SYNERGISM BETWEEN DATA MODELING AND DATA ELEMENT FORMULATION

1. Advantages and disadvantages presented above for chained, coupled, and multi-purpose composite element formulations elevate data element mapping as a management tool for documenting and deciding how a specific element should be implemented. A clear distinction can be made between formulation practices for communicating data requirements, and formulation practices for supporting physical database implementation.

a. A logical data element (i.e., attribute) is the smallest concept that is named and modeled (i.e., it cannot be decomposed without loss of meaning). Logical data elements must communicate data requirements. Data elements formulated to describe a single concept communicate data requirements well because they are modular and mutually exclusive in their definition.

b. Physical data elements must carry data and support implementation related requirements for storage, performance (retrieval and update), and information exchange. These requirements sometimes can best be met by designing composite elements.

c. When composites are designed, they spawn associations due to partially overlapping definitions that hide information important for managing integration and redundancy. If not managed properly, composites can hinder communication and coordination across the department. To mitigate against these disadvantages, data element associations created by composite elements need to be documented so they can be quickly detected during downstream data element research.

2. Composite elements should be decomposed early in the data modeling projects because they often reveal important information or business rules for supporting the data modeling effort. Figures 2-8 and 2-9 illustrate this point by example -- a legacy element named Troop Program Sequence Number (TPSN). This element is a composite of approximately nine concepts. When elements like TPSN are modeled as shown in Figure 2-8, no consideration is given for discovering and communicating the concepts and business rules hidden within their formulation. The model shown in Figure 2-9 reveals data requirements and subtyping of MTOE Units that could

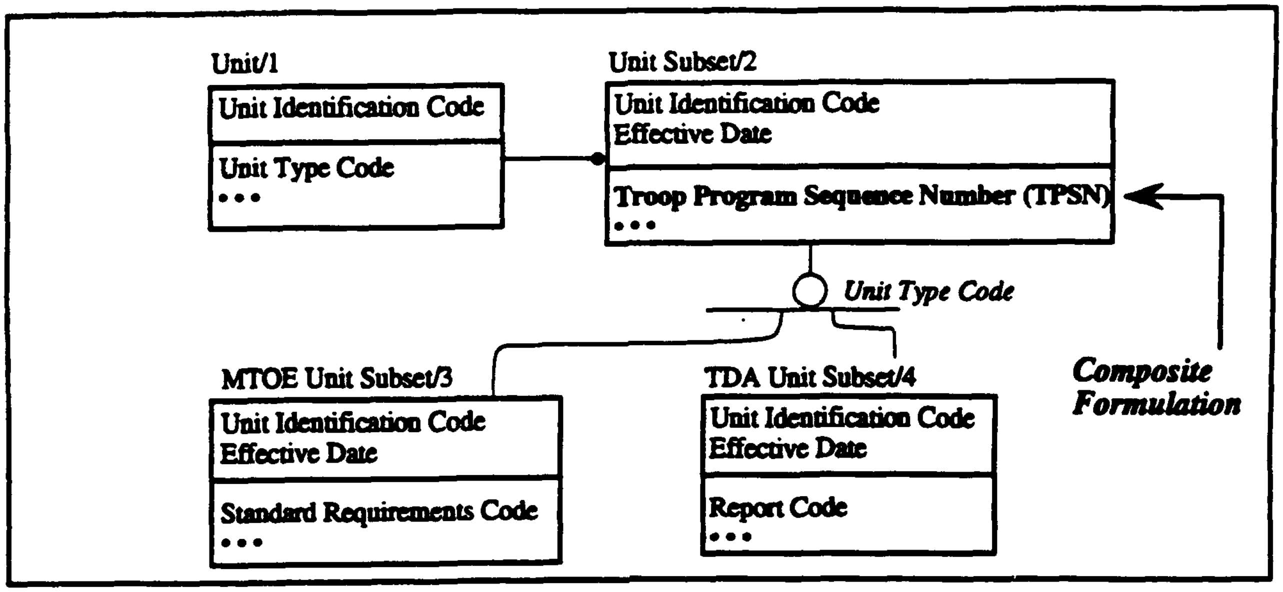


Figure 2-8 ERD with Composite Troop Program Sequence Number

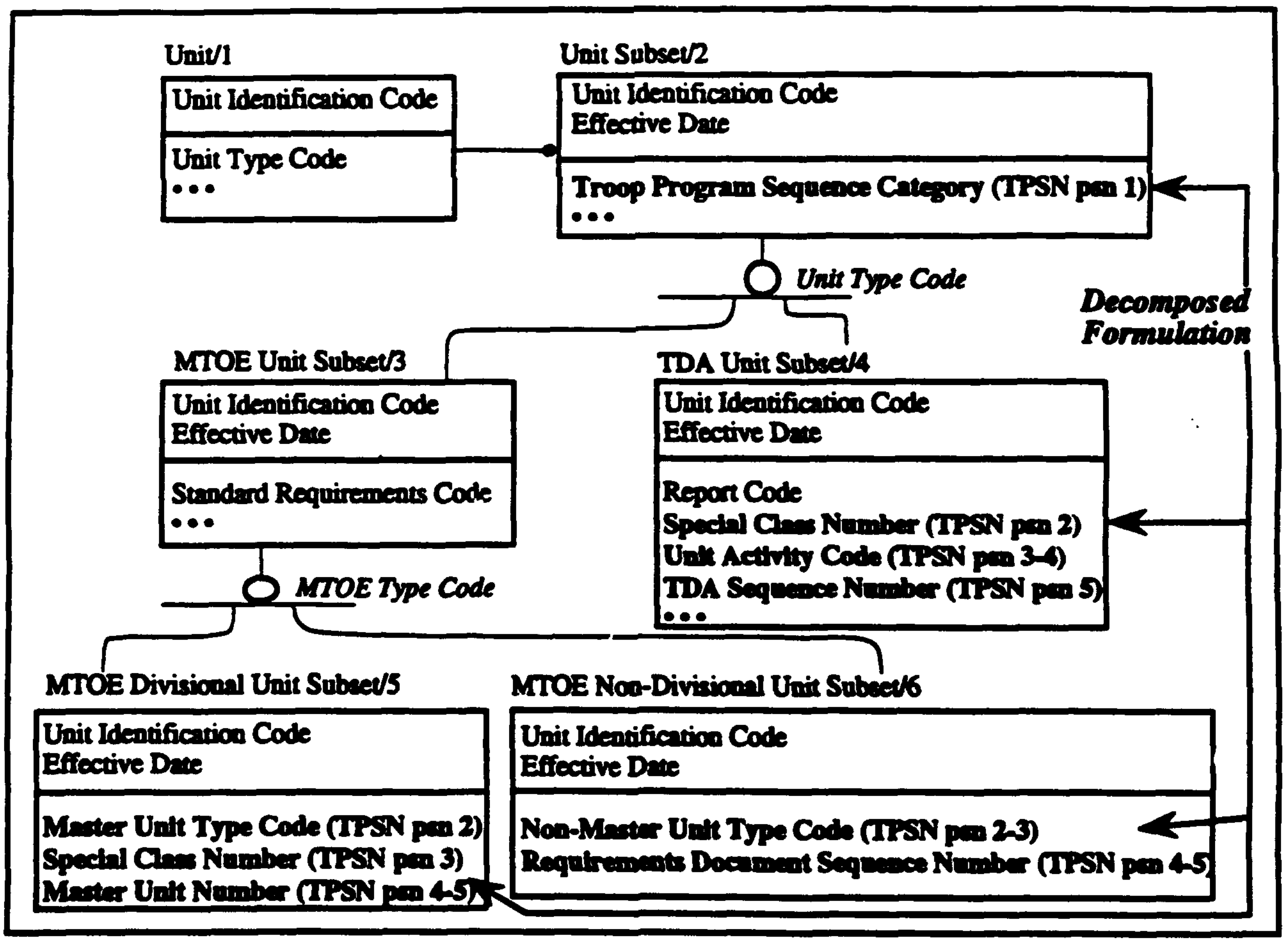


Figure 2-9 ERD with DecomposedTroop Program Sequence Number

not be communicated without reading the regulation (reference (h)) developed to help users enter values into the TPSN.

G. COMPOSITE ELEMENT STANDARDIZATION GUIDELINES

1. Practices used to design composite data elements generally lower the element's familiarity to the users, restrict the element's usage to the application for which it is designed, and increase the probability that the element will regularly need to be changed. Furthermore, composite element definitions partially overlap with definitions of other data elements used throughout the Department. This redundancy sets the stage for data inconsistencies, increases system maintenance costs, and reduces system flexibility for accommodating new data requirements.

2. If managed as a technique for reconciling low risk exceptions to data standardization rules, practices used to design composite data elements can effectively address external data exchange requirements, satisfy performance issues, and expedite data integration.

3. A practical approach must be taken when deciding how to reconcile composite data elements. Many chained elements are institutionalized and well understood by the functional community. For institutionalized composite elements, a decision to standardize should consider options to partially decompose the element. The objective is to improve data sharing with full consideration of the costs and benefits in terms of specific obstacles the element presents to data sharing versus data exchange. Consider options for partial decomposition of institutionalized composite elements when:

a. The element is thoroughly institutionalized and well accepted as a standard approach for accessing and exchanging data.

b. Concepts embedded in the composite element do not appear to have potential use across functional areas.

c. The element has shown no instability in the past (e.g., no projects have been initiated to re-design the coding structure).

d. Chained concepts appear to represent a naming discipline that does not extend beyond the scope of the object described by the data element.

4. Coordination and communication about the composite data element can be improved by mapping its formulation to a set of single concept equivalent formulations. Mapping is essential whether the composite data element is standardized as a single concept or composite concept formulation. Mapping improves:

a. Database Migration. Recognizing that composite elements abound in existing DoD systems and data exchange transactions, DoD data standardization procedures and tools must accommodate and manage migration of composite elements to single concept elements. When a composite element is fully documented, database re-engineering can accelerate because the data requirements are already decomposed into equivalent sets of single concept formulations. Additionally, the composite element relates more easily to data outside the system (e.g., external standards).

b. System Usability. Mapping documentation helps new system users understand composite elements, and provides a basis for improving labels used in system interfaces.

c. Data Sharing. Mapping documentation improves coordination and communication for any aspect of data sharing. Although difficult and time-consuming, proper analysis for documenting composite elements prevents repetitive analysis in the future.

J. MODEL FOR DOCUMENTING COMPOSITE ELEMENT FORMULATIONS

1. Perspective.

The model presented below will help capture and coordinate information about how composite data element formulations decompose or map into equivalent single concept formulations.

2. Semantic Rules.

Any approach used to map a composite element to a set of equivalent single concept formulations must account for three requirements:

a. A many-to-many relationship exists among composite elements and equivalent single concept elements.

b. A composite element can hierarchically decompose through an arbitrary number of levels to a set of equivalent single concept elements.

c. Different types of associations (e.g., chain, coupling, multi-purpose) exist among the elements in a hierarchical decomposition. Each type is characterized by attributes (e.g., element 'A' PARTICIPATES IN 'position x' of chain 'B', where position x is the value of an attribute for the association between element 'A' and chain 'B'.).

3. <u>Relational Model Overview</u>

A relational model in Figure 2-10 supports semantics described above using seven entities. The data element entity is already provided for in the DDRS. The remaining tables can be added in pairs to provide for increasing levels of functionality in documenting and managing data element associations:

a. <u>Document Data Element Associations.</u> The Association entity and Association Member entity together provide the information needed to document data element associations for all three types of composite elements discussed (i.e., chain, coupling, and multi-purpose).

b. <u>Document Attributes for the Data Element Associations.</u> The Association Attribute Value entity and the Association Member Attribute Value entity provide information for describing specifically how a composite element decomposes into its constituent simpler pieces.

c. <u>Define New Types of Associations.</u> The Association Type entity and Association Attribute entity provide information for defining new types of associations. For example, an association could be defined for tracking elements that when viewed individually carry unclassified information, but when viewed as a group communicate classified information.

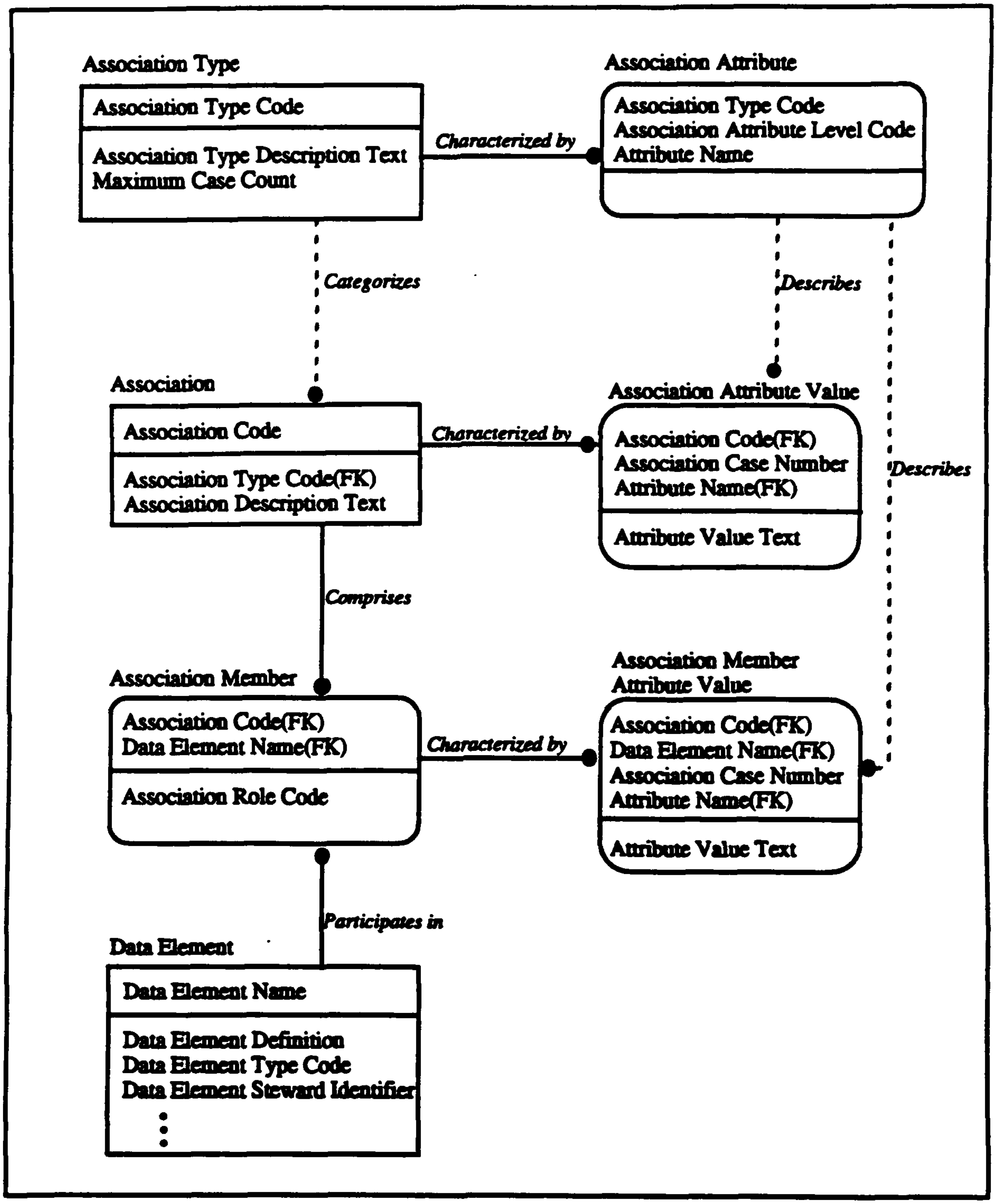


Figure 2-10 Logical Data Model for Documenting Composite Formulations

4. Entity Descriptions

a. Association Type. Lists all types of associations (e.g., Chain, Couple, and Multi-purpose).

b. Association Attribute. Defines attributes for documenting each association type. Metadata attributes below represent example attributes for the three different types of associations discussed so far:

(1) Couple. Values of composite elements correlated to counterpart values of their single concept equivalents.

(2) Chain. The specific position(s) each secondary element occupies in the domain values for the composite element.

(3) Multi-purpose. Values of the element(s) used to determine the different uses of a composite element.

c. Data Element. Specifies all data elements, composite and single concept.

d. Association. Identifies and describes each instance of an association among data elements participating in a composite formulation.

e. Association Member. Lists data elements participating in each of the associations recorded in the Association entity, and indicates the role ('composite whole' versus 'composite part') each element serves. For each of the association types discussed earlier (i.e., chain, couple, and multipurpose), an element can serve in one of two roles:

(1) Primary Element. Represents the 'composite whole.' The element bundles into itself all concepts carried by each of the other elements in the association. For example, Four Passenger Automobile Count is a primary element that bundles into itself the concepts carried by Automobile Count, Automobile Type Code, and Automobile Seating Capacity Count.

(2) Secondary Element. Represents the 'composite part.' The element participates in the association by carrying a subset of the concepts bundled by the primary element.

A secondary element represents a lower level of concept bundling than the primary element. The elements Automobile Count, Automobile Type Code, and Automobile Seating Capacity Count are each secondary elements associated with Four Passenger Automobile Count.

f. Association Attribute Value. Records the values for the association attributes identified in the Association Attribute entity at the association level.

g. Association Member Attribute Value. Records the values for the association attributes identified in Association Attribute entity at the association member level. As described above for the Association Attribute entity, attributes appropriate for describing an association vary for different types of element associations. For example, this entity could capture the actual value of an attribute named 'Chain Column' for elements participating in a 'Chain' type association.

K. EXAMPLE COMPOSITE ELEMENT FORMULATION

1. Introduction. This section describes an example composite element called the Unit Requirements Objective Code (ROBCO) summarized in Figure 2-11. This example is used to illustrate how the logical model described in Section E can be used to document the decomposition of composite elements into equivalent single concept formulations.

2. Chain Formulation (Level 1). ROBCO is a four position data element chain. The primary and secondary elements in the chain association are:

Primary Element	Secondary Elements	
Unit Requirements Objective Code	Arrival Time Period	(Position 1)
	Theater Employment Code	(Position 2)
	Functional Role Code	(Position 3)
	POMCUS Code	(Position 4)

Each position of the composite chain further decomposes into a second layer of associations. For this example, the first and fourth positions (i.e., Arrival Time Period, and POMCUS Code) are further decomposed below.

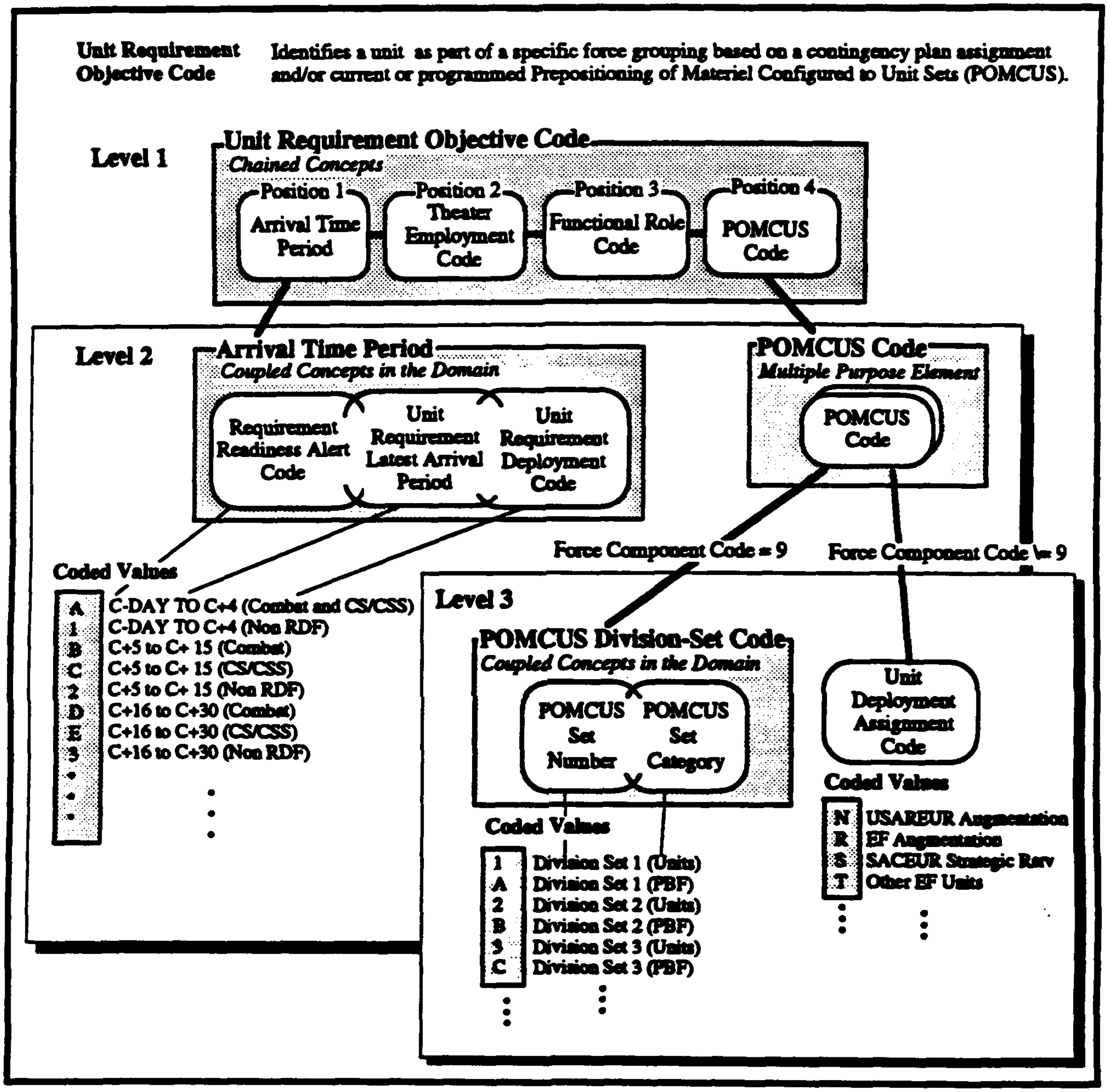


Figure 2-11 Example Decomposition of a Composite Element to Equivalent Single Concept Elements

4. Couple Formulation (Level 2, Position 1 -- Arrival Time Period)

a. The Arrival Time Period is formulated as a coupling of three concepts:

Primary Element	Secondary Elements
Arrival Time Period	Requirement Readiness Alert Code
	Unit Requirement Latest Arrival Period
	Unit Requirement Deployment Code

b. The secondary elements are bundled into the first position by assigning different coded values for each allowable combination of the three different concepts they describe. There are, for example, three different values for 'C+5 TO C+15': 1) the value 'B' indicates that a unit supports Combat requirements; 2) the value 'C' indicates that a unit supports CS/CSS (Combat Support/Combat Service Support) requirements; and 3) the value '2' indicates that a unit supports Non-RDF (Rapid Deployment Force) requirements. Names for the secondary elements have been synthesized from the coded values as follows:

(1) Requirement Readiness Alert Code describes whether the unit is to arrive on station when mobilization begins (i.e., 'M'-Day), deployment begins (i.e., 'D'-Day), or commencement of hostilities (i.e., 'C'-Day).

(2) Unit Requirement Latest Arrival Period describes the earliest and latest number of days in which the unit is to arrive on station after the start of Latest Arrival Period (e.g., 0-4, 5-15, 16-30).

(3) Unit Requirement Deployment Code describes whether the unit is serving in a category of Combat, Combat Support (CS), Combat Service Support (CS/CSS), and/or Non RDF (Rapid Deployment Force).

5. Multi-Purpose Formulation (Level 2, Position 4 -- POMCUS Code)

a. The POMCUS Code (representing the Prepositioning of Materiel Configured to Unit Sets) is formulated as a multipurpose element for two concepts:

Primary Element	Secondary Elements
POMCUS Code	POMCUS Division-Set Code
	Unit Deployment Assignment Code

b. The names for the secondary elements have been synthesized from the coded values as follows:

(1) POMCUS Division-Set Code identifies the number for a POMCUS Division-Set (e.g., '1' for Division-Set 1, '2' for Division Set-2, etc.) and the Division Set Category (e.g., units or PBF). The POMCUS Division Set Code applies to documentation for units that have a Force Component Code equal ("=") to 9.

(2) Unit Deployment Assignment Code describes the force grouping a unit supports as part of a specific contingency plan assignment. It applies to Non-POMCUS units (i.e., Force Component Code not equal ("\=") to 9).

5. Couple Formulation (Level 3, Position 4 -- POMCUS Division-Set Code)

Two concepts are coupled into the POMCUS Division-Set Code by assigning different coded values for each allowable combination of a POMCUS Set Number, and a POMCUS Set Category. There are, for example, two different values for 'Division Set 1': 1) the value '1' indicates that the record describes a unit; 2) the value 'A' indicates that record describes a PBF.

L. DOCUMENTATION FOR THE EXAMPLE COMPOSITE FORMULATION

1. Figure 2-12 displays the documentation for concepts bundled into the ROBCO formulations described above using the model proposed in Section E.

2. One record exists in the data element entity for each of the primary and secondary elements.

3. The four associations discussed are documented in the Association entity.

4. The participation of data elements in each association is documented in the Associate Member entity.

5. The hierarchical decomposition of the composite element is represented in the Associate Member entity by the recurrence of a single data element supporting different roles for different association instances. For example, Arrival Time Period participates as a secondary element in association '111' but participates as a primary element in association '112'. Likewise the POMCUS Code participates as a secondary element in association '111' but participates as a primary element in association '113'. This unbundling occurs again for the element POMCUS Division-Set Code; it participates as a secondary element in association '113', but participates as a primary element in association '114'.

Association Type

Assoc Type Code	Association Type Description Text	Max Case Count
COUPL	Coupled Composite Element	5
CHAIN	Chained Composite Element	1
MULTI	Multi-purpose Element	1

Association Attribute

Assoc Type Code	Association Attribute Level	Attribute Name
COUPL	Member	Element Value
CHAIN	Member	Chain Column
MULTI	Member	Usage Context

Association

Assoc Code	Assoc Type Code	Associate Description
111	CHAIN	Unit Readiness Objective Code Data Element Formulation
112	COUPL	Arrival Time Period Formulation
113	MULTI	FOMCUS Code Formulation
114	COUPL	FOMCUS Division Set Formulation

Association Attribute Value

Assoc Code	Assoc Case Number	Attribute Name	Attribute Value Text

Association Member

Assoc Code	Data Element Name	Element Role Code*
111	Unit Readiness Objective Code	P
111	Arrival Time Period	S
111	Theater Employment Code	S
111	Function Role Code	S
111	FOMCUS Code	S
112	Arrival Time Period	P
112	Requirement Readiness Code	S
112	Unit Requirement Latest Arrival Period	S
112	Unit Requirement Deployment Code	S
113	FOMCUS Code	P
113	FOMCUS Division Set Code	S
113	Unit Deployment Assignment Code	S
114	FOMCUS Division Set Code	P
114	FOMCUS Set Number	S
114	FOMCUS Set Category	S

P = Primary Associate
S = Secondary Associate

Association Member Attribute Value

Assoc Code	Data Element Name	Assoc Case Number	Attribute Name	Attribute Value Text
111	Arrival Time Period	1	Chain Column	1
111	Theater Employment Code	1	Chain Column	2
111	Function Role Code	1	Chain Column	3
111	FOMCUS Code	1	Chain Column	4
112	Arrival Time Period	1	Element Value	1
112	Requirement Readiness Code	1	Element Value	C
112	Unit Requirement Latest Arrival Period	1	Element Value	0:4 ∞
112	Unit Requirement Deployment Code	1	Element Value	Non-RDF
112	Arrival Time Period	2	Element Value	2
112	Requirement Readiness Code	2	Element Value	C
112	Unit Requirement Latest Arrival Period	2	Element Value	5:15 ∞
112	Unit Requirement Deployment Code	2	Element Value	Non-RDF
113	FOMCUS Division Set Code	1	Usage Context	Parent Component Code = 9
113	Unit Deployment Assignment Code	1	Usage Context	Parent Component Code \=9
114	FOMCUS Division Set Code	1	Element Value	1
114	FOMCUS Set Number	1	Element Value	1
114	FOMCUS Set Category	1	Element Value	Units
114	FOMCUS Division Set Code	2	Element Value	A
114	FOMCUS Set Number	2	Element Value	1
114	FOMCUS Set Category	2	Element Value	PBP

Data Element

Data Element Name
Unit Readiness Objective Code
Arrival Time Period
Theater Employment Code
Function Role Code
FOMCUS Code
Requirement Readiness Alert Code
Unit Requirement Latest Arrival Period
Unit Requirement Deployment Status Code
FOMCUS Division Set Code
FOMCUS Set Number
FOMCUS Set Category
Unit Deployment Assignment Code

Figure 2-12 Documentation of the Example Composite Element in the Model

6. The Association Member Attribute entity documents the different attribute values for each of the different types of associations based on entries in the Association Attribute entity. For example:

a. 'Chain Column' attribute for chain type associations are recorded for each of the secondary elements participating in association '111'.

b. 'Usage Context' for the different uses of the multipurpose association are documented for each of the secondary elements participating in association '113'.

c. 'Element Value' taken on by secondary elements when uncoupled from primary elements for associations are documented for elements participating in associations '112' and '114'.

7. The secondary elements in associations '112' and '114' do not appear as primary elements in any other associations. If the analysis for multiple concepts is complete, then these elements are single concept elements. Because the redundancy will not be masked by partially overlapping definitions, the single concept formulations can be analyzed for redundancy with other single concept elements in the dictionary. Redundancy is hard to detect or verify across data elements that bundle multiple concepts under a single name, but can reasonably be detected when disciplines such as naming conventions and/or keyword associations are applied to the single concept elements.

CHAPTER 3

DERIVATIONS

A. DEFINITION

1. Derived data elements represent the results of computational operations performed on other data elements. The computations may involve algorithms joining two or more standard elements or algorithms summarizing multiple occurrences of a single element.

2. Computational associations among elements may extend multiple levels, creating derived elements from other derived elements.

Example:

Military Personnel Allowance Amount = BAQ + BAS

BAQ = Basic Allowance for Quarters by Grade

BAS = Basic Allowance for Subsistence
= Military Personnel End Strength by Grade * BAS Rate

B. DERIVATION STANDARDIZATION ISSUES

1. Case for Standardization of Derivations

a. Coordinate Definitions of Common Derivations. If not documented and agreed upon, inconsistently derived data can easily lead to discrepancy resolution projects to trace down the rationale for different answers to a single question.

Example:

How many people work for the Department of Defense?

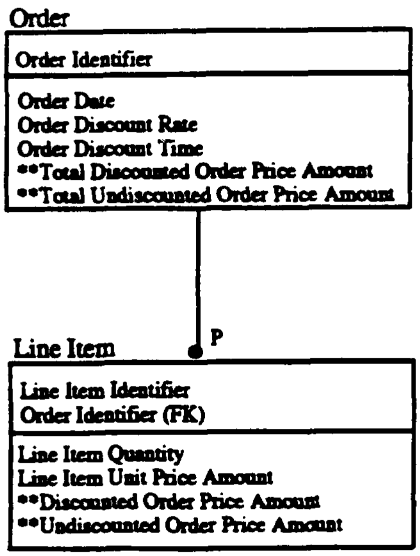
Different people could come up with very different answers for this question based on whether the data used includes trainees, contractors, and/or unfilled positions. Standard algorithms for answering this type of question provides coordinating guidance to analysts and decision makers working to obtain consistent results. These algorithms relate primitive 'keyed-in' data to the derived answer.

b. Support for Policies, Business Rules, and Legal Requirements. Some derived data elements are used to determine what processes are to be performed or what logic is to be applied to transactions or related data based on business rules (e.g., Set the minimum and maximum inventory for a specific repair part based on the total number of supported end items coming due for a 60 thousand operating hour check-up within three months). Calculated elements in Figure 3-1 illustrate a second related rationale for representing derived elements; these elements support accounting requirements. Other derived elements may be legally required (e.g., cumulative annual employee pay amount). These types of derived elements need to be represented as requirements in logical data models and coordinated to communicate policy, business rules, and legal requirements.

c. Support Data Exchange Requirements. Figure 3-2 illustrates a data exchange phenomenon that is projected to be quite common across DoD. Many decision support (DSS) systems extract and summarize snapshots of data from transaction systems. Data elements output from the extract procedures are commonly documented as memoranda for agreements (MOA) or by standards that have been established to support data sharing (e.g., MIL-STD-1388-2B; MIL-STD-1840; US Message Text Formats). Although the transaction systems store data at the primitive level, the DSS applications store the data at an aggregate level. If enhancing data shareability is the objective the CIM Data Administration program, then derived data need to be documented to:

(1) Manage Reuse of Data Exchange Agreements. Data appearing in data exchange agreements can help focus data administration efforts on data that are widely shared. Statistical distribution of derived data appearing in these exchange agreements indicate what derived data are of corporate interest.

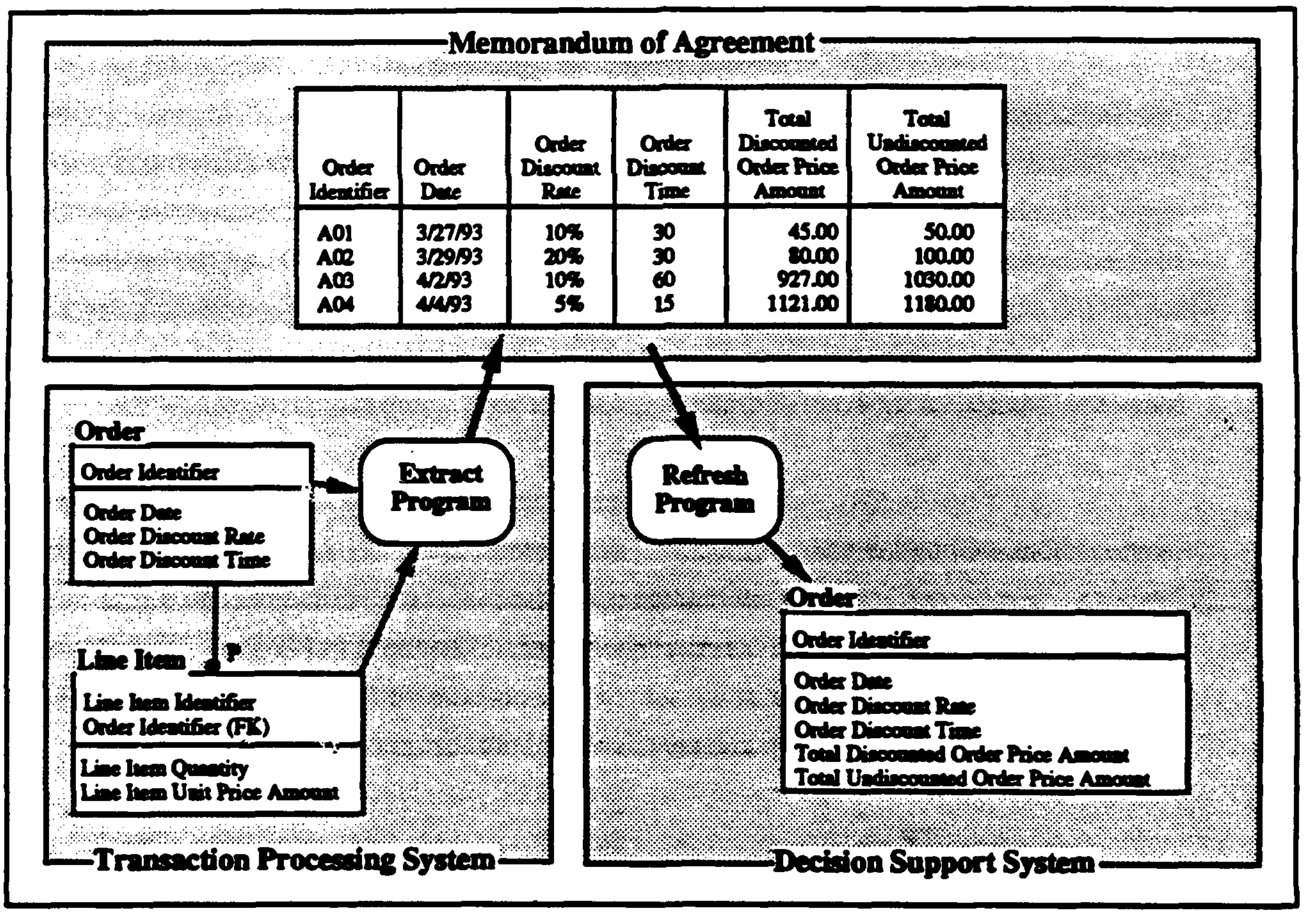
(2) Communicate Data Requirements for Decision Support Systems. Decision Support Systems are likely to deal directly with derived data, and modeling the derived data is appropriate for these types of systems.



				Derived Data Requirement	
Order Identifier	Order Date	Order Discount Rate	Order Discount Time	Total Discounted Order Price Amount	Total Undiscounted Order Price Amount
A01	3/27/93	10%	30	45.00	50.00
A02	3/29/93	20%	30	80.00	100.00
A03	4/2/93	10%	60	927.00	1030.00
A04	4/4/93	5%	15	1121.00	1180.00

				Derived Data Requirement	
Order Identifier	Line Item Identifier	Line Item Quantity	Line Item Unit Price Amount	Discounted Order Price Amount	Undiscounted Order Price Amount
A01	001	2	10.00	16.00	20.00
A01	002	1	30.00	27.00	30.00
A02	001	1	100.00	80.00	100.00
A03	001	1	30.00	27.00	30.00
A03	002	2	500.00	900.00	1000.00

Figure 3-1 Calculated Data Requirements - IDEF1X Model and Table Mockups



Order Identifier	Order Date	Order Discount Rate	Order Discount Time	Total Discounted Order Price Amount	Total Undiscounted Order Price Amount
A01	3/27/93	10%	30	45.00	50.00
A02	3/29/93	20%	30	80.00	100.00
A03	4/2/93	10%	60	927.00	1030.00
A04	4/4/93	5%	15	1121.00	1180.00

Figure 3-2 Exchange of Calculated Data

2. Case Against Standardization of Derivations

a. Derived data elements possess a number of undesirable characteristics for data element standards. Table 3-1 provides a quick comparison of the traits for primitive and derived data.

(1) Primitive data represent observable facts of interest to an organization. The population of primitive data elements describing these facts is finite, and, so long as an organization's mission is stable, the population of primitive data used by the organization is stable. Each primitive data element serves a definable role that can be represented in a structured data model. With the exception of keys (elements used to uniquely identify individual records), the data elements can be modeled as non-redundant attributes in the data model. These traits together with the common objective that a single primitive data element should be shared to support a wide range of uses predisposes primitive data for standardization.

(2) Derivative data are generated as sums, ratios, averages, or similar transformations of primitive data. For practical management purposes, there are an infinite number of ways to select and manipulate combinations of primitive data to derive the results used to support decision makers. There is also an issue of derivation stability because they are objects defined to support the styles of individual managers. As managers change, the procedures and derivation items used to support decisions also change. For this reason, derivations represent a dynamic and explosive population of elements generally designed to support the skill mixes of individual managers or groups of managers, and not well suited for standardization.

(3) Derivations are by their very nature redundant with the primitive elements from which they are assimilated. Furthermore, the various combinations of primitive elements, select criteria, and computational operations that can be used to derive a result guarantee that derivative data overlap with other derivative data. The matrix in Figure 3-3 plots overlaps among a set of primitive elements and a set of elements derived from those primitives. The primitive elements are mutually exclusive as a rule, but the derivations overlap as a rule.

Characteristic \ Type of Data Element	Primitive	Derivative
Source of Value	Observed Inputs	Generated from Primitives (sums, counts, averages)
Number of Elements	Finite	Infinite
Definition	Static	Dynamic
Usage	Structured Widely Available Mutually Exclusive	Unstructured Private Overlapping Definitions
Examples	Employee Grade Employee Step Employee Pay Rate	Total Expended Employee Pay Amount

Table 3-1 Primitive Versus Derived Data

	Element \ Related Element	Primitive					Derivative				
		Unit Identification Code	Stock Item Shipment Date	Stock Item Nomenclature	Stock Item Quantity	Stock Item Type	Performance Timely Follow-up Response Percentage	Performance Total Records Matched	Additional Buy-out Require-ment	Additional Requirement Buy-out in Subtotal	Additional Requirement Buy-out Total
Primitive	Unit Identification Code								1		
	Stock Item Shipment Date						1				
	Stock Item Nomenclature							1			
	Stock Item Quantity						1	1	1	1	1
	Stock Item Type						1	1			
Derivative	Performance Timely Follow-up Response Percentage		2		2	2		3	3	3	3
	Performance Total Records Matched			2	2	2	3		3	3	3
	Additional Buy-out Requirement	2			2		3	3		3	3
	Additional Requirement Buy-out in Subtotal				2		3	3	3		3
	Additional Requirement Buy-out Total				2		3	3	3	3	

Legend

1. Element PARTICIPATES IN DERIVING Related Element
2. Element DERIVED FROM Related Element
3. Element's DERIVATION OVERLAPS WITH DERIVATION OF Related Element

Figure 3-3 Relationships Among Sample of Primitive and Derived Elements

(4) Derived data directly link to implementation issues concerning performance of data retrievals versus data updates, and synchronization of redundant derived data with the primitive data used to assimulate the result. Derivations should not be represented in logical data models because they bias the design with a premature solution to these issues. Derived data should be adressed in physical process modeling.

b. The traits listed above prompt many data administrators to avoid managing derivatives as data standards, or even attempting to represent derivatives in corporate data models; rather, they delegate responsibilities for derived data to database administration and system configuration management.

3. Traditional Versus Modern Management Environment for Derivations

Software configuration management has traditionally managed derivation algorithms. This worked when significant derivations required support of software designers and developers. Modern technology makes it possible to extract primitive data from transactional source systems and develop derivatives with little programmer participation. Alternative approaches need to be developed for coordinating information on derivations that are of corporate interest. One important management consideration is to model data to support transaction systems separately from data to support DSS applications. This encourages an early distinction between uses of the data in these two very different environments.

C. DERIVATION MANAGEMENT GUIDELINES

1. Derivations in Data Models for Transaction Systems. Evaluate derivations projected to be stored in transaction systems to determine whether they support accounting, auditing, policy, or business rule enforcement purposes. These elements are of 'corporate interest' and should be adopted for management as data element standards.

2. Data Summarizations for DSS Applications. If a computational result characterizes an entity that represents a summarization or aggregation type object, evaluate the use of the data.

a. If the data support management type functions rather than day-to-day operations, they should be treated as DSS application requirements. Data Models representing requirement for day-to-day transactional operations will be managed separately from data models representing requirements for managerial DSS applications. An element appearing in DSS data models will be of corporate interest and standardized if it satisfies one of the following criteria:

(1) Supports a Formalized Process. A derived element is computed in support of an officially documented process based on inputs from multiple functional areas.

(2) Used By Multiple Functional Areas. Once derived, the result is shared with at least five organizations in different functional areas.

(3) Shared with External Organization(s). Once derived, the result is shared with at least one external organization.

b. Data elements that appear to be derivatives must be closely investigated before relegating them to DSS application models. Some counts and totals which appear to be derivatives may, in fact, have no primitive source for their computation. Figure 3-4 lists some examples appearing in the U.S. Message Text Formats (USMTF). For example, a count on the number of displaced females over 60 is developed by a person or group of persons actually counting dislocated woman over 60 and reporting this number for transmittal. Processing and databases for the operational environment used to gather these data clearly must change before this data can be documented and managed as DSS aggregates. So long as the aggregate must be observed (i.e., manually counted) and keyed for transmittal, the element should be managed as a primitive.

3. Derivation Mapping Documentation. Improve the coordination and communication about a standardized derived element by mapping it to the primitive source elements, and documenting the formula used to manipulate the primitive sources and obtain the result. If derived data are to be effectively coordinated, documentation specifying both which data elements participate in a derivation and what operations are performed against the data elements must be captured.

US-CIVILIAN PERSONNEL QUANTITY: The non-monetary unit representing the count of American non-military persons in the area of operations

COMMAND AUTHORIZED MILITARY PERSONNEL QUANTITY: The non-monetary unit representing the count of persons employed by the Armed Forces who are approved to serve within an organization of units under the authority of one individual.

DISLOCATED FEMALE CIVILIAN PERSONNEL OVER-60-YEARS QUANTITY: The non-monetary unit representing the count of non-military, female persons over the age of 60 who are displaced from their normal locations.

INTERNED ENEMY CIVILIAN PERSONNEL QUANTITY: The non-monetary unit representing the count of non-combatant, hostile prisoners.

TOTAL FUEL REQUIRED HUNDREDS-OF-POUNDS WEIGHT: The mass of total propellent times the acceleration of gravity, expressed in hundreds of pounds, that a tanker aircraft needs to transfer to receiving aircraft.

ESTIMATED MILITARY PERSONNEL KILLED-IN-ACTION QUANTITY: The non-monetary unit representing the approximate count of persons employed by the Armed Forces who die of wounds received in combat before reaching a medical treatment facility.

Figure 3-4 U.S. Message Text Formats - Counts Recorded

4. Derivation Software Reuse. Develop modularized code for calculating derived data that satisfies the criteria for reusable software. This code will improve the reuse of algorithms used to manipulate primitive data. Register these modules in the software reuse library, and record the name of the reusable software module as an attribute of the derived data element.

D. MODEL FOR DOCUMENTING DERIVATIONS

1. Perspective. The model in Figure 3-5 builds upon the model presented earlier for documenting a composite element's formulation. From this perspective a derivation is an algorithmic association among two or more data elements.

2. Semantic Rules

A derivation model must account for the following inherent characteristics of a derivation:

a. A many-to-many relationship exists between derived elements and the primitive elements participating in the algorithms used to generate the derived elements.

b. A derived element can hierarchically decompose through multiple levels to a set of primitive source elements.

c. Attributes, such as the 'derivation algorithm text', and 'reusable software module identifier' that characterize the derivation need to be captured.

3. Relational Model Overview

The model presented earlier, Figure 2-10, is adapted for documenting derived data in Figure 3-5. The data element entity is already provided for in the DDRS. The remaining tables can be added in groups of two or three to provide for increasing levels of functionality in documenting and managing derivations:

a. Document Data Elements Participating in Derivations. The Association entity and Association Member entity together provide the information needed to document what data elements participate in a derivation.

b. Document Attributes for the Derivation. The Association Attribute Value entity, Association Member Attribute Value entity, and the Domain Constraint Description Text entity provide information for describing a calculation.

c. Define New Types of Associations. The Association Type entity and Association Attribute entity provide information for defining new types of associations.

4. Entity Descriptions. The model comprises the following eight entities:

a. Association Type. Defines 'derivation' as a type of association.

b. Association Rule. Defines attributes for documenting derivations (e.g., 'derivation algorithm text', and 'reusable software module identifier').

c. Data Element. Defines primitive and derived data elements.

d. Association. Identifies and describes each instance of an association among data elements participating in an algorithm to generate derived data.

e. Association Member. Identifies the data elements participating in each derivation and the association role each element serves. An element can serve in one of two roles:

(1) Primary Element. Represents the 'result.' For example, Employee Age is the result of the computational difference between today's date and the Employee Birth Date.

(2) Secondary Element. Represents a 'computational variable' used to compute the result.

f. Association Attribute Value. Records values for derivation attributes identified in the Association Attribute entity at the association level (e.g., values for 'derivation algorithm text', and 'reusable software module identifier').

g. Association Member Attribute Value. Records values for derivation attributes identified in the Association Attribute entity at the member level (e.g., a short 'argument name' might be defined for each data element to make the mathematical relationships among elements appearing in the 'derivation algorithm text' easier to observe).

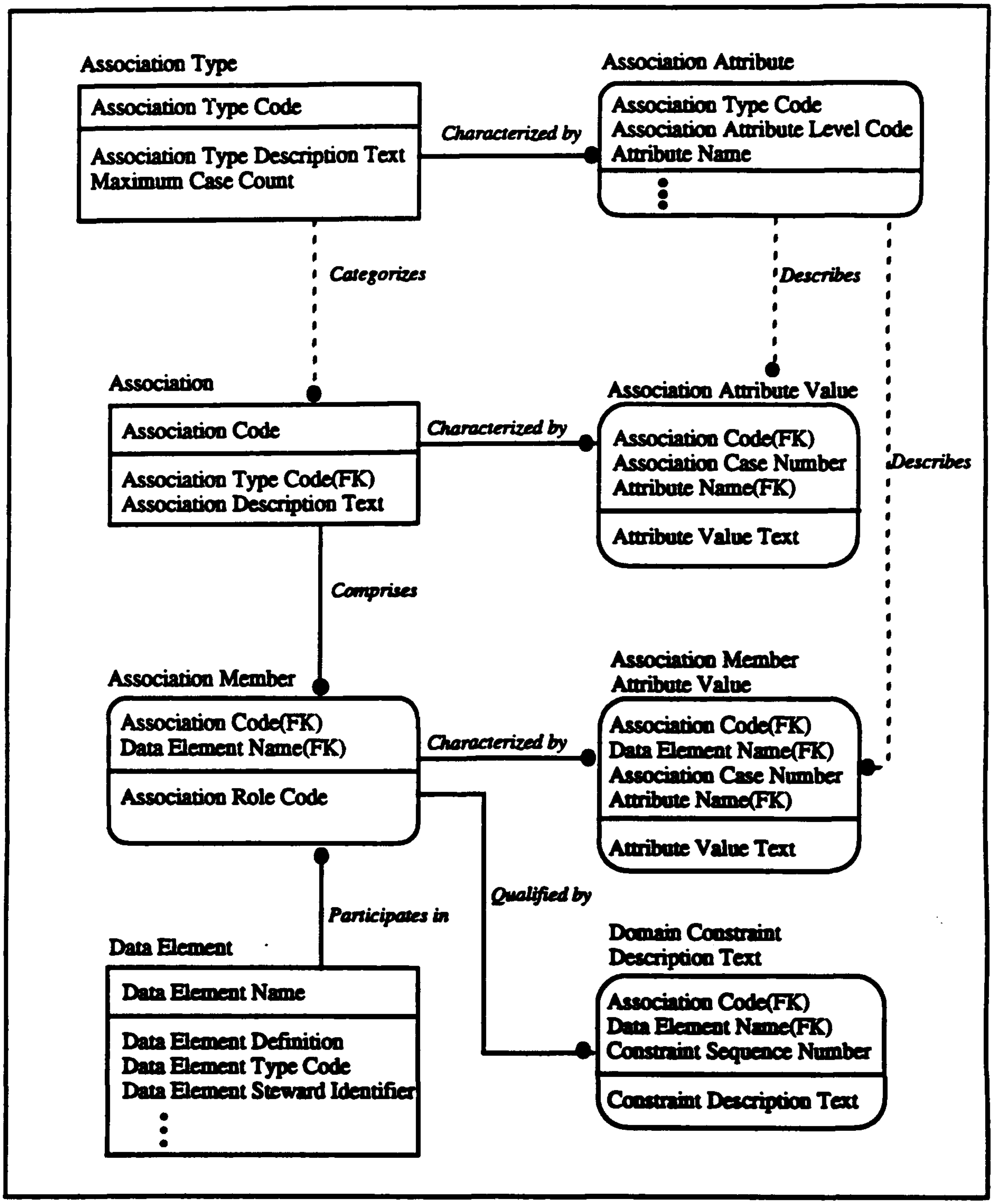


Figure 3-5 Logical Data Model for Documenting Derivation Associations

h. Domain Constraint Description Text. Specifies any constraints in effect for selecting or using data to generate the derived data (e.g., enumerated values, ranges, or SQL 'where-clause' text).

6. Possible Extensions to the Model

Formulas could be treated more rigorously by modeling a standard list of operators (e.g., addition ('+'), multiplication ('*'), and square root ('SQRT()'). Given the objective of simply improving communication rather than actually automating the generation of program code to perform the computations, this additional level of complexity was dropped from the model.

E. EXAMPLE DERIVATION

1. Figure 3-6 presents an example of a derived data element called Military Personnel Pay Amount:

Primary Element		Secondary Elements
Military Personnel Pay Amount	=	Military Personnel Base Pay
	+	Military Personnel Retired Pay
	+	Military Personnel Allowance Amount

2. Each of the secondary elements on the right side of the equation above also represent derivations:

Primary Element		Secondary Element
Military Personnel Base Pay	=	Military Personnel End Strength (by Grade)
	*	Military Personnel Base Pay (for Grade)
Military Personnel Retired Pay	=	Military Personnel Base Pay
	*	Military Personnel Retired Pay Accrual Factor Amount

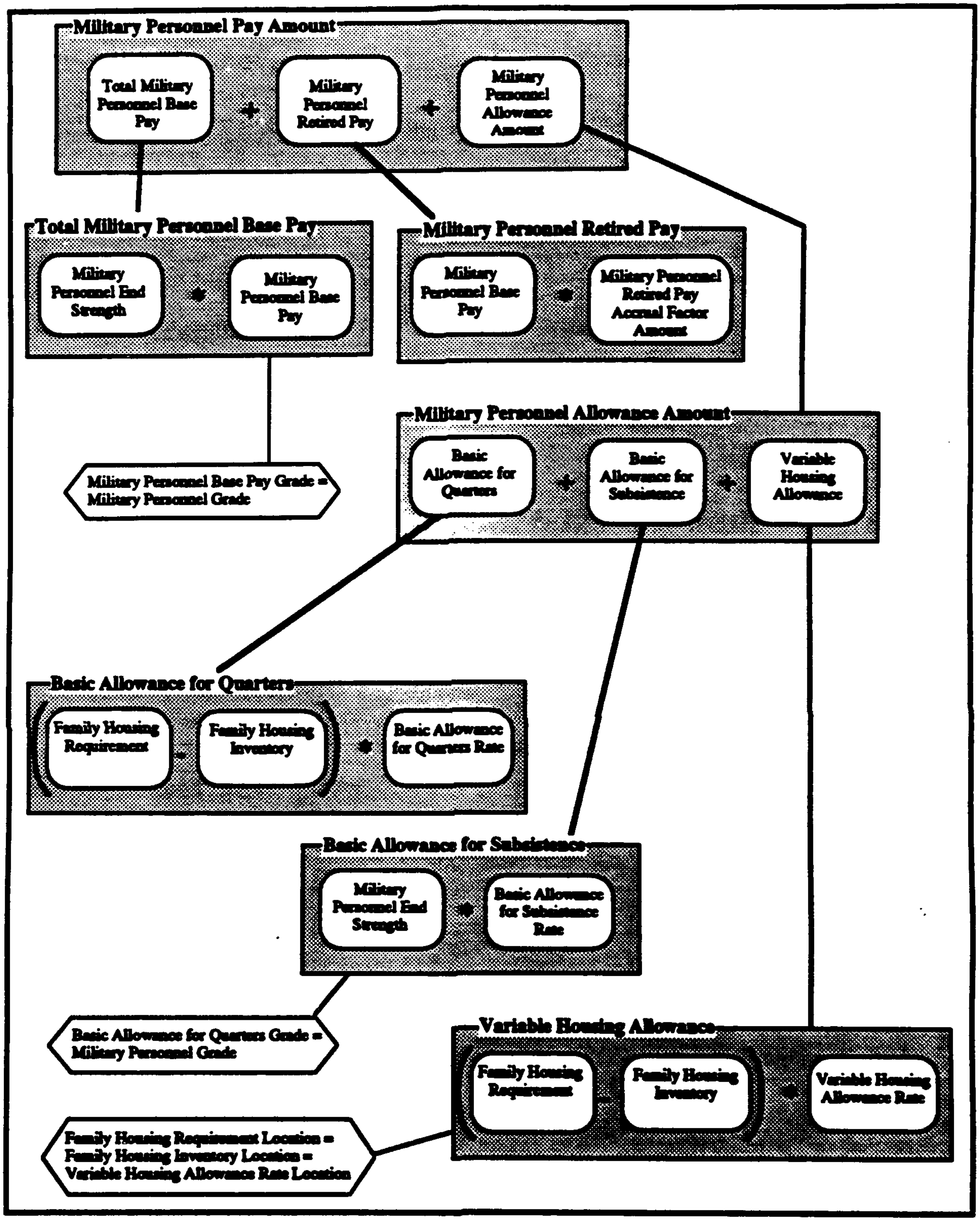


Figure 3-6 Example Decomposition of a Derived Element

Military Personnel Allowance Amount	=	Basic Allowance for Quarters
	+	Basic Allowance for Subsistence
	+	Variable Housing Allowance

3. Elements on the right side of the 'Military Personnel Allowance Amount' are derived as:

Primary Element		Secondary Element
Basic Allowance for Quarters (BAQ)	=	[Family Housing Requirement
	-	Family Housing Inventory]
	*	BAQ Rate
Basic Allowance for Subsistence (BAS)	=	Military Personnel End Strength (by Grade)
	*	BAS Rate
Variable Housing Allowance (VHA)	=	[Family Housing Requirement (by Location)
	-	Family Housing Inventory (by Location)]
	*	VHA Rate (by Location)

F. EXAMPLE DERIVATION DOCUMENTATION

1. Figure 3-7 depicts how the relational model for associating derived elements presented in Figure 3-5 can be used to document the primitive sources of the example derived data element.

Association Type

Assoc Type Code	Association Type Description Text	Max Case Count
DRVTN	Derived Data Element	1

Association Attribute

Assoc Type Code	Association Attribute Level	Attribute Name
DRVTN	Associate	Derivation Text
DRVTN	Associate	Reusable Software Module
DRVTN	Member	Argument Name

Association

Assoc Code	Assoc Type Code	Associate Description
511	DRVTN	Military Personnel Pay Amount Computation
512	DRVTN	Military Personnel Base Pay Computation
513	DRVTN	Military Personnel Retired Pay Computation
514	DRVTN	Military Personnel Allowance Amount Computation
515	DRVTN	Basic Allowance for Quarters Computation
516	DRVTN	Basic Allowance for Subsistence Computation
517	DRVTN	Variable Housing Allowance Computation

Association Attribute Value

Assoc Code	Assoc Case Number	Attribute Name	Attribute Value Text
511	1	Derivation Text	MPPA = TMPBP + MPRP + MPAA
512	1	Derivation Text	TMPBP = MPES * MPBP
513	1	Derivation Text	MPRP = MPBP * MPRPAFA
514	1	Derivation Text	MPAA = BAQ + BAS + VHA
515	1	Derivation Text	BAQ = (FHR - FHI) * BAQR
516	1	Derivation Text	BAS = MPES * BASR
517	1	Derivation Text	VHA = (FHR - FHI) * VHAR
511	1	Reusable Software Module	MPPA_Compn

Association Member

Assoc Code	Data Element Name	Element Role Code *
511	Military Personnel Pay Amount	P
511	Total Military Personnel Base Pay	S
511	Military Personnel Retired Pay	S
511	Military Personnel Allowance Amount	S
512	Total Military Personnel Base Pay	P
512	Military Personnel End Strength	S
512	Military Personnel Base Pay	S
513	Military Personnel Retired Pay	P
513	Military Personnel Base Pay	S
513	Military Personnel Retired Pay Accrual Factor Amount	S
514	Military Personnel Allowance Amount	P
514	Basic Allowance For Quarters	S
514	Basic Allowance for Subsistence	S
514	Variable Housing Allowance	S
515	Basic Allowance For Quarters	P
515	Family Housing Requirement	S
515	Family Housing Inventory	S
515	Basic Allowance for Quarters Rate	S
516	Basic Allowance for Subsistence	P
516	Basic Allowance for Subsistence Rate	S
516	Military Personnel End Strength	S
517	Variable Housing Allowance	P
517	Family Housing Requirement	S
517	Family Housing Inventory	S
517	Variable Housing Allowance Rate	S

* P = Primary Associate
S = Secondary Associate

Association Member Attribute Value

Assoc Code	Data Element Name	Assoc Case Number	Attribute Name	Attribute Value Text
511	Military Personnel Pay Amount	1	Argument Name	MPPA
511	Total Military Personnel Base Pay	1	Argument Name	TMPBP
511	Military Personnel Retired Pay	1	Argument Name	MPRP
511	Military Personnel Allowance Amount	1	Argument Name	MPAA
512	Total Military Personnel Base Pay		Argument Name	TMPBP
512	Military Personnel End Strength	1	Argument Name	MPES
512	Military Personnel Base Pay	1	Argument Name	MPBP
513	Military Personnel Retired Pay	1	Argument Name	MPRP
513	Military Personnel Base Pay	1	Argument Name	MPBP
513	Military Personnel Retired Pay Accrual Factor Amount	1	Argument Name	MPRPAFA
514	Military Personnel Allowance Amount	1	Argument Name	MPAA
514	Basic Allowance For Quarters	1	Argument Name	BAQ
514	Basic Allowance for Subsistence	1	Argument Name	BAS
514	Variable Housing Allowance	1	Argument Name	VHA
515	Basic Allowance For Quarters	1	Argument Name	BAQ
515	Family Housing Requirement	1	Argument Name	FHR
515	Family Housing Inventory	1	Argument Name	FHI
515	Basic Allowance for Quarters Rate	1	Argument Name	BAQR
516	Basic Allowance for Subsistence	1	Argument Name	BAS
516	Basic Allowance for Subsistence Rate	1	Argument Name	BASR
516	Military Personnel End Strength	1	Argument Name	MPES
517	Variable Housing Allowance	1	Argument Name	VHA
517	Family Housing Requirement	1	Argument Name	FHR
517	Family Housing Inventory	1	Argument Name	FHI
517	Variable Housing Allowance Rate	1	Argument Name	VHAR

Data Element

Data Element Name
Military Personnel Pay Amount
Total Military Personnel Base Pay
Military Personnel Retired Pay
Military Personnel Allowance Amount
Military Personnel End Strength
Military Personnel Base Pay
Military Personnel Retired Pay accrual Factor Amount
Basic Allowance For Quarters
Basic Allowance for Subsistence
Variable Housing Allowance
Family Housing Requirement
Family Housing Inventory
Basic Allowance for Quarters Rate
Variable Housing Allowance Rate

...

Domain Constraint Description Text

Assoc Code	Data Element Name	Constraint Sequence Number	Constraint Description Text
512	Total Military Personnel Base Pay	1	Military Personnel Base Pay Grade = Military Personnel Grade
516	Basic Allowance for Subsistence	1	Basic Allowance for Quarters Grade = Military Personnel Grade
517	Variable Housing Allowance	1	Family Housing Requirement Location = Family Housing Inventory Location
517	Variable Housing Allowance	2	Family Housing Requirement Location = Variable Housing Allowance Rate Location

Figure 3-7 Documentation of the Example Derived Element in the Model

2. 'Derived Data Element' is identified as a type of association (i.e., 'DRVTN') in the Association Type entity. The Association Attribute entity identifies three attributes to be recorded for each instance of a derivation:

a. Derivation Text (associate level).

b. Reusable Software Module (associate level).

c. Argument Name (member level).

3. Each of the data elements participating in the derivation are documented in the Data Element entity, and related through the Association Member entity.

4. Each computation is identified in the Association entity, and related to elements participating in the computation through the Association Member entity. For example, the derivation Military Personnel Pay Amount is assigned an Association Code of '511'. This code identifies four elements involved in the derivation within the Association Member entity (i.e., Military Personnel Pay Amount, Total Military Personnel Base Pay, Military Personnel Retired Pay, and Military Personnel Allowance Amount). Each association includes:

a. One derived element (Element Role Code = 'P' for 'Primary Element').

b. One or multiple computational variables (Element Role Code = 'S' for 'Secondary Element').

5. Each data element in the Association Member entity is assigned an Argument Name in the Association Member Attribute Value entity (e.g., the data element Military Personnel Pay Amount is represented as 'MPPA'). The argument name is then used within the derivation text assigned to each association as an 'Attribute Value Text' in the Association Attribute Value entity. Substituting an argument for the data element name in the formula provides some intelligibility for the data elements being used, and, at the same time, shortens the formula so that mathematical relations among the elements can more easily be observed. "Search and replace" logic could provide a user interface capable of presenting the equations with either full names or argument substitutions.

6. Constraints appropriate for each computation are documented in the Domain Constraint Description Text entity. If more rigor is desired for capturing constraints, one possibility is to explicitly identify data elements participating as part of constraint criteria in the Association Member entity. These elements could then also be assigned Argument Names that would be substituted for the data element names in the Constraint Description Text column.

CHAPTER 4

COMPLEX DATA STREAMS

A. DEFINITION

1. Complex data streams use strings of ordered characters or bits to communicate information through a variety of approaches, including graphics, documents, sound, and video. The ordering of the characters or bits within the stream is important for correctly formatting and interpreting the information. Some special escape character sequences within a document, for example, may trigger special processing by applications that interpret the data stream to format the text (e.g., center, bold, and underline the following text).

2. Microcomputer applications (e.g. word processors, spreadsheets, graphics, sound and video simulators, and hypertext) originally designed to boost individual productivity often create large files of complex data streams. These applications store data they input and output in non-relational formats because the relational model is an unsatisfactory approach for supporting their processing requirements. Several relational database management systems have extended their data types to include Binary Large Objects (BLOBs) capable of storing and sharing files created by these various applications. The BLOB data type allows the DBMS to work around the issue of knowing how these complex data streams are formatted.

3. Storing complex data streams in database management system as BLOB fields does little to improve their shareability. At a minimum, additional information must be correlated with the BLOB to describe what class or type of data stream it represents (e.g., Microsoft word document, Excel spreadsheet, sound recording). These attendant elements should be standardized to ensure that a wide variety of applications can correctly initiate procedures to access, interpret, and present data stored in the BLOB field.

B. CLASSIFICATION OF COMPLEX DATA STREAMS

Complex data streams include:

1. Documents. Large text-based files created by word processors or text editors. Documents are often formatted for interpretation and manipulation by a specific application, and commonly contain embedded or linked BLOBs (e.g., graphics and spreadsheets).

2. Spreadsheets. Tables of two or more dimensions usually holding numerical information. Many financial accounting needs are performed on computer spreadsheets to utilize the automated cross checking, editing, and mathematical processing capabilities. Applications which create spreadsheets also commonly manipulate the data to produce graphical charts.

3. Graphics. Simple or complicated drawings. CAD/CAM systems and graphics programs such as MacDraw or Visio can be used to create these pictures.

4. Video and Sound. Video and sound digitally recorded and manipulated by software under user direction.

5. Hypertext. Compilations of various text, video, and sound linked together. Applications that create and manipulate hypertext allow users to review various topics and seamlessly jump to related topics.

C. COMPLEX DATA STREAM STANDARDIZATION ISSUES

1. Trends toward development of new data types (e.g. other than integer, character, string, and date) require data administration to extend data sharing and data reuse disciplines to account for these new data types. Files produced by word processors, spreadsheets, graphics applications, and other productivity improvement applications are becoming a more widely 'shared' resource within some organizations than traditional character and numeric types of data extracted from databases. Standards need to be defined if complex data streams are to be effectively shared when stored in BLOB type fields.

2. Standards for BLOBs can be viewed at two levels:

a. Internal Storage Format Standards. Within the types of BLOBs being created, various standards exist to increase the shareability among applications in the same product type. For example, the Standard Generalized Markup Language (SGML) has been created as a formatting language in word processing documents. This standard facilitates the sharing of documents because any SGML compliant word processor can read the document file. Within the graphics arena, various standards exist for the organization of the data files. These standards can serve as a basis for any graphics program, increasing the compatibility between graphics program~~.~~ The knowledge of such standards is important, and organizations should encourage vendors to adopt common storage formats.

b. Description Standards. Standards should be developed for the metadata associated with BLOBs. These standards will allow data administrators to manage the object's reuse, regardless of internal format. Three issues must be addressed:

(1) The existing application types will increase in capability and complexity, with the potential for creating composite complex data streams. The use of multiple applications to create one final product (e.g., word processor, graphics and spreadsheet application products are combined to produce a single document) has already placed a heavy emphasis on sharing.

(2) BLOBs are now being recognized as formal data types that can be managed and reused as a very simple form of information object. Under the Object Oriented paradigm, for example, BLOBs can be administered as encapsulations of methods and data. However, procedures for administering object reuse are immature, and few repository tools exist to support object reuse.

(3) Object Oriented technologies are sold largely to formalize practices for managing object reuse, and to increase productivity of system analysis, design, and development. An object management infrastructure must exist to support object search, discovery, create, and store activities across system development projects if these reuse objectives are to be fulfilled.

D. MODEL OF DATA REQUIRMENTS FOR BLOB REUSE

1. Perspective

The logical model for complex data streams, Figure 4-1, is designed to track the applications used to create BLOBs, and to identify substitute applications capable of reading and further manipulating the BLOBs.

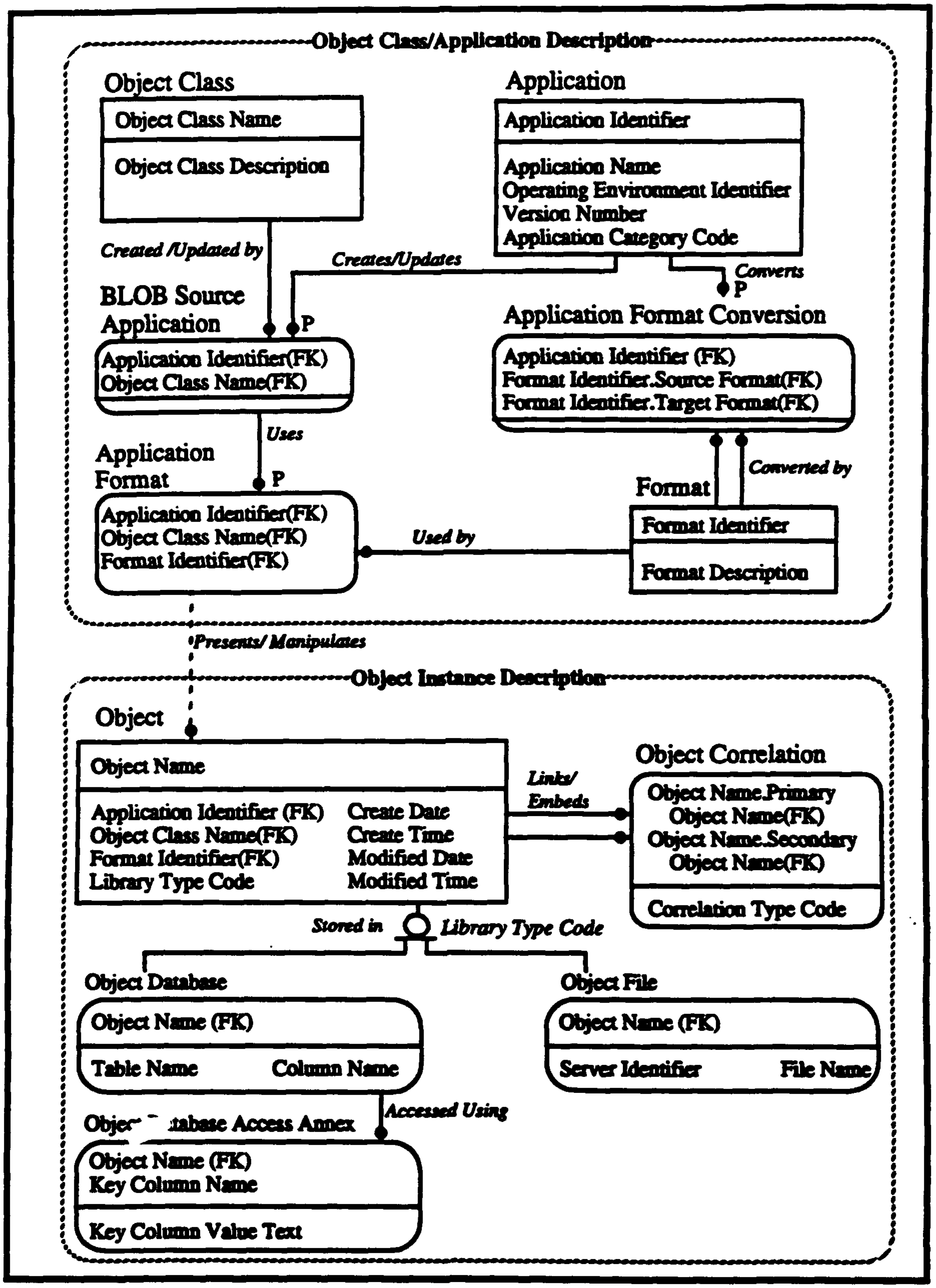


Figure 4-1 Preliminary Logical Data Model of Data Requirements for Administering Complex Data Streams as Reusable Assets

2. Semantic Rules

A BLOB is created by an application, and can be accessed for viewing and further manipulation by the same application or any other application capable of parsing the format under which the BLOB is stored. A model designed to facilitate BLOB reuse must account for the following inherent characteristics of BLOBs and applications that create/manipulate BLOBs:

a. A many-to-many relationship exists between applications and the different types of BLOBs (e.g., document, graphics, and spreadsheets) they can create/manipulate.

b. A many-to-many relationship exists between an application and the format(s) it can use to access a specific type of BLOB. One standard format can be supported by multiple applications, and a single application may support or translate multiple formats.

c. A BLOB can link to or embed other BLOBs (e.g., a word processing document can have embedded graphics).

d. The manipulations that an application can perform on a BLOB may be constrained by the syntax of the format in which the BLOB is stored. For example, a word processing application will often not edit an embedded graphic. It may, however, allow linking to the authoring graphic application for editing.

e. Currently no universally accepted standards exist for formatting the various types of BLOBs (e.g., word processing, spreadsheet, graphics, and voice). Although there is some movement to provide import and export capabilities to share files across different applications, in the short term applications will continue to create and store files in incompatible formats.

3. Relational Model Overview. A relational model in Figure 4-1 supports semantics described above using 11 entities. These entities divide into two groups:

a. Object Instance Description. Five entities in the lower half of Figure 4-1 describe object instances (i.e., data streams) registered for reuse in either a library of files or in a database repository. Presumably the repository is managed by an Object Oriented or a Relational DBMS that would store the information in BLOB fields. Data for these five entities could be populated or updated as a part of registering a specific object (e.g., a specific diagram or chart) for reuse. It would be deleted when an object instance is removed from the library. The parent entity named "object" contains information that allows a user to determine what application created the object (e.g., MacDraw II), what type of object it is (e.g., graphic), and what format is used to store the library copy (e.g., PICT). Data access software could use this information to automatically retrieve the data stream from the library using location data in either the Object File or the Object Database and associated Object Database Access Annex entities. Users not having the requisite application on their workstation, if well versed in the capabilities of different applications available in the office, could identify a substitute applications to access the data. The Object Correlation entity records what objects are linked or embedded with other objects - providing some measure of reuse within the library, and data required for configuration management of the object instance.

b. Object Class/Application Description. Six entities in the upper half of Figure 4-1 describe object classes (e.g., graphics), applications that create instances for each object class (e.g., graphics programs such as MacDraw II, Visio, or Harvard Graphics), and the file formats these applications can accept as inputs and produce as outputs (e.g., PICT). A database containing this information would allow data access software to automatically identify substitute applications for accessing a specific object instance stored in the reuse library. This information is very stable; it can be catalogued each time an application is purchased as a supported "standard" for the open system environment (OSE). The documentation captured in these entities and middleware to support data access to this data represents a benefit provided to organizations that comply with the OSE standards adopted by the organization.

4. Entity Descriptions

a. Object Class. Specifies the type of objects which can occur. Example types are document, graphics, and spreadsheet.

b. Format. Identifies and describes formats supported across the different applications (standard, and proprietary) used to store BLOBs. The description simply communicates the semantics supported by a format without attempting to convey any information about the syntax used. For example, a description tells what the format can generally support in terms of object classes and methods, but reveals nothing about the code stored in position 1 or what a specific sequence of special characters represents).

c. Application. Documents existing applications that create and/or perform operations on BLOBs. An application can have BLOB Source Application and/or Application Format Conversion capabilities.

d. BLOB Source Application. Lists all the Object Classes a specific application supports. Some applications (e.g., Excel and Enable) are capable of producing objects falling within multiple object classes (e.g., spreadsheet, graphic, and document).

e. Application Format. Lists all formats supported by a specific BLOB Source Application. Compatibility among BLOB Source Applications is detected by shared formats (e.g., MacDraw II and Visio are compatible graphics applications because both applications operate on files stored using the PICT format).

f. Application Format Conversion. Lists all conversions that a BLOB conversion application supports by correlating source formats with allowable target format options (e.g., Microsoft Word source format to a WordPerfect target format).

g. Object. Identifies and describes all objects created that represent reusable assets. Each object:

(1) Refers to its source application through the Application Identifier.

(2) Belongs to an object class specified by the Object Class Name attribute.

(3) Stores information in a specific format specified by the Format Identifier.

(4) Has special locational attributes that direct users to where the authoritative version of an object is stored based on differentiation provided by a Library Type Code. The model shows example attributes for Database and File type libraries:

(a) Object Database. Describes where to locate an object stored within a BLOB field of a database (e.g., what table and column).

(b) Object Database Access Annex. Lists column names and column values for identifying a unique row in a database table storing a specific object.

(c) Object File. Describes where to locate an object stored as a file on a server (e.g., Server identifier, and file name).

h. Object Correlation. Records object linkages or embedding. If the linked and embedded objects are stored, the ability to track changes to the original BLOB is required. Administrative information, such as a create date, last change date, and version number, assigned to each Object instance could be used to track updates.

5. An Extension on Methods. If the six entities in the top half of Figure 4-1 are used to support automated capabilities for identifying substitute applications for accessing and displaying the data, then capabilities of the substitute application to process the data may become an important discriminator for selecting among multiple substitutes. Figure 4-2 introduces two new entities into the model described above that record these capabilities:

a. Method. Identifies and describes the types of actions that can be performed on different types of objects (e.g., play, edit, display).

b. Method-Application Format Correlation. Identifies the actions available for a specific Application Format. This information communicates constraints for compatibility across different Application Formats (e.g., Visio can display and edit a graphic in the 'PICT' format, while WordPerfect can only display the graphic in the 'WPG' format).

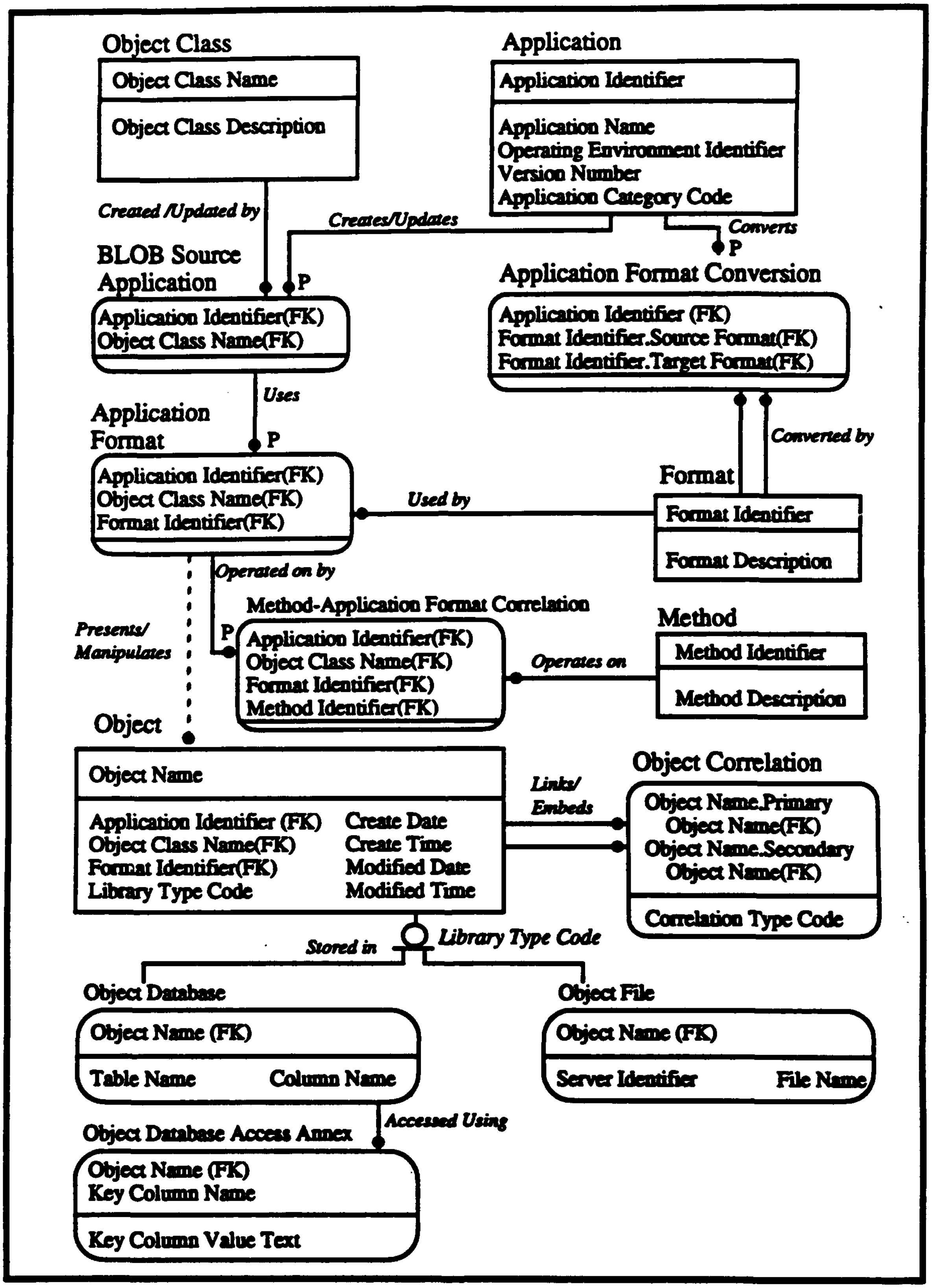


Figure 4-2 Methods Extension of Model for Administering Complex Data Streams

E. EXAMPLE COMPLEX DATA STREAM REUSE APPLICATION

1. Figure 4-3 presents an example application for Complex Data Stream reuse using graphic, spreadsheet, and document types of information.

2. A WordPerfect document named 'Strategy Plan' uses spreadsheet and graphics information that are also cataloged separately:

a. 'Projected Expenses' is a LOTUS 1-2-3 spreadsheet saved in a relational database using a BLOB type field.

b. 'Agency Organization Chart' is a MacDraw II graphic stored in a graphics file in a directory established for reusable graphics.

3. The 'Strategy Plan' is stored in a WordPerfect document in a text library established for reusable documents.

F. MODELED DOCUMENTATION OF THE COMPLEX DATA STREAM

1. Figure 4-4 uses the model developed in Figure 4-1 to capture the example complex data stream application.

2. Each of the object classes defined in this report (i.e., document, graphic, spreadsheet, and others) are identified in the Object Class entity.

3. A sample of applications used to create and manipulate BLOBs (i.e., Application Category Code = 'Source') is defined in the Application entity along with one application for converting BLOBs across a set of widely used formats (i.e., Application Category Code = 'Conversion' for the application named 'MacLink'). The application identifier is used as a key to relate information in the Application entity to information in the BLOB Source Application, Application Format Conversion, and Application Format entities (e.g., Application Identifier = '4' specifies WordPerfect, DOS, Version 5.1).

4. Sample records in the Application Format entity for the WordPerfect, Microsoft Word, MacDraw, Visio, LOTUS 1-2-3, and Excel applications illustrate how compatibility among these source applications can be inferred from file formats shared across the different

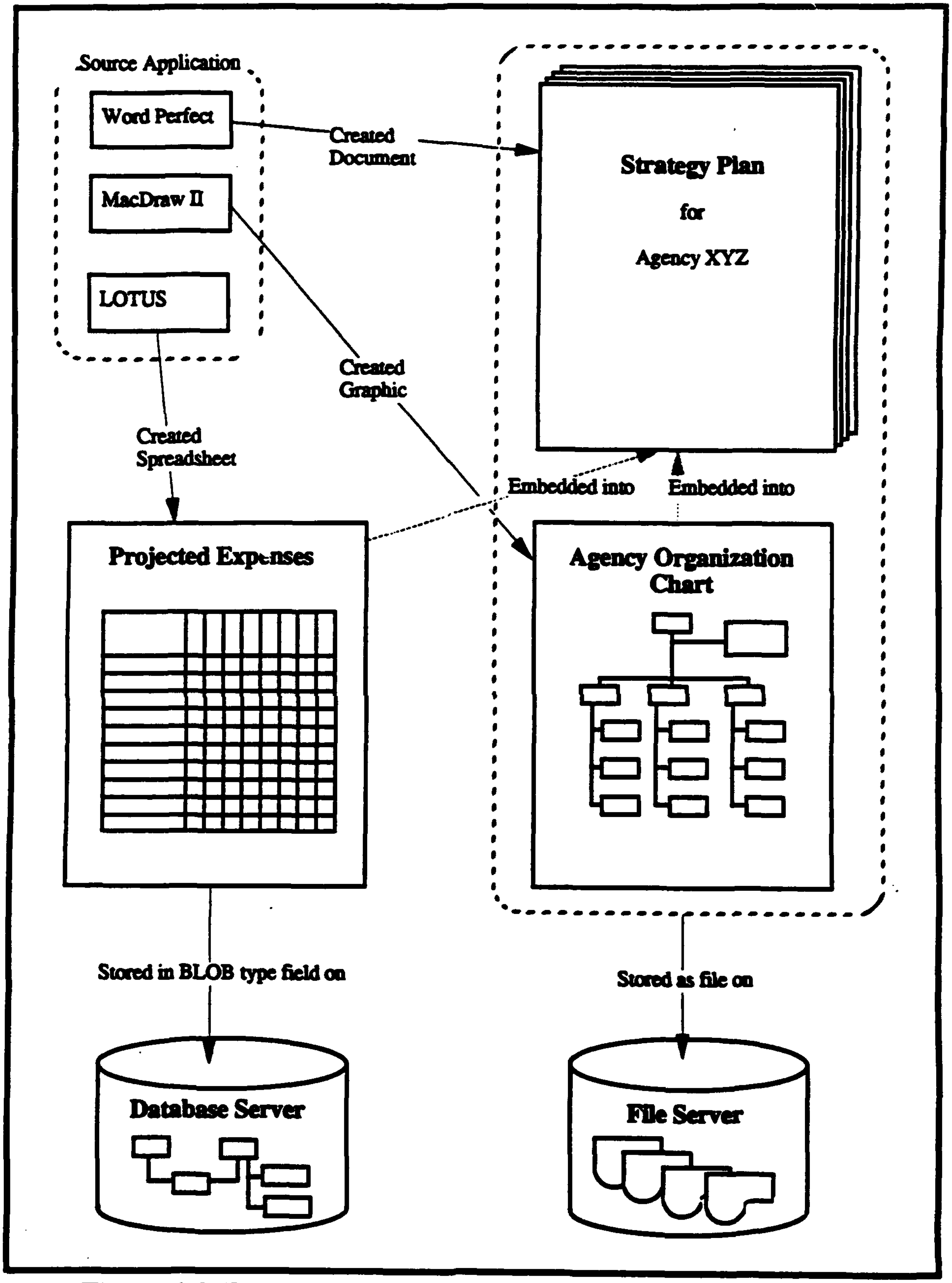


Figure 4-3 Example Complex Data Stream Reuse Application

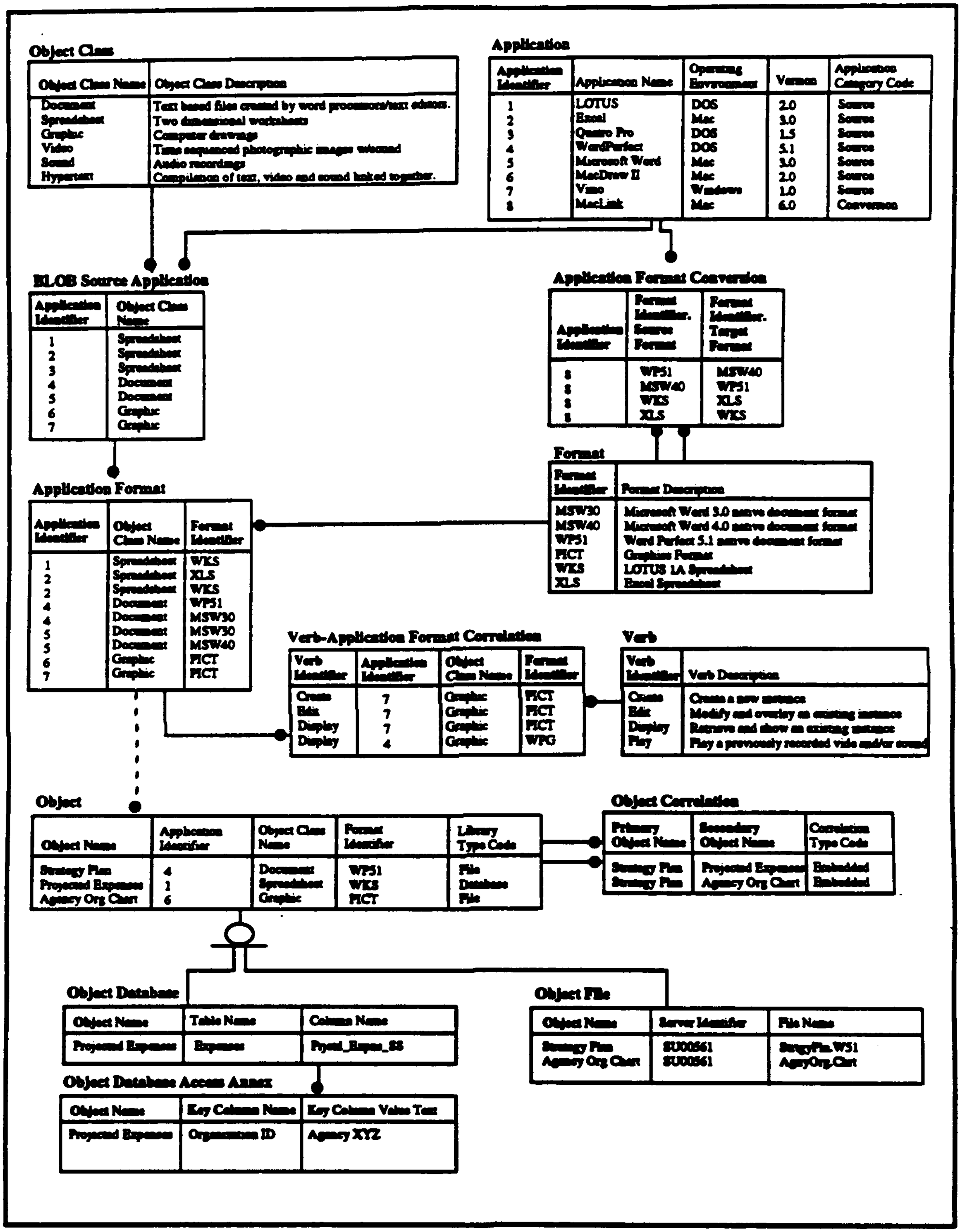


Figure 4-4 Documentation of the Example Binary Large Objects in the Model for Administering Reuse of Complex Data Streams

applications (e.g., WordPerfect 5.1 can access and store documents in Microsoft Word 3.0 formats, but Microsoft Word will not read or write WordPerfect documents).

5. Sample records in the Application Format Conversion entity for the MacLink application illustrate how BLOBs can be shared across applications which otherwise show little or no compatibility. For example, Microsoft Word 3.0 files (i.e., format 'MSW40') can be converted to WordPerfect 5.1 files (i.e., format 'WP51')).

6. The three reusable objects described for the example are recorded in the Object entity. Use of the 'Organization Chart' graphic and 'Projected Expenses' spreadsheet by the 'Strategy Plan' document is depicted in the Object Correlation entity. Location information for each of the objects is documented in the Object Database and Object File entities.

7. A small sample of data in the Verb-Application Format Correlation entity related the 'WPG' format used for WordPerfect graphics and the 'PICT' format shared between MacDraw II and Visio illustrates how object manipulation constraints can be recorded. The Visio supports 'Create', 'Edit', and 'Display' actions on the 'PICT' format, while WordPerfect only supports 'Display' actions on the 'WPG' format ('WPG' format needs to be confirmed).

G. ROLE OF DATA STANDARDIZATION IN SUPPORTING BLOB REUSE

1. It will take some time to develop standard formats for documents, graphics, spreadsheets, and other classes of BLOBs. However, concepts represented in the relational data model presented in Figures 4-1 and 4-2 are currently being implemented in widely varying and incompatible ways by a number of commercial applications (e.g., Microsoft's OLE, IBMs IRMS, Lotus Notes). Each time a proprietary variant is implemented, the prospects for implementing enterprise-wide approaches for sharing complex data streams as corporate assets get more complex; the codes used to identify different object classes, applications, and formats will vary across the implementations. To minimize the impact of proprietary solutions on sharing data streams across the enterprise, standards are needed for six of the attributes appearing in Figures 4-1 and 4-2:

a. Object Class Name
b. Application Identifier
c. Application Name
d. Operating Environment

d. Format Identifier

e. Method Identifier

2. These elements are likely to be developed by many middleware applications supporting the reuse of BLOBs. They also have domains of values that will be defined differently in each case unless proactive action is taken for standardizing the elements.

3. Interest in standardization of these elements extends beyond the boundaries of DoD, and it would be in DoD's interest to promote a project to standardize these elements at a national level through the American National Standards Institute (ANSI).

CHAPTER 5

ASSEMBLIES

A. DEFINITION

Assemblies represent entities which have relationships to themselves (i.e., instances within the entity relate recursively to other instances within the same entity). Organization structures, equipment assemblies and subassemblies, and geographic terrain features such as roads, rivers, and facilities all represent examples of assemblies. Assemblies often represent dominant entities which commonly appear across multiple functional data models. The relationships assembly entities have to themselves are commonly called recursive relationships.

B. REUSABILITY ISSUES

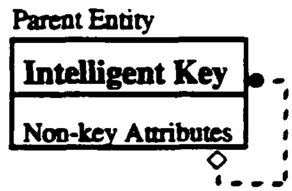
1. Model reuse has largely been viewed from the perspective of functional or subject area oriented classifications (e.g., personnel, logistics, finance, and operations). Assemblies represent commonly recurring objects that span functional areas and provide focal points for model integration.

2. Elements of recursion found within assemblies are intellectually complex, and are treated differently in different models. In fact, much of the knowledge gained by the modeler in discovering the correct representation of an assembly often never gets communicated through the depiction of entity relationships; rather, they are represented in edits developed for add, change, and delete operations or event triggered alerts. These rules should be communicated with the model, possibly as extensions using structured English or predicate calculus.

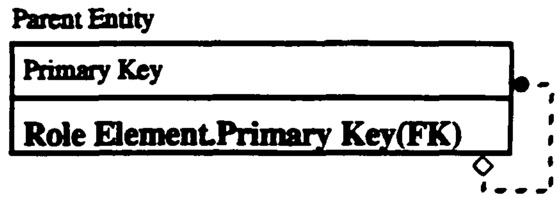
3. Analogous to the improvement in program readability brought about by structured programming, standard templates for the treatment of recursion would improve model readability for assemblies. Possible elements of these templates are:

a. Standard entity relationship profiles for modeling recursion. Examples for one-to-many and many-to-many entity relationship profiles for recursive relationships are depicted in Figure 5-1. Standard profiles developed for treating recursive relationships in data modeling would be analogous to standard structured programming constructs developed for control logic such as 'DO WHILE', 'DO FOR', and 'DO UNTIL' looping.

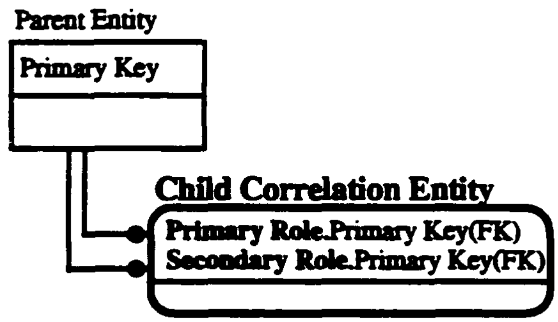
Intelligent Key: One-to-many recursive relationship based on intelligence embedded in the coded values of the key (e.g., 0.0, 1.0, 1.1, 1.1.1, 1.1.2, 1.1.2.1)



Foreign Key Role Element: One-to-many recursive relationship based on linking foreign key of a child entity instance to the primary key of another parent entity instance.



Child Correlation Entity: Many-to-many recursive relationship correlating a child entity having primary and secondary foreign key role elements. The names assigned to these foreign keys indicate the nature of the relationship between entity instances in the parent entity.



Association: Many-to-Many Recursive Relationship based on creation of an independently identified Association entity. The association entity is related to the parent entity using an Association Member correlation entity. The association identifier is a fabricated element which ultimately is system maintained. Roles are identified by assigning values to an Association Role Code in the Association Member entity.

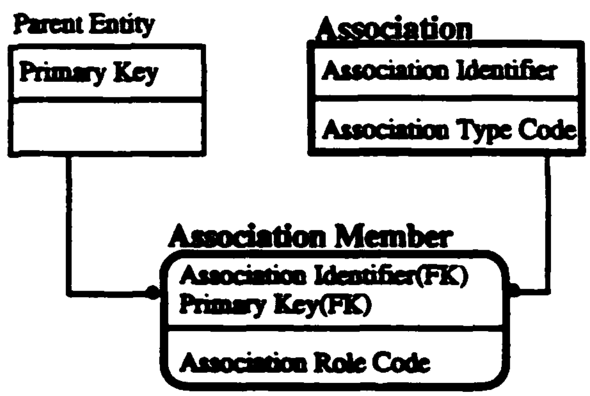


Figure 5-1 Example Alternative Profiles for Modeling Recursion

b. Standard vocabulary for naming associative entities designed to support a recursive relationship (e.g., suffixes to the entity name, such as 'Correlation', 'Association' and 'Association Member'). If used in a standard way, these words would alert readers that the entities are designed to support a recursive relationship.

c. Standard vocabulary terms for naming relationships supporting recursion within a single entity.

D. REUSABILITY GUIDANCE

1. Guideline templates on structured modeling for Assemblies should be developed. Figures 5-2 through 5-5 represent a starter set of templates which expand on the profiles identified in Figure 5-1. Evaluation criteria need to be developed as part of the guidelines to help modelers select among the templates. Five evaluation criteria for selecting among the templates shown in Figures 5-2 through 5-5 follow:

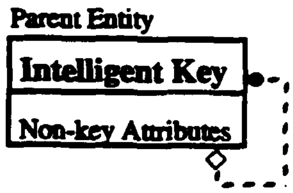
a. Simplicity of Syntax. This criteria measures the ability of the template to represent recursion without introducing a lot of new entities and attributes into the model. A few entities and attributes are better than many entities and attributes. For example, the Intelligent Key template's approach would score well by this criteria because it introduces no new entities or attributes. In contrast, the Association approach introduces two new entities and three new attributes, and would rate lower by this criteria.

b. Maintainability. This criteria measures the difficulty of maintaining recursive relationships among data instances using a template. Lowering the requirements to cascade an update to multiple records is particularly desirable. Notice, for example, that if the Intelligent Key named 'Work Breakdown Identifier' (Figure 5-2, part C) changes for a high level node (e.g., change 2.0 to 5.1), the update will cascade to all lower level nodes (i.e., 2.1, 2.2, and 2.3 would change to 5.1.1, 5.1.2, and 5.1.3 respectively). This is an undesirable characteristic of the Intelligent Key template. In contrast, reassigned key values in a Correlation Entity template (Figure 5-4) do not cascade to other records; this makes the Correlation Entity a more desirable template from the maintainability perspective.

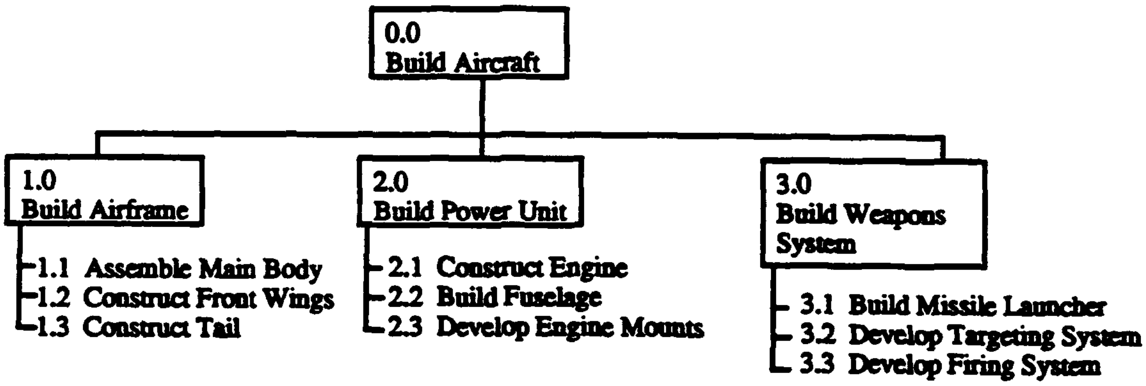
c. Flexibility. This criteria measures the ability of a template to support 'many-to-many' as well as 'one-to-many' cardinality for recursive relationships. If there are possible exceptions to a one-to-many rule, it is best to model the relationship using a template that

Intelligent Key

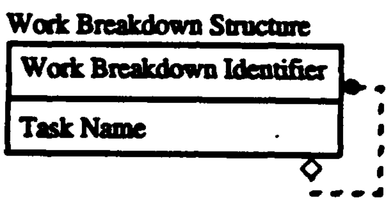
A. General Syntax



B. Example Work Breakdown Structure For Building and Airplane



C. Modeled with Intelligent Key



D. Example Instance Table

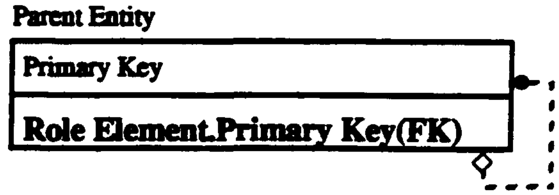
Work Breakdown Structure

Work Breakdown Identifier	Task Name
0.0	Build Aircraft
1.0	Build Airframe
1.1	Assemble Main Bode
1.2	Construct Front Wings
1.3	Construct Tail
2.0	Build Bower Unit
2.1	Construct Engine

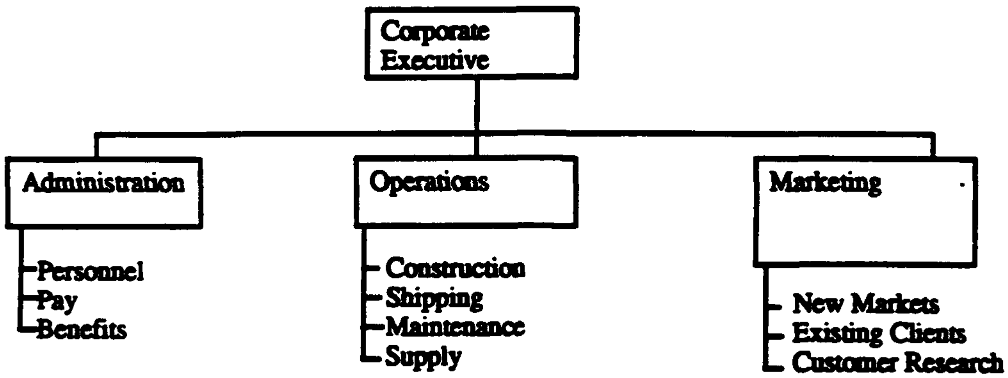
Figure 5-2 One-to-Many Recursive Relationship Modeled with Intelligent Key

Foreign Key Role Element

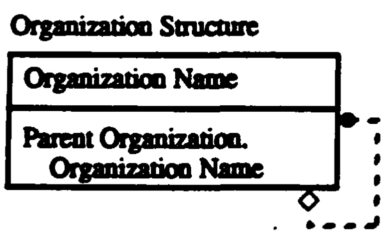
A. General Syntax



B. Example Organization Structure



C. Modeled with Foreign Role Key



D. Example Instance Table

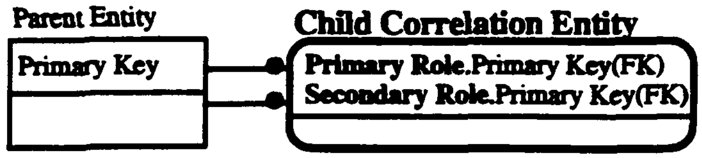
Organization Structure

Organization Name	Parent Organization
Corporate Executive	"
Administration	Corporate Executive
Personnel	Administration
Pay	Administration
Benefits	Administration
Operations	Corporate Executive
Construction	Operations
Shipping	Operations
Maintenance	Operations
Supply	Operations

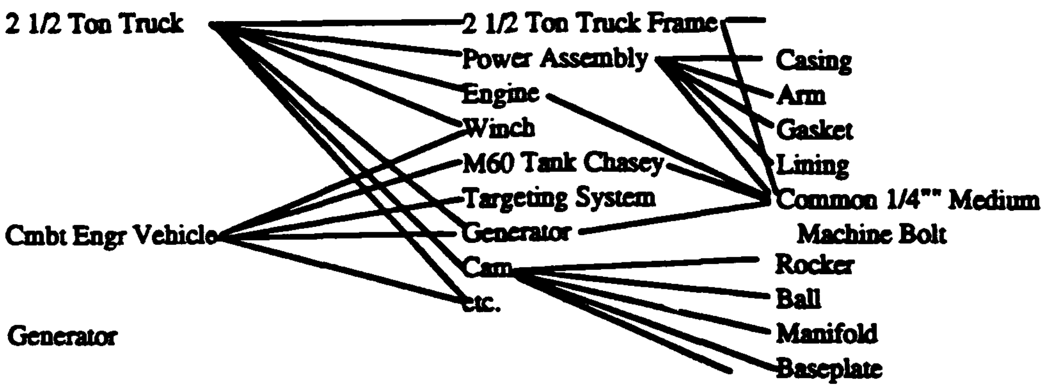
Figure 5-3 One-to-Many Recursive Relationship Modeled with Foreign Role Key

Child Correlation Entity

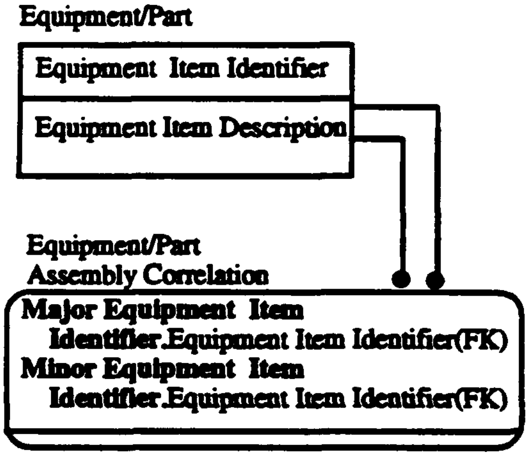
A. General Syntax



B. Example Equipment/Assemblies Structure



C. Modeled with Correlation Table



D. Example Instance Table

Equipment/Part

Equipment Item Identifier
2 1/2 Ton Truck
Cmbt Engr Vehicle
Winch
Cam
Rocker

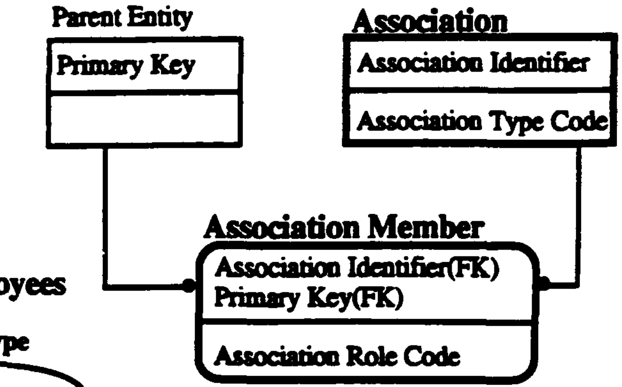
Equipment/Part Assembly Correlation

Major Equipment Item Identifier.	Minor Equipment Item Identifier
2 1/2 Ton Truck	Winch
2 1/2 Ton Truck	Cam
Cmbt Engr Vehicle	Winch
Cam	Rocker

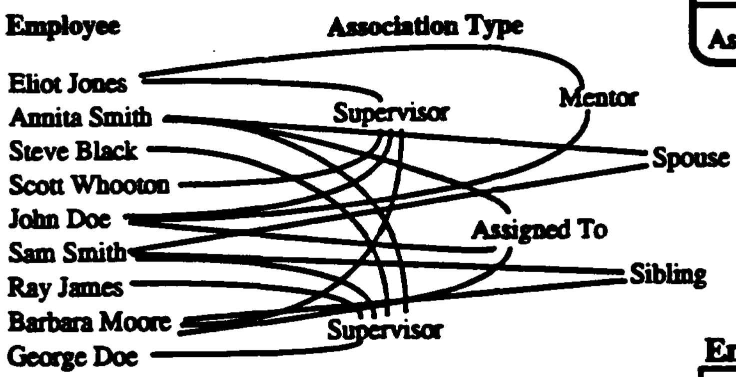
Figure 5-4 Many-to-Many Recursive Relationship Modeled with Correlation Entity

Association

A. General Syntax



B. Example Associations Among Employees



C. Example Association Documentation

Employee Association

Association Identifier	Association Type Code
001	Supervisor
002	Supervisor
003	Assigned To
004	Sibling
005	Spouse
006	Mentor

Employee

Employee Number	Employee Name
501	Eliot Jones
502	Annita Smith
503	Steve Black
504	Scott Whooton
505	John Doe
506	Sam Smith
507	Ray James
508	Barbara Moore
509	George Doe

Employee Association Member

Association Identifier	Employee Number	Association Role Code
001	501	Manager
001	504	Subordinate
001	505	Subordinate
001	508	Subordinate
003	502	Manager
003	505	Subordinate
003	508	Subordinate

⋮

Figure 5-5 Many-to-Many Recursive Relationship Modeled as Association

supports many-to-many relationships. Both the Intelligent Key (Figure 5-1) and the Foreign Role Key (Figure 5-2) templates are incapable of supporting many-to-many cardinality, and score low in their flexibility. Because the Correlation Entity (Figure 5-4) and the Association (Figure 5-5) templates both support many-to-many as well as one-to-many cardinality for the recursive relationships, they are preferable alternatives from the flexibility perspective.

d. Extensibility. This criteria measures the ability of a template to adapt to new types of recursion after design or implementation of the database. Each of the templates that force the modeler to either embed intelligence into the key or into the name of a 'role element' (i.e., Intelligent Key, Foreign Role Key, and Correlation Entity templates) place some limitations on the extensibility of the recursive relationship. The relationship is bounded to some degree by the role element's name. For example, in Figure 5-3 part C, the element named 'Parent Organization' restricts the relationship to support the definition of a 'higher level authority'. Sibling type relationships (e.g., supplier/customer) could not be supported. A similar type of restriction is embedded in the names 'Major Equipment Item Identifier' and 'Minor Equipment Item Identifier' assigned to role elements for the Correlation Entity template. These names prohibit the relationship from tracking 'standard' and 'substitute' parts. The multiple types of relationships shown by example for the Association template (e.g., Supervisor, Sibling, and Spouse in Figure 5-5, parts B and C) illustrate extensibility possible when the roles can be designated by value assignments rather than name assignments (e.g., values for the Association Role Code in the Association Member entity).

e. Intellectual Complexity. This criteria measures how easily the template communicates model semantics. A compromise position must be discovered for reducing clutter introduced by embedding role information in entity names and attributes names, and avoiding of intellectual complexity introduced by abstraction. The Association template encourages relationship abstraction; this results in many fewer entities and elements than the Correlation Entity template. However, it's important to note that entities and attributes are reduced by loading business rules into the domains of allowable values assigned to role elements in the Association template. This makes the overall model easier to understand in general, but more difficult to understand in detail. When the Correlation Entity template is used and roles are assigned through the entity or attribute names, users must grasp the meaning of many more entities and attributes before formulating the SELECT clause of a query. When the Association template is used and roles are assigned as attribute values, the user must grasp the meaning of many more domain values before formulating the WHERE clause of a query. This gives credence to the idea that data modelers must be concerned about domain values because they always relate to a more detailed set of business rules than entity relationship diagrams are designed to communicate.

2. As suggested in Figure 5-6, no single template can be declared the "standard" or "preferred" approach for all situations. Just as a programmer must decide which construct to use in controlling program logic (e.g., 'DO WHILE' versus 'DO FOR'), modelers must decide which template is appropriate. Just as some algorithms are complex enough to require nesting of different control logic, assemblies may be complex enough to require merging of several templates.

3. Assembly type objects should be identified within functional models and separated for reuse independently of the functional model. The following criteria are provided to help identify assemblies within a data model:

a. An independently identified entity has numerous one-to-many relationships oriented away from the entity.

b. The entity has one or multiple recursive relationships associated with it.

c. The entity appears to exist in different functional models.

4. Use of assemblies by various functional data models should be tracked to support configuration management of the assembly as its semantics become more clearly understood and focused with each reuse.

Evaluation Criteria \ Alternative	Intelligent Key	Foreign Key Role Element	Child Correlation Entity	Association
Simplicity of Syntax	••••	•••	••	•
Maintainability	•	•••	•••	•••
Flexibility	•	••	•••	•••
Extensibility	•	•	••	••••
Intellectual Complexity	••	•••	•••	••

Legend	• - Poor •• – Fair ••• - Good •••• - Excellent

Figure 5-6 Evaluation of Alternative Templates for Representing Recursive Relationships in Assemblies

APPENDIX A
REFERENCES

(a) FIPS Pub 11-3, "American National Dictionary for Information Systems, Federal Information Processing Standards Publication," (adopted in entirety from American National Standards Institute (ANSI) X3.172-1990), February 1991.

(b) National Bureau of Standards (NBS) Special Publication 500-149, "Guide on Data Entity Naming Conventions", October 1987.

(c) National Bureau of Standards (NBS) Special Publication 500-152, "Guide to Information Resource Dictionary System Applications: General Concepts and Strategic Systems Planning," April 1988.

(d) DoD Directive 8320.1, "Department of Defense Data Administration," September 26, 1991.

(e) DoDD 5200.28, "Security Requirements for Automated Information Systems," March 21,1988.

(f) DoD 8320.1-M-1 (Draft), "DoD Data Element Standardization Procedures," January 1993

(g) NIST Special Publication 500-208, "Manual for Data Administration," National Institute of Standards and Technology, March, 1993.

(h) Army Regulation 18-19, "Troop Program Sequence Number", Headquarters, Department of the Army, Washington, DC, 5 December 1986

(i) Philip Cykana, "White Paper: Derived Data, Data Standardization, and Conceptual Schemas," Defense Information Systems Agency, Joint Interoperability and Engineering Organization, Center for Information Management/XD, Data Administration Program Management Office, 21 April 1993

(j) Major Ronald S. Merriman, "Complex Data and the DoD Data Administration Program," US Army Office of the Director of Information Systems for Command, Control, Communications, and Computers, December 1993

APPENDIX B
DEFINITIONS

1. Assemblies. Data structures which include recursive relationships (i.e., instances within the entity are related to other instances within the same entity). Organization structures, roads, buildings, and equipment part assemblies are all examples of assemblies.

2. Attribute. A property or characteristic of an entity; for example, COLOR, WEIGHT, SEX. Also, a property inherent in an entity or associated with that entity for database purposes. (FIPS Pub 11-3 (reference (a)))

3. Chain. See Data Chain.

4. Complex Data Element. A data element that cannot be fully described as a single attribute within a data model.

a. Composite Data Elements. Data elements which embed intelligence about multiple concepts in their names, definitions, and domains.

b. Derivations. Data elements representing concepts computed, aggregated, transformed or inferred from the values of one or more other data elements.

c. Data Streams. Bundles of information carried in sequence which represent information in a variety of forms (e.g., graphics, voice, text documents, and spreadsheets).

5. Composite Data Element. A data element designed to communicate information about more than one concept by embedding intelligence in the name or the coding of values. See Data Chain, Data Coupling, Multipurpose Data Element, and Heterogeneous Domain.

6. Coupled Data. See Data Concept Coupling.

7. Data. A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automatic means. (FIPS Pub 11-3 (reference (a)))

8. Data Administration. That function of the organization which oversees the management of data across all functions of the organization, and is responsible for central information planning and control. (NBS Special Pub 500-149 (reference (b)))

9. Data Attribute. A characteristic of a unit of data such as length, value, or method of representation. (FIPS Pub 11-3 (reference (a)))

10. Data Chain. A composite data element that links an ordered set of concepts within its coded values (e.g., Equipment Order Code with sample Domain (AB001, AB002, AC001, AC002) where the first two positions identify the type of equipment, and the last four positions identify the order number for that type of equipment).

11. Data Concept Coupling. The embedding of two or more concepts within a data element's name or domain of allowable values.

a. Coupled Concepts in the Name. Elements with domain values for two or more other elements embedded in their names (e.g., Materiel Inventory Second Fiscal Year Authorized Quantity conveys domain values for two concepts it its name: Fiscal Year with Domain (1, 2, 3, ...), and Inventory Status Name with Domain (Authorized, Required, Damaged, ...)). This element should be reformulated to carry at only set of domain values in the name, and only if the domain is stable and has fewer than ten values.

b. Coupled Concepts in the Domain. Elements with domain values that are not mutually exclusive (e.g., Plan Objective Rating Code with Domain (A =Priority 1, Easy; B=Priority 2, Easy; C=Priority 1, Difficult, D=Priority 2, Difficult, ...)). This element should be reformulated as two elements: Plan Objective Priority with Domain (1, 2, 3, ...) and Plan Objective Rating Name with Domain (Easy, Moderate, Difficult, ...)

12. Data Dictionary. A specialized type of database containing metadata managed by a data dictionary system; a repository of information describing the characteristics of data used to design, monitor, document, protect, and control data in information systems and databases; and application of a data dictionary system. (FIPS Special Pub 500-152 (reference (c))).

13. Data Element. A named identifier of each of the entities and their attributes that are represented in a database. (FIPS Pub 11-3 (reference (a)))

14. Data Element Formulation. The design of a data element in terms of it's name, definition, type (e.g., character, date, integer, decimal), length, domain of allowable values, data steward specification, security characteristics and other attributes as required to manage the data element as a reusable asset.

15. Data Element Mapping. Documentation describing how two or more data element formulations overlap in meaning.

16. Data Element Standardization. The process of documenting, reviewing and approving unique names, definitions, characteristics and representations of data elements according to established procedures and conventions.

17. Data Entity. An object of interest to the enterprise, usually tracked by an automated system. (NBS Special Pub 500-149 (reference (b)))

18. Data Model. In a database, the user's logical view of the data in contrast to the physically stored data, or storage structure. A description of the organization of data in a manner that reflects the information structure of an enterprise. (FIPS Pub 11-3 (reference (a)))

a. Logical Data Model. A model of the data stores and flows of the organization derived from the conceptual business model. (NBS Special Pub 500-149 (reference (b)))

b. Physical Data Model. A representation of the technologically independent requirements in a physical environment of hardware, software, and network configurations representing them in the constraints of an existing physical environment.

19. Data Steward. The person or group that manages the development, approval, and use of data within a specified functional area, ensuring that it can be used to satisfy data requirements throughout the organization.

20. Data Structure. The logical relationships which exist among units of data and the descriptive features defined for those relationships and data units; an instance or occurrence of a data model. (NBS Special Pub 500-152 (reference (c)))

21. Database. A collection of interrelated data, often with controlled redundancy, organized according to a schema to serve one or more applications; the data are stored so that they can be used by different programs without concern for the data structure or organization. A common approach is used to add new data and to modify and retrieve existing data. (FIPS Pub 11-3 (reference (a)))

22. Dictionary. See Data Dictionary.

23. DoD Data Model. A corporate level data model developed based on the integration of data models developed within individual functional areas.

24. Domain. The set of permissible data values from which actual values are taken for a particular attribute or specific data element. In a relational database, all of the permissible tuples for a given relation. (FIPS Pub 11-3 (reference (a)))

a. General Domain. The permissible data values allowed in representations of a data element defined in terms of the character set which can be used; e.g., A-Z, 0-9, etc.

b. Specific Domain. An enumerated set of values allowed in data representations of a data element; e.g., Friday, Saturday, Sunday.

25. Entity. See Data Entity.

26. Information System. The organized collection, processing, maintenance, transmission, and dissemination of information in accordance with defined procedures, whether automated or manual (DoDD 5200.28 (reference (e)), modified)

27. Metadata. Information describing the characteristics of data; data or information about data; descriptive information about an organization's data, data activities, systems, and holdings. (NBS Special Publications 500-152 (reference) (c))).

28. Migration Data. Data from or within a migration system. See also Migration System.

29. Migration System. An existing automated information system, or a planned and approved automated information system, that has been officially designated to support standard processes for a functional activity applicable DoD-wide or Component-wide.

30. Multiple Purpose Element. Elements formulated to have multiple meanings based on the context of the record or values held by other fields in the record (e.g., Equipment Sterwardship Assignment Code with Domain (AO=Admin Office, ES= Engr Shop, ... other organizations) when the Quantity On-hand > 0, and Domain (PP = Planned Procurement, ET=Exchange Turn-in, ... other status codes) when the Quantity On-hand = 0).

31. Nonstandard Data Element. Any data element that exists in a system or application program and does not conform to the conventions, procedures, or guidelines established by the organization.

32. Standard Data Element. A data element which has been submitted formally for standardization in accordance with the organization's data element standardization procedures.

ABBREVIATIONS AND/OR ACRONYMS

FIPS	Federal Information Processing Standards
OSD	Office of the Secretary of Defense

APPENDIX C
DOCUMENTING DATA ELEMENT GROUP CLASSIFICATIONS

A. INTRODUCTION

This appendix describes how the data models described in Chapters 2 and 3 of this manual may be used to document multiple levels of security or sensitivity for specific data elements when considered in various groupings of other data elements.

B. EXAMPLE CLASSIFIED DATA ELEMENT COMBINATIONS

A data element may be combined with other data elements in a wide variety of ways to produce information. The element may normally be considered as describing relatively low risk information; however, the element may participate in some combinations of elements that collectively describe sensitive data. Figure C-1 summarizes three examples of three levels of data security which commonly occur in DoD:

1. Classified Data Elements. Individual data elements may transmit information which is viewed as classified. In these circumstances, the data element's security classification rating (e.g., classified, secret, top secret) can be assigned as an attribute of the data element itself.

2. Classified Groups of Data Elements. An individual data element considered as transmitting unclassified information may be viewed together with other elements that collectively transmit information that is classified. For example, access to an individual's skills, the capabilities of a piece of equipment, and the planned location of a unit may not in and of themselves be classified. But the fact that a set of people with particular skills, and or equipment with particular capabilities are destined for a unit at a particular location may compromise military intentions, or the Department's knowledge of enemy intentions. To support data security administration and management, data element collections which transmit classified information should be cataloged, and an appropriate security classification should be assigned as an attribute of the group.

3. Classified Value Associations. There are cases where groups of data elements that are normally unclassified may be classified for specific value combinations. This happens when a management code for a classified program is explicitly associated with

Classified Data Elements

Individually the data element carries classified information.

Operation Plan Number	Operation Description
Classified Value 1 Classified Value 2 Classified Value 3 • • •	Unclassified Value 1 Unclassified Value 2 Unclassified Value 3 • • •

Classified Groups of Data Elements

Groups of data elements comprised of members which when taken individually are unclassified, but collectively carry classified information.

Unit Identification Code	Deployment Station Code
Unclassified Value 1 Unclassified Value 2 Unclassified Value 3 • • •	Unclassified Value 1 Unclassified Value 2 Unclassified Value 3 • • •

Classified Value Combination

Classified Value Associations

Groups of data elements that are normally unclassified, but become classified for specific combinations of values.

Unit Identification Code	Program Management Structure Code
Unclassified Value 1	Unclassified Value 1
Unclassified Value 2	Unclassified Value 2
Unclassified Value 3	Unclassified Value 3
Unclassified Value 4	Unclassified Value 4
• • •	• • •

Classified Value Combination

Figure C-1 Example Classified Data Element Groups

a specific unit. These types of data element collections should be cataloged along with the appropriate security classification for the classified value sets, and the values which determine the security classification of the group (e.g., Program Management Structure Code in above example) should be documented.

C. DOCUMENTATION OF THE CLASSIFIED COMBINATIONS

1. Figure C-2 depicts how the relational model proposed for associating composite and derived elements presented in Figures 2-10 and 3-5 can be used to document the classified groups of data elements.

2. From the perspective of this model, classified groups of data elements are viewed as a type of data element association. 'Classified groups of data' is identified as a type of association (i.e., 'SCRTY') in the Association Type entity. The Association Attribute entity identifies four attributes to be recorded for each instance of a classified group of data:

a. Security Classification Code (associate level). The level of restriction for information transmitted by the data element group(e.g., C = classified, S = secret, TS = top-secret).

b. Interruption Risk Level Name (associate level). The impact of interruption or unavailability of data to mission accomplishment (e.g., serious = unacceptable, vital = tolerated for < 3 days, tolerable = tolerated for 3 to 8 days, nonessential = tolerated for > 8 days).

c. Disclosure Risk Name (associate level). The impact of disclosure of information to adversaries (e.g., high = irreparable harm, medium = consequential harm, low = embarrassment/prejudicial harm).

d. Security Class Setting Domain Value (member level). The value for a specific element that, when viewed in combination with values provided by other elements in the group, determines the security classification of information provided by the group of elements.

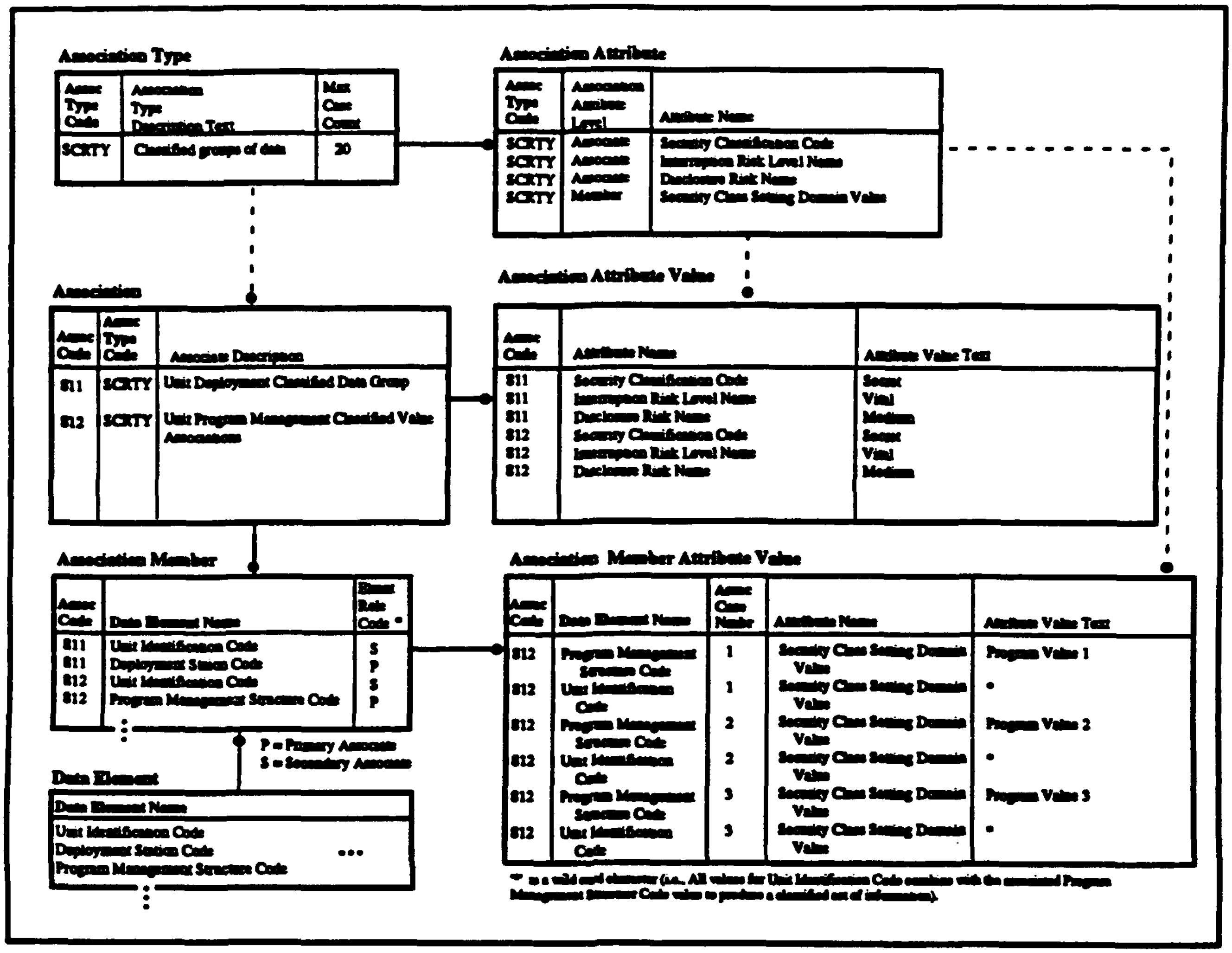


Figure C-2 Documentation of the Example Classified Groupings of Data Elements in the Model

3. Each of the data elements participating in a classified group of data elements are documented in the Data Element entity, and related through the Association Member entity.

4. Each classified group of data elements is identified in the Association entity, and related to participating elements through the Association Member entity. For example, the 'Unit Deployment Classified Data Group' is assigned an Association Code of '811'. This code identifies two elements involved in the group within the Association Member entity (i.e., Unit Identification Code, and Deployment Station Code). Each association includes:

a. One primary or dominant element (Element Role Code = 'P').

b. One or multiple secondary or subordinate elements (Element Role Code = 'S').

5. The 'Unit Program Management Classified Value Associations (Association '812') document which values of the Program Management Structure Code (e.g., Program Value 1, Program Value 2, and Program Value 3) determine the classification of the group.

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Appendix

D. NOTES FROM THE 5TH I/DB WORKSHOP HELD MARCH 4–5, 1993 AT IDA.

1. TABLE OF CONTENTS

2. AGENDA

MEETING OF DMSO I/DB TASK GROUP

THURSDAY, MARCH 4, 1993

8:00—8:30	Overview of meeting and goals, introductions, DMSO status: Tom Shook, Iris Kameny

UPDATE ON DMSO WORKING GROUP AND PROPOSAL ACTIVITIES

8:30—9:00	DMSO Architecture Working Group and call for Architecture for Dynamic Scalability: Cy Ardoin
9:00—9:30	DMSO Environment Working Group and call for Environmental Representation: Paul Birkel
9:30—10:00	DMSO I/DB Task Group and call for Complex Data and Common Tools: Iris Kameny
10:00—10:30	Break
10:30—11:00	Questions and discussion
11:00—11:30	Update on DMSO Information System: Cy Ardoin
11:30—12:00	Update on DMSO database directory IDEF1X model: Iris Kameny
12:00— 1:00	Lunch

UPDATE ON DATA ADMINISTRATION AND STANDARDIZATION EFFORTS

1:00—1:30	Update on NIST standards for IDEF and IRDS: Bruce Rosen
1:30—2:00	DISA/CIM: update on DoD CIM data administration, policy, procedures, modeling, etc.: Bob Molter
2:00—2:30	JIEO Center for Standards: update on FDAd C2 activities and support for Modeling and Simulation: Dunham
2:30—3:00	Questions and discussion
3:00—3:30	Break

REPORTS ON PROJECTS, STANDARDS, VV&C, ETC. ACTIVITIES

3:30—4:30	Report on Close Combat Tactical Trainer (CCTT) project data activities: Rob Wright

FRIDAY, MARCH 5, 1993

CONTINUATION OF REPORTS ON PROJECTS, STANDARDS, VV&C, ETC. ACTIVITIES

8:00— 8:30	Update on Joint Data Base Element (JDBE) project activities: Peter Valentine
8:30— 9:00	Lessons learned from JDBE IDEF1X classes: led by John McDonnell

9:00— 9:30	Brief and demo of Army M&S Catalog: Darlene Pittenger and Wanda Wharton
9:30—10:00	Report on TRAC Automated Data System (TADS) data activities: Howard Haeker
10:00—10:15	Report on Army Modeling and Simulation Executive Council (AMSEC) Subcommittee on Data: Erwin Atzinger
10:15—10:45	Break
10:45—11:15	Report on data standards activities: Iris Kameny
11:15—11:45	Report on new DARPA BAAs in the data area: Gio Wiederhold
11:45—12:15	Status of Navy Verification, Validation, and Accreditation (VV&A) Processes: Simone Youngblood
12:15— 1:15	Lunch
1:15— 1:30	Report on (SDIO) Analytic Tool Box: Anne Marie Gnacek
1:30— 2:10	Briefing for Strategic Planning for DoD intelligence Data Administration: Linda Calvert
2:10— 2:30	Discussion
2:30— 3:00	TECNET brief and demonstration: George Hurlburt
3:00— 3:30	Break

BRIEFS AND DISCUSSION OF GEO-SPATIAL DATA

3:30— 4:30	DMA brief on Geo-Spatial Information to include new available products and prototypes (e.g., Digital Chart of the World), terrain data models, DMSO Project 205A, and products of the future, and JCS MOP 31: Dave Danko and Bob Jacober
4:30— 5:00	Discussion of geo-spatial information needs, standards, etc.: led by Paul Birkel

3. LIST OF ATTENDEES

Tom Adrian, CACI-USA		
Cy Ardoin, IDA	(703) 845–6647	ardoin@ida.org
Erwin Atzinger, USA/AMSAA	(410) 278–6576	erwin@brl.mil
James Augins, Navy	(619) 553–6085	augins@nosc.mil
Robyn Benensohn, SAIC	619–546–6231	robyn@jupiter.saic.com
Paul Birkel, MITRE	(703) 883–6399	pbirkel@mitre.org
Bob Bishop, DTIC-AP	(703) 274–7662,1,	rbishop@dgis.dtic.dla.mil
William Burch, Navy		burch@nosc.mil
Linda Calvert, MITRE	703–883–6326	calvert@mitre.org Wallace
Chandler, USA/CAA,	(301) 295–1652	
Bill Clydesdale, SPAWAR	(703) 602–5696	
Deborah Cooper, Paramax	703–620–7778	cooper@rtc.reston. paramax.com
Martin Costellic, DITRA	(408) 655–0400 x 4248	

Willie Cowan, BDM (NASA)	(202) 479–5293	fax (202) 863–8407
David Danko, DMA	(703) 487–8151	
Tina De Angelis AF/SDIO	310–363–3253	fax: 310–363–1753 Charlie
Dunham, JIEO	(703) 487–8340	
CDR Jim Etro, CNO,	202–653–1616	
COL Ed Fitzsimmons, DMSO	(703) 998–0660	fitzsim@charm.isi.edu
Anne-Marie Gnacek, NRC, SDIO/GMN		
Peggy Gravitz, Adv Res Cen	(205) 922–1512 x2170	
John Griffiths, Intel. Community M&S Coordinating Group	703–820–2841	
Lucy Haddad, Resource Consultants Inc., (CCTT)	(407) 282–1451	
Howard Haeker, USA/TRAC	(913) 684–3030	haekerh@tracer.army.mil
Becky Harris, CIM/XF	(703) 285–5381	harrisb%cimtys%cim @cimgate.disacim.osd.mil
Dan Hogg, JCS/J8	(703) 697–8899	
Chien Huo, JIEO	(703) 487–8046	huoc@cc.ims.disa.mil George
Hurlburt, NavAirWarCen		hurlburt@technet1.JCTE.JCS.mil
CDR Rick Huska, (AFMSC) SDIO/GMN		
Bob Jacober, DMA (presented with Dave Danko)		
Iris Kameny, RAND	(310)393–0411	kameny@rand.org
Kenneth Kaufmann, NCCOSC	(619) 553–6098	kaufmann@nosc.mil
Tom Kurihara, DISA Studies	(203) 318–1074 x311	
Steve Lawyer, IDA	(703) 845–6696	lawyer@ida.org
Mike Ligtner JMASS	(513)476–4464	fax 513–476–4746
Mike Lilienthal, DMSO	(703) 998–0660	mlilient@dgis.dtic.dla.mil
Ernie Lucier, NASA/SED	(202) 358–0772	nhqvax.hq.nasa.gov
Gary Mayes, SSDC	(205) 955–4904	
John McDonnell USA/EPG (huachuca)		
Lana McGlynn, USA/MSMO	(703) 607–3335	
Ronald Merriman, Army/ODISC4		
Grant Miller NASA EOSDIS Program		
Bob Molter, DDI/CIM	(703) 746–7926	rmolter@ddi.c3i.osd.mil
Jack Nicklas, RCI	(703) 893–6120	
William P. Pala, NRL		pala%sunburst.nrl.navy.mil
Darlene Pittenger, USA/MSMO	(703) 607–3419	fax (703) 607–3381
Clay Putnam, GPS Technology	(703) 271–1700	
Lauri Rohn, OSD (PA&E)	(703) 695–1681	rohnll@scpae1,pae.osd.mil
Bruce Rosen, NIST	(301) 975–3246	rosen@ecf.ncsl.nist.gov
C. Roswell, HQ/DMA		
Mike Sarkovitz, PMA 205 Code 1D1	(703) 692–2641 x 3006	
Richard Schiller, mwvm.mitre.org		
Roberta Schoen, DTIC	(703) 274–5367	rschoen@dgis.dtic.dla.mil
Steve Shervais, CACI AFSAA	(703) 875–2911	
Maj Tom Shook, DMSO	(703) 998–0660	tshook@dgis.dtic.dla.mil
Bob Sutter, Argonne Lab	(202) 488–2427	sutter@anl.gov
Peter Valentine, USA/EPG	(602) 538–4976	valentin@huachuca-emh17. army.mil
Jim Weatherly, Navy	(703) 602–4540	weatherj@smtp-gw.spawar. navy.mil

Ron Weller, SAIC, Arlington
Wanda Wharton, USA/MSMO (703)607–3383 fax 703–607–3381
Gio Wiederhold, DARPA/SISTO (703) 696–2218 gio@darpa.mil
Ken Wimmer, SAIC/DMSO (703) 379–3770 kwimmer@dgis.dtic.dla.mil
Joyce Wineland, Navy Intel Cmd (301) 763–1390
Rob Wright, RCI (407) 282–1451
Simone Youngblood, John Hopkins U/APL (301) 953–5000 x4000 simone@aplcomm.jhuapl.edu

4. SUMMARY OF ISSUES, WORK-TO-DO, TOPICS FOR NEXT MEETING

(1) Most significant happenings between the two I/DB meetings were: the new DoD Enterprise Model seems to allow bottom-up data modeling and definition of entities and data element standards (need to find out more at the March 22nd meeting), and DISA/CIM will now support composite and derived data entities in addition to atomic data elements in the DDRS. If all this is true, then Iris and Twyla need to work with the DMSO to begin to develop data administration procedures and/or guidelines conformant with the new DoD Enterprise Model.

(2) Iris organize special working group session: classified workshop on intelligence data

(3) Ken Wimmer obtain documents:
- — Update on 8320.1.M
- — Get copy of John Keene's Technical Architecture for Information Management

(4) With respect to signup lists at workshop:
- a. Iris: Put together I/DB Task Group members interests. First circulate as file and then make into database to enter under I/DB bulletin board.
- b. Ken Wimmer: be sure names from signup sheet for DIS Conference Information get on DIS mailing list.
- c. Ken Wimmer/Iris Kameny: be sure people signing for DoD TRM and/or NIST APP get documents.
- d. Ken Wimmer: be sure people signing up for DSB Summer Study report on M&S, get document.

(5) Iris/Steph work with Cy and Ken to populate I/DB bulletin so that soon I/DB users can begin accessing it.

(6) Iris/Steph, organize task groups for study of complex data and data VV&C

(7) Topics for next meeting:
- — Brief from Navy on oceanography and atmospheric data standards.
- — Brief from NASA librarian on EOS databases that are available for use.
- — Brief on DIS and PDUs towards understanding how data standardization affects/works with the DIS world.

— Brief on X3L8, the committee on data representation standards, regarding: framework for generation and standardization of data elements, classification of concepts for identification of domains, basic attributes of data elements, registration and naming principles for data elements.
— Brief on how DMA relational standards relate and map to/from USGS object standards.
— Brief update on DoD Enterprise Model

5. UPDATE OF DMSO WORKING GROUP AND PROPOSAL ACTIVITIES

This set of briefings provided an update on what was happening with DMSO FY93 proposals and to make more explicit the kinds of efforts DMSO is interested in with respect to the upcoming call for FY94.

(1) DMSO Architecture Working Group and call for Architecture for Dynamic Scalability: Cy Ardoin
Scalability is the ability to accommodate large, dynamic changes in size and complexity within models and simulation systems. It can be characterized as having the following dimensions:
— Cardinality: number of objects in the simulation
— Granularity: fidelity and level of detail of objects and environment
— Heterogeneity: diversity of objects and environment
— Variability: cardinality and granularity may differ over time and by node
There are three generally accepted classes of simulation: (1) constructive (computer models), (2) virtual (distributed interactive weapon system simulation), and (3) live (instrumented tests and exercises). The call is for architectural projects addressing either of these three classes of simulation or an architecture for coupling simulation classes (constructive, virtual and live).

Forty-nine proposals were received in this area and each was reviewed by five reviewers.

(2) DMSO Environment Working Group and call for Environmental Representation: Paul Birkel
The synthetic environment for use in M&S includes terrain data, bathymetry data, meteorology, and atmosphere and near-earth space information. This area also includes methods for handling changes to the synthetic electronic environment based on both natural and man-made disturbances as well as well as electromagnetic propagation effects.

There were three focuses to the call: (1) Tri-service data and model standards development for atmospheric and oceanic data and transfer formats, (2) Improved production development of synthetic environment data; and (3)

Methods for handling dynamic changes—effects of natural and man-made disturbances that need to be reflected in the underlying environmental data.

Thirty-six proposals were submitted in this area, most addressing standards and DIS, a few addressed the creation of a realistic environment. There were many joint proposals across services and labs but most were lacking a well integrated management plan. There were some good proposals addressing dynamics but most were laboratory based technology—perhaps this work is not ready for the M&S community yet. Many of the proposals overlapped the scalable architecture area. The technical review team rated each proposal with respect to how well it addressed at least one of the three areas and how well it addressed the needs of the M&S community. Some of the proposals were to build a prototype to see if a problem could be solved and did not address standards for exchange. Most were not concerned with getting the community to agree on a standard but rather were trying to promote their service's model onto the community.

Paul mentioned the DMSO desire to create a mentoring team to work with the groups winning awards and several questions were later asked (and not answered) about the specifics of this.

(3) DMSO I/DB Task Group and call for Complex Data and Common Tools: Iris Kameny

The 60 proposals in this area were reviewed by a team of 8 people mainly members of the I/DB group. There were so many proposals because many submitters checked off data and tools as a secondary area. On a whole, the proposals were disappointing since most of them failed to address the areas described in the call. Iris went over the call areas again to familiarize people with the problems and to encourage people who are interested in addressing one of the problem areas or know of someone else who is, to call her or the DMSO office for copies of the FY94 call once it is available. We believe we need a better way to reach the people who are working these problems.

The areas specifically written up in the call were:

- Complex data: develop metadata extensions or new concepts of "standard data element" for complex data types compatible with CIM if possible.
- Design/develop tools/techniques for management of complex data repositories.
- Develop standards for nomenclature (e.g., aircraft type names) and symbology (e.g., graphics icons).
- Develop approaches and methodology for verification, validation, and certification of data.
- Develop approaches to capture and manage historical data (e.g., simulation data).
- Develop classification and typing taxonomies to support search across repositories.
- Define/develop mechanisms for interchanging data (including complex data) across repositories

Develop an approach to the data aggregation security issue and the policy and procedures to support finding information across classified and unclassified directories and dictionaries.

(4) Welcome and overview: Tom Shook
Data and database development is a very technical and painful process. Both fall into the M&S infrastructure area since distributed interactive simulation requires the sharing and exchange of data which in turn requires a strong foundation embodying data standards. The goals and objectives of DISA/JIEO are to give the user on defense networks the best technology possible and are consistent with DMSO communication and data objectives. We need to work out the details of execution and share common problem solutions across organizations. We need to move forward by bringing the community ahead...which is not an easy thing to do.

Tom sees a bright future for DMSO within the new administration and the DMSO has been busy educating the new people as to the DMSO goals and the issues. DMSO needs to help in the development of working level standards to promote interoperability. This needs to be accomplished by building consensus, which is a difficult task. DMSO is committed to working with the JIEO/Center For Standards (CFS), CIM, NIST, etc. We are working toward a future when MILSTDs are a thing of the past. Some of the technology needed by the M&S community will not be furnished by commercial products and developments. The M&S community needs to make its needs known to the commercial world so that they are more likely to be met in standards and products. CFS is playing a unique role in pulling together DoD needs so they can be heard as a single voice. An important I/DB task group role is to help DMSO re-vector for the future.

The M&S community has to play at the realtime C3I level. There is wide acceptance now of what DMSO is trying to do. The DSB summer study report on M&S has just been signed off and people can sign up to request copies (a sign-up sheet was made available at the workshop and will be handled by Ken Wimmer in the DMSO). Copies should be available by March 16 and draft versions may be available now through the Public Affairs Office or DDR&E.

A Distributed Interactive Simulation (DIS) workshop is held every six months and the next one is in Orlando March 22–25. DIS has been accepted as an IEEE standard for using WANs for intercommunication. It is non-proprietary (as are all standards) and examples of its use for interoperability were demonstrated at the last DIS workshop with different contractors connecting individually developed simulations. The DIS 1.0 protocols have been defined but help is needed with later (2.0...7.0) sets of protocols.

The DMSO FY94 call for proposals will be coming out soon. People can check with Gary Bridgewater or Ken Wimmer (at (703) 379–3770 or by email:

kwimmer@dgis.dtic.dla.mil and gbridgew@dgis.dtic.dla.mil) to find out the date.

(5) Update on M&S Information System: Cy Ardoin
The M&S IS goal is to provide an information resource center that will help members of the community in locating, retrieving and communicating information in a distributed environment. It is based on commercial standards and tools that include Archie (provides string search on file names), Wide Area Information System (WAIS) provides string search on the contents of files, gopher (access to bulletin systems), and telnet. Types of data provided include: general information about M&S, database and M&S catalogs for M&S developers and users, general information for community (POCs, organizations, calendar, glossary), online help, e-mail, world wide bulletins, and local bulletins and file space. The I/DB Task Group will be the first user of the bulletin board support for an M&S special interest group.

The I/DB bulletin board will include access to: glossary, document references, published meeting notes, I/DB objective, database of I/DB members and their areas of interest, list of ongoing projects in the M&S and data areas, minutes for review from the last meeting, etc. (People were asked to give Iris a list or paragraph describing their interests and she will begin to compile these, possibly into a database that includes other general information such as organization, phone, email, address).

Issues include: need to decide on a standard WP format, delay in getting the Oracle server at DTIC, and security (see later brief on TECNET).

It was mentioned that there is a Defense Information Systems Security Program (DISSP) and that Barbara Kirsch (703–487–8252) at JIEO was a POC. Roberta Schoen (DTIC) furnished the following information after the meeting: DISSP is doing central guidelines for DoD security, contact point is Lt. Col. Joe Jaremko at (703) 696–1904. They have soup to nuts consulting on security, but are VERY understaffed right now. Their Divisions are Accreditation, Architecture and Engineering, INFOSEC Products, INFOSEC Professionalization, and INFOSEC Countermeasures. Lt Col. Jaremko is head of Architecture and Engineering and oversees several task groups, including the one on security guidelines, and on security of DISN (MILNET).

By the end of March, the M&S IS will be asking for volunteer users. Users will be limited to government and government supported contractors. The number and makeup of the volunteer users testing the system will be controlled until the system is operational at DTIC and running reliably.

(6) Update on DMSO database directory IDEF1X model: Iris Kameny
Work done by Kameny and Valentine (JDBE project) on developing an IDEF1X model for the database directory from the E-R model was presented. Iris presented IDEF1X modeling observations made during her initial exposure to the methodology. She believes tools are needed to support the

capture and automated use of business rules: to add in clarification when models become more complicated, to capture differences in model views as different groups concur on a single model (such as cardinality differences), some people may relate better to textual business rules than to graphics, and machine processing of such rules could be used to detect inconsistencies. Also, the graphics can become unwieldy when M-N relationships require the creation of associative entities and generating informative arc labels for these is difficult. Also, multiple relationships between two entities may be difficult to understand in terms of the appropriate attributes. As we build bottom-up models, we need to use naming conventions that are as consistent as possible with CIM.

Pete Valentine will be generating the Oracle database schema for the DMSO database directory, and he will prepare a short writeup addressing the interfaces needed. Other issues include: need to develop a key word taxonomy to support searches, need to decide how the directory will be populated, and there may be a need for further collaboration with others needing a database directory. With respect to the latter, we should coordinate with George Hurlburt on TECNET catalog for T&E databases. A copy of the IDEF1X briefing and model was left with Beckie Harris at DISA/CIM.

6. UPDATE ON DATA ADMINISTRATION AND STANDARDIZATION EFFORTS

(7) Update on NIST standards for IDEF and IRDS: Bruce Rosen
Bruce began by updating the group on the IRDS FIPS 156 standard. It is coming to the end of its 5 year review cycle and they expect the ANSI X3H4 group to renew it as a standard. The IRDS export/import ANSI standard X3.195–1991 is now under review at NIST to be made into a FIPS. It will be an exchange standard for data between IRDSs and/or other tools. The services interface to IRDS has also been published as an ANSI standard X3.185–1992, but NIST does not plan to make this into a FIPS. He discussed the differences between the IRDS ANSI X3H4 standard and the international (ISO IS10728) IRDS standard. The ISO standard is more like the ANSI services standard but based on a different model. The ISO IRDS interface is based on a relational concept and is a software to software interface and does not address the human interface. The ANSI standard is based on a model of exchange at the human interface level and the screen interface level. The ANSI services interface standard describes exchange at the software-to-software level based on the ANSI human interface. Both ANSI and ISO have services level interfaces but they are incompatible, i.e., cannot be mapped to each other.

The X3H4 is working with the ISO IRDS rapporteur group on the next version of an IRDS standard, IRDS+ (which is not as inclusive as the future IRDS2 standard described in the briefing I/DB received in June 92). This would be a services interface standard not a human interface standard. X3H4 has submitted a large number of changes to the ISO IRDS group to try to get the ISO standard to incorporate US needs. The US is saying that the future lies in cooperating in the development of an international standard and this is where they want to go with IRDS2. If things go well, by June there may be a first draft of one unified IRDS+ international standard.

Question about what effect one unified ISO standard would have on ANSI IRDS standard? Answer is that it probably would not affect the renewing of IRDS1, and since the ISO standard wouldn't address the human interface, the ANSI could try to map the human interface onto the ISO services interface.

A question was asked about PCTE (Portable Common Tool Environment) provided by the European Computer Manufacturers Association (ECMA), standard ECMA 149, and its relation to IRDS. The purpose of PCTE is to enable software tools to work together through definition of a common environment. Some think this just involves a common repository, others a dictionary. The old dictionary concept was based on a fixed metadata schema, the new dictionary concept supports describing the structures needed such as databases, resource assets, etc., in content modules. For purposes of the new dictionary, the metadata descriptions of structures are called content modules and the word "schema" is reserved for referring to database structures. In the new dictionary, there would be multiple content modules describing the structure of the objects in the repository. However, the PCTE people are not coordinating their effort with the IRDS groups.

Question about object-oriented SQL: people are currently working on SQL3 to provide a standard language for object oriented DBMSs. It will be a large standard and will be issued in the 95–96 timeframe. (Bruce noted how large and complex the standards were getting: IRDS is about 700 pages long and PCTE around 400 pages). CORBA is an object-oriented standard that has come from the Object Management Group (OMG) consortia. Future IRDS versions will be oriented toward supporting an object-oriented machine. The most important thing for IRDS would be to unite the ANSI and ISO standards into one standard. There is a question about whether they will be able to define a common data object; it is conceivable that there may be different standards for different views.

Bruce next discussed IDEF standards. He announced that IDEF is now an acronym for "Integration Definition Language". NIST developed the criteria for evaluating modeling methodology based on non-proprietary information engineering. Criteria for standards usually come from a standards body that is composed of experts from government, academia, and commerce but the IDEF users group was different. Their charter did not include voting procedures and they tended to be more of a discussion group. Based on input from that group the draft IDEF1X FIPS contains two parts, a formative part (defining the standard) and an informative part (on how the standard should be used). By March 15th, NIST expects to receive consolidated comments from the IDEF1X users group that will clean up the draft and comments from DoD. They will then have 30 days to respond to comments, and will then finalize and publish the document. The document does not have to go through another round of review. An IDEF1X subgroup developed a formal mathematical logical description of the standard and forwarded that version to the IDEF senior committee. NIST will probably put this into the informative section because it has not been formally reviewed and it seemed that it was too difficult for many people to read and understand. The IDEF FIPS may be the first to go to Mr. Brown, the new Secretary of Commerce.

(8) DISA/CIM: update on DoD CIM data administration, policy, procedures, modeling, etc.: Bob Molter

Bob went over the implementation status of the data administration areas: policy, standards, infrastructure, procedures, tools, training, and miscellaneous (data administration strategic plan, FY93 planning guidance, data migration and reverse engineering and data migration and implementation planning). High points: 8320.1-M is in informal coordination, comments were due Jan 20 and it will be distributed as a new draft at the Data Administration Council meeting on March 19. It will be aligned with the new DoD Enterprise Model which is being released on March 22. He expects it to go out for formal coordination, three weeks after that session. 8320.1-M-1 has become a standard. Reverse engineering: Aiken is leading this effort to reverse engineer six systems in the business area to develop and refine procedures and to identify tools that are helpful or not helpful. CIM is beginning to address security (data aggregation and multi-level security requirements), quality assurance, and are interested in "other" data types and welcomes support and good ideas in this area from the I/DB task group. A question was asked about adding structured data objects to Bob's list and he brought up an issue as to whether messages and transactions should be considered as data objects and how these would be packaged as objects.

Bob, then gave us a preview of the DoD Enterprise Model which was developed through Bunny Smith's organization with DDI sponsorship. It is the result of work done by both contractors and government people. It will be presented in a 3–4 hour session at George Mason University on March 22 and again at the FIM/TIM conference in Monterey just for government people (Melanie Williams 703–756–4740, 41,42). One appendix discusses how to do model integration. Instead of top-down and bottom-up linking up, it discusses layering. This will make it easier to integrate policy and data models though there will probably be some holes. The bucket approach allows one to start modeling from the middle-down or bottom-up but one would need to get with functional experts first to be sure they are getting the right things into the right buckets. There may be a need to come in at the middle level and further sub-categorize entities and decompose their attributes to arrive at the lower level at which you want to model. The Enterprise Model has its basis in the CALS support for weapon system development. John Keene's effort to develop a DoD architecture preceded the Enterprise Model and is the environment the Enterprise Model will be implemented in (whatever this means). There is a close fit between John Keene's and the Marine's architecture. The Enterprise Model document will be given out at the meeting on March 22 and will also be given to DTIC for distribution. Russ Richards is in charge of the buckets (data side) at 703–285–5378).

(9) JIEO Center for Standards: update on FDAd C2 activities and support for Modeling and Simulation: Charlie Dunham

The JIEO/DISA/CFS/Information Directorate/C3I Support Division's mission is to achieve a fully interoperable C2 environment through effective data standards coordination and program development. This includes management of and active participation in the development of standards for data elements and data models for C2 programs, projects, and migrating C2 legacy systems. Thrust areas include: C2 data standards coordination, C2 data elements, C2 data modeling, and C2 functional data administration. Charlie provides staffing and support for Dr. Quinn, the C2 FDAd. The last page of his briefing included POCs for each of the four thrust areas.

Developing standards for C2 requires much horizontal coordination since DoD overall standards are unknown, there are multiple uncoordinated C2 "architectures", and there is conflict among acquisition specific standards. In addition, most standards and specification work has been done by individuals, there is resistance to accepting standards of others, and no good mechanism exists for enforcing standards. There is thus a real need to focus on standards coordination.

An important objective (from the DMSO perspective) in the C2 data elements program is the development of a C2 Data Element Dictionary repository which facilitates application requirements and conforms with the DoD-wide DDRS. They are looking at the requirements for a C2 Distributed Dictionary with coordinated contributing databases, that addresses the C2 user requirements and is aligned with the CIM process. This needs to be defined in a way that addresses working level needs and has to have good links to programs and projects. They need to develop integrated procedures to perform C2 data standardization for the mandated procedures: need a unified process to achieve consensus and approval for DoD wide C2 data element and model standards. They need to develop a uniform process for technical coordination of C3 data fora to facilitate applications development and life cycle management. They need to coordinate among projects with different data element standards (e.g, MTFs, TADILs, IDEAS, JOPES). They look at DMSO as being a node in their distributed dictionary network.

Charlie's group needs to provide interim C2 data element approval. For example, the JUDI (C4I for the Warrior) C2 interim data elements are available for C2 FDAd approval. The JUDI effort has been developing SDEs from the USMTFs by looking at 13 basic message formats. They also need to deal with data verification and validation, some data may be "made-up" because it is missing. They also need to identify those areas in which there is no good source of data.

As far as data modeling goes, they are validating the fire support model for the second time, and are establishing justification for requiring that all entities in a model satisfy all three services. Steps for technical validation include: use of subject matter experts, developing consensus on IDEF1X model, and capturing rational. They plan to integrate the fire support and air operations data models into one data model architecture. They are currently testing out the approval process for seven JOPES entities.

7. REPORTS ON PROJECTS, STANDARDS, VV&C, ETC. ACTIVITIES

(10) Report on Close Combat Tactical Trainer (CCTT) project data activities: Rob Wright

CCTT will consist of fully interactive networked simulators and C3 workstations that replicate the vehicles and weapon systems of a mechanized infantry or armor company team, portray supporting combat, combat support, and combat service support elements, and operate on a simulated real-time electronic battlefield. It is a follow-on to SIMNET-T with more battlefield effects, greater field of view, more realistic data package, open systems architecture, configuration management, and higher resolution terrain. The CCTT data collection program's purpose is to provide CCTT contractors with certified, accurate, and usable data in a timely manner. The data requirements categories include: weapon system/equipment characteristics, weapon system/equipment performance characteristics, doctrine and tactics, occupational information, crew/force configuration, and environment. The CCTT documentation collection consists of many varieties of documents including: engineering drawings, specifications, CM reports, firing tables, models, anomalies, design documents, test reports, service bulletins, overhaul manuals, training circulars, system performance tests, etc. Entries for these are documented in the DOCATs system which is moving to FOXPRO.

The CCTT contractors are limited in combat arms experience so the CCTT data collection activity provides them with VV&Aed relevant and appropriate data that will be consistent across the various contractors. The VV&A process includes participants from various schools who help develop data and design tests that can be used for verification of contractor developed simulator models. The CCTT data collection effort supports VV&A in that it verifies that data is complete, identifies data voids, identifies discrepancies, validates that information is complete, and certifies that data is acceptable.

They currently have databases of ground systems populated with tank platoons and in future will have company/teams, battalion/task force. CCTT will eventually incorporate Army attack helicopters and Black Hawks and aviation tactical trainers. They need to link the parameters database to the document system. They will also be maintaining a database of red and blue semi-automated force (SAFOR) behaviors that will need to be linked to the documents. Asked about security: hasn't been addressed yet but will be because they will be required to operate in a classified mode and handle classified data when they participate in the Louisiana Maneuvers.

Rob described their success with using the IDEF0 activity modeling procedures to model the CCTT CALS information flows to specify management, data and information exchange, etc. needed among the many different CCTT players. This was a great experience and showed explicitly how contractual agreements, CDRLs, letters etc. would flow and they strongly recommend its use for other projects.

(11) Update on Joint Data Base Element (JDBE) project activities: Peter Valentine

JDBE staff works in the Test and Evaluation Command of the Army. Their major goals are to standardize definitions of data elements, and promote exchange and sharing of data between existing legacy systems. Their current area of concentration is electro-magnetic characteristics of equipment which includes all emitters. A suggestion was made that they focus on one specific class of emitters to do a proof of concept for DMSO. They have developed their own repository to hold IDEF1X models, standard data elements, directories, etc. because the DISA/CIM DDRS did not include storing anything other than metadata for SDEs (the future repository Jeff Wolfe's people are working on will hold many types of objects including data models). Their repository will include a browsing tool for helping users find what they are looking for.

Question was asked as to who is involved? and answered that they need to get more people involved (in the Army at least AMSAA and TRAC) and that they need to work through CDAds and FDAds to be sure they have participants representing the service and functional area preferred databases.

NOTE: Another important suggestion was that they keep track of the costs involved in training, participants preparing database models and enterprise model, and JDBE preparing the subject area of interest data model, entities and data elements so others will have an idea of cost involved for future efforts.

Question: How does JDBE interface with DIS, or affect the PDU format standards? No answer, but good question. Iris will try to get briefer on DIS, Protocol Data Units (PDUs), etc. for next meeting and we can then revisit this question.

Question from the floor about the credibility of this approach: answer from the audience that the Marines are using the JDBE approach and will be building a common database of standard data elements thanks to JDBE.

That one of the biggest benefits of this approach is in helping people to document what they have by reverse engineering their database through IDEF1X data modeling practices.

JDBE has recently been coordinating with CIM: with DISA/CIM training, with Aiken on methodologies for reverse engineering, and differences in M&S community and CIM with respect to needs and uses.

Question: Is there a need for JDBE to interface with CALS in the future? Answer, doesn't seem to be a need at this time.

Question from SDIO project: how do the users take the SAI models, use them and maintain and update them? Answer someone/organization has to take responsibility for maintaining the data models and entities and attributes and recalling the SAI group when appropriate due to changes. It is currently unclear who should have responsibility for this.

JDBE today: changed from developing military standard to developing military handbook; distributed the third version of the JDBE methodology paper; have conducted two training classes; are evaluating DISA training for further use; have completed two project models; schemas for the repository, dictionary, and directory are in draft form, and they have initiated interactions with CIM groups.

(12) Lessons learned from JDBE IDEF1X classes: led by John McDonnell (because the previous brief generated so much discussion, there was only about 10 minutes left for this)
Performance of students: quick in picking up IDEF1X, but those without experience with PC windows have problems in using the Erwin tool within the windows environment. Lesson learned is to be sure a student without PC windows experience is paired with one that knows PC windows. They went over the organization representation of students in the class and they seemed to come from a wide variety of organizations. The student' class evaluations were quite positive.

(13) Brief and demo of Army M&S Catalog: Darlene Pittenger and Wanda Wharton
Wanda Wharton is the system administrator of the Army M&S Catalog. The Catalog resides on a PC running MS/DOS. It has been designed and implemented as an Infobase/Folio Views application and its services are: to maintain catalog and service updates, provide search and retrieval to remote users, distribute extracts to other catalogs, and to communicate with the M&S community. The value of the Catalog is very dependent on the information the Army proponents supply and its current entries were taken from the J-8 Catalog. The Catalog is currently undergoing beta testing by 3 sites (very successfully) and will be available for general use after May 31st. Each entry is a folio, and groups are collections of folios.

The demonstration was very impressive. There is no user manual, self-help is built into the system. Remote users need to use VT100 keyboard emulation mode and there was some discussion about support for other terminal types. It is designed so that the first browsing screen of a M/S shows the most critical data. There is excellent support for exact queries, and sophisticated text-based searches (but not for soundex searches). Catalog data will be validated before it is entered (proponents do not enter it directly) and for each M/S V&V information is supplied by the proponent and accreditation information by the accrediting authority. They estimate that 400 M/S will take up about 1 megabyte of storage. The Army has agreement to be able to distribute a runtime version of Folio with the Catalog for individual use. Currently, downloading this takes about 25 minutes at 2400 Baud. Lana McGlynn said the Army is glad to make the software available to other services and that the contract vehicle is in place and would allow customization of software.

(14) Report on TRAC Automated Data System (TADS) data activities: Howard Haeker

TADS is a method to electronically request, receive, authenticate, graphically display, mathematically transform, and reformat data from data providers into TRADOC's combat development models. It supplies data to 12 active models and more.

They have recently completed developing categories for TADS technical data. There are 11 identified categories: equipment performance, equipment characteristics, unit performance, scenario, environment, force description, tactics/doctrine/operational, test, human factors, geopolitical, and logistics.

Howard went through the Army's M&S data element submission life cycle: proposed, candidate, approved, installed, archived. Data elements are proposed by their originator when they are under development and the originator wants the Army subject area experts to start evaluating the data element informally as a standard. It moves to the candidate stage when it is completely developed where it undergoes more stringent expert evaluation. It then moves into the approval phase where the ICP (Information Class Proponent) must formerly approve it and it is then installed in the Army Data Dictionary. Lana McGlynn, as the ICP for M&S, wants most of the review to take place in the proposed and candidate phases so that actual approval can be done quickly. One assumes that once it gets into the Army Data Dictionary, it will go through some process to be nominated to the DoD CIM level. (I see a need to make repositories for proposed, candidate, and service approved DEs available through searches to everyone across DoD so we don't get duplication of effort in developing DEs in different organizations at the same time.)

Howard addressed several problems. The top of the list is complex data and data dictionary limitations in describing complex data. Another problem he identified (which will probably become worse in the future when more and more people are involved in data standardization) is the overload on the network when he tried to reach the Army DISC4 dictionary. Since the Army data administration group has moved into CIM, the ADD will, probably in the future, be a partition in the DDRS. However, there will be DoD-wide contention for use of the DDRS so it is hard to see how this problem will lessen unless the partitions are maintained on different processors and there is good network management to sense and prevent congestion.

(15) Report on Army Modeling and Simulation Executive Council (AMSEC) Subcommittee on Data: Erwin Atzinger

The Army Modeling and Simulation Management Office (AMSMO) is the DMSO of the Army. The Army Modeling and Simulation Executive Council (AMSEC) is the AMSMO advisory body and is headed by Walt Hollis. The AMSEC Data Subcommittee is the focal point for the Army AMSEC on matters related to data development (management). The AMSEC Data Subcommittee provides guidance to ICP (Lana McGlynn) for Army data modeling of the M&S process, is the interface to the DMSO Task Group, advises AMSEC on AMIP/SEMTECH program, provides fora for Army data development and management issues relevant to M&S and recommends policy and procedural guidance (re data standardization and interoperability). A current AMSEC initiative was sponsoring the Orlando TADS and AMSMO meeting to develop data categories. This will be followed up by further decomposing these 11 categories, and the agenda also includes getting courses in IDEF1X going, etc. Jim Shiflett, who is PMO for CCTT, is very anxious to address complex data and in getting the data community involved in the DIS PDUs.

(16) Report on data standards activities: Iris Kameny

Iris Kameny presented Twyla Courtot's briefing because Twyla was unable to make the meeting. The briefing covered the different standard committees of interest. Twyla's updates on IRDS, SQL, and object management repeated some of the information Bruce Rosen had presented to us earlier.

Twyla also discussed the IRDS "content module" concept. She said X3H4 are working to define the term "content module" so other standards groups can create them for inclusion in a new IRDS standard. The new standard is expected to be a compilation of these modules. There would, for example, be a content module for security, one for object management, etc. The IRDS would knit these content modules together into a functional repository. Efforts are being concentrated in defining a schema by which the IRDS itself can be described. Conceptual graphs are being investigated, and a proposal for a Normative Schema standard has been put forward.

The report on X3L8, the committee on data representation standards, covered interesting efforts on a framework for generation and standardization of data elements, classification of concepts for identification of domains, basic attributes of data elements, and registration and naming principles for data elements. The registration effort is focusing on using a classification scheme for unique identity of elements rather than relying on a name. All these issues are very important to our effort and perhaps Twyla can give us a more comprehensive briefing at the next meeting.

(17) Report on new DARPA BAAs in the Data Area: Gio Wiederhold
Gio gave us an overview of the technology organization in DARPA/SISTO. SISTO has three strategic plans: (1) intelligent systems covers autonomous systems, interactive problem solving, and intelligent integration of information; (2) software engineering covers SEI, STARS, evolutionary software development, and software engineering foundations, and information technology for manufacturing covers manufacturing automation and design engineering. In evolutionary software development, there are four programs: domain specific architectures, PROTOTECH, software development environments, and persistent object base. The PROTOTECH program includes development of tools for rapid prototyping to replace the waterfall method (8120.1.,.2). In the Persistent Object Base Program, DARPA is supporting: the OMG standards group by supporting Texas Instruments in participating and writing the standards document; the Object Request Broker; and the building an example since it is difficult to define a specification without an example.

The BAA for new proposals in advanced software covered 6 areas: component-based software (tools and languages for putting components developed in different languages together), domain-specific architectures (could simulation be a domain specific area (e.g., JMASS)?, advanced software environments, high-assurance software (verification vs specification), software understanding and re-engineering, and persistent object bases.

In the interactive problem solving area there are program areas for human language, planning and decision aids, human computer interaction, and Joint Task Force ATD. Human-computer interaction is a new area that is just starting up.

The I3S is addressing data overload, information starvation, system rigidity, and management of complexities. Intelligent mediation acts to reduce data to information—current federated systems are similar to current simulation model interfaces—whereas intelligent mediation is managed by domain specific experts. (For more information, Gio referred to two papers he has written, "Mediation Approach to Future Architectures" in IEEE Computer, March 1992, and a paper on software composition in ACM Communications, November 1992.) Main activities in mediation are summarization, fusion, generation, and use of histories. He used a system security officer (SSO) mediator as an example. An SSO mediator would use methods to summarize and abstract the essence from the multitude of small audit trail events to provide a higher level, more meaningful organization of events. (The lower level audit trail is, for all practical purposes, unreadable by humans.) A research issue is that of understanding where to locate mediator nodes for the most efficient processing.

He also mentioned KQML (Knowledge Query Management Language) which is an interface specification language that provides a wrapper standard and has been written up in a document by Bob Neches at ISI (neches@isi.edu). This runs on Unix platforms.

Gio would like to see a SIMQML analogous to KQML to interface to simulators. (This fits with the current interest in providing some kind of wrappers around simulations to enable them to be more easily integrated into larger systems that require the interoperation of simulations.)

(18) Status of Navy Verification, Validation, and Accreditation (VV&A) Processes: Simone Youngblood

Simone began by showing us the Navy M&S structure:

— RADM Allen, N81, is Director of the Assessments Division of OPNAV and is POC for DMSO and other DoD components
— CAPT McClure, N812D, is Head of M&S Section within the Net Assessment and Affordability Branch and is Executive Agent for N81 and Executive Secretary for Team Mike
— Team Mike is the Naval Warfare Analytical/Modeling and Simulation Oversight Council (NMSOC) that is technical advisor on analysis and M&S, and interface to DIS Task Force
- SPAWAR 31 Modeling and Simulation Technical Support (MSTS) through Navy R&D Centers and JHU/APL

The SECNAV or OPNAV instruction to address Navy and Marine M&S issues (similar to Army Regulation 5–11) is expected to be released in early April 1993 and is expected to contain a number of TABs (e.g., Team Mike charter, M&S master plan and investment plan) including VV&A processes for M&S which is the project being addressed by JHU/APL. Status of the work: it was distributed to Team Mike membership on February 10 for review and N812D expects comments back by March 15. Simone gave us copies of the "Preliminary Bibliography for Modeling and Simulation (M/S) Verification, Validation, and Accreditation (VVA)" which contains about 250 entries and has been distributed to Team Mike and reps from the Army and Air Force. The Navy VVA process is based on: VVA being an integral part of the M&S development process; VVA being moved as far forward in the development process as possible (validate the concept); automate as much of the process as possible; and formalize VVA processes for future endeavors.

The VVA paradigm presented shows VVA at six stages in M&S development with documented review at each step: (1) conceptual validation of the conceptual model; (2) design verification of the M&S specification, (3) code verification of the development code,(4) results verification of the M&S implementation, (5) domain accreditation of the problem domain, and (6) application-specific accreditation of the specific application including the input data. This will require getting a review team together at each level.

Note, that the process is consistent with the steps required by SEI for the software development process. They have proposed four levels of accreditation: Inspection (a few manweeks), general (less than 6 manmonths), robust (manyears), endorsed (cost may exceed M&S development).

Questions were asked about: dealing with stochastic models which is more difficult than dealing with deterministic models; modifications to models requiring re-accreditation; the need to re-certify data that has been changed due to updates (version changes); and need to re-verify derived data even if the data it was derived from was certified (really verifying the derivation process).
Simone discussed the new DMSO VVA Task Group which held a kickoff meeting on 17 February and is expected to run for 6–8 months. Its objective is to produce a policy statement on VVA for all services (an instruction, handbook, and/or a pamphlet. We discussed who would lead that activity and Iris incorrectly thought it was Paul Davis. At this time, there is no designated leader.

N812D also formally submitted a proposal to DMSO for a VVA Institute that would be analogous to the Software Engineering Institute and the Institute for Simulation and Training.

(19) Report on (SDIO) Analytic Tool Box (ATB): Anne Marie Gnacek
Objectives of the ATB project are to provide SDIO with an institutionalized collection of models, simulations, and data that will support GPALS architectural examination, development, test, and evaluation requirements; provide capability to match an analyst to a model; and provide a management tool for SDIO Deputies and Directors. The problem is that SDIO has to report to Congress that SDS will work but SDIO has not established baseline of accredited M&S, no methodology to build confidence in models quickly and cost effectively, and some differences in simulation results are directly attributable to use of "nonstandard" databases. ATB should provide: basis for comparative analysis and trade studies; enhanced SDIO ability to explain differences in model results; confidence building; establishment of learning curves and lessons learned; driving toward accreditation (but not integral part of ATB); cost effective in using M&S to support acquisition process; capability to match analyst to model (software reuse); and use of objective assessments/procedures by joint team of experts. The ATB approach is basically that of determining customer requirements; aiding in model selection; after model is identified for use do confidence assessment, model enhancement, and configuration management; then go into the VVA process (including flight and testing program) and finally do model maintenance.

Models could be submitted to the ATB from Services if they have SDIO applicability and even before they had undergone VVA by the Service. For models designed for SDIO usage, ATB would do: configuration management if asked to (or serve on Configuration Management boards). Confidence assessment for SDIO developed models consists of four steps: verify the intended use of a baseline model; do continued review of the model; V&V of selected portions of models independent of developers but based on what the SDIO sponsor wants them to do and continued V&V of model sections. They showed 5 levels of M&S support using ATB and other procedures: architectural analysis, low confidence models, medium confidence models, high confidence models, and VV&A models. However, they seemed to be saying that given the perspective of the JHU/APL VV&A study for the Navy, they are not doing accreditation. I believe they said they will do VV&A and CM for the tools/software that are a part of the operation of the testbed and optionally offer this service to developers who will be submitting tools to the testbed or to tools that SDIO wants them to do V&V on. (It would be interesting to go through the JHU/APL six steps and see at which of these steps the ATB project would offer independent V&V to developers.)

The ATB was developed on a PC and is currently running, on a classified network, on a Sun using the Oracle DBMS and contains 6 models (out of approximately 500 SDIO models). In the future they expect to also run an unclassified version. In summary it provides: a collection of accessible and verified and validated M/S and data; configuration management of those resources consistent with SDIO policy; and establishing methodologies to support confidence assessments, appraisals, and VV leading to accreditation.

(20) Department of Defense Strategic Planning for Intelligence Data Administration: Linda Calvert

Linda went over some background including the DoD Data Administration Strategic Plan(s) (DASP) planning cycle which requires that all DoD FDAds and CDAds submit their DASPs to the DoD DA by 30 December. The Intelligence DASP includes NSA, DIA, and CIO plans. The DoD DASP vision of the future includes operational central repository; standard data (architecture, models, entities, data elements); use of common procedures and tools; quality data; education, training, and consultation services; effective infrastructure; and (not on list) data security policy and procedures. She gave us an excellent diagram of the DASP DoD DAd framework and identified POCs within DISA/CIM, (Tom Weber, talk to him about the taxonomy for accessing products in the repository), and for intelligence (Charles Hawkins and James Davidson). The intelligence DAd framework shows 7 functional activity managers with CIO responsible for IMINT, NSA for SIGINT, and DIA for GMI, S&T, CM, MASINT and HUMINT.

Intelligence data issues include: need for secure, compartmentalized data elements and databases and merging of secure with open source data; users of data are needed to do analysis; complex data types; overlapping international, national and intelligence organizational procedures, definitions, and standards; and legacy and evolving M&S systems. There is a combined intelligence working group being formed to deal with these issues (we should coordinate with them) and DISA/CIM action plans include dealing with security requirements. Security is a big issue. For example, the intelligence community has to address the security level of meetings in order to meet. An example of changes is that during a Copernicus exercise classified data was downgraded to be used in the exercise.

There is a formal intelligence M&S group that maintains a catalog of M&S models in the intelligence community, the majority of which are unclassified. For general information, Linda noted that it is taking 1.5 times as long to re-engineer data in legacy systems as to build a new data model.

View of new post cold war era for M&S: models must be flexible to accept complex data from new sources quickly; M&S must expand to include new areas such as economic, agricultural, social; security classifications and compartmentalizations must be re-examined for inclusion rather than exclusion; and intelligence information must be shared more widely for peaceful purposes.

(21) TECNET Brief: George Hurlburt
TECNET is a user controlled network governed by a Joint Service Steering Committee, service funded, designed for all DoD Test and Evaluation Communities (developmental, operational, all services) to promote efficiency of T&E within DoD, provide forum for T&E players, relieve communications bottlenecks and problems, increase awareness through sharing. Services include: e-mail, bulletin board facilities, binary file repository system, database support (directories and private databases), specialized user services (DoD News, Electronix 'Early Bird", Aerospace Daily, CBDs, etc.), integrated fax, and extensive help. Its available all the time and can be accessed through DDN and Federal telephone system. TECNET is on a DSNET machine and is C2 accredited to run system high at the secret classification level at Aberdeen. All services are available at system high except for downloading and faxing but do have file transfer available. It has over 3,000 registered users, 148 active bulletin boards, supports a number of databases, has liaison with many organizations, and protocols support kermit transfer, simple mail, telnet access and FTP.

The future vision is to systematically migrate existing TECNET resources to create a standards compliant, multi-level secure communications and processing capability that links DoD T&E entities to a shared but controlled user community information resource. Plan to move from present configuration OSI (TCP/IP, X.25), Unix, C-2 trust, 1200–9600 Baud, DBASE, system high, RISC, MILSPEC, C, DDN host) to future (GOSIP, POSIX, B-2 trust, T-1, MLS RDBMS, MLS, Multi-RISC, CALS, Ada, Internet). Research initiatives are for state-of-the-art internet GUI, file and fax manipulation, distributed data (common data dictionary, heterogeneous database exchange), multi-level secure. They plan to use JDBE methodology to model their T&E data dictionary. MLS has to address the data aggregation problem (aggregated data should be at a higher classification level than the data it was aggregated from). TECNET will be publishing the results of their security experiment by September 1993 and DMSO will receive a copy. When

DMSO clients apply for TECNET use, you need to let them know on the form that you are a DMSO user.

They have a real heterogeneous database problem to access range data for different databases. Problems include outdated documents, unavailable data, no standard terminology, misconception of need, and ranges are not able to present their capabilities effectively. At present they have used the TRW TDIE tool to service canned queries by mapping the query and the database schema to the range data but this will not work for ad hoc queries. Also this may be difficult to maintain, i.e., when a data schema changes, one would need to update all the mappings affected by the change.

TECNET development started at the same time as the DMSO Information System development, but appears to be ahead of the DMSO IS. Perhaps we should look into possibility of acquiring some of their software? Their contract development agencies were Clemson U, TRW, MITRE, AT&T and Sun.

8. BRIEFS AND DISCUSSION OF GEO-SPATIAL DATA

(22) DMA brief on Geo-Spatial Information to include new available products and prototypes (e.g., Digital Chart of the World), terrain data models, DMSO Project 205A, and products of the future, and JCS MOP Dave Danko and Bob Jacober
Digital Chart of the World (DCW) goals: to establish a suite of standards for vector digital MC&G products to support direct user interaction, compatible with the DMA Digital Production System (DPS), meet product requirements at many scales, designed for use in wide range of computer environments, and to develop a product specification using the new standards to support robust GIS analysis and to support graphics display. Thus goals are to develop standard and product (includes wealth of data) which includes application software for accessing standard data sets, global and theater planning and assessment capability, and briefing and decision graphics. (ARCINFO will support the DCW standards within the next few months.) Co-developers of DCW are Australia, Canada, and UK (through use of Nunn amendment) and US contractors include ESRI, Loral, GEOVISION, and SAIC. A prototyping approach was taken to incrementally develop the standards. Developed 4 prototypes: (1) small dataset with contractor proprietary code; (2) new non-proprietary code, more data, expanded bandwidth; (3) refined structure and format to include wider variety of maps and charts, more data, wider bandwidth; and (4) final structure and initial production products.

The vector product format (VPF) (MIL-STD 600006) describes conceptual model (DIGEST based), physical model (relational), supports various levels of topology and integration, inter-tile topology, and spatial and thematic indexing. It is a self-describing format (using headers), has on-line dictionary to fully describe feature codes, and product has quality data (i.e., polygons, attributes, etc. checked back to original source). Product consists of five libraries (browse, North America, Europe and Northern Asia, South American and Africa, and Southern Asia and Australia) on 4 CD-ROMs (each with own browse library), a total of 1700 MB of information, and some products are available through DMACSC and USGS. DCW is not GIS, it can retrieve information through query by attributes but does not do spatial analyses. DMA vector products include: World Vector Shoreline, Digital Nautical Chart, Vector Smart Map (1:250,000 and 1:50,000), and Urban Vector Map. Coverages include boundaries, elevations, hydrology, individual objects (processing plant, storage depot, etc.), physiography, population, transportation, utility, vegetation. DCW has 17 layers and features are supported as lines, points and vectors. They have digitized the cartographic to look like geographic in that compiled roads can be supported going through built-up area though there is no room on paper map to show these. Also need to be sure that polygons are closed in order to compute areas, also if paper map showed stream, road, railroad in canyon, it probably separated them and these can be put together in proper place for geographic presentation. Noted that 1:250,000 vector maps for within US and nautical maps are releasable as products to public but rest are not releasable to public.

DMA strategic plan 2000: expand DPS to support crisis response to hot spots to provide the user the most current information, the right information at the right time (will be large customer accessible database). Global Geospatial Information (G2I): define "geospatial information; articulate transition to geospatial information vs products; create "gateway" project of the customer accessible/exportable "geospatial information" database; and change collection strategy to provide global coverage (land, ocean, aeronautical, geophysical). In future will have electronic online catalog and will be able to transmit or distribute standard products or tailored database on standard media.

CJCS MOP 31: DoD components and Federal agencies submit MC&G support requirements and justifications in accord with appropriate DMA instructions. Director DMA, etc. in accord with DoDD 5105.4 reviews and validates submitted requirements and priorities to ensure compliance with MOP. DMA produces, maintains, and distributes MC&G products over specific geographic areas based on the prioritized MC&G support requirements. The revised MOP 31 includes a new priority system, emphasizes country precedence list, includes level of risk as consideration, submission is ongoing process, and DMA submits to CJCS and ASD(C3I). DMA organizational objectives are to: determine and satisfy area requirements; give crisis support; improve contingency support posture; meet future demands; and support standards and interoperability.

DMSO Terrain Requirements and Standards Project objectives: to survey community to determine content, accuracy and location requirements for digital geographic data to support M&S, survey community to determine spatially related value-added data requirements to support M&S; prototype digital geographic datasets to support M&S applications; assess commercial equipments and methods for production of digital geographic data; and begin production of digital geographic data to support M&S.

To date: survey methodology was completed in September 92, will complete all surveys by 28 February and report to DMSO by 15 May 1993. Made approximately 125 on-site visits (will go to 250 before complete) with sites determined by service/agency. SAIC is under contract for aggregation, consolidation, and in-depth quantitative analysis of completed sample. Preliminary findings: all users predict increasing use of M&S, boundaries defining traditional application areas are blurring, and there is an increasing requirement for MC&G data to support analytical, non-visual applications. The draft product specification should be available by 15 June 1993, first prototype by 15 July and second prototype by December 31, 1993.

(23) Discussion of Geo-Spatial Information Needs, Standards, etc. led by Paul Birkel

Question: Commonality of this project with project 2851: DMA's past efforts didn't address project 2851, a tri-service initiative. Project 2851 has concurred on a standard interface format for simulators and they can take DMA data in standard DMA format and translate it into project 2851 standard format. Originally Project 2851 standards were developed by Service group with Service funding, DMA is now beginning to work with them.

Question: how does USGS new object model standard relate to DMA DCW relational model standard? Answer: need to get USGS to come and present with DMA next time and discuss how these two standards relate.

Appendix

E. NOTES FROM THE 6TH I/DB WORKSHOP HELD JULY 28–29, 1993 AT IDA.

CONTENTS

1. AGENDA

MEETING OF DMSO I/DB TASK GROUP

WEDNESDAY, JULY 28, 1993

UPDATE ON DMSO HAPPENINGS

8:00—8:20	Welcome and DMSO update: CDR Mike Lilienthal (DMSO)
8:20—8:35	Introduction to Dr. Chien Huo who will be supporting DMSO, and an overview of the JIEO M&S support activities: Ms. Iris Kameny/Dr. Chien Huo (JIEO)
8:35—8:50	Update on DMSO Information System: Mr. Ken Wimmer (SAIC) and I/DB Partition: Ms. Iris Kameny (RAND)
8:50—9:00	M&S Information Analysis Center: Mr. Ernest Smart (U of Central Florida/Institute for Sim and Training)

REPORTS FROM NEW M&S ORGANIZATIONS

9:00— 9:20	New Air Force M&S organization: Dr. James Vernon (AF/XOMT)
9:20— 9:40	*New Marine M&S organization: Mr. Frank Hoffman (USMC)
9:40—10:00	Intelligence Community M&S Coordinating Group and intelligence models: Dr. Sid Kissin (NSA)
10:00—10:20	Break

DATA SECURITY

10:20—10:40	Security CONOPS for Intelligence Community Catalog of M&S: Mr. John Griffiths (IC M&S Coordination Group)
10:40—11:00	Defense Information System Security Program (DISSP):Mr. Hart DeGrafft

DATA ADMINISTRATION, STANDARDIZATION AND MODELING ACTIVITIES

11:00—12:00	DoD Enterprise Model: Mrs. Bunnie Smith (ODASD(IS))
12:00— 1:00	Lunch
1:00— 1:30	Update on DoD Data Administration Program (including reverse engineering, repository, etc.): Ms. Becky Harris, Ms. Lynn Henderson (DAPMO)
1:30— 2:00	Report on IDEF Users' Group meetings and issues: Mr. John Tieso (ODASD(IS))
2:00— 2:30	Air Mobility Command Information Resources Repository System: Major Doug Hurd (AF/HQ/AMC/SCTI)
2:30— 3:00	ATCCIS Battlefield Generic Hub Data Model: Iris Kameny for Major Matt O'Hanlon (NATO/ATCCIS)

3:00— 3:30	Break
3:30— 4:00	Update on C2 data modeling activities at JIEO: LTC Mike Robinson (JIEO/CFS)
4:00— 4:30	MORS Mini-Symposium on M&S Data Issues (Nov. 16–18): Mr. Howard Haeker (Army/TRAC)
4:30— 5:00	Update on complex data issues: Ms. Iris Kameny (RAND)

THURSDAY, JULY 29, 1993

ENVIRONMENTAL DATA MANAGEMENT AND DATA STANDARDS

8:00– 8:30	Navy Oceanographic and Atmospheric Master Library and data standards: Mr. Alan Chappel (Navy)
8:30— 9:00	EOSDIS overview: Ms. Debbie Blake (NASA)
9:00— 9:45	Developments in spatial data standards: Mr. Dave Danko (DMA) Joint MC&G Interoperability: Col Rich Johnson (DMA)
9:45—10:15	Project 2851 standards; Major Kent Johnson (Aeronautics System Command/YTMS)
10:15—10:35	Break
10:35—11:00	*Army environmental data transformation standards: Mr. Robert Atkins (Army TEC)
11:00—11:25	Dynamic Environment and Terrain Modeling in DIS: Mr. Jeff Turner (Army TEC)
11:25—11:55	STRICOM DIS standards initiatives: Mr. Gene Wiehagen (STRICOM)
11:55—12:20	Distributed Interactive Simulation standards process: Dr. Chien Huo (JIEO/CFS)
12:20— 1:10	Lunch

DATA STANDARDS ACTIVITIES IN M&S PROJECTS/PROGRAMS

1:10— 1:30	Standardization of moving models in virtual simulation: Mr. Farid Mamaghani (consultant to IDA and PM-CATT)
1:30— 2:00	Close Combat Tactical Trainer (CCTT) update and data standards: Mr. Rob Wright (CCTT/RCI)
2:00— 2:30	Universal Threat System for Simulation (UTSS): Clay Putman (GPS Tech supporting Navy/UTSS)
2:30— 3:00	Data Base System Upgrade Project: LTC Rayford Eubanks (JS)
3:00— 3:30	Break
3:30— 4:00	Operations Analysis and Simulation Interface System (OASIS): LTC Dan Hogg (JS/J8)
4:00— 4:30	Joint Data Base Elements (JDBE) experience with developing subject area information models: Mr. Steve Matsuura (Army/EPG)
4:30— 5:00	Summary and Wrapup: led by Dr. Chien Huo

* These briefings were not given

Name/Affiliation	Phone	Fax	Email
Tom Adrian, CACI	(703) 875–2911	(703) 875–2904	
Cy Ardoin, IDA	(703) 845–6647	(703) 845–6848	ardoin@ida.org
James Augins, Navy	(619) 553–6085		augins@nosc.mil
Robyn Benensohn,SAIC	(619) 546–623	(619) 546–6709	robyn@jupiter. saic.com
Paul Birkel, MITRE	(703) 883–6399		pbirkel@mitre.org
Bob Bishop,DTIC-AP	(703) 274–7662	(703) 617–7087	rbishop@dgis. dtic.dla.mil
Don Blanton, AMSAA	(410) 278–3368	(410) 278–6242	blanton@brl.mil
Larry Buchsbaum, NAWC	(215) 441–1534		buksbaum@nadc.navy.mil
William Burch, Navy	(703) 578–2587	(703) 379–8077 or 578–2568	
Chuck Burdick	(703) 759–1407	(703) 759–1450	
Linda Calvert,MITRE	(703) 883–6326		lcalvert@mitre.org
Gary Carlson,	(619) 553–3017	(619) 553–5933-fax	
Virginia Castor,ODDRE	(703) 614–0212		castor@ajpo.sei.cmu.edu
Herman Cisneros,SSDC	(205) 955–4527	(REPLACES GARY MAYS)	
Jacquelyne Neville	(703) 683–7287	(703) 418–0775	
Twyla Courtot,MITRE	(703) 883–7343	(703) 883–6991	courtot@mitre.org
David Danko, DMA	(703) 285–9238	(703) 285–9383	
Tina De Angelis, AF	(310) 363–3253	(310) 363–1753	deangelitm@cn. laafb.af.mil.ucsd.edu
Tim Doane, GPSC	(703) 271–7700	(703) 271–8566	
Christine Donohue,USN	(703) 693–5928	(703) 693–7329	donohuec@cc. ims.disa.mil
John Eisenhardt,	(313) 761–5836	(313) 761–5368	FAAC,Inc.76104. 607@compuserve.com
Peggy Gordon, AF	(703) 693–5745	(SEE MAJ JACK JORDAN)	
LTC Chris Grates,USN	(904) 884–6926		gratesc@vax1.jwc.af.mil
Peggy Gravitz,Colsa	(205) 922–1512	(205) 971–0002 x2170	
John Griffiths,Intel.	(703) 820–2841	Same as phone #	
CDR Charlotte Gross	(703) 746–7939	(703) 746–9396	cgross@ddi.c3i. osd.mil
Lucy Haddad, RCI	(407) 282–1451	(407) 658–9541	
Howard Haeker,USA/TRAC	(913) 684–3030	(913) 684–3866	haekerh @tracer.army.mil
Lynn Henderson (DAPMO)	(703) 285–5377	(703)285–5403	
Scott Herman, DBMd	(202) 863–9960	(202) 863–8407	
Dan Hogg, JCS/J8	(703) 697–8899	(703) 693–4601	dhogg@mh1.js.mil
Chien Huo, JIEO	(703) 487–8036	(703) 487–8038	huoc@cc.ims.disa.mil
Major Doug Hurd,HQAMC	(618) 256–5663	(618) 256–5673	mscti7@mhs.safb.af.mil
George Hurlburt, Navy	(301) 826–3625	(301) 826–3134	hurlburt@ technet1.JCTE.JCS.mil
Mike Hopkins,	(813) 830–6210	(813) 830–4919	
CSC for CENTCOM Phil Hwang	(703) 285–9286	(703) 285–9396	
Major Bill Johnson, USA	(407) 380–4328	(407) 380–4201	
Major Jack Jordon,	(703) 693–5745		jajordan@sysp3.hq.af.mil

Iris Kameny, RAND	(310) 393–0411	(310) 393–4818	kameny@rand.org
Martin Katz			katz@cseic.saic.com
Kenneth Kaufmann,NCCOSC	(619) 553–6098	(619) 553–6083	kaufmann@nosc.mil
Edward Khedouri	(601) 688–4556	(601) 688–5759	N22%N2%CNOC@ comis.conoc.navy.mil
Bob Kero,Argonne Lab	(708) 252–3752		bkero@eid.anl.gov
Sid Kissin, NSA	(301) 688–0562		
K. Konwin, AFSAA	(703) 697–5616	(703) 697–3441	
Richard Kruger	(703)525–0081	(703) 524–1643	kruger@cpms.saic.com
Chris Landauer, Aerospace	(703) 318–5403		psc@aero.org
Steve Lawyer, IDA	(703) 845–6696		lawyer@ida.org
Dan Lewis, DISA/CIM	(703) 536–6900	(703) 536–7480	
Mike Lightner JMASS	(513) 476–4464	(513) 476 4746	
Mike Lilienthal,DMSO	(703) 998–0660	(703) 998–0667	mlilient@dgis.dtic.dla.mil
Ernie Lucier,NASA/SED	(202) 358–0772		lucier@nhqvax.hq.
D. Lunceford,CCTT	(407) 380–8193		luncford@charm.isi.edu.nasa.gov
Bill Macon,	(703) 325–0918	(703) 325–2964	
Major Doug Martin	(703) 998–0660	(703) 998–0667	
Janet McDonald, USA	(602) 538–4958	(602) 538–4973	mcdonald@hua chuca-emh7.army.mil
Rich Moore	(407) 282–4583		moore@orlando.loral.com
Tom Nabors	(601) 688–5248		
Jack Nicklas, RCI	(703) 893–6120	(703) 893–0917	
Chris Olson	(703) 683–7287		
Bob Overholt	(215) 897–5546	(215) 897–6707	
LTC Ron Parker, AF	(703) 693–5745	(SEE MAJ. JACK JORDON)	
Mr. Mike Piercy	(703) 998–0660	(703) 998–0667	
Clay Putman, GPS	(703) 271–7700	(703) 271–8566	
Don Rea, MITRE	(703) 883–6249		drea@mitre.org
Chunghye Read	(703) 285–9236		
Robert Reed, Mike Robinson	(703) 487–8024	(703) 487–8038	
Michael Rybacki	(703) 607–3385	(703) 607–3381	
Richard Schiller, MITRE	(703) 883–3741		m23517@mwvm.mitre.org
Steve Shervais,CACI	(703) 875–2911	(703) 875–2904	
Ernie Smart			
Jim Stempeck	(719) 548–9704		
Walt Swindell, USA	(913) 684–3030		swindelw@tracer.army.mil
Peter Valentine,USA	(602) 538–4976	(603) 538–4973	valentin@huachuca-emh7.army.mil
Massey Valentine, COLSA			
James Vernon	(703) 697–3635		
LTC J. Weidewitsch	(703) 998–0660	(703) 998–0667	
Ken Wimmer, SAIC/DMSO	(703) 379–3770	(703) 379–3778	kwimmer@dgis. dtic.dla.mil
Rob Wright, RCI	(407) 282–1451	(407) 658–9541	
S. Youngblood,JHU	(301) 953–5000	(301) 953–6910 x4000	simone@aplcomm.jhuapl.edu

PRESENTERS THAT ARE NOT MEMBERS

Mr. Hart DeGrafft	(703) 696–1906 or 1904	
Ms. Debbie Blake	(202) 863–9960	blake@spso.gsfc.nasa.gov
Mr. Alan Chappel	(601) 688–4892	(601) 688–5332
LTC Rayford Eubanks	(813) 830–6210	(813) 830–4919
Mr. Bill Greyard	(703) 285–5375	(703) 285–5403
Mr. Frank Hoffman	(703) 640–3714	(703) 640–3714
Maj. Kent Johnson	(513) 255–0549	
Mr. Farid Mamaghani	(206) 957–3264	farid@charm.isi.edu
Mrs. Bunnie Smith	(703) 746–7222	
Nancy Thatcher	(703) 746–7190	
Mr. John Tieso	(703) 746–7938	(703) 746–7396
Mr. Jeff Turner	(703) 355–3838	(703) 355–3176
Mr. Gene Wiehagen	(407) 380–4363	(407) 380–4258

ATTENDEES THAT ARE NOT MEMBERS

Jim Calvin (LOREL)	(617) 873–3603	(617) 873–2099 calvin@camb-lads.lorel.com
Mr. Jim Davidson (DoD)		
Mr. George Endicott (DoD)		
Kim Gebhardt, DMA	(703) 285–9383	
Ms. Brooke Guthrie	(301) 763–1390	(301) 763–1359
J.Lencozowski, DMA	(703) 285–9783	
Capt Jerry McWhorter	513–255–0549	
Col Al Moore, DMA	(703) 285–9344	(703) 285–9397
Peter Robison, DMA	(703) 285–9383	
Eleanor Schroeder	(601) 688–4270	(601) 688–5701
Kent Sieverding	(513) 429–6158	
Opal Stroup, DMA	(703) 285–9344	(703) 285–9397

3. SUMMARY OF ISSUES, WORK-TO-DO, TOPICS FOR NEXT MEETING

(1) Topics suggested for the next I/DB:
DTIC brief: Bob Bishop —— TECNET update: George Hurlburt Theater Battle Management C4I (architecture automation "example of process and data modeling": Captain David Hess Update on Security CONOPS for IC Catalog: Dr. John Griffiths Merits/problems with data modeling: DMSO report on focus calls and funded projects Session on sources of data

(2) DMSO Data Administration Survey contact Dr. Chien Huo at huo@dmso.dtic.dla.mil or 703–487–8036, or AUTOVON 364–8036.

(3) New reference documents: Guidance for Definition of Managed Objects ISO 10165–2 (Robinson)

(4) Iris Kameny action item: coordinate with Sid Kissin on visit to NSA to discuss intelligence data for M&S and intel models

<u>People signed up:</u>

Chris Landauer	cal@aero.org
Bill Burch	703–824–0100
Rich Moore	moore@orl1.orlando.loral.com
Richard Kruger	rkruger@spms.saic.com
Martin Katz	703–749–5414, katz@coeic.saic.com
Mike Lightner	DSN 785–4429
Mike Seiverding	513–429–5580/6158
James Hines	703–556–1299, fax 703–556–1174

(5) Chien Huo/Iris Kameny action item: coordinate visit to Bunnie Smith to discuss M&S data administration issues

Chris Landauer	
Clay Putman,	703–271–7700
Bob Bishop	703–274–7661
Mike Rybacki	703–607–3385
Luci Haddad	407–282–1451

(6) Be sure to put the MORS Mini-Symposium on "Modeling and Simulation Data Issues", Nov. 16–18, on your calendar. Contact Howard Haeker 913–682–3030, or Natalie Addison at the MORS office 703–751–7290 for more information.

(7) Note that the next I/DB meeting will probably be held in January due to the MORS meeting in Nov. and the holiday season.

(8) Suggested working groups that could be formed from I/DB members (1) IDEF modeling (2) Exploring data standards in FDAD area such as C2 (3) Investigating types of data (Marty Katz volunteered)

— metadata
— empirical data
— planning factors
— rules of engagement
— tactics

(4) Dealing with the area of data reconciliation

(5) Challenging the data standardization process

— alternatives
— goal? where are we going?

(6) Exploring characteristics/types of models and the metadata needed to describe them (this is needed to make an effective directory of models and to support reuse repository): Farid Mamaghani was very interested in this

4. UPDATE ON DMSO HAPPENINGS

(1) Welcome and DMSO Update: LTC Jerry Wiedewitsch
LTC Jerry Wiedewitsch, the DMSO Deputy Director, opened the meeting with a brief on the DMSO. Navy Captain Bruce McClure is the new DMSO Director. The DMSO vision is to create realistic, recyclable, and complex "worlds" through modeling and simulation (M&S) to improve how we do everything: readiness and warfighting, design and prototyping, education and re-training, and emergency preparedness. The DMSO mission is to strengthen the use of M&S in joint education, training and military operations; research and development; test and evaluation; analysis; and production and logistics. Important areas to be supported by current M&S activities are joint combined arms and the JWC. Dr. Anita Jones, who chairs the EXCIMS, is looking beyond use of M&S in support of readiness to its use by the acquisition community (who have expressed a lack of confidence in its use). DMSO working with OTA and OSTP is contributing to technology transfer through exploring and supporting the dual use of M&S in K-12 education in the DoD Dependent Schools (DoDDS) as well as for military education. The DMSO FY93 Infrastructure Task Force's mission is to determine what infrastructure building blocks need to be put in place and what are the technology gaps that need to be filled in. The DMSO FY94 call for proposals is focused in 4 areas: M&S components, M&S common system support, M&S interoperability, and M&S community awareness. A new M&S industry steering group has been formed whose subgroups are all chaired by people from industry and academia.

(2) Introduction to Dr. Chien Huo and an overview of the JIEO M&S support activities: Iris Kameny and Dr. Chien Huo
Iris Kameny introduced Dr. Huo who will be joining her as a co-leader of the I/DB Task Group. Iris will continue focusing on issues in complex data and data verification, validation, and certification (VV&C) while Chien will concentrate on M&S data administration issues with MITRE aid. Both will support the I/DB task group, coordinate I/DB activities with the new DMSO supported Information Analysis Center (IAC) and maintain the I/DB part of the DMSO Information System. Chien described the Joint Interoperability and Engineering Organization (JIEO) Center for Standards (CFS) to which he belongs and its program support for DMSO in S&T Thrust #6 "Synthetic Environments", the DMSO Information System, standards support for DIS, and his new role in data administration for M&S. He discussed the DMSO data administration/standardization program objectives, his responsibilities and approach in establishing a framework for the data administration program, interacting with key customers such as STRICOM and DIS, and establishing and prioritizing customer requirements and support for data-related projects. By September 30, he plans to have an initial DA Concept of Operations, analysis of the DMSO DA survey, and an evaluation of the utility and expandability of the Defense Data Repository System.

Chien distributed a "DMSO Data Administration Survey" which you are all urged to fill out. The information gathered will facilitate building consensus and cooperation among the M&S community on the definition and implementation of the DA program.

(3) Update on DMSO Information System: Mr. Ken Wimmer and I/DB Partition: Iris Kameny

Ken announced that the DMSO Information System is finally up and running and distributed membership forms for all to join and become users. The system contains many DMSO documents in electronic form, organizations and POCs, several M&S catalogs and more to come later. If you haven't joined, you can get information by sending email to comments@dmso.dtic.dla.mil or by calling Ken Wimmer at 703–379–3770. Through the top DMSO Information System menu, I/DB members can call up a menu of I/DB relevant material including an acronym list, definitions relevant to data, a document reference list relevant to data, interest areas of I/DB members, I/DB membership list, agenda for the next I/DB meeting, calendar for I/DB, and past meeting notes.

(4) M&S Information Analysis Center: Mr. Ernie Smart

The Tactical Warfare Simulation and Technology Information Analysis Center (TWSTIAC) is sponsored by DMSO and jointly operated by the University of Central Florida's Institute for Simulation and Training (IST) for DIS related M&S projects and by Battelle for tactical warfare projects. The heart of the TWSTIAC will be access to databases containing thousands of documents, pictures, and other material dealing with the technologies and research involved in live, constructive, and virtual M&S. It is intended to become DoD's primary agent for M&S information and to provide short term support on urgent matters such as reports, studies, benchmarking, identification of appropriate data, and creation of unique databases, catalogs and documents. Its support activities include: primary research; supporting use of standardized M&S; promoting standardized processes for collection, analysis, etc. of test data; conducting M&S seminars, symposia, and workshops; conducting methodological feasibility testing; performing technical area tasks for tailored customer needs; and providing technical consultation on M&S issues. Its information clearinghouse activities include: collection and management of relevant reference information; identification of knowledge gaps; putting selected data in electronic form; informing customers of information via catalogs, newsletters, etc., providing single entry point for new customers; developing and maintaining M&S tutorials; answering questions and conducting searches; and operating an electronic bulletin board.

5. REPORTS FROM NEW M&S ORGANIZATIONS

(1) New Air Force M&S Organization: Dr. James Vernon (AF/XOMT) Captain David Hess: TBM C4I Architecture

The Air Force Director of Modeling, Simulation and Analysis (USAF/XOM) is Brig Gen Campbell; the office is under Deputy Chief of Staff Plans and Operations (USAF/XO) which is under HQ/USAF. The XOM mission is to strengthen operational readiness by providing direct support to the warfighter for USAF modeling, simulation, and analysis that involve plans, operations, and operational requirements. XOM is the AF focal point for M&S and objectives include development of analytical tools and procedures to support cost effective decisions; insight into force structure deficiencies; providing education and training; and demonstrating the capability and use of air power. XOM consists of three divisions: Warfighting Support (XOMW), Evaluation Support (XOME), and Technical Support (XOMT).

Captain Hess works for Air Combat Command and is concerned with Theater Battle Management C4I architecture. They are participating in the joint Tactical Battle Management (TBM) Global Operations Steering Group (GOSP) which is an initiative to improve theater C4I by applying CIM methodology which includes quality improvement teams, identifying and applying technology, migration paths to interoperability and standards, and rapid prototyping and testbeds. The TBM C4I Architecture project requirements include: central control and configuration management, distributed data gathering, data ownership, central repository, and support for dynamic analysis. They are using Zackman's architecture to define the TBM C4I Architecture to express what, how, where, who, when, why. The 1993 program scope is deployed sustained theater with focus on the Air Tasking Order (ATO) process analysis and build using top-level models for CRC, ASOC, AWACS, JSTARS, ABCCC, TACP, FACP, and C-130 wing. They are building detailed theater information flows between all AF OPFACs and indepth as-is and to-be static and dynamic models for force-level Air Operations Center and Wing Operations Center. They ultimately want to be able to link their architecture to the ARPA Warbreaker architecture by providing a process model and simulation tool so that, for example, the Warbreaker project will know what ABCCC does by looking at the process model through the simulation tool. For the Air Ops data model kick-start project sponsored by DISA/JIEO/TBC and J6I, they are mapping info from activity models to or e data model. They are using subject matter experts (SMEs) from all services to define what data is used, standardize data descriptions, and determine the relationship of one piece of data to another.

(2) Intelligence Community M&S Coordinating Group and Intelligence Models: Dr. Sid Kissin

The IC M&S Coordinating Group was established in October 1992 to be a focal point for M&S coordination within the IC and to work with DoD. Its proposed responsibilities are to: provide information about M&S applications, support the DoD Master Plan and Investment Plan, explore joint or cooperative developments, and to establish VV&A policies, procedures and guidelines. They have established four working groups: symposium (their next Symposium on Intelligence Applications of Modeling and Simulation will be held November 16–17 at NSA), M&S catalog, community relations, and standards and protocols. Dr. Kissin represents the IC M&S Coordinating Group on the USD(A&T) EXCIMS for M&S.

A major benefit in use of M&S in IC is to take care of the seams that occur because of non-overlapping charters/missions of IC organizations. ARPA will be doing this for Warbreaker which will include simulation of intel. An example of cost savings that could be accomplished through an M&S clearinghouse would be that instead of each service maintaining a facility model there could be one general purpose facility model for which each service could add its special enhancements.

The IC M&S Coordinating Group was established in anticipation of a DDR&E directive which will call on all DoD organizations to establish a central focus for M&S and be responsible for accrediting models within their focus area. There were questions from the audience about:

(a) Models such as TACWAR include an intelligence collection asset and the new directive would require that the model be accredited by the IC as valid. However, without a policy or set of standards and procedures, it appears possible for the IC to refuse to validate a model and not necessarily explain how to make it valid. Then there would be a sort of limbo, the model is invalid for use but there is no clear way to make it valid. Kissin's reply was that the accreditation responsibility was being put upon them by DoD without adequate policies and guidelines to prevent this from happening.

(b) Availability of intelligence data for tactical models: so far the IC has avoided sharing of data with the tactical world but Kissin believes they will have to start doing this. (my comment: it would appear that they would also have to certify that the intel data was verified and valid in order to accredit the model.)

6. DATA SECURITY

(1) Security CONOPS for Intelligence Community Catalog of M&S: Dr. John Griffiths (IC M&S Coordinating Group)

The IC Coordinating Group wants to build an M&S catalog similar to those built by J8, the Army and the Navy. A lot of intel models already exist in the Army and Navy catalogs. The IC will need to control the data going into the catalog because of the security risks of data aggregation—a large amount of unclassified data may become sensitive because more knowledge can be inferred from the aggregated data than from the data in each contributing source considered alone. Because of the data aggregation problem and because the IC community will have classified information about some of its models, the IC catalog will be composed of two parts: unclassified and classified. The unclassified catalog will be able to co-exist on the DMSO Information System while the classified part will be a separate IC catalog. Because users in the IC do not have access to the unclassified internet, the IC will also need to migrate the existing Army, Navy, and J8 catalogs onto a classified IC net. Access to the classified catalog, for now, will be by hard copy but in the future may be part of a secure network using electronic transfer. For now, there will be POCs throughout the community that will have copies of the classified catalog that exists in a central repository, and they will be responsible to determine a user's need to know and if established will furnish him/her the catalog information. Another point is that for classified models, they will try to have scant information in the unclassified catalog that will indicate the general nature of the model and a point of contact.

(2) Defense Information System Security Program (DISSP): Mr. Hart DeGrafft

The DISSP organization started in 1990 and recently became a part of the JIEO Center for Information Systems Security. It is jointly staffed with people from DISA and NSA. The major missions of the center are: DISSP, multi-level security, and operational INFOSEC. There are six directorates in DISSP:

(1) Policy, plans, programs and resource management: supports C3I in policy development; coordinates information systems security studies requested by OSD; coordinates NSA and NIST security initiatives to ensure consistency; provides funding to non-DoD government security activities; recommends development of new technology; provides database of solutions that services and agencies can use to satisfy security requirements; performs planning, programming and budgeting for DISSP; supports OSD in DoD INFOSEC program fiscal review, project monitoring, etc.

(2) Evaluation, certification, and accreditation: develops DoD wide certification and accreditation standards, can reach into NSA security center for support if needed. Reviews service and agency policy and procedure documents to correct conflicting policies and oversee security aspects of standards implementation and tests to validate that security requirements have been met. Supporting about 50–60 programs in this way.

(3) Security products: with respect to programs for which DISA is responsible: will establish a database of INFOSEC R&D programs, will establish a program to solicit requirements for INFOSEC products (look to fill in voids); will establish program of fiscal support to INFOSEC programs; assures INFOSEC product availability; acquires and deploys security products; assists OSD in designing and implementing tech transfer program in security products and technology.

(4) INFOSEC professionalism: will establish career path for INFOSEC in DoD and military, develops program and standard courses for INFOSEC training, provides symposiums for DoD information systems security; coordinates comprehensive INFOSEC conference and awareness programs.

(5) Security architecture and engineering: will establish DoD AIS/T infrastructure functional and technical info systems security requirements, develops security architectures, transitions plans for architecture implementation, performs configuration management of DoD ISS architecture and AIS/T standards in coordination with DISA Joint Center for

Standards. This group is located at NSA and is writing transition plan for legacy systems.

(6) Countermeasures: will establish automated info systems security incident support team (ASSIST), will establish vulnerabilities analysis and assistance program to assess how penetration resistant your system is, will perform INFOSEC threat assessment and share with intel organizations, will establish program to incorporate INFOSEC countermeasures in DoD architectures (e.g., intrusion detection, virus eradication).

Questions:
Dan Hogg: INGRES/Sun has mls product in pre-beta test, what happens if he uses it in the OASIS system, what are the implications wrt his applications? ANSWER: NSA is providing security profiles to be able to take a system and evaluate it. These will be available for a combination of products but if your combination isn't addressed, then put it on the list. They will facilitate what they can.

Question about availability of tools to aid in security assessment and evaluation of systems. ANSWER: DISSP can point people to those who have such tools but are not doing much tool work themselves. However they can help you formulate your requirements and then see if there is an existing tool or one under development.

7. DATA ADMINISTRATION, STANDARDIZATION AND MODELING ACTIVITIES

(1) DoD Enterprise Model: Mrs. Bunnie Smith (ODASD(IS)) (email: smithb@pentagon-hqda.dss.army.mil)
Bunnie Smith briefed the DoD Enterprise Model (viewgraphs of which are available from CIM). She came into CIM in summer 91 and looked for a plan and picture without finding one. GM would have had an overall view of itself before embarking on a CIM effort. There was a need to establish a corporate goal of addressing the joint good for the corporation. CIM goals are to establish a common view of the corporation and a common language and to establish functional direction. They have now put information management (IM) infrastructure into the business operations. The key to IM integrity is data, not just with respect as to how it is used in the machine but why people use it. Data describes the "rules" of the process and the links among all processes.

They will be bringing the ATCCIS Generic Hub Data Model together with the DoD Enterprise Data Model which they have adjusted to add entities such as activity. They have linked the strategic entities from the Enterprise Model down to the ground model and also want to do the same with the air model.

After ODS, there was no longer separate accounting for deployed forces vs CONUS forces and systems, these are both integrated in the FYDP. These are now included in "provide capabilities" rather than in "employ forces". CIM is directed toward "acquire assets" and "provide capabilities". The custom is to "employ forces". One needs to work backward with customers to change direction from employing forces:

direction<--assets<--capabilities<--employ forces

In as-is modeling, there are two communities: the Joint Staff and CINCS do this from operational plans, and the military departments do this from the developed program and budget.

They have been asked to pull out "A42 Provide Operational Intelligence" from the Enterprise Model to be separate from "Employ Forces'. The Joint Staff will also rework "A43 Conduct Operations." What won out with 90% customer agreement was "conduct intra-inter government operations". This would serve to cover civilian disasters like hurricane Andrew cleanup and support modeling of organizations like FEMA which is split into traditional civil defense and natural disasters with incompatibilities between the two, e.g., in accommodating different communication systems.

A data model can't be built on its own, the Enterprise Model is built with a goal to support the corporate good. Data approach:

models-->architecture-->SDEs-->database

She believes that almost all concepts are strategic level entities.

By September 1, the Enterprise Model and ATCCIS will be put together and a keybased data model produced. She asked what we thought were the categories needed to break the model down further toward the bottom data definitions? (My comment: we think this taxonomy has been missing from the start and are working on developing it from the bottom-up because we are not sure you can get there only from the top-down.) Bunnie said to call her when you are developing bucket breakdown structure—and report on pieces of the undefined taxonomy. They and we are also concerned with a way to develop data models that supports multiple views. She agreed that we also need to be able to state business rules in a machine processable way but this is not currently supported in the DDRS.

(2) Update on DoD Data Administration Program: Ms. Lynn Henderson (DAPMO)
Center for Information Management (CIM) has responsibility for definition, organization, supervision and protection of data within an enterprise or organization (from DoDD 8320.1). CIM's purpose is to provide effective, economic acquisition, and use of accurate, timely and shareable data to enhance mission performance and system interoperability (from DoD DASP FY92). There are two classes of beneficiaries: decision makers (end-users: e.g., warfighters, CINCs, SecDef) and systems builders. For the decisionmaker, the right data needs to get to the right person at the right time for enhanced performance and at reduced cost. Benefits for the system builder are: controlled redundancy, expedition of information system development and maintenance, and facilitation of data reuse and exchange—results in cost savings.

CIM initiative context: DoD missions, policies, strategies, tactics, goals, objectives, critical success factors, doctrine, laws, directives, regulations, commander's guidance and operation orders feed into the processes of building activity/process models and building data models. The data model results in coordination and registration of DoD standard data which is managed in a DoD data repository. Iterative feedback occurs between process and data modeling to develop models that are used to engineer the information system software and data (data standards from the DoD data repository). This results in interoperable/integrated systems that can share data.

The CIM policies, procedures, etc. are described in the DoD 8000 series. DoD 8020.1 describes the business process. DoD 8120.1 describes the information system process design and development, and DoD 8320.1 the DoD data administration process (including the DoD Data Administrator (DA), Functional Data Administrator (FDAd) and Component Data Administrator (CDAd) roles and process).

Where are they?

- Strategic planning: doing an annual update to plan with FDAd and CDAd participation and eight year strategic plan is in final draft form.
- Policies, procedures, and standards: DoDD 8320.1 "DoD Data Administration" issued Sept. 1991, DoD 8320.1-M "DoD Data Administration Procedures Manual" in final form, D0D 8320.1-M-1 on data element standardization is approved, DoD 8320.1-M-x on modelsand model standardization is under development, and other DoD 8320.1-M-x documents on DB administration, quality, and security are under development.
- Education, training and consultation: have established executive and management-level seminars, classroom training modules, remote training capability, and computer-based training. Trained over 2,000 people during past year.
- DoD data model and architecture: Developed the DoD Enterprise Data Model and are looking to integrate it with the ATCCIS Generic Hub data model. Right now there is no way to bridge the DoD Enterprise model from the top down with models from the bottom-up. To help address this problem they will be allowing interim data models developed from the bottom-up. Beckie Harris' CIM group is also addressing complex data standards.

  One problem is that the functional areas don't fit the data buckets of the Enterprise Model. Recognized data entities will have stewards and the stewards will coordinate on proposed data entities. When we begin to develop a data model, we need to let the functional area stewards know we are doing so. Question: how do we know who the functional area data stewards are? (or how do the Component M&S offices learn who the data stewards are? For if they know, then M&S projects could coordinate with them.)

- Data dictionary/repository: defining future repository capabilities and have support for current Defense Data Repository System (DDRS) (have developed user manual, access procedures, approval process, IOC dictionary capability). They are trying to establish a baseline for all DoD repositories that exist and establish the DoD repository requirements by collecting all the requirements on which the different repositories were based. They are not forcing use of the DDRS, but need to know about all repositories. However, all data elements (DE) in use throughout DoD should be registered in the DoD repository. They also recognize that instance data has to have an owner that is a responsible party.
- Quality assurance: they have established guidelines and assessments for data but so far there are few if any approved DE in the DDRS.

MY COMMENT: THE NEW INTERIM DATA STANDARD APPROACH (AS DESCRIBED BELOW) IS VERY IMPORTANT TO THE DEVELOPMENT OF M&S DATA ELEMENTS. THE NEW M&S FDAd SHOULD HAVE MORE TO SAY ON THIS SUBJECT IN THE FUTURE.

DoD Challenge: they have been told by developers and functional customers that more rapid development of standard data is needed. They are kicking off an accelerated program to define more DEs through use of Interim Data Standards (IDS). The FDAds will assess demand/risks, select and enter IDSs, and develop plans to merge with formal data standards. The data architecture people will use cluster analysis to scope, focus, validate and refine extensions while integrating models and views into the DoD Data Model. Constraints on IDSs are: (1) FDAds must cross-functionally coordinate; (2) IDSs will be placed in functional partitions of DDRS; and (3) IDSs will be used until Formal Data Standards are approved. The approach is to develop IDSs in priority areas of the Enterprise Model. The major change is for a DE to be entered unlinked to the Enterprise Model and then integrate it later.

The DAPMO will be developing a starter set of model-based IDS from models already submitted to the DoD DA, and will circulate these for cross-functional coordination. DAPMO provides options for FDAds to designate alternative sets of IDSs based on their model, systems, or dictionary. FDAds with DAPMO will develop a plan and schedule for merging IDSs into formal data standards.

Options for FDAds developing IDSs:

(1) Functional model: develop/identify IDSs for its own data based on its functional data model or functional subset of some other DoD or external model

(2) Systems model: develop/identify IDSs for its own data based on a logical model reverse engineered from a designated migration system.

(3) Scrubbed dictionary: develop/identify IDSs for its own data based on functional data dictionary DEs scrubbed to minimize data redundancy, provide clear definitions and essential metadata

(3) Report on IDEF Users' Group meetings and issues: Mr. John Tieso (OSASD(IS)) (No viewgraphs presented)

There are three things to report on: (1) initiatives about activities; (2) where things are with respect to guidance and handbooks; and (3) where the IDEF users' group and other groups are with respect to definition of a common tool set.

The M&S community needs to go through business process modeling and identify standard data which can be simulated and finally model that data in a data model.

Concurrent work is going on between NIST and the IDEF Users' Group with respect to IDEF0 and IDEF1X. The objective is to define how the same IDEF model can be dealt with by any tool set, to enable moving from tool to tool to deal with as-is and to-be models. Want to be able to move IDEF models across different repository systems.

DoD has to convince vendors to adopt common definitions to make it easier to move models to and from repositories. An IDEF interface definition language (IDL) should be unveiled in October which if used by vendors developing information management toolsets should make model exchange easier.

A FIPS is coming out in three weeks that includes an IDEF IDL. This means that ICASE vendors will be required to meet the IDL standard in their toolsets. Use of a standard should support model movement across tools. A contract has also been negotiated between NIST and the IDEF Users' Group to address IDEF3 (dealing with time) and IDEF4 (dealing with object-oriented databases). IDEF4 should allow us to deal with legacy systems by making objects out of them.

Tieso has also been involved in standards for groupware, a whole series of new tools that will dramatically change the way we perform functional process improvement.

There is a big gap between the capabilities of an operational DBMS and the current DDRS. There is a need to provide users with common sense ways to do business at a lower cost. CIM is looking at an integrated toolset for an "Intelligent Repository" to replace what is currently called the DDRS. This would allow one to easily take data out of the repository and use it in applications

Finally, vendors are realizing that CIM is real.

(4) Air Mobility Command Information Resources Repository System: Major Doug Hurd, (AF/HQ/AMC/SCTI)
The AMC 4-star has called for a single, integrated AMC C2 system for the planning, scheduling and execution of mobility forces. Users don't care where the data is managed just so long as they can access it when they need it. The AMC future C2 architecture has one place to store all data, all applications access the same database, users need only one terminal or PC to access everything, and eventually MLS will allow users to traverse between classification levels.

AMC is in its third year of process modeling having switched to IDEF0 tools and modeling discipline about a year ago. Process modeling takes a long time. Doug showed an Aerial Port model which took over $350K to build. They have also invested resources over the past three years in data standardization and are working with AF and USTRANSCOM to nominate data elements to the DDRS.

They feel a key to success is to provide a capability to enable meta-information customers access to whatever data they need to conduct analysis, overhaul business practices, standardize data, or build integrated systems. They need a repository system that can support all kinds of metadata about differing types of information assets including links between different types of metadata. They believe that centralization will help them control, register, validate, and manage all of this metadata as well as help in designing auditing capabilities to alert them to possible inconsistencies in the metadata.

The Repository IOC will be within the next 12–15 months. The effort consists of 12 objectives which are funded and of low technical risk.

(1) Hardware: Sun 2000 (CPU, memory, and storage can be expanded)

(2) Air Force Information Resource Dictionary System (AFIRDS): changed to implement 8320.1-M-1 data element descriptions, and are testing a remote printing capability for dial-in and DDN users (unlike DDRS) which should be available by September. Also working toward possible merger of AFIRDS with DDRs. (To that end are lining up resources for conversion to Ada.)

(3) Pilot evaluations of tools: need to bridge gap between IDEF0 and final delivery of C4 system so are doing joint agency pilot tests using real AMC data and models as input. These include: CM, ADAPT tool test and IDEF3 sponsored by DDI, and Design CPN.

(4) Meta-Information Linkage: overall repository management system is an Infospan product. Looking for Infospan assist in designing number of audit-like programs to detect metadata inconsistencies between IDEF0 and IDEF1X models and in future may look at intelligent cross audits.

(5) Process "To-Be" Analysis: augmenting going from as-is to to-be models by using simulation tools and activity-based costing in deriving desired implementation target plans and strategies.

(6) Data Modeling: ensure consistency between system models and approved command level logical data model and ensure that all command efforts reflect latest available data from DoD data standardization process.

(7) Data Element Level Processes: begin augmenting process modeling efforts by identifying specific data items from forms, computer screens, etc., which are input/output from decomposed process model activities. This will enable linking business process to data model and to SDE metadata in dictionary as well as providing basis for design of specific applications.

(8) 1,000 Data Elements: continue effort to create command level SDEs to meet January 1994 start date for AMC's transportation systems modernization project.

(9) Technical Integration Strategy document: identifies technologies, methodologies, tools and strategies that lead to integrated supportable systems and how these will work together, who will perform the activities, and what are the expected outcomes.

(10) Repository CONOPS: user-level concept of operations for the repository.

(11) Repository User Manual: to describe repository mechanics to users and at same time provide for system order and integrity overall.

(12) Repository Process Models: provide a process model of the entire operation of the repository with a view of capturing how they are executing systems integration end-to-end. These models will become the primary tool for analyzing their integration process and for planning process and repository improvements in the future.

Future directions

- "hot key" from process model, to message read by activity, to IDEF1X entity relation chart containing data element in message.
- "autoload" meta-information between similar tools like those in the IDEF0 family, and freely upload same validated information upward toward systems integration process.
- "meta-information integration": need to piece differing types of meta-information together to produce an integrated look to processes, models, architectures, and data.

(5) ATCCIS Battlefield Generic Hub Data Model: Iris Kameny for Major Matt O'Hanlon (NATO/ATCCIS)

The objective of the ATCCIS generic hub model is to model tactical structured data to help define the standard data elements to facilitate interoperability between ATCCIS conformant C2 information systems of NATO nations. In May 1992, the ATCCIS permanent WG accepted use of IDEF methodology to support activity and data modeling. They decided to develop as-is process models and to-be data models. The process models are to show current data flows and where possible, message formats, and will be used to validate the data models.

The generic hub data model describes the real world objects and happenings on the battlefield as high level entities in terms of their: classes, locations, activities, capabilities (actual, expected, and required), and guidance. Who? units, formations, personnel. What? material. Where? location, geographics, C2 features. When? battlefield dynamics. Actions? describes actions carried out on the battlefield. The core information defined in the hub is data that is common to all subfunctional areas. The hub represents a common agreed to view of the core information requirements, and provides the base from which each subfunctional area (SBA) can provide its own "spoke" model. The SBA models will then be consistent with each other and the hub. At least one subfunctional area, the fire support area, has developed a full data model as a spoke to the hub.

Current status of ATCCIS Generic Hub Data Model:
NATO/ATCCIS: V1.0 released, SFA's Fire Support, Communication, and Barrier Operations under final review; Air Defense and Intelligence SFAs begun. U.S.: adopted by JIEO 6/93 as Core C3 Data Model; adopted by USAF as start-point for Air Ops Data Model as part of RCAS Block 2B; trial underway to integrate Human Resources and Force Authorization RCAS

Block 1 models with generic hub; and is under negotiations with CIM for final integration with DoD Enterprise data model.

(6) Update on C2 data modeling activities at JIEO: LTC Mike Robinson (JIEO/CFS Chief, C3I SPT Div)
There were three tasks identified at the May 27 MCEB:

- to publish the 210 interim C2 data elements derived for the Joint Universal Data Interface (JUDI) from JOTS, STALLS, and AIS legacy/existing systems
- to propose adoption of generic hub data model
- to submit fire support extension of generic hub data model

On 15 July, Dr. Quinn C3I(A&T), C2 FDAd held C2 coordination meeting at which it was decided:

- To agree on publishing the 210 interim C2 data elements which have been described in conformance with 8320 but have not been data modeled. These will be submitted to a DoD data standardization acceleration project for data modeling no later than 1 October. They will be part of an interim core starter set of data elements. This will require coordination of data stewardship with other FDAds. In the long term, the C2 FDAd will continue with the formal data standardization process.
- To agree on generic hub for C2 data model when integrated with DoD Enterprise Data Model. They will continue building Air Ops model on modified generic hub. In the nearterm, JIEO focus group will integrate the C2 view into the DoD Enterprise Model. In far term will continue formal DoD standardization process.

JIEO Recommendations to Services:

- 210 C2 data elements: review proposed interim data elements and send results to JIEO by 1 September, and consider these available for use in new acquisitions
- C2 data modeling: build C2 models on C2 generic hub data model, identify current modeling activities to JIEO no later than 1 September 1993

(7) MORS Mini-Symposium on M&S Data Issues (Nov 16–18): Mr. Howard Haeker (Army/TRAC)
Objective of symposium: to explore the application of standards, technology, procedures, and policy to simulation data and its management
When: 16–18 November 1993
Where: Fairview Park Marriot, Falls Church VA
Announcement and Call for Papers: Abstracts due to chairs by 31 August 93
Price: $150.00 government and $300 others
POCs: Howard Haeker, TRAC, 913–682–3030, and Natalie Addison, MORS office, 703–751–7290
Working groups: Working Group 1: Verification, Validation and Certification (Iris Kameny, Bill Dunn, Dale Pace, and Simone Youngblood)

Working Group 2: Complex Data (Roy Reiss, Steve Shervais)
Working Group 3: Standardization of Data (Twyla Courtot, Bob Molter)
Working Group 4: Tools and Techniques (Chien Huo, Len Seligman)
Working Group 5: Research Issues (Don Hodge, Charles Herring)
Working Group 6: Data Suppliers (Dan Hogg, Robert Wright

Speakers: Walt Hollis, DUSA(OR) Dr. Jeremy Kaplan, Directory, JIEO/Center for Standards CAPT Bruce McClure, Director, DMSO Ed Fitzsimmons, Special Assistant for Education and Training, OSTP White House

(8) Update on complex data issues: Iris Kameny (RAND)
Goal of complex data task is to develop guidelines for data modeling and data standards for syntactically complex data (e.g., terrain and road data), and semantically complex data (e.g., data derived in complicated way such as PK and PH). To recommend, if necessary, extensions to data modeling and data definition standards to accommodate complex data.

The approach is to: perform a few small pilot studies for semantically complex data (the first to be TRAC TADS in August); do the same for syntactically complex data; convene Complex Data Task Force to collect more examples and develop taxonomy of complex data types; identify modeling and standardization issues and suggest solutions; present to I/DB for discussion and review; document results and brief widely.

Results of an initial session with TRAC/TADS were presented.
IDEF1X: It is easy and seems intuitive to subject area experts to model complex data elements as attributes of the relationship between multiple entities. These relationships between two or more entities can be modeled using the IDEF1X associative entity but the usage is different than that of representing a many-to-many relationship between two entities, which is the primary use of an associative entity. There is reason to question whether this new usage overloads the associate entity construct and will be more confusing to the user. We found a need to represent causal relationships between activities (e.g., target acquisition, fire, hit, kill). We also found a lack in the IDEF1X implementations in capturing in machine readable form: cardinality, entity relationships, activities and activity relationships, and different conceptual views of an integrated data model.

DoD metadata representation: we are uncertain as to how to name data elements that result from the relationship between multiple independent entities since DoD naming rules allow only the use of one prime word (entity) though other prime words may be used as modifiers. This means that the data modeler must arbitrarily select one entity as the prime word.

8. ENVIRONMENTAL DATA MANAGEMENT AND DATA STANDARDS

(1) Navy Oceanographic and Atmospheric Master Library (OAML) and data standards: Mr. Alan Chappel (Navy)
By congressional mandate, the Navy is responsible for the Oceanography standards which includes meteorology (atmospheric), oceanography (and acoustics), astrometry, and mapping, charting and geodesy (MC&G). These are exercised through the Oceanographic and Atmospheric Master Library. All on-scene and shore based acoustic system performance products and the Geophysics Fleet Position Library (GFMPL) will use the standards and the standards apply to both models and databases.

The environmental data standards and structures manual will include OAML: data model, information model, security model, data element dictionary, and database structure diagrams. The plan of action includes: reviewing and correcting data element names; proposing developmental DE names and metadata definitions; developing database structure diagrams; deconflicting DEs in multiple databases; correcting the OAML data model; and revising the data standards and structures manual.

The OAML performs configuration management of CNO standard environmental models, databases and documentation. It sits between the suppliers (system commands, labs, contractors) and operational users (environmental systems, weapons systems, and trainers). There is a Software Review Board (SRB) and a Configuration Control Board (CCB) that oversee, and prioritize activities. The briefing included lists of models, databases, major players, and a distribution list. The models are mostly coded in Fortran and C and mainly take observations which they merge with historical data. The models are mainly machine independent except for I/O routines and they come with routines for I/O testing. They will be adding upper air climatology and three more atmospheric databases next year. Some instance databases are collected by the oceanographic office for use by others and these have instance types in the library and are updatable by developers. In July 1993, the Naval Warfare Tactical Database (NWTDB) program furnished data standards using IDEF1X methodology including identifying data entities and elements.

In the future, they would like to develop databases of temporal snapshots and have made a proposal through the DMSO focused call to collect datasets over windows of time and geographic areas (CMR Wes Barton, 601–688–4892).

Environmental systems issues and needs: early incorporation of end user capabilities; methods and constraints of model validation practices; verification procedures and criteria; documentation; greater degree of standardization; and bounded, well defined prototypes.

Question was asked wrt data about cloud cover ANSWER: there has been a big effort over the past year for the Navy and Air Force to cooperate on joint areas and standard products and cloud cover is one of these areas and the Air Force data will be included in their studies.

(2) EOSDIS Overview: Ms. Debbie Blake (NASA)
Mission Objectives:

(1) To create an integrated scientific observing system that will enable multidisciplinary study of the earth's critical, life-enabling, interrelated processes involving the atmosphere, oceans, land surface, polar regions, and solid earth, and the dynamic and energetic interactions between them.

(2) To develop a comprehensive data and information system including a data retrieval and processing system to serve the needs of scientists performing an integrated multidisciplinary study of planet earth.

(3) To acquire and assemble a global database emphasizing remote sensing measurements from space over a decade or more to enable definitive and conclusive studies of key aspects of earth system science.

(4) To improve predictive models of the earth system that involve interaction of system components such as air-sea coupling or biospheric/climate interactions. A longer term goal only attainable if the other objectives are successfully accomplished.

EOSDIS version 0 will be available July 1994 as a working prototype to the science community—will not be open to outside users at this time. It provides a uniform, system-wide information one-stop search and order function to access the data collections at the eight Distributed Active Archive Centers (DAACs) (includes legacy systems data, near-term non-EOS space flight data, and NASA/NOAA pathfinder datasets). It provides interoperability among heterogeneous data inventories at the DAACs: geographically distributed, different hardware and software platforms, different relational DBMSs, discipline specific metadata and science data. Prototype will include: Wide Area Information Servers (WAIS) distributed guide information server under development; world wide web hypertext capability; and X-mosaic (X widgets to be integrated into IMS GUI). Access to other Federal agency and International Earth Science data includes: access to all global change data sets; future interchange with Oak Ridge NL, NOAA, CIESIN/SEDAC, and CEOS Inventory Interoperability Experiment. EOSDIS Version 0 IMS interoperability includes chosing a catalog Working Group Level from 3 interoperability models: user interface uses common set of keywords and valid values for searching data systems; use message passing software for communication among data systems; or at each DAAC develop a mapping layer that translates key word names and key word values.

DAACs are looking into converting data into Hierarchical Data Format (HDF) for distribution (decided on HDF because there is more HDF software available than for other standards). For the Global Change Master Directory, they developed a client that searches against the Directory and returns the answer in DIF format.

Future EOS versions will manage data collected from EOS spacecraft also.

(3) Developments in spatial data standards: Mr. Dave Danko (DMA)
Geospatial data is information defined by precise geographic location and descriptive attributes.

Geospatial data standards are defined conceptual and physical models allowing the exchange and/or utility of geospatial data. A geospatial data standard is a coherent structure to support measurement, mapping, monitoring, modeling, terrain evaluation, and spatial reasoning applications. There are two basic geospatial structures: vector and raster. Commonly used vector formats/products are DFAD (Digital Feature Analysis Data, SLF (Standard Linear Format), DLG (Digital Line Graph), and TIGER. Commonly used raster formats/products are ADRG, DTED, LANDSAT, AND SPOT.

There are two geospatial data exchange standards: DIGEST (Digital Geographic Information Exchange Standard) and SDTS (Spatial Data Transfer Standards). SDTS is general and provides a standardized tool-kit of formats and structures out of which one can construct an exchange profile. The onus is placed upon the user to be able to decipher any particular dataset. By creating a profile, a general format becomes a defined format. DIGEST is a defined standard providing a small number of choices for the structuring and encoding of data. For one class of data, one unique way of structuring the data is provided. The onus is placed on the sender to organize his data so that it fits within the more narrow defined constraints of the format. SDTS can be viewed as a large pipe (general format) and DIGEST as a narrow pipe (defined format). In theory the narrow pipe can fit within the large pipe. However, DIGEST components may directly align with equivalent SDTS components when a SDTS profile is developed but there may be minor incompatibilities due to terminology, use of different ISO and ANSI standards, or differences in the feature catalogs. The SDTS data dictionary is used to construct a catalog where DIGEST provides an internationally coded catalog (FACC).

DIGEST is a "defined" format developed by the military mapping organizations of 11 NATO nations for the exchange of common digital production datasets between agencies. For one class of data one unique way of structuring data is offered. DIGEST has a family of defined formats for RASTER, MATRIX, and VECTOR data found in Annex A – ISO 8211 (Archival), Annex B – ISO 8824 (Telecommunication), and Annex C - Georelational (direct utilization). DIGEST is used for the exchange of data within the members of the Digital Geographic Information Working Group (DGIWG) and is used in the production of geodetic, geographic, geological and geophysical information. The DIGEST/Vector Product Format (VPF)is a user-oriented direct access product format developed by DMA as a MILSTD and used in Digital Chart of the World (DCW), Digital Nautical Chart (DNC) and Vector Smart Map (VMAP).

SDTS (FIPS 173) is the US National standard for exchange of spatial data. As a "general" format for the exchange of arbitrary data sets, it provides the capability to fit a very broad range of data into its conceptual model. It provides choices so that the data collector or generator can define which classes of phenomena are of interest and which spatial objects and relationships should be used. SDTS has transfer module formats for VECTOR and RASTER data types carried in ISO 8211 encoding. SDTS as of February 1994 is the US required (mandatory) standard. It is not intended to facilitate product distribution of spatial data in a form designed for direct access.

In examples of DIGEST and SDTS data models, Danko showed that they are not that dissimilar. DIGEST has pointers back to higher level indices and the SDTS spatial object has pointers to a composite data object made up of feature objects.

OMB Circular A-16 established the Federal Geographic Data Committee (FGDC) of fourteen departments and agencies to promote the coordinated development, use, sharing and dissemination of surveying, mapping, and related spatial data. Subcommittees include: base cartographic, cadastral, geodetic, ground transportation, wetlands, bathymetric, cultural and demographic, geologic, soils, and water. The National Spatial Data Infrastructure (NSDI) is concerned with determining what data exists, access to data, and identification of needs for and generation of digital data of value to users. The FGDC standards WG is concerned with developing content standards for spatial metadata. The metadata will be available via internet utilizing WAIS software. The spatial metadata content includes: identification information, contact information, transfer information, status information, source information, metadata reference, processing history, data quality information, entity/attributed information, and coordinate information. The initial draft was sent out in Sept 92 to government, industry, and academia and comments returned April 1993. A new draft will be available in August 93 and has been provided to DISA who is reviewing elements in accordance with 8320.1-M-1.

Other related efforts are: MC&G data administration which is to develop a cadre of information modelers, develop a detailed data model and elements with a DMA product using the DIGEST FACC, provide model to JDBE for SAI modeling, and submit group of MC&G data elements into the DoD approval process. DMSO Terrain Requirements and Standards Project is DMSO supported and has collected information from 154 questionnaires for analysis.

Col Rich Johnson, Chief DMA TIJ (703-285-9238) reported on Joint MC&G Interoperability and the DMA mission in standardization per DoDD 5105.40.

DMA is the PM for DoD MC&G and prepares, coordinates, and issues MC&G specifications and standards, and guides DoD Components to ensure standardization and interoperability of systems that use MC&G. New organizations that have formed since April 1993 include MC&G Joint Interoperability Board (MJIB) and the Geospatial Standards Mgt Committee (GSMC).

The MJIB is a flag level advisory board chartered and chaired by Director, DMA with members from ASD C3I, JS, Agencies and Offices, Military Departments, Joint Command, US Coast Guard, JDG-CE and associate members from NOS (NOAA) and USGS. Its current tasks include: multiple raster format issues (e.g., compression for joint use), CTAPS mapping support, and how to support Air Force Common Mapping Support for joint use, and in future digital imagery standards and MC&G, preliminary MC&G standards hierarchy, domestic and international MC&G standardization, MC&G support to M&S, MC&G data element standardization, and digital MC&G products for review.

The GSMC is a O-4/O-5 level working group formerly the SRAG. It supports the MJIB and fits as the former MC&G SMC under the Standards Coordinating Committee (DISA and MCEB) and is chaired by a DMA O-6.

DMA is undergoing a paradigm shift. In order to keep combat support relevant to the nation and its warriors in the 21st century, DMA must reorient from manufacturing specific "products" to correlating and managing "Global Geospatial Information and Services (G2IS)". DMA view now is that part of development is to identify applications that need to be developed (e.g, three dimension perspective views) and will go out and solicit products and evaluate, select, and standardize on best one. The software modules will be in reusable packages and distributed through DISA.

(4) Project 2851 Standards Simulator (Digital) Data Base Program: Major Kent Johnson (AST/YTMS)

Program objectives are to reduce development redundancy and cost, decrease schedule and performance risk, and improve database correlation between training systems. This is a tri-service sponsored program with AF lead and strong DMSO support and its objective is to produce high fidelity images for use in realtime aircraft simulators with refreshes 60 times/second.

The original concept was to move source data to a production site where data was produced in a Generic Transformed Data Base (GTDB MIL-STD 1820, 17 Dec 92) format for use in simulators. Revised concept is to move source data to library/production facility where data is produced in GTDB format for use in simulators and for simulators to send data in standard interface format (SIF MIL-STD 1821, 17 Jun 93) back to library/production facility to store in library. Facility operations are scheduled to begin in 1994. DMA will provide and manage the physical facility which will be funded by services and operated by a contractor.

The objective is to develop reusable databases that can be shared across DoD training programs. The standard simulator database (SSDB) terrain culture as of July 1993 consists of: 5 cells Mac corridor, 4 cells San Francisco area, 10 cells Wyoming, 4 cells Fallon Nevada, 2 cells China Lake, 4 cells Hunter Liggett, 8 cells San Diego/Yuma, 3 cells Ft. Rucker.

The system products are GTDB, and SIF for high detail input/output (SIF/HDI). SIF/HDI data formats include gridded terrain (3D), vector map features and attributes, constructive solid geometry (CSG) and polygons, and imagery with photo-texture. There are area blocks at multiple levels of detail. Visual, radar, FLIR, NVG, and EO datasets are supported. The active library maintains a cumulative database of the best/current data, and it validates and merges selected data with the SSDB. The passive library stores validated input/output tapes and allows users to get exact copies of existing databases. They have limited production to create library content from charts, DMA products, USGS, photos, imagery, etc. and estimate they can produce 200 geo-cells per year of level 1 type data.

GTDB is an output product tailored only for specific image generators and/or applications (e.g., pilot cockpit). Its tailoring includes: min/max number of polygons/edges, LOD, area, models, coordinate system, convex polygons, etc. SIF is both input and output format, is system independent and closely represents SSDB contents. Data formats for SFI/HDI include model geometry (up to nine levels of detail per model), model attributes, model type (2D static for surface models, 3D static for objects fixed on terrain, and 3D dynamic for moving/articulated objects); culture geometry, culture attributes, culture geometry types, culture geometry primitives, gridded terrain/texture geometry, gridded terrain/texture attributes, texture sources, and texture libary stages.

Question about 3D model Answer: no scripted positioning, the database supports movement but the application has to manage this.

(5) Dynamic Environment and Terrain Modeling in DIS: Jeff Turner (Army TEC)

The project objective is to support dynamic environment and terrain in DIS by developing DoD standard physics-based software models, DIS protocols, and DIS graphic rendering techniques. Primary sponsor is DMSO, the Program Manager is STRICOM and the team players include USATEC (Lorel and Grumman), USAES, USAWES, NPGS, USAF Phillips Lab (TASC). They are modeling mobility of vehicles, dynamic terrain and obscurants. For enhanced mobility models they use DMA Interim Terrain Data (ITD) support and ITD(SIF) format data importer for mobility model synthesis. Dynamic terrain models support cratering, berm penetration, defilade positioning, berm construction, and rut creation. Obscurants will include battlefield smoke, atmospheric cumulus and stratiform clouds, atmospheric fog and haze, vehicle dust, and fire and explosions. They are using Computer Image

Generator Logical Interface Package (CLIP) to provide a common application programmer's interface for the development of visual applications. Phase I results will be demonstrated at the March 94 DIS Conference and will show 2 networked image generators showing DIS battlefield smoke and atmospheric clouds and a virtual bulldozer proof of concept. Phase II will be demoed in December 94 and will show all developed models.

The major issue has to do with performance in supporting dynamic changes. The target platform is a high-powered Onyx workstation: 10 frames/sec appears to be ok for obscurants. They are planning to pre-distribute data/information about the atmosphere. If smoke is detonated during play, that fact will be sent in a PDU to all relevant models which will be using the same atmospheric model for dispersion.

(6) STRICOM DIS Standards Initiatives: Gene Wiehagen (STRICOM)
Wiehagen went over the history of the DIS workshops from August 1989 to present and the DIS compliant systems/programs. DIS working groups and subgroups include: communication protocols, interface, time, mission control; emission; simulation management; radio communications; communication architecture security; simulated environment; atmosphere; land; sea; fidelity, exercise control, feedback requirements; and field instrumentation. There are many international participants at the DIS workshops. Gene went over the DIS standardization process—Chien Huo has recently written a paper that shows an as-is process model and suggests a to-be process model for DIS standardization. Wiehagen also has a list of the DIS 1.0 PDUs, of the proposed DIS 2.0 PDUs (these are emission, laser, transmitter, signal, and simulation management; and DIS 3.0 PDUs (potential) which will cover C3I, dynamic terrain, weather/atmosphere, fidelity controls, transfer control, aggregate/disaggregate, and instrumentation. DIS regime goes from high level units using the Aggregated Level Simulation Protocol (ALSP), to platforms using DIS protocol, to components in MODSIM, to parts in JMASS. The regime varies in time from the aggregated level of weeks down to microseconds for part simulations.

(7) DIS Fidelity Issues: John Eisenhardt
Though not on the schedule, John Eisenhardt talked about DIS fidelity issues. Fidelity needs to be measured in the context of the application. An asset is validated for a designed application and because it is validated does not necessarily mean it can be reused in DIS applications without revalidation. There is a a database catalog of DIS components and their fidelity but there is a need to look at overall DIS fidelity, the system fidelity when DIS simulators are interconnected. There needs to be a hierarchy of fidelity domains and components need to reference those domains, include their past VV&A history in relation to how they were used in DIS applications.

(8) Distributed Interactive Simulation Standards Process: Chien Huo (JIEO/DFS)

Chien discussed the DISA JIEO Center for Standards (CFS) and what they are doing to give program support to DMSO and the M&S community. In the DMRD 918 Defense Information Infrastructure, the Information Technology Standards Program Office serves as the mechanism for developing, specifying, certifying, adopting and enforcing standards. The DISA CFS is the executive agent for DoD information standards and the DISA/Joint Interoperability Test Center (JITC) is the executive agent for information systems testing. DoD spends over $50 billion annually on information technology, there are over 2000 IT standards, and over 700 standards committees. The problem is that most DoD standards efforts are done by individual DoD projects, there are uncoordinated "architectures" and acquisitions that specify conflicting standards and the process for enforcing compliance is embryonic. The new order for preference for standards are: international, national, federal, and military. Chien presented a map of standard thrusts and discussed the DIS standards initiative. He gave a vision of the Directorate for DoD Standards Assistance as a one stop shop which would provide open systems standards and profile solutions for architects, engineers, and implementors.

9. DATA STANDARDS ACTIVITIES IN M&S PROJECTS/PROGRAMS

(1) Re-utilization and Standardization of Moving Models in Virtual Simulation: Farid Mamaghami (PM-CATT, IDA)
Farid provided a general definition of a model as a filtered representation or instantiation of characteristics and attributes associated with real entities. Specific to his brief was a description of a model as a 3-D representation of vehicles (simulation entities) and their attributes for visual and sensor systems. He pointed out that many variations of the same "model" exist among DoD programs in different forms and what is needed is a central repository and catalog of models created under DoD programs (much agreement from all of us). He said that, for example, CAD vendors or individual simulation houses provide catalogs of their existing models but catalog formats are different and limited in capacity to carry all pertinent information and attributes. He believes that unlike terrain databases, models are easier to convert and interchange. Challenges to re-utilization are application requirements and run-time platform capabilities (e.g., simple vs detailed models, texture vs geometry detail, collision and bounding, data organization, etc.). He recommended that DMSO assess the value for establishing a central repository and catalog capability, establish the technical mechanism for access and distribution of data, acquire the data and organize a repository, organize the library based on category of use, and within each category organize data for the same model based on fidelity and performance use.

(2) Close Combat Tactical Trainer (CCTT) update and data standards: Rob Wright (CCTT/RCI)
Combined Arms Tactical Trainer (CATT) Task Data Base is an information system developed to provide battlefield oriented Collective Task data to

software engineer development teams. The CATT approach is to seamlessly integrate text (WordPerfect), data (FoxPro), and graphics (PCX). The data sources are: ARTEP manuals, proponent schools information, subject matter expert's information, and field manuals. The CATT Task Data Base is applicable to analyze Collective Tasks as they apply to: training development and analysis, trainng manual development and production, simulator/software development and verification, standardizing Collective Tasks of the ARTEPs, and comparing TTPs to the ARTEP tasks. The database may be applicable to any source of Collective Task data in any of the military services. CATT Task Data Base is a weapons' performance database and one of its uses wil be to be able to validate SAFOR behaviors by seeing how different units perform comparable tasks and then to reuse behaviors in other similar or SAFOR units. They plan to incorporate short videos into the database so a programmer can see how the object operates.

The PM-CATT Software Initiatives Program was briefed by Luci Haddad. The program goals are to: support DoD computing infrastructure and initiative principles; improve interoperability, productivity, quality and reliability; and reduce costs. The program consists of three parts: process improvement, data element standardization, and asset reuse and technology insertion. They have used IDEF0 to show the process flow of administrative papers, etc. to satisfy a CCTT CALS requirement.

(3) Universal Threat System for Simulation: Clay Putman (GPS Tech supporting Navy/UTSS)

UTSS is the joint service repository for DIA approved threat data and validated real-time simulation software used as standardized input to DoD training simulation programs. The main goal of UTSS is to enhance training and improve operational readiness while significantly reducing acquisition and support costs. Current problems include lack of standards; unvalidated data; and threat models are recreated with each new simulation acquisition. There are 3 UTSS efforts to address these problems: (1) creation of a universal database; (2) consolidation of threat simulations into a threat simulation library where they can be reused; and (3) developmental standards for data and simulations. This is a three-phased effort: phase 1 is requirements analysis (doing this now); phase two is design synthesis; and phase 3 wil be development.

Currently most of the threat data is for air crew training devices. All of the data has to be validated and much of it is eight years old. They are establishing two working groups: database (want to get MITRE and RAND involved), and realtime simulation software.

(4) Data Base System Upgrade (DBSU) Project: Col Rayford Eubanks(JS)

DBSU is a DMSO funded project to enhance database systems developed by USCENTCOM, HQMC, and JWC that provide data for M&S. DBSU allows for sharing of capabilities and the enhancement of tools to improve and expand the scope of data available to joint models. DBSU components are: conventional force database (CFDB), master simulation data base (MSDB), data quality engineering (DQE), and ancillary database (ADB) which expands model data with parametric data such as weapon parameters, aircraft and ship characteristics. The objectives are to apply DQE to both databases, build an ancillary database supplement to the MSDS, and to design a graphical user interface for the MSDS. The data architecture shows the sources (units, personnel, equipment, DIA's DB) coming into a repository where DQE is applied and from there being entered into the CFDB where it can be presented to the end user as 16 ASCII files or be refined for the MSDS (where data is joined with JWC's ADB) to supply models such as JTLS, CBS, TACWAR and JCM. In the future there may be new interfaces to other models.

They have 20 worldwide joint and service users. The Marine Corps currently does quality checks on their databases. The database has over 500K blocks of data in a fully operational system, the current effort is just to enhance the system. Some of the ancillary databases may consist of open data like data from Jane's.

Some of their user problems: simulation variables often have no real world source, organizations don't like to share data, many models provide no training, and there is a lack of advice on appropriate models. Solutions: new models where the data issues are addressed during development and funding includes both training and data sources, for existing models use some of the current funding to centralize functions, and eventually establish an organization that provides training and data assistance for widely accepted joint models.

(5) Operation Analysis and Simulation Interface System (OASIS): LTC Dan Hogg (JS/J8)

The OASIS strategy is to maintain data in a central location and allow widest access possible to all J-8 action officers. They are using object-oriented design and have built-in verification and validation. They furnish OASIS data to outside sources as a single point of request and can prepare and download data to be sent to others. The system runs on frontend sun workstations using a fileserver and backend Vax cluster. They are running Unix with Ingres on the Suns, and VMS with Ingres on the Vax. The system supports a hierarchical structure from folders to classes to object lists and details. The system includes access control, windows4GL (point and click), V&V, data transfer, data editing, on-line help and event tracking.

Status: They are at IOC/milestone III but are having system performance problems probably due to the network; they are incorporating conventional force data; and creating a liaison with DIA for IDB products. Some concerns are with continually changing requirements; the resources required for data modeling using IDEF1X, security considerations with interoperability and incorporation of MLS technology (how to change legacy OASIS system to use new security technology); and with performance issues. An agenda topic for the upcoming mobility conference is: whether there is an IDEF process and data model for mobility data and, if not, then will there be one.

(6) Joint Data Base Element (JDBE) experience with developing subject area information models: Peter Valentine (Army/EPG)
JDBE status: the JDBE methodology paper and methodology assessment white paper have been published; the JDBE military handbook is available in draft form, the subject area information model for radio frequency spectrum design is complete, and the data repository design is completed and the repository is being populated. The JDBE Military Handbook explains the JDBE process, gives step-by-step directions on how to proceed and the appendices for the first SAI model in radio frequency spectrum will be published separately. The data dictionary/directory is in electronic form on PC-based software and contains standard data element and entities with mapping between the entities and elements and traceabilty to project databases.

Lessons learned: interest in data modeling is high; demand for training is high; resources for project modeling are limited; reverse engineering from databases and other non-data modeling standards efforts is doable; subject matter expert participation is critical; understanding of scope, frame of reference, and level of abstraction is important but may not be good enough for M&S; and there are risks in pushing the technology. The project models used in the JDBE SAI model were: CROSSBOW, ECASC, ECE threat, EMETF DBR, EWIR, MUES, RASPUTIN, and TEARS, There were three views: antenna, RF signal, RF equipment each with a different number of entities but about the same number of attributes. They gave an example of the issue with modeling different levels of abstraction between an antenna model and an antenna model with an antenna pattern.

10. SUMMARY AND WRAPUP: DR. CHEIN HUO (JIEO/CFS)

(1) Guidance: we could take guidance from this meeting in the data modeling area: use the integration of the DoD Enterprise Model with the ATCCIS Generic Hub Data Model to develop bottom-up (or middle-up_ interim data models.

(2) Change in I/DB meeting structure: discussed whether the next meeting should be handled as a short general session and then break the group up into working groups? The consensus was to keep it the way it is, as one general session. But people would like to see some special sessions like one on data modeling, and Howard Haeker would like to see a session on sources of data.

(3) Need to define types of data in databases. We may need to collect information about databases and then try to determine types from the information collected. Ken Kaufman said that we need to try to get database information from the services.

(4) There is also a need to define the terminology we use and develop a lexicon so we are all talking the same language.

(5) VV&C: need to look at how to get to the operational data gathered by users and use these as part of the validation process

(6) People asked for an overview of DMSO in terms of who they are funding to do what

(7) Suggestion that the I/DB form scme working groups (See Section 4).

(8) Data reconciliation is an issue that hasn't been addressed: what does one do with overlapping data?

(9) If there are difficulties with the standardization process, what might alternatives to standard data elements be?

F. ACRONYMS

A3H7	Name of a CDIF working group OME/A3H7
ADDs	Army Data Dictionary
ADMIN	Administration
AF	Air Force
AFC4A	Air Force Command, Control, Communications, and Computers Administration
AFSAA	Air Force Studies and Analysis Agency
AJTSH	Name of a data base
AMSAA	Army Material Systems Analysis Activity
AMSMO	Army Model and Simulation Office
API	Application Program Interface
ARL	Advanced Research Laboratory
ARMs	Automated Repository for Models and Simulations
ARRIIPS	A database used by TECNET
ARTBASS	A terrain database being used by a RAND project
ASC	An organization
ASN.1	Abstract Syntax Notation.1
ATRIS	A database used by TECNET
AVCATT	Avionics Combined Arms Tactical Trainer
BDS-D	Battle Field Distributed Simulation Demonstration
BFTT	Battle Fleet Tactical Trainer
BLOB	Binary Large Objects
C3I	Command, Control, Communications and Intelligence
CAGIS	Cartographic and Geographic Information System
CATT	Combined Arms Tactical Trainer
CCTT	Close Combat Tactical Trainer
CDIF	CASE Data Interchange Standard
CDTF	Complex Data Task Force
CENTCOM	Central Command
CFDB	Conventional Force Data Base
CFS	Center For Standards
CIM	Center for Information Management or Corporate Information Management
CNA	Center for Naval Analysis
CNO	Center for Naval Operations
COE	Common Operating Environment
COEAs	Cost and Effectiveness Analysis
CONOPS	Concept of Operations
CSC	Name of a Company
DA	Data Administration
DB	Data Base
DBMS	Date Base Management System
DDN	Defense Data Network
DDR&E	Director Development, Research, and Engineering
DDRS	Defense Data Repository System
DE	Data Element

DFAD	Digital Feature Analysis Data
DIA	Defense Intelligence Agency
DISA	Defense Information Systems Agency
DMA	Defense Mapping Agency
DMSO	Defense Modeling and Simulation Office
DQE	Data Quality Engineering
DSNET	Defense Secure Network
DTED	Digital Terrain Elevation Data
DTIC	Defense Technical Information Center
DUSA	Deputy Under Secretary of the Army
DoD	Department of Defense
DoDD	Department of Defense Directive
E2DIS	Environmental Effects Distributed Interactive Simulation
ECDB	Equipment Characteristics Data Base
ECM	Electronic Counter Measures
EPG	Army organization
EPL	A database used by TECNET
ERX	Name of IDEF1X tool: ERwin/ERX
EWIR	A database used by TECNET
EXCIMS	Executive Council for Models and Simulations
EXCOM	Executive Committee
FACC	Feature Attribute Coding Catalog
FDAd	Functional Data Administrator
FDTS	Federal Data Transfer Standard
FFRDC	Federally Funded Research and Development Center
FGDC	Federal Geographic Data Committee
FIPS	Federal Information Processing Standard
FPI	Functional Process Improvement
FY	Fiscal Year
GCCS	Global Command and Control System
GPS	Global Positioning System
GUI	Graphical User Interface
HQ	Headquarters
IC	Intelligence Community
ICP	Information Class Proponent
IDA	Institute for Defense Analysis
IDEF	Integrated Computer-Aided Definition Language
IDL	Interchange Definition Language
IGES	Initial Graphics Exchange Specification
IM	Information Management
INNET	A database used by TECNET
IRDS	Information Resource Dictionary System
ISA	A company name
ISC	Information Systems Command
ITD	Interim Terrain Data
ITF	Infrastructure Task Force
JCM	Name of a model
JCS	Joint Chiefs of Staff
JDBE	Joint Data Base Elements (project)

JHU	Johns Hopkins University
JIEO	Joint Interoperability Engineering Organization
JITC	Joint Interoperability Test Center
JMA	Data used by ARMS project
JMASS	Joint-Modeling and Simulation System
JOPES	Joint Operation Planning and Execution System
JS	Joint Staff
JTAD	Joint Test Asset Database
JTLS	Joint Theater Level Simulation
JUDI	Joint Universal Data Interpreter
LRPS	A database used by TECNET
LSAR	A database used by CCTT
M&S	Modeling and Simulation
MC&G	Mapping, Charting, and Geodesy
MCEB	Military Communications Electronics Boards
MICOM	Missile Command
MIIDS	Military Intelligence Integrated Data System
MISIC	A DIA organization
MLS	Multi-Level Security
MORS	Military Operations Research Society
MSDS	Master Simulation Data System
MSTIRC	A database used by TECNET
MTFs	Message Text Formats
NASC	Navy organization
NAVINTCOM	Navy organization
NAVOCEANO	Navy organization
NAVSEA	Navy organization
NCCOSC	Navy organization
NERF	A database used by TECNET
NID	A database used by TECNET
NIST	National Institute of Standards and Technology
NL	Naval Laboratory
NRL	Navy Research Laboratory
NRaD	Navy Research and Development
NSA	National Security Agency
NSTDB	A NWTDB database
NVWC	A Navy organization
NWTDB	Navy Warfare Tactical Data Base
OCEANCOM	A Navy organization
OME	A name of a CDIF working group
OPNAV	A Navy Organization
ORG	Organization
OSD	Office of the Secretary of Defense
OTECC	A database used by TECNET
PA&E	Program Analysis and Evaluation
PCTE	Portable Common Tools Environment
PDU	Protocol Data Unit
PEGASYS	A system
PH	Probability Hit

PK	Probability Kill
POC	Point of Contact
PRC	Name of a corporation
PVDB	Database from PEGASYS
RCI	Name of a corporation
RDBMS	Relational Data Base Management System
RFP	Request For Proposal
RLF	Reuse Library Framework
SDE	Standard Data Element
SID	Systems Information Directory
SIF	Standard Interchange Format
SIMDAT	Simulation Data
SIMVAL	Simulation Validation
SML	Standard Markup Language
SOCOM	Special Operations Command
SPAWAR	A Navy organization
SQL	Standard Query Language
SR	Software Reuse
SSDC	Space System Development Center
STANAG	Standard Agreement
STRICOM	Simulation Training and Instrumentation Command
SYNETICS	Name of a company
SYSCOM	A Navy organization
T&E	Test and Evaluation
TACWAR	Name of a simulation model
TADILS	Tactical Data Information Link
TAFIM	Technical Architecture Framework for Information Management
TECHMATES	Name of a company
TECNET	Technical Network for the Test and Evaluation Community
TESTFACS	A database used by TECNET
TEXIS	A TECNET database
TF	Task Force
TRAC	Training Command
TRADOC	Training and Doctrine Command
TSD	Name of an organization
TWSTIAC	Name of an Information Analysis Center that Supports M&S
UCF	University of Central Florida
UNISYS	Name of a company
USAEPG	Name of an Army organization
USCENTCOM	U.S. Central Command
UTM	Universal Transverse Mercator
UTSS	Universal Threat System for Simulators
V&V	Verification and Validation
VDS	A company name
VMS	VAX operating system
VPE	Visual Programming Environment
VV&A	Verification, Validation and Accreditation
VV&C	Verification, Validation and Certification

WAIS	Wide Area Information Server
WARSIM	A simulation model
WG	Working Group
WWW	World Wide Web
X3H4.1	ANSI working group
X3L8	ANSI working Group
XOMT	Air Force M&S Organization