RL-TM-92-26
In-House Report
October 1992

PROGRAM 6 TECHNICAL INTERCHANGE MEETING PROCEEDINGS

Walter Gadz, Patrick McCabe

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Rome Laboratory
Air Force Systems Command
Griffiss Air Force Base, New York

RL-TM-92-26 has been reviewed and is approved for publication.

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Technical Director
Intelligence & Reconnaissance Directorate

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave Blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	October 1992	In-House 11 - 12 Feb 92

4. TITLE AND SUBTITLE
PROGRAM 6 TECHNICAL INTERCHANGE MEETING PROCEEDINGS

5. FUNDING NUMBERS
PE - 63260F
PR - 3481
TA - PR
WU - OJ

6. AUTHOR(S)
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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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8. PERFORMING ORGANIZATION REPORT NUMBER
RL-TM-92-26

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
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10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
Rome Laboratory Project Engineer: Walter Gadz/IRDS (315) 330-3221

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

The second annual Program 6 Technical Interchange Meeting (TIM) was held 11-12 February 1992. An informal symposium of contractors and Government personnel, the TIM fosters the interchange of ideas and encourages cooperation.

14. SUBJECT TERMS
Natural Language Understanding, Intelligence Data Handling, Heterogeneous Database Access, Neural Networks

15. NUMBER OF PAGES
240

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	U/L

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18
298-102

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ACKNOWLEDGEMENTS

We would like to thank TJ Farr for all of her help in preparation and conducting the TIM. The TIM would not have been possible without her support.

In addition, we would like to thank all the attendees at the TIM for their participation, and the openness with which they offerred us their suggestions.

PROGRAM 6 TEHNICAL INTERCHANGE MEETING TIM)

ROME LABORATORY

11,12 FEBRUARY 92

PROCEEDINGS

1. BACKGROUND.

1.1 Rome Laboratory's Intelligence Data Handling Division (RL/IRD) held it's second annual Technical Interchange Meeting for Program 6 research and development on 11 and 12 February 92. The TIM was held in building 240 and consisted of RL/IRD personnel and contractors of on-going 6.2 and 6.3 programs. A complete agenda, list of attendees and set of briefing slides is attached.

1.2 The objective of the TIM was to provide an informal forum to hold discussions of on-going work in the areas of AI/expert systems, database technology, neural networks and natural language understanding, and to present an updated roadmap of future direction. Briefings and demonstrations of current work were given as part of the TIM to stimulate open discussion and participation. Selected Intelligence Data Handling operational systems were briefed and demonstrated on the first day to give the attendees a feel for the operational environment as it exists today, and where some of the technology currently being developed might be used in the future.

2. 0 SYNOPSIS

2.1 Mr. John Salerno (RL/IRD) kicked off the TIM with an overview of the intelligence environment as it exists today. He proceeded to give a notional IDHS architectural overview. This was followed by the program 6 perspective of the IDHS as a set of databases connected to a local area network and accessed by display workstations. He went on to discuss the Intelligent Predictive Assessment System (IPAS) 2000 concept and how Program 6 development will "plug and play" in the IDHS environment. The agenda for the TIM was presented and discussed briefly as was a list of items for thought and further discussion. In concluding his presentation Mr. Salerno stressed cooperation among all parties to ensure the successful development of the IPAS 2000 concept.

2.2 The first "block" of the TIM consisted of briefings and demonstrations of operational IDHS systems and programs. These included the Defense Automated Warning System (DAWS), Computer Aided Tactical Information System (CATIS), Modular Architecture for the eXchange of Intelligence (MAXI), and Extended Integrated Data Base (XIDB). Briefings of all IDHS programs were presented at the unclassified level in the IR conference room while demonstrations of DAWS, CATIS and MAXI were conducted in the Intelligence Information Processing Facility (IIPF) at the SCI level.

2.3 The second "block" of the TIM was an Operational IDHS briefing presented by Mr. Steve LaFata of the 480th Air Intelligence Group (AIG). (The 480th AIG will soon become the Air Combat Command (ACC)). Mr. LaFata conveyed the 480th AIG's mission as it stands today, and addressed their changing requirements in order to support the ACC Intelligence Network (ACCINTNET). He presented an overview of the current IDHS systems in use today and a future IDHS architecture diagram (CIRCA1996) representing ACC. The proposed architecture provided insight into potential areas for program 6 technology transition in support of their changing requirements.

2.4 The third "block" of the TIM was an IPAS 2000 briefing conducted by Mr. John Pirog (RL/IRDS). Mr. Pirog briefly discussed IRD's R&D program and provided insight into a future IDHS. A formal roadmap was presented depicting the entire 6.2/6.3 program as it currently exists through the FY99 timeframe. Mr. Pirog made reference to the RL Technical Report 91-319 entitled, "Research and Development for Intelligence Data Handling", which will be updated as a result of the TIM.

2.5 The fourth "block" of the TIM was the heart and soul of the agenda. Individual 6.2/6.3 research and development programs were briefed, and where appropriate, demonstrations were conducted. The programs included message processing/natural language technology (i.e. Generic Intelligence Processor (GIP), Advanced Reasoning Theory (ART), Warning Information Dissemination Experiment (WIDE), and NLU Speech Integration), neural network technology (i.e. Connectionist Networks for Information Exploitation (CONNIE), database technology (i.e. Query Support Processor), and expert system technology (i.e. Cooperative Knowledge Base Architecture (CKBA), Prototype Intelligence Processor (PIP), and Indications and Warning for Defense (IW4D)).

The briefings provided a technical overview of the individual programs as well as a program status.

3.0 Conclusions

3.1 RL's TIM provided a valuable forum for presenting current work, sharing ideas and giving constructive feedback in an informal atmosphere on the 6.2/6.3 program. In the way of action items, RL/IRD will be updating the IPAS 2000 concept paper over the next couple of months and it will be disseminated to the TIM attendees. The CKBA ICD was recently distrubuted to the TIM attendees and RL is soliciting feedback on the document (send comments to Mr. Dan Ventimiglia, RL/IRDW). In the next few months RL/IRD will be conducting follow-up visits to individual contractors to discuss their programs and any feedback that they might provide with respect to the TIM. It was suggested by several attendees that it would be practical to hold future TIMs on a yearly basis, however it was concluded that the next TIM should probably be held in the late fall timeframe.

Attendees by Name

Steve Barth	PRC	(315)330-3221
Madeline Bates	BBN	(617)873-3639
Hatte Blejer	SRA	(703)558-7843
Chris A. Boehm	PRC	(703)556-1045
Brandon L. Buteau	PRC	(703)556-1355
Gary R. Dolson	PRC	(703)5561859
David J. Gray	Sterling	(315)336-0500
Noreen S. Heyda	Harris	(407)984-6384
Jay Jesse	GTE	(719)570-8896
Lisa Jesse	GTE	(719)570-4730
Steve Lafata	480AIG/INPX	
Henry Lefkovits	AOG	(508)456-9368
Robert Loatman	PRC	(703)556-1646
Mark T. Maginn	Sterling	
Howard A. Melching	GTE	(719)570-8898
Vincent Montaldo	480AIG/INPX	
Russ Moody	Orion	(513)427-5496
Jonathan H. Reed	Harris	(407)984-6008
William J. Reed	Sterling	
John Sautter	Sterling	(315)336-0500
Kevin Sculley	PRC	(402)291-5533
Stefan Shrier	MRJ	(703)934-9249
Peter Soliz	Orion	(505)262-2260
Aaron Temin	SRA	(703)558-7642
Mike Thomas	Sterling	(315)336-0500
John R. Thompson	SAIC	(505)247-8787

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Vincent Montaldo	480AIG/INPX	
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John Sautter	Sterling	(315)336-0500
Mike Thomas	Sterling	(315)336-0500

PROGRAM 6 TECHNICAL INTERCHANGE MEETING AGENDA

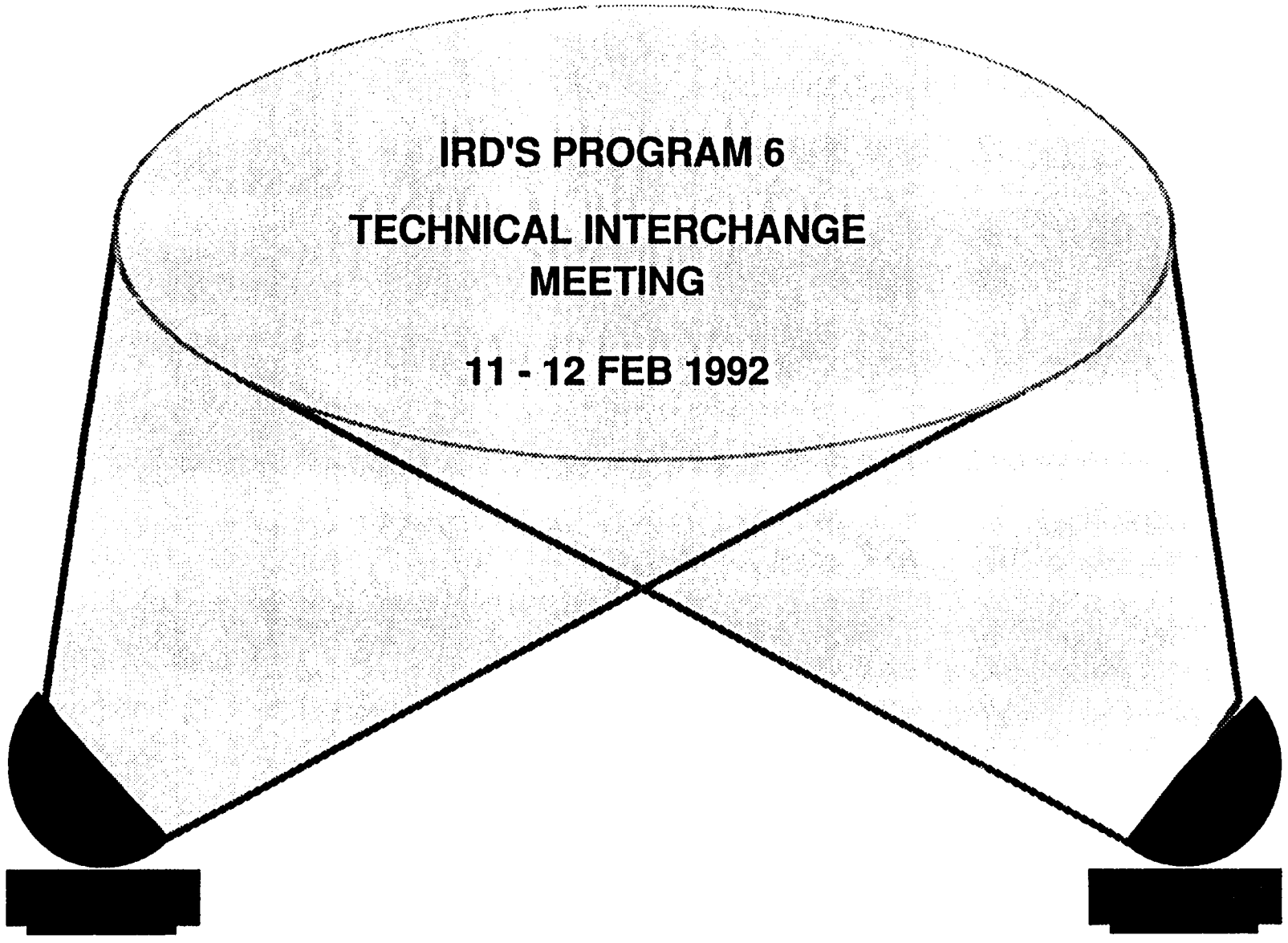
11 FEBRUARY 1992

Time		Topic	Presenter	Class.	Location
8:00	30	Welcome/Overview	J. Salerno	U	IR Conf Rm
8:30	30	DAWS	Capt Colas	U	IR Conf Rm
9:00	30	CATIS	Mike Welch	U	IR Conf Rm
9:30	15	Break			
9:45	45	CATIS/DAWS Demo		SCI/SCI	1327/1327
10:30	45	DAWS/CATIS Demo		SCI/SCI	1327/1327
11:15	30	XIDB	L Lehman	U	IR Conf Rm
11:45	75	LUNCH			
13:00	30	MAXI	M Anken	U	IR Conf Rm
13:30	45	MAXI Demo		SCI	1327
14:15	15	Break			
14:30	30	Operational IDHS	S. Lefata	U	IR Conf Rm
15:00	30	IPAS 2000	J. Pirog	U	IR Conf Rm
15:30	15	Break			
15:45	30	GIP Briefing	M Thomas	U	IR Conf Rm
16:15	30	CONNIE Briefing	Lt. E. Jumper	U	IR Conf Rm
16:45	45	GIP/CONNIE Demo		U	ISF
17:30	45	CONNIE/GIP Demo		U	ISF
18:00		Social Hour			

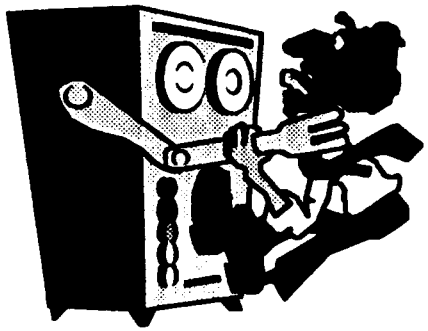
PROGRAM 6 TECHNICAL INTERCHANGE MEETING AGENDA

12 FEBRUARY 1992

Time		Topic	Presenter	Class.	Location
8:00	30	QSP	S. Oschner	U	IR Conf Rm
8:30	60	CKBA Technology	B. Buteau	U	IR Conf Rm
9:30	15	Break			
9:45	30	ART Briefing	J. Reid	U	IR Conf Rm
10:15	30	PIP Briefing	L. Jesse	U	IR Conf Rm
10:45	45	ART/PIP Demo		U/SCI	ISF/918
11:30	45	PIP/ART Demo		SCI/U	918/ISF
12:15	60	Lunch			
13:15	30	IW4D Briefing	G. Dolsen	U	IR Conf Rm
13:45	30	WIDE Briefing	A. Temin	U	IR Conf Rm
14:15	45	IW4D/WIDE Demo		SCI/U	918/ISF
15:00	45	WIDE/IW4D Demo		U/SCI	ISF/918
15:45	15	Break			
16:00	30	NLU Speech Integration	L. Bates	U	IR Conf Rm
16:30		Discussions		U	IR Conf Rm


IRD'S PROGRAM 6
TECHNICAL INTERCHANGE
MEETING
11 - 12 FEB 1992

THE INTELLIGENCE ENVIRONMENT - TODAY



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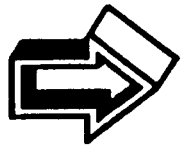

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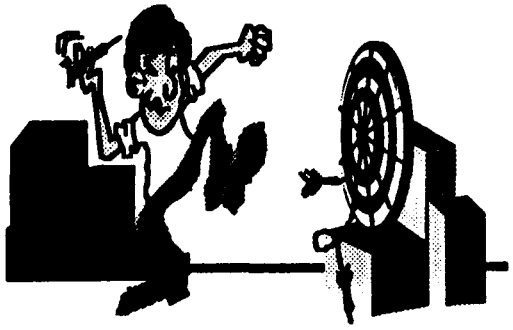
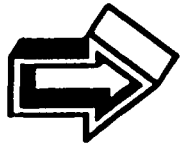


ANALYSIS



DISSEMINATION

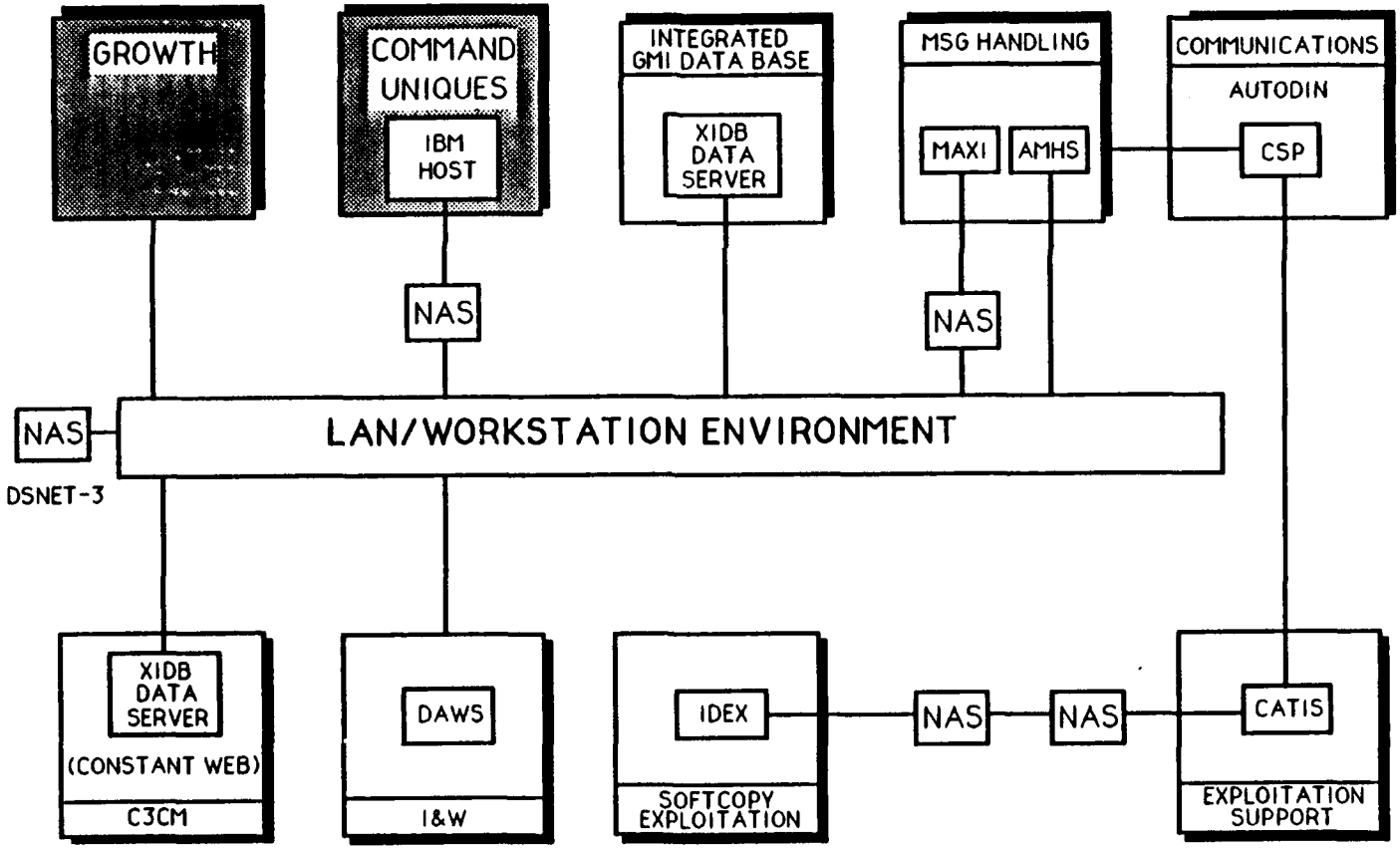
Program 6 TIM

OBJECTIVES

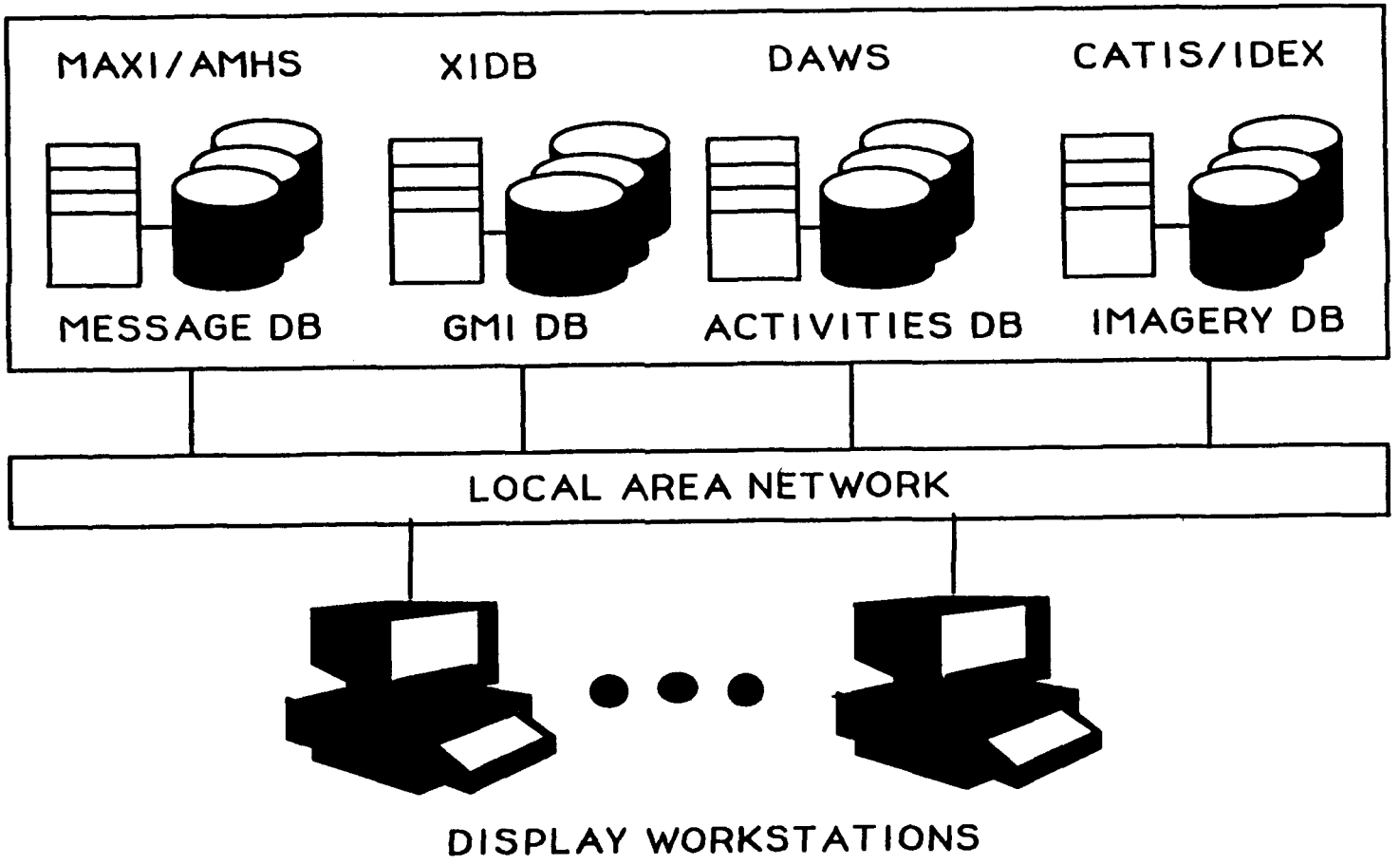
PROVIDE AN OPEN FORUM FOR TECHNICAL DISCUSSIONS OF IRD'S RESEARCH AND DEVELOPMENT EFFORTS

PEER REVIEW OF TECHNICAL/PROGRAMMATIC PLANS FOR IPAS 2000

INTELLIGENCE DATA HANDLING SYSTEM (IDHS)
NOTIONAL ARCHITECTURE

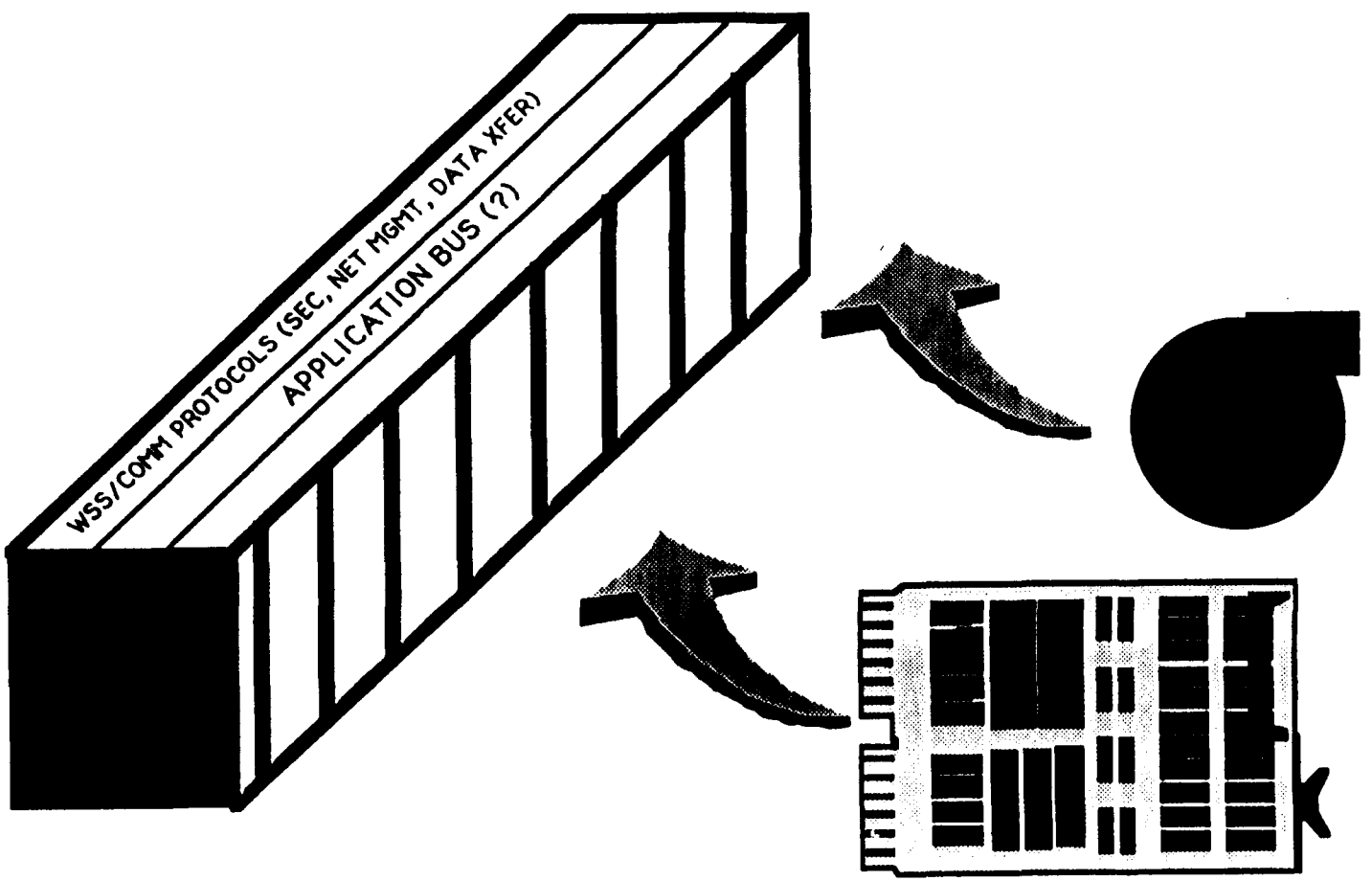


INTELLIGENCE DATA HANDLING SYSTEM (IDHS)
A DIFFERENT PERSPECTIVE

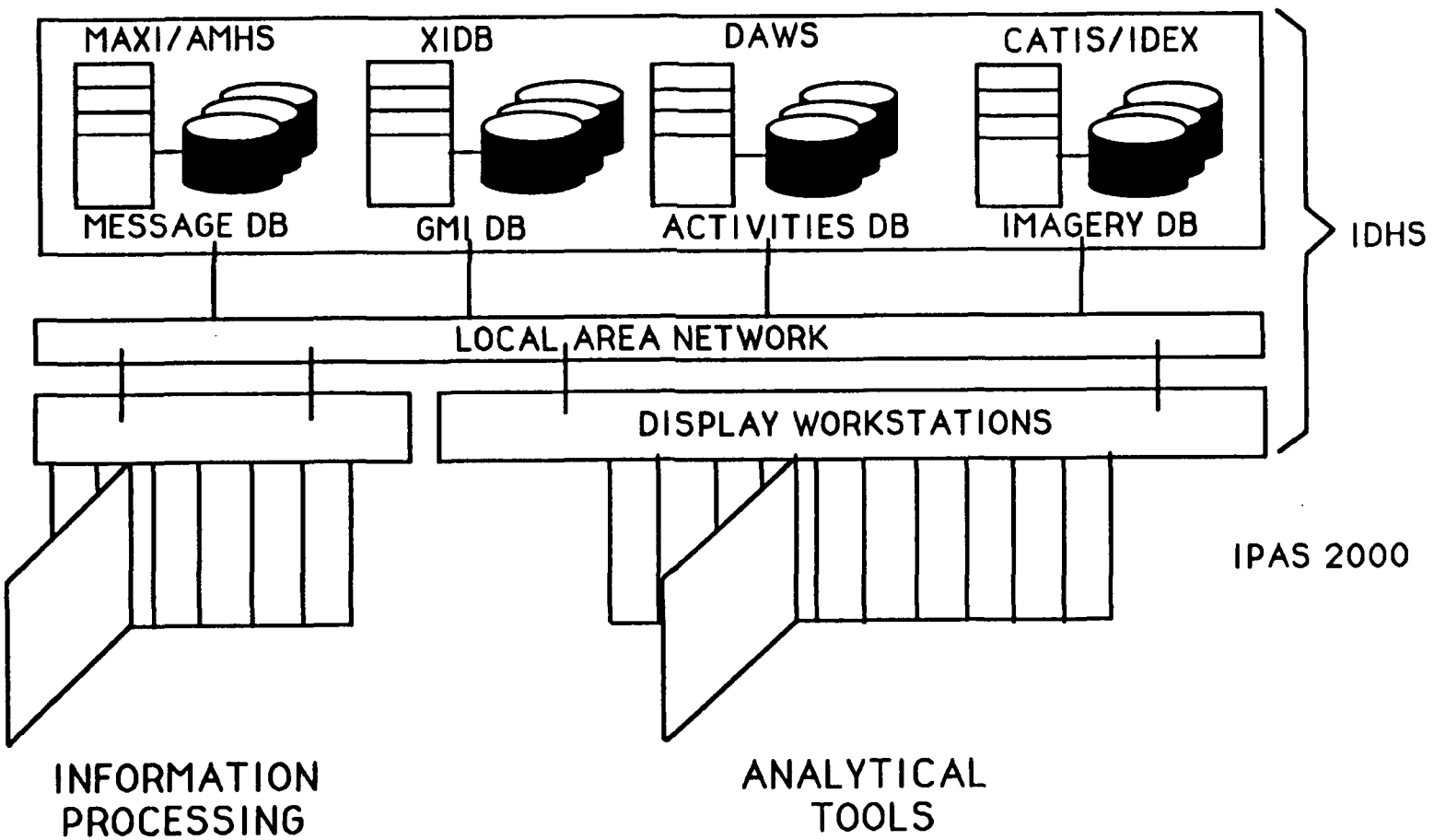


Program 6 TIM

CONCEPT



INTELLIGENT PREDICTIVE ASSESSMENT SYSTEM (IPAS) 2000
NOTIONAL ARCHITECTURE



SOME THOUGHTS

EVENT MANAGER/CKBA AS STANDARD APPLICATION INFORMATION TRANSFER MECHANISM

SCHEDULE OF NEXT TIM

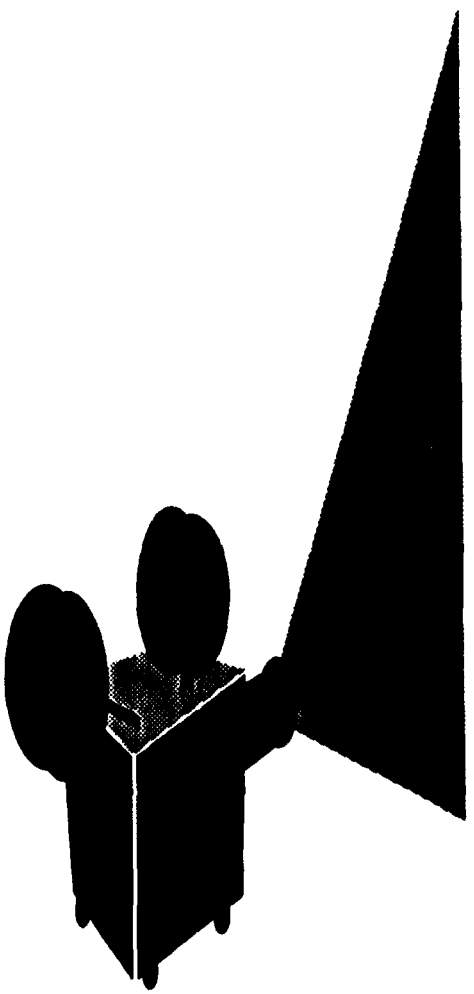
ACTION ITEMS

PROGRAM 6 PHILOSOPHY

FOLLOW-UP VISITS

IPAS 2000 PAPER

AGENDA



BLOCK I - IDHS SEGMENTS
(DAWS, CATIS, XIDB
MAXI)

BLOCK II - OPERATIONAL IDHS

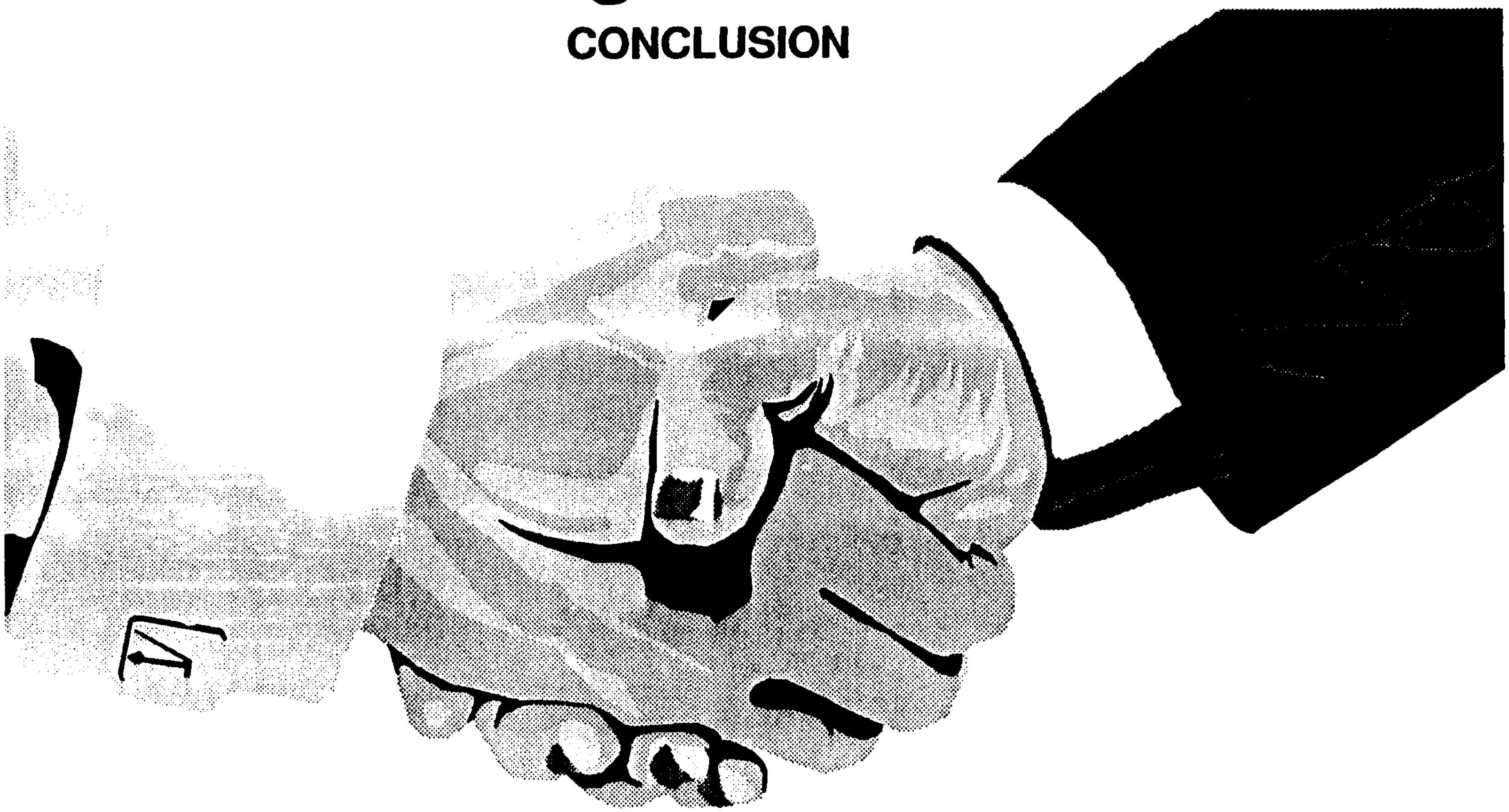
BLOCK III - IPAS 2000 OVERVIEW

BLOCK IV - PROGRAM 6 EFFORTS

BLOCK V - WRAP UP

Program 6 TIM

CONCLUSION



COOPERATION

DEFENSE AUTOMATED WARNING SYSTEM

OBJECTIVES

AUTOMATE THE I&W MONITORING FUNCTION

PROVIDE AUTOMATED TOOLS TO ASSIST THE WARNING OFFICER IN PERFORMING I&W ANALYSIS

PROVIDE THE INTELLIGENCE COMMUNITY A STANDARD I&W APPLICATION CONSISTENT WITH THE DODIIS ARCHITECTURE

BACKGROUND

BASED ON DIA JS / DS AGREEMENT (JAN 90)

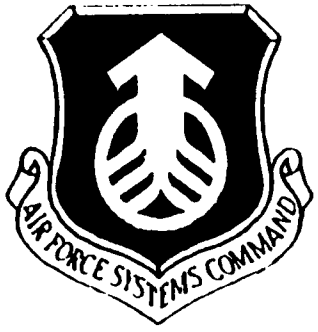
- AFISA DESIGNATED AS THE EXECUTIVE AGENT

DAWS EXPECTED TO

- INTEGRATE THE INDICATOR BASED STRUCTURE OF AUTOMATED WWIMS WITH THE ADVANCED APPLICATIONS OF SACWARNS

FIRST CASE UNDER NEW DODIIS MANAGEMENT STRATEGY EMPLOYING:

- CORE SYSTEMS
- STANDARD APPLICATIONS



ROLES AND RESPONSIBILITIES

FUNCTIONAL MANAGER (DIA)

- VALIDATE USER REQUIREMENTS
- PROGRAM OVERSIGHT
- FUNDING SUPPORT

EXECUTIVE AGENT (AFISA)

- PROGRAM FUNDING
- PROGRAM DEVELOPMENT / INTEGRATION / IMPLEMENTATION

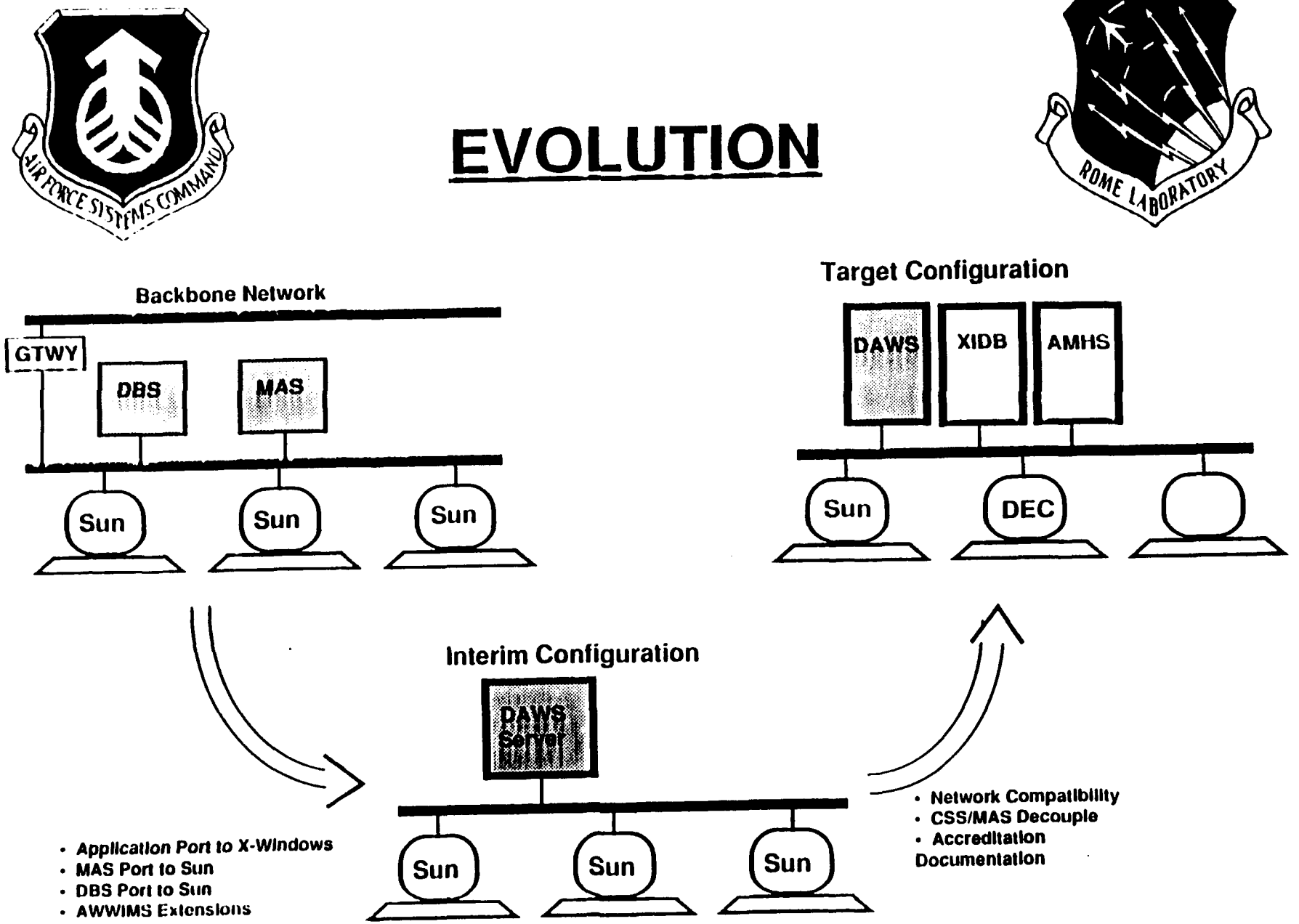
TECHNICAL MANAGER (RL)

- DEVELOPMENT AND DELIVERY

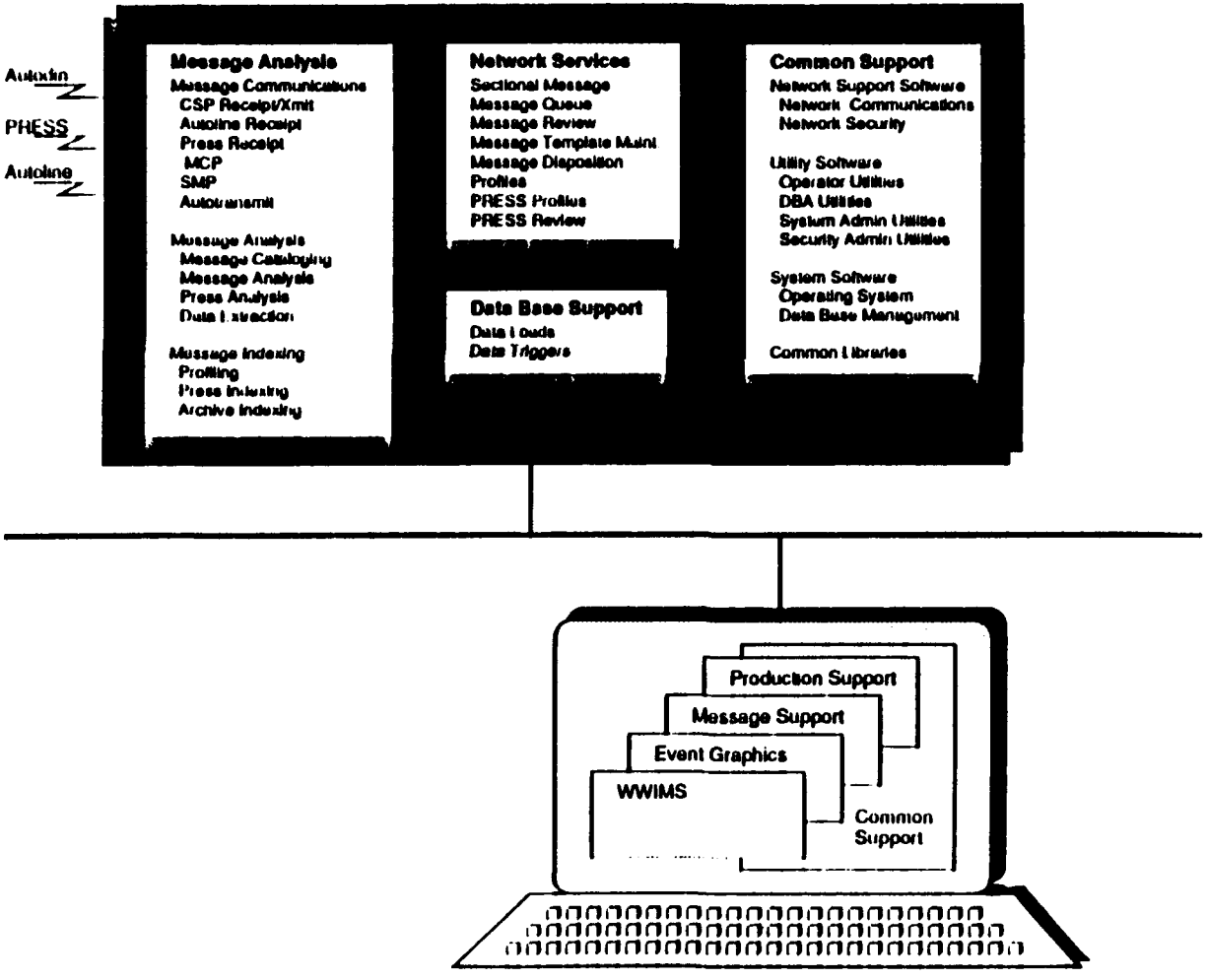
USER GROUP

- DETERMINE NEW REQUIREMENTS

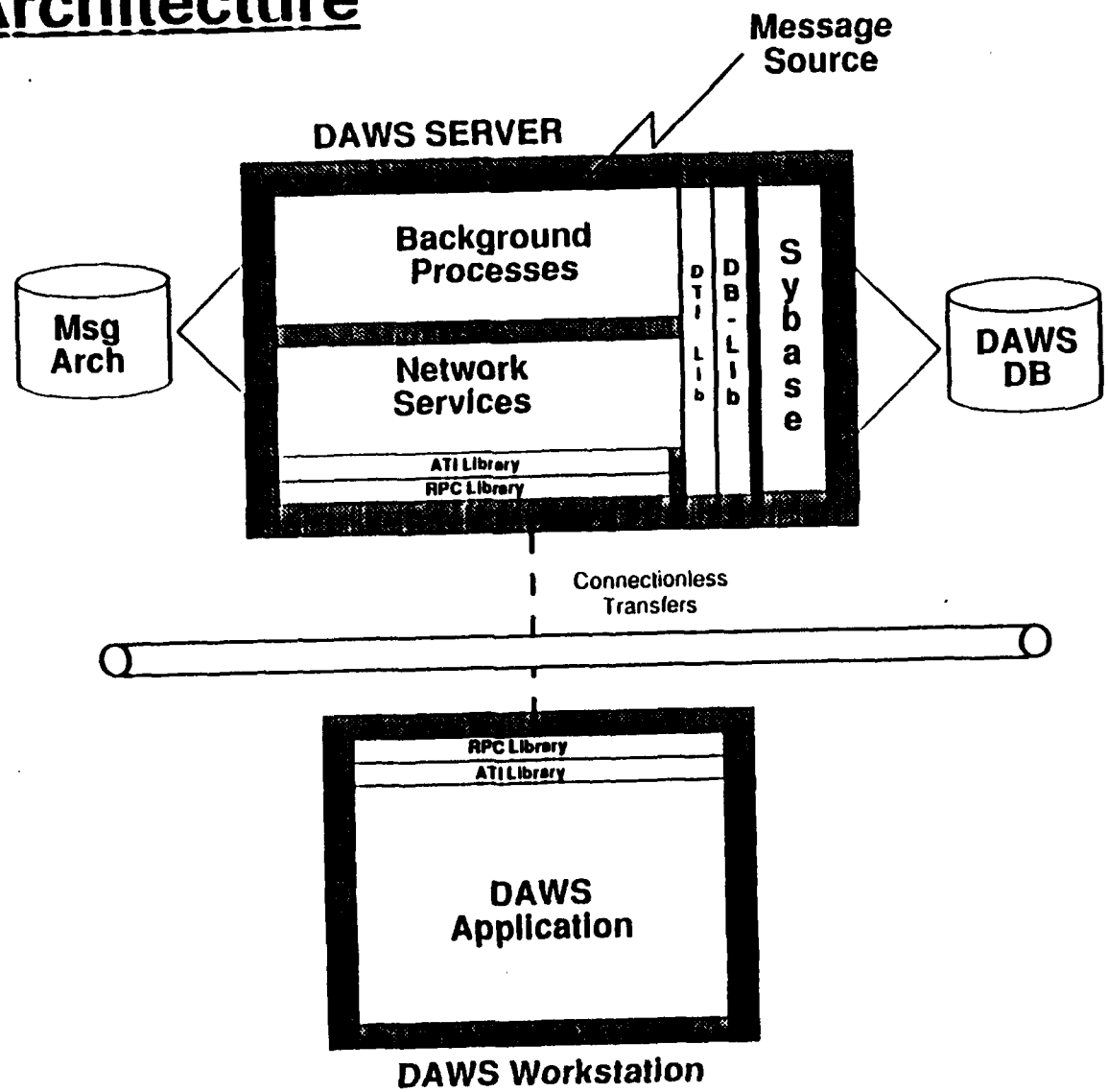
EVOLUTION


Backbone Network
GTWY
DBS
MAS
Sun
Sun
Sun
Target Configuration
DAWS
XIDB
AMHS
Sun
DEC
Interim Configuration
DAWS Server
Sun
Sun
Sun
• Application Port to X-Windows
• MAS Port to Sun
• DBS Port to Sun
• AWWIMS Extensions
• Network Compatibility
• CSS/MAS Decouple
• Accreditation Documentation

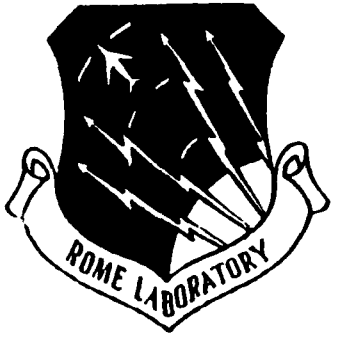
DAWS Architecture Overview



DAWS Architecture



COMMON SUPPORT



PROVIDE SERVICES TO ALL DAWS APPLICATIONS AND USERS

PASSWORD MAINTENANCE

WORKSTATION SETUP

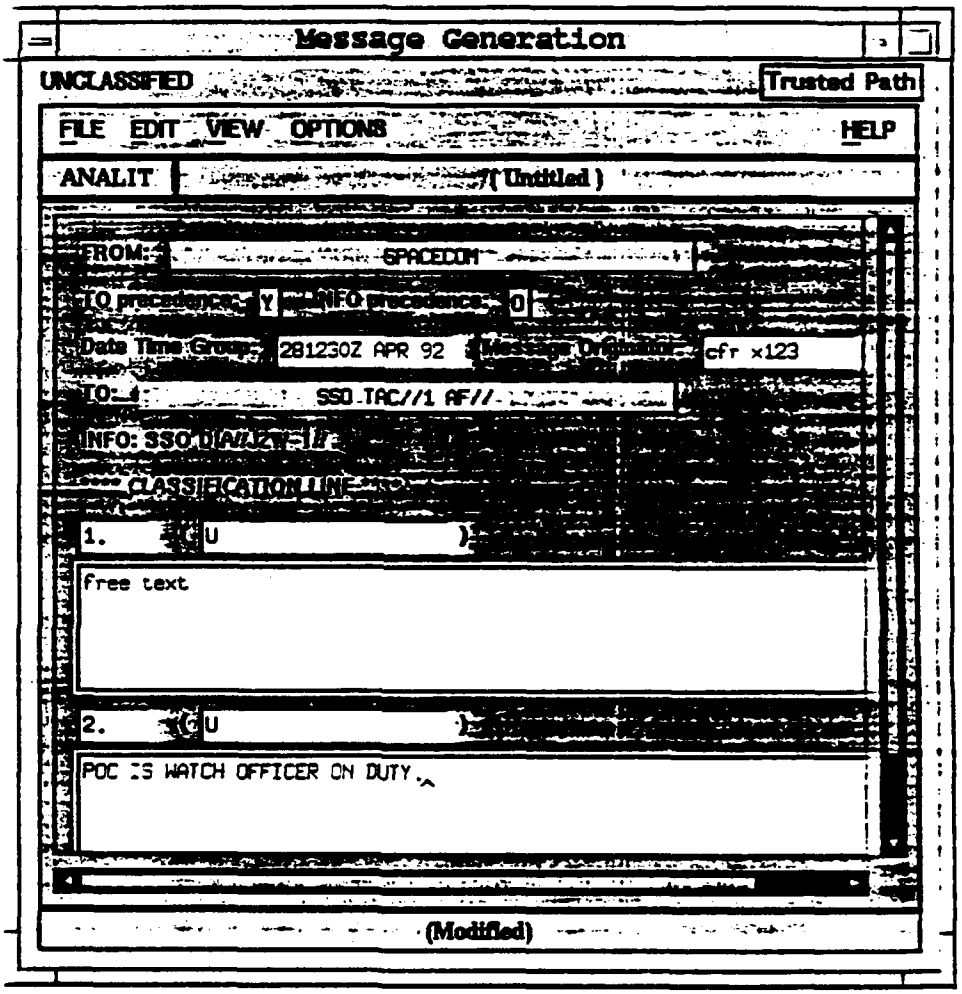
MAIL SERVICES

WORD PROCESSING SERVICES

MESSAGE SUPPORT

AUTOMATED SUPPORT FOR INCOMING AND OUTGOING MESSAGES

- DATA EXTRACTION OF SEMI-FORMATTED MESSAGES
- PROFILES
- QUERIES
- MESSAGE GENERATION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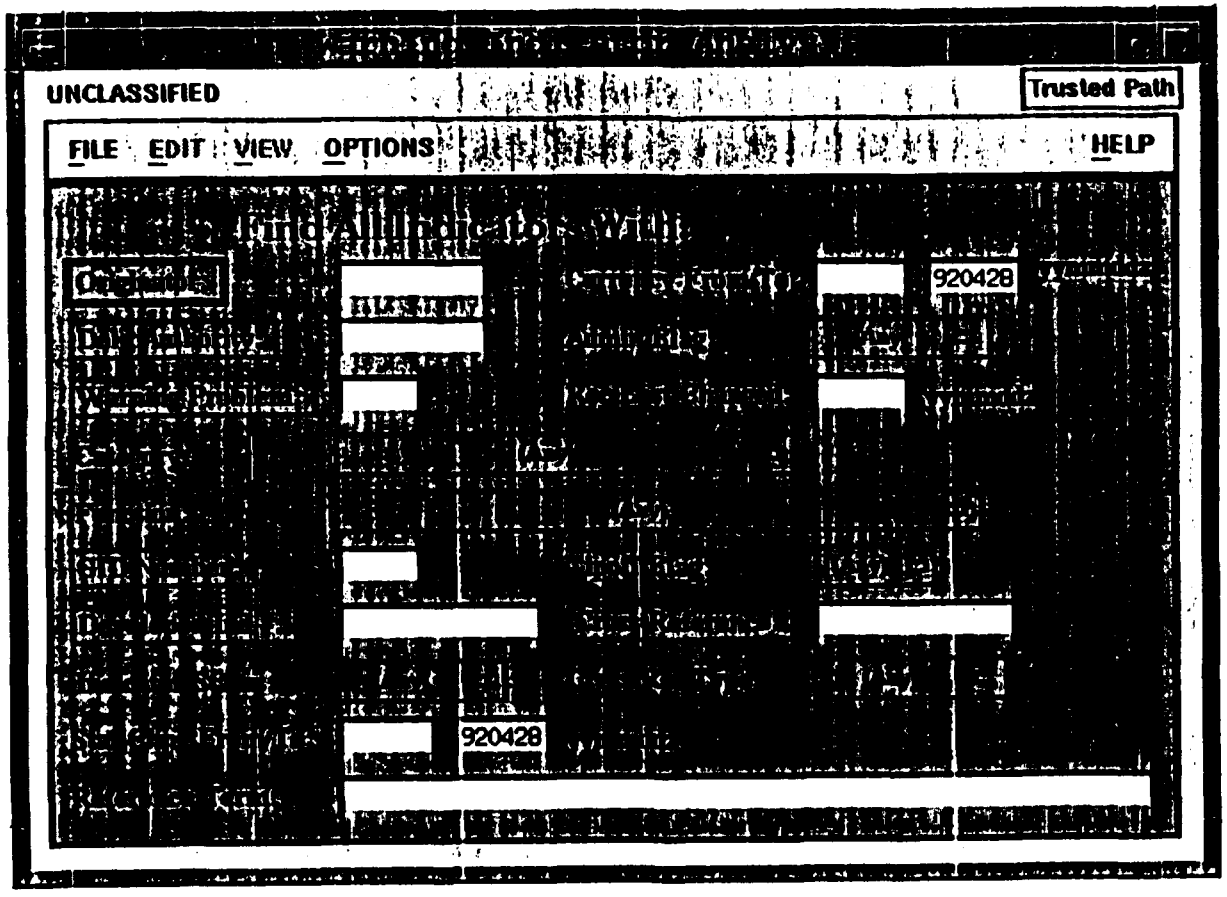
UNCLASSIFIED
Trusted Path
FILE EDIT VIEW OPTIONS HELP
ANALIT
(Untitled)
FROM: SPACECOM
TO precedence: Y INFO precedence: O
Date Time Group: 281230Z APR 92
cfr x123
TO: SSO.TAC//1 AF//
INFO: SSO.DIA/JCS-1//
CLASSIFICATION LINE
1. (U)
free text
2. (U)
POC IS WATCH OFFICER ON DUTY.
(Modified)

WWIMS

PROVIDES I&W SUPPORT FUNCTIONS

- SUPPORTS RESPONSIBILITY TO MONITOR ASSIGNED INDICATORS AND REPORT DEVELOPMENTS
- STATUS REVIEW OF WARNING PROBLEMS, CATEGORY FUNCTIONAL AREAS AND INDICATORS
- ANALYST NOTIFICATION OF WWIMS RECORD CHANGES AND ADDITIONS


UNCLASSIFIED
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FILE EDIT VIEW OPTIONS HELP
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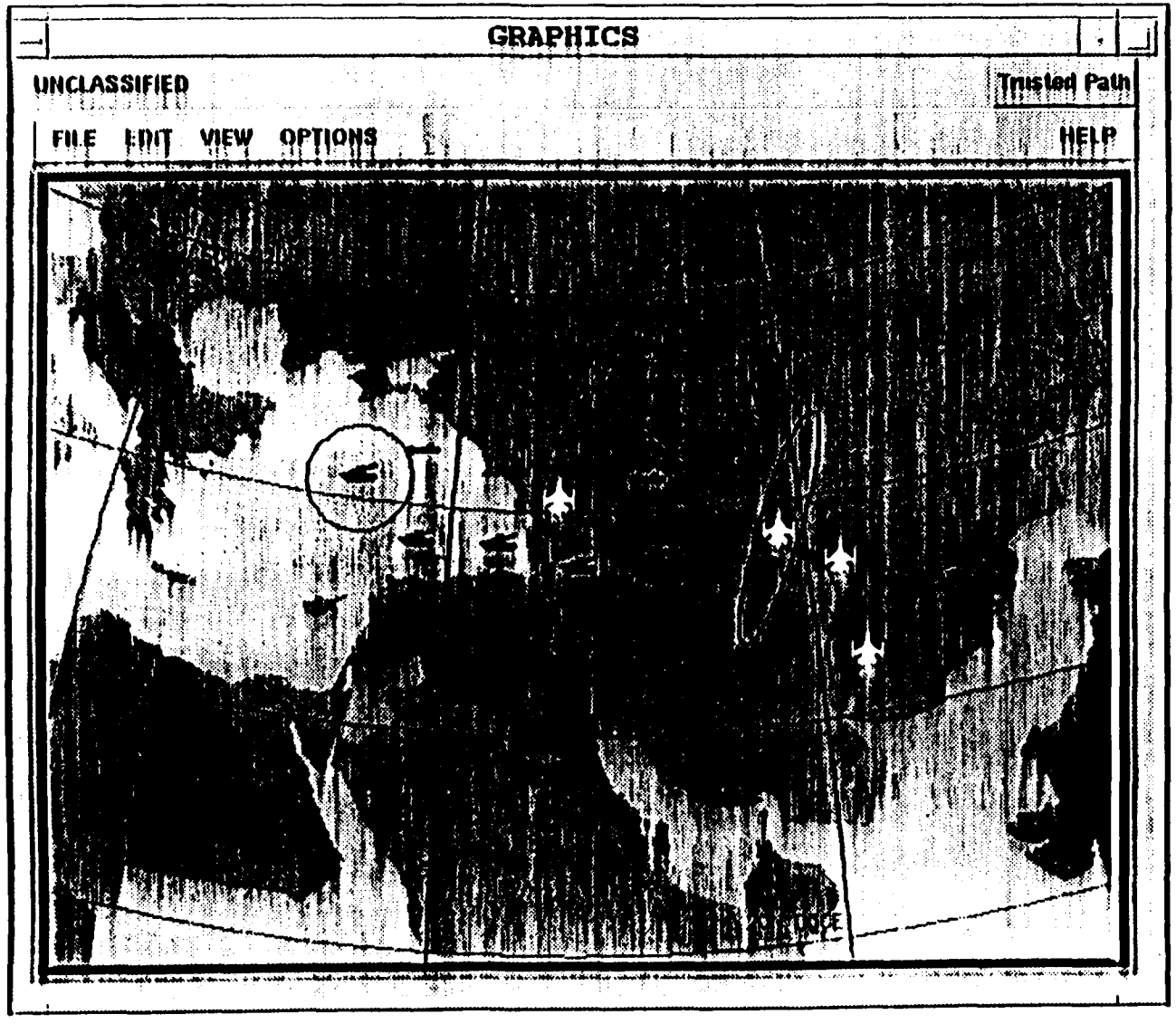
EVENT GRAPHICS

USES GRAPHICS (GKS,GSS) TO SUPPORT I&W ANALYSIS

PROVIDES MAP GRAPHIC DISPLAY FOR:

ORDER OF BATTLE DATA ANALYSIS

TRACKING


GRAPHICS
UNCLASSIFIED
Trusted Path
FILE EDIT VIEW OPTIONS
HELP

PRODUCTION SUPPORT

BRIEFING AND BOOK GENERATION AND DISPLAY

COMBINES INTEGRATED TEXT, GRAPHIC, AND GEOGRAPHIC CAPABILITIES

SPREADSHEETS TO BAR GRAPHS

MAP AND TEXT OVERLAY

File Edit View Options Help

UNCLASSIFIED

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column d	85	267	352
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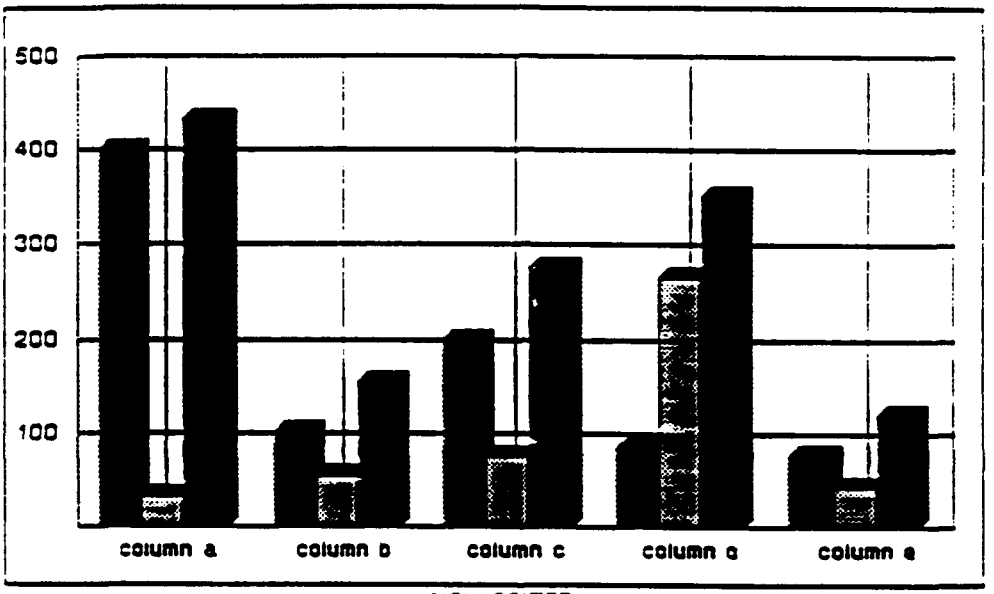

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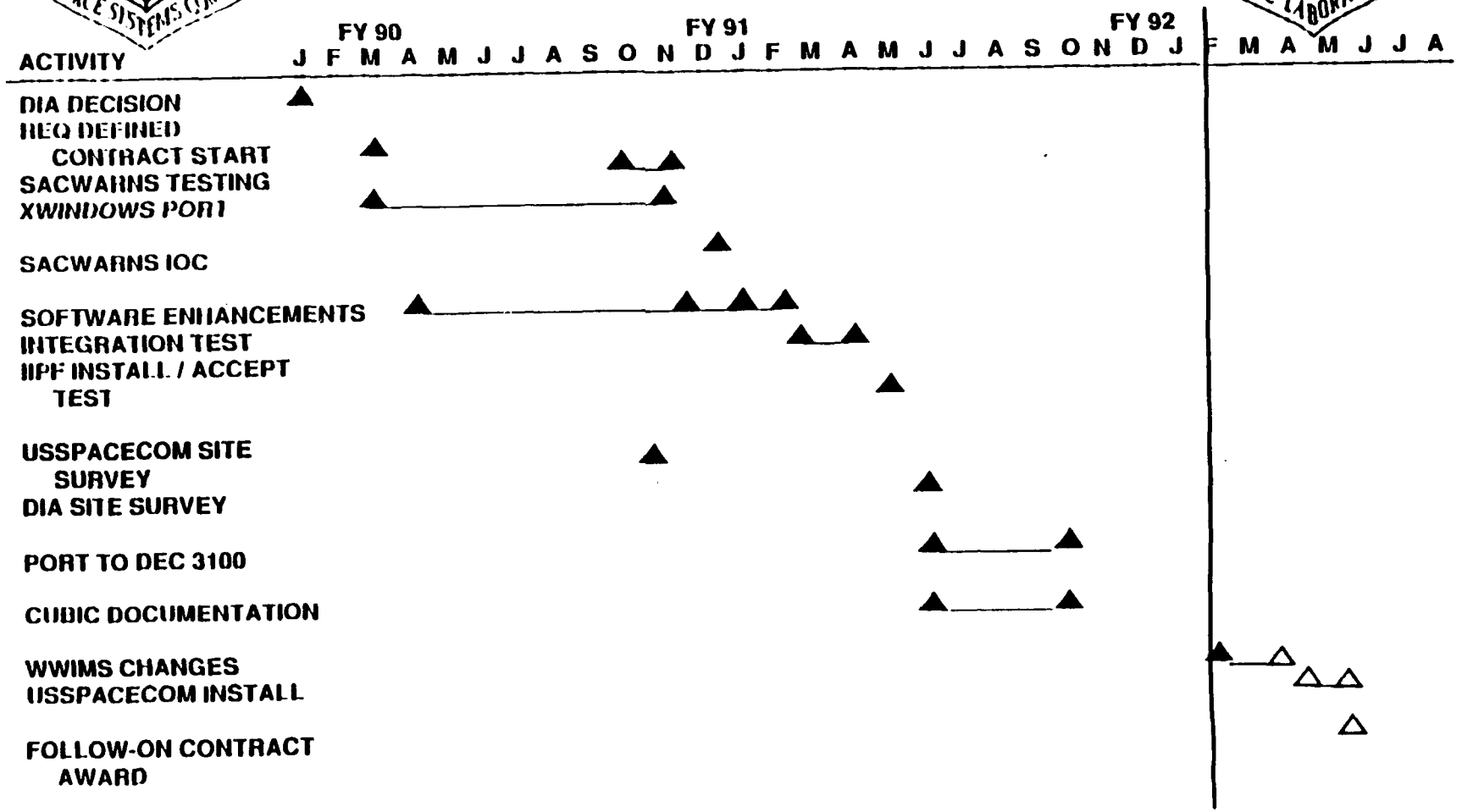
SCHEDULE


AIR FORCE SYSTEMS COMMAND


ROME LABORATORY


FY 90
FY 91
FY 92
ACTIVITY
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A
DIA DECISION
REQ DEFINED
CONTRACT START
SACWARNS TESTING
XWINDOWS PORT
SACWARNS IOC
SOFTWARE ENHANCEMENTS
INTEGRATION TEST
IIPF INSTALL / ACCEPT TEST
USSPACECOM SITE SURVEY
DIA SITE SURVEY
PORT TO DEC 3100
CUBIC DOCUMENTATION
WWIMS CHANGES
USSPACECOM INSTALL
FOLLOW-ON CONTRACT AWARD

MAJOR ACCOMPLISHMENTS

COMPLETED PORT TO UNIX SERVER / CLIENT ARCHITECTURE

COMPLETED PORT TO X-WINDOWS / MOTIF

COMBINED AUTOMATED WWIMS / SACWARNS FUNCTIONALITY

INSTALLED BASELINE IN ROME LABORATORY INTELLIGENCE INFORMATION PROCESSING FACILITY

COMPLETED USSPACECOM AND DIA SITE SURVEYS

CONCLUSION

DAWS IS THE FIRST AUTOMATED SYSTEM FOR THE I&W ANALYST

ALLOWS ANALYST MORE TIME FOR ANALYSIS

GOAL HAS BEEN TO FIELD IN LIMITED TIME AND FUNDING

R & D ON-GOING FOR SYSTEM ENHANCEMENTS

INTELLIGENCE AND RECONNAISSANCE DIRECTORATE

Computer Aided Tactical Information System (CATIS)

Dennis O. Jones
RL/IRDO

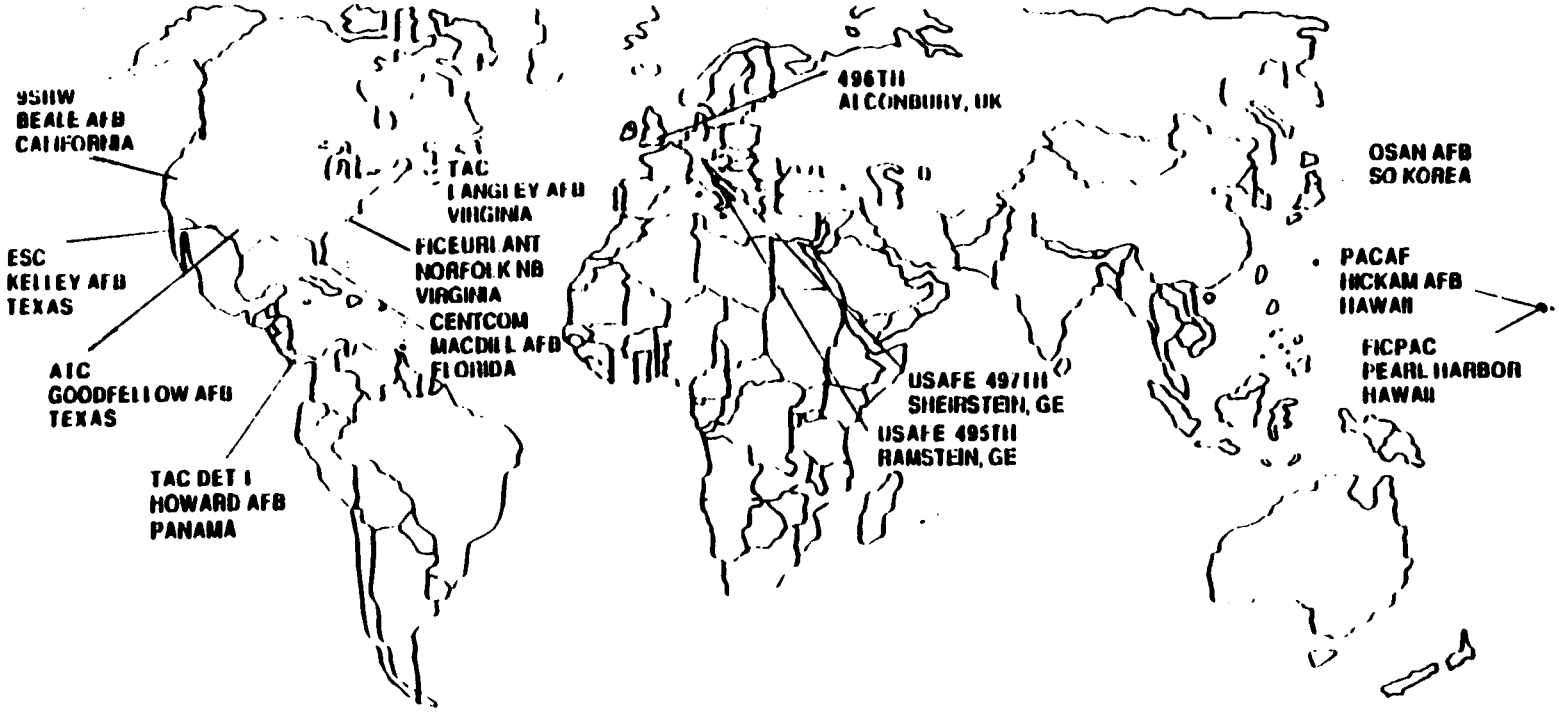
CATIS

OBJECTIVE: Provide imagery analysts the capability to exploit increased volumes of near-real-time intelligence, maintain current operational CATIS systems and provide transition for future system capabilities

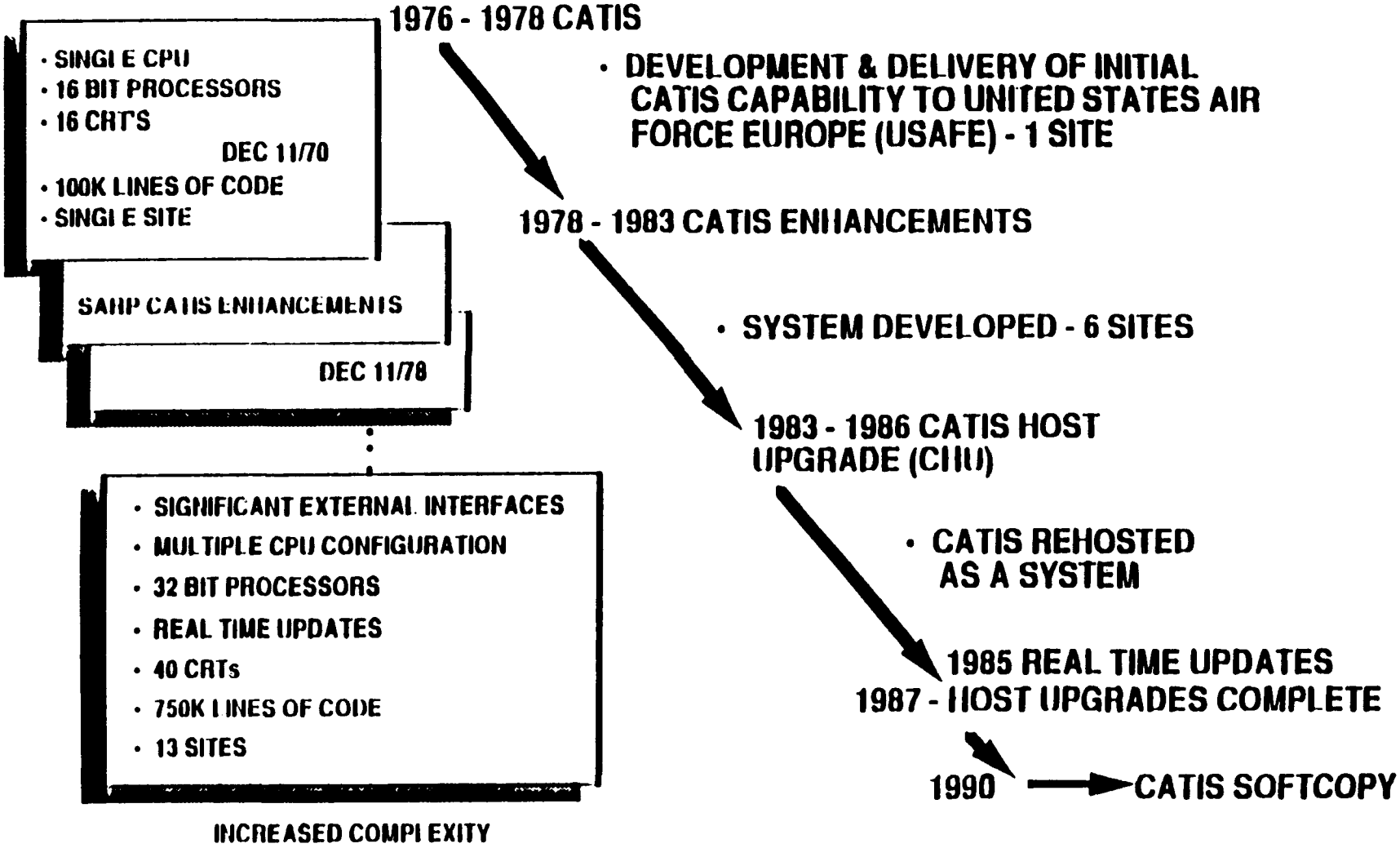
APPROACH: Concentrate on site support, central maintenance, softcopy demonstration support, DSNET3 implementation and upgrading the CATIS LAN

D. Jones
19 Jul 91

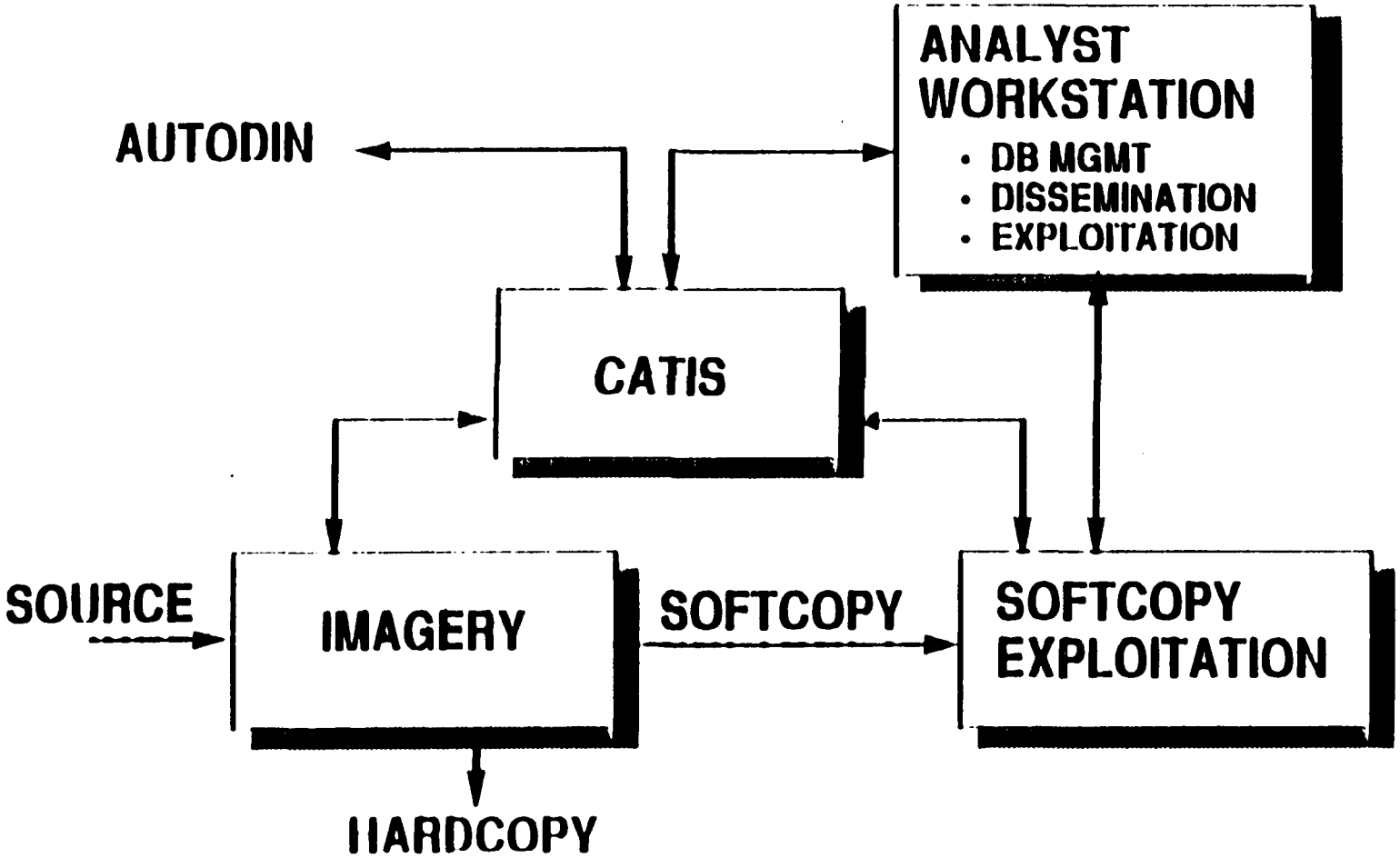
WORLDWIDE CATIS SITES



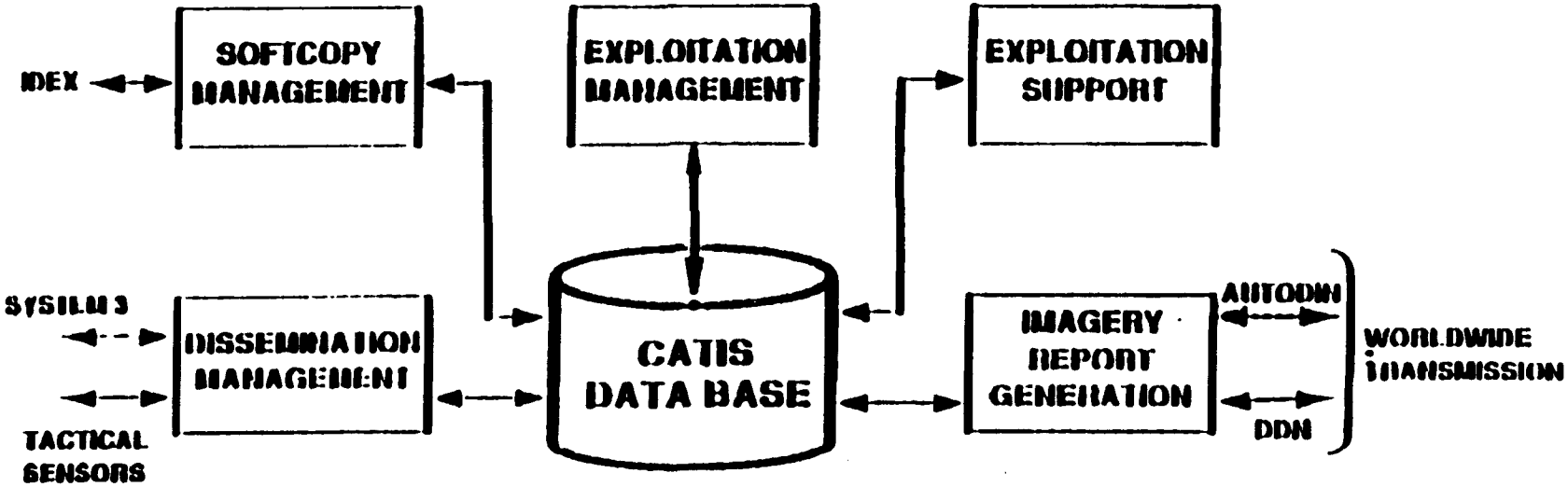
HISTORY


1976 - 1978 CATIS
• SINGLE CPU
• 16 BIT PROCESSORS
• 16 CRTS
DEC 11/70
• 100K LINES OF CODE
• SINGLE SITE
• DEVELOPMENT & DELIVERY OF INITIAL CATIS CAPABILITY TO UNITED STATES AIR FORCE EUROPE (USAFE) - 1 SITE
1978 - 1983 CATIS ENHANCEMENTS
SAHP CATIS ENHANCEMENTS
DEC 11/78
• SYSTEM DEVELOPED - 6 SITES
1983 - 1986 CATIS HOST UPGRADE (CHU)
• SIGNIFICANT EXTERNAL INTERFACES
• MULTIPLE CPU CONFIGURATION
• 32 BIT PROCESSORS
• REAL TIME UPDATES
• 40 CRTs
• 750K LINES OF CODE
• 13 SITES
• CATIS REHOSTED AS A SYSTEM
1985 REAL TIME UPDATES
1987 - HOST UPGRADES COMPLETE
1990
CATIS SOFTCOPY
INCREASED COMPLEXITY

CATIS ARCHITECTURE



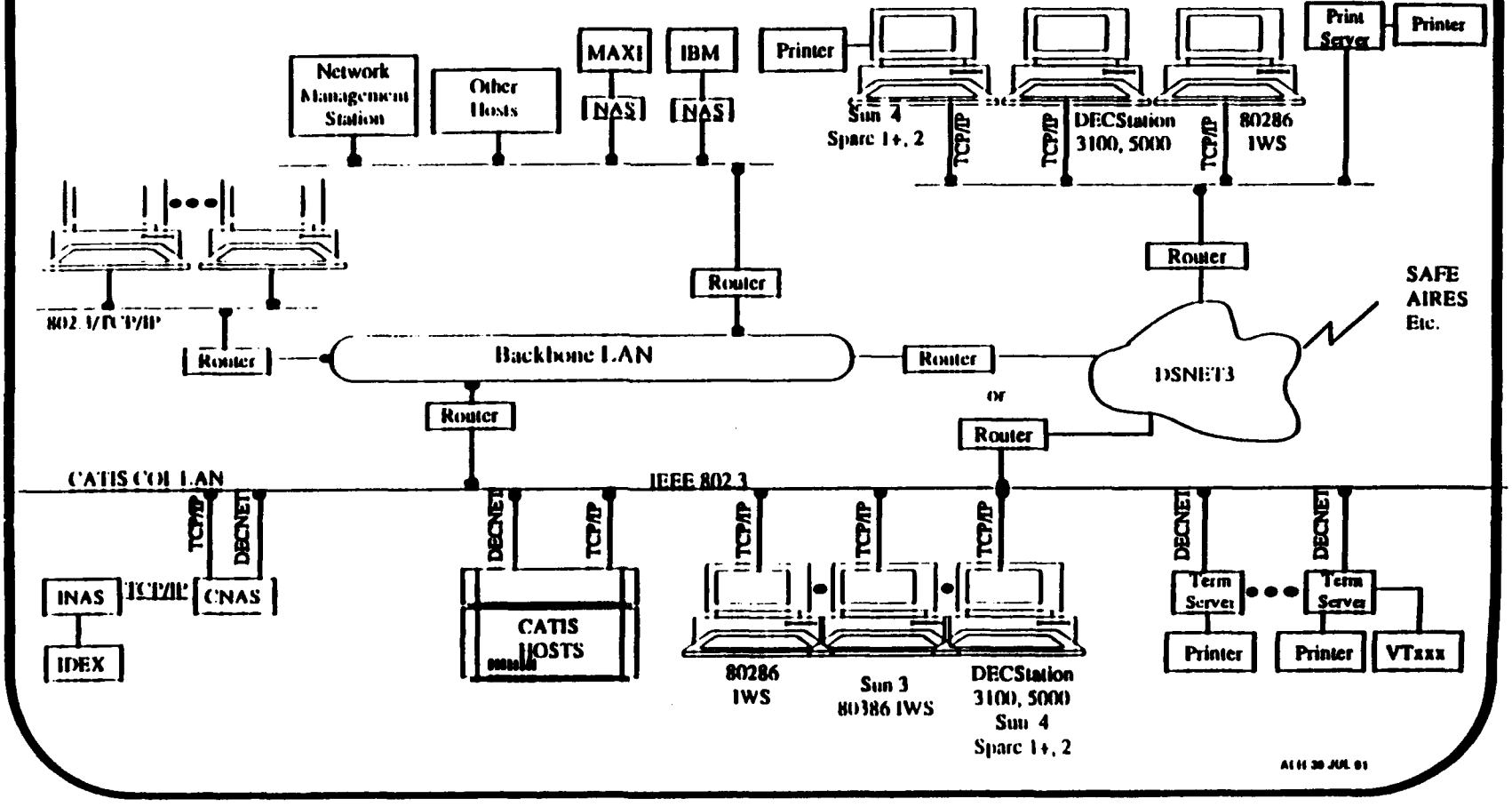
MAJOR CATIS FUNCTIONS



- 1 - 5 GB
- Updated via Worldwide Message Traffic
- Comprehensive Target, Coverage, and Requirements Intelligence Information
- 150,000 Targets

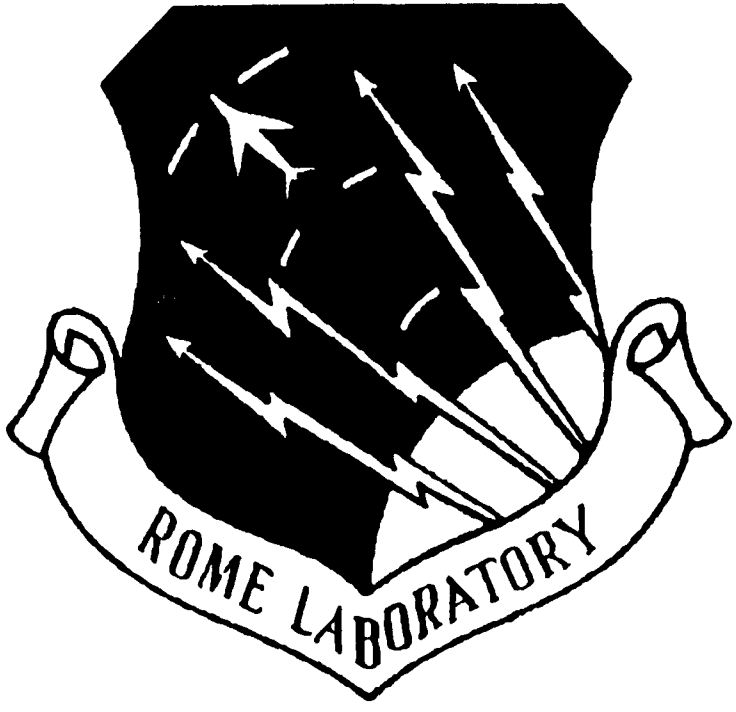
- o SUPPORT FOR UP TO 60 USERS
- o GENERATE UP TO 3000 REPORT ITEMS DAILY
- o OVER 700K LINES OF CODE

CATIS LAN UPGRADE ARCHITECTURE



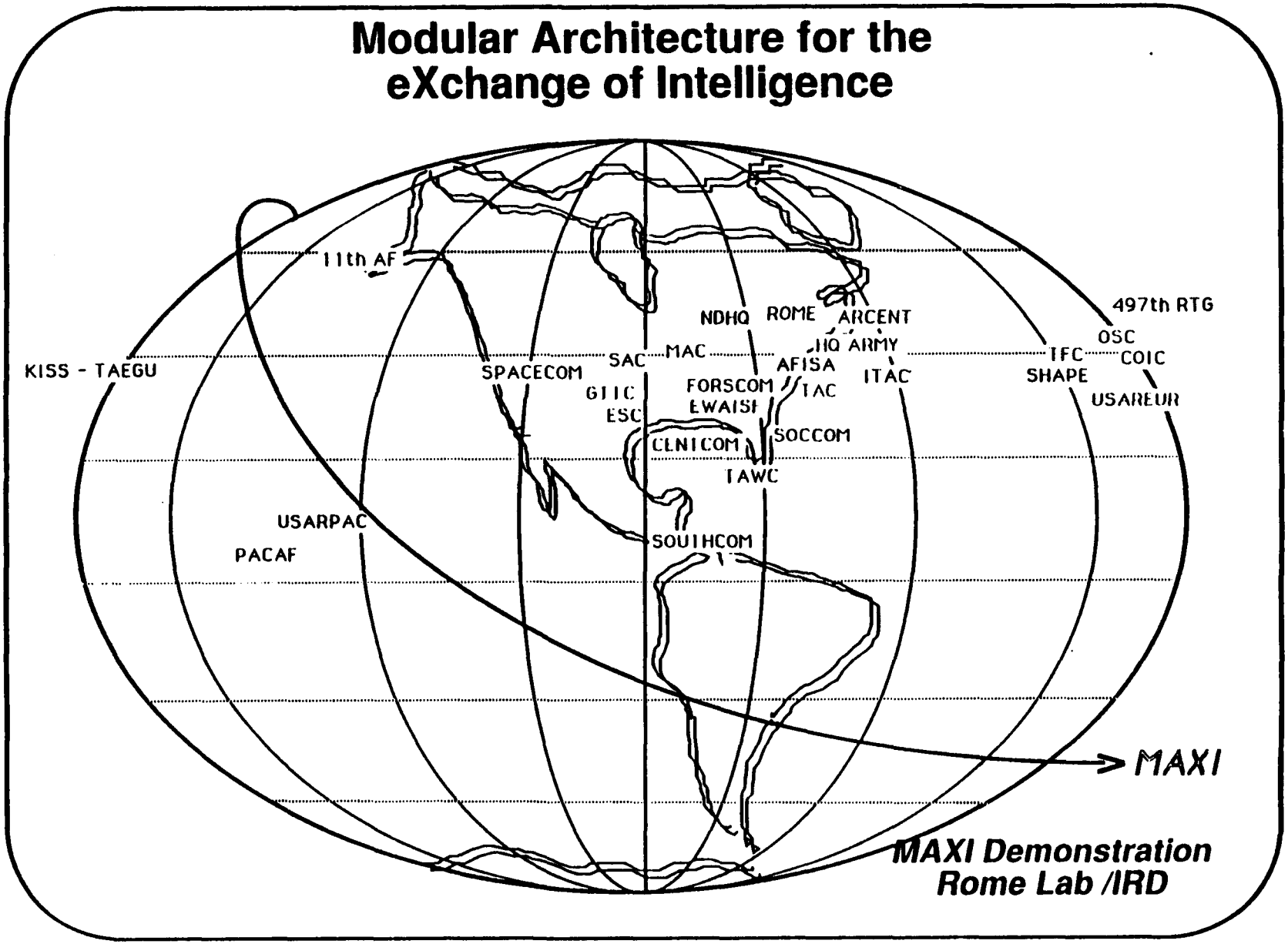
MAXI System Demonstration
Rome Laboratory

Intelligence Information Processing Facility



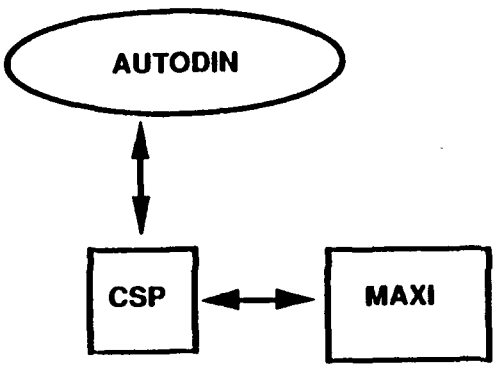
MAXI Demonstration
Rome Lab /IRD

Modular Architecture for the eXchange of Intelligence

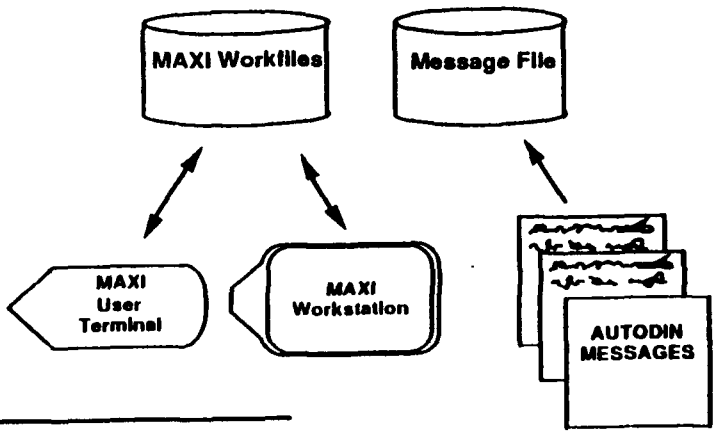


MAXI Functional Overview

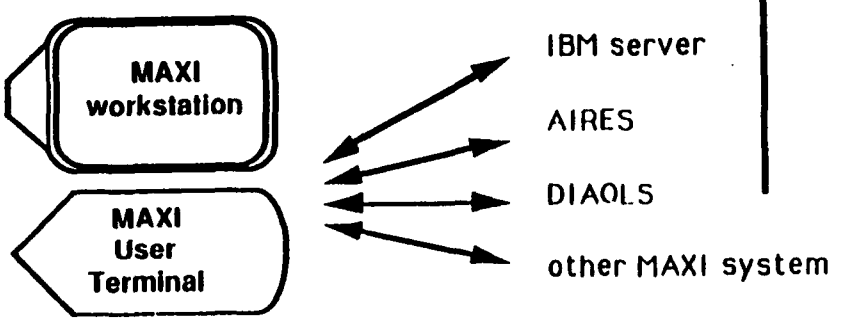
message handling



data storage (text files)

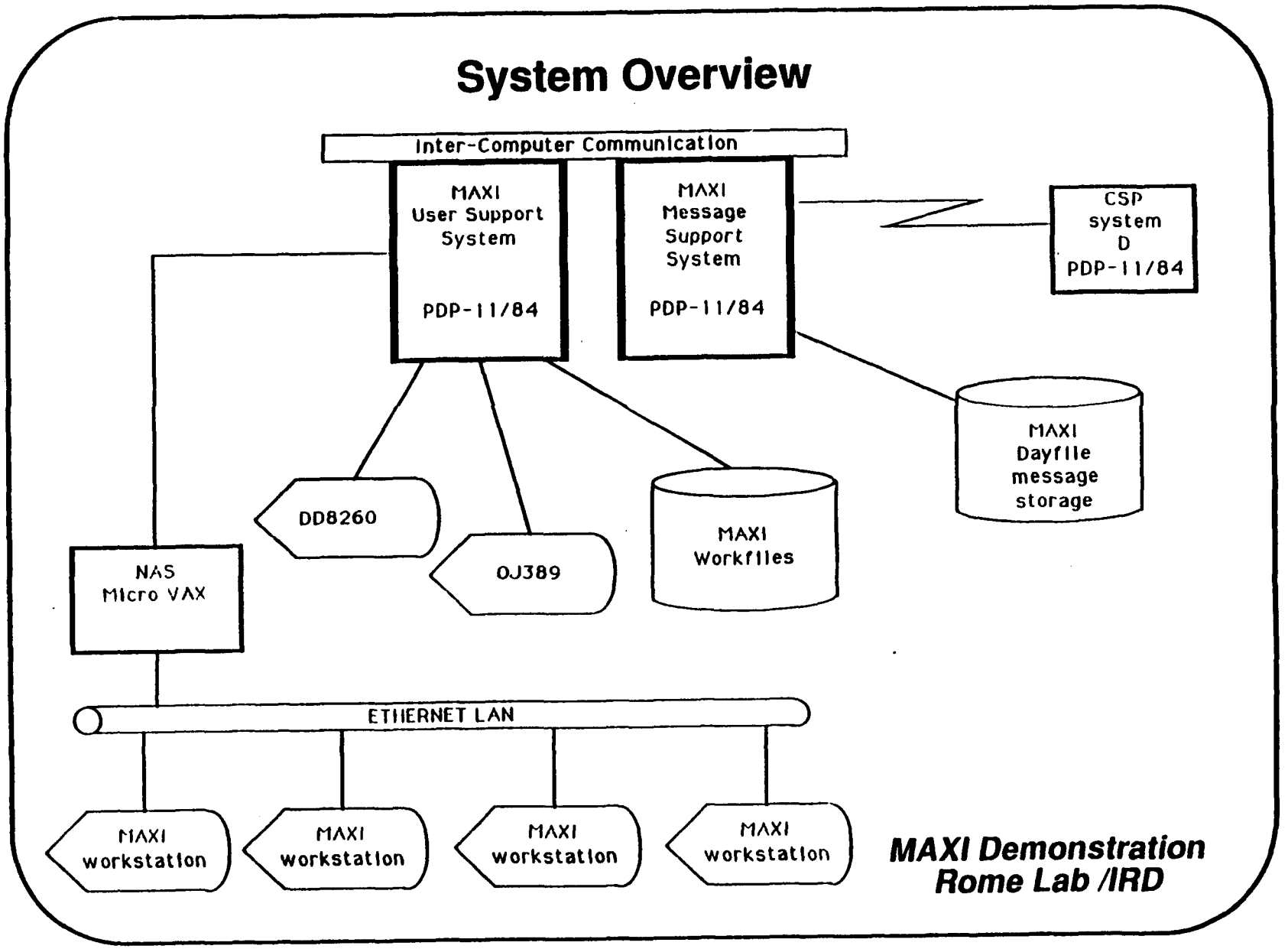


network access

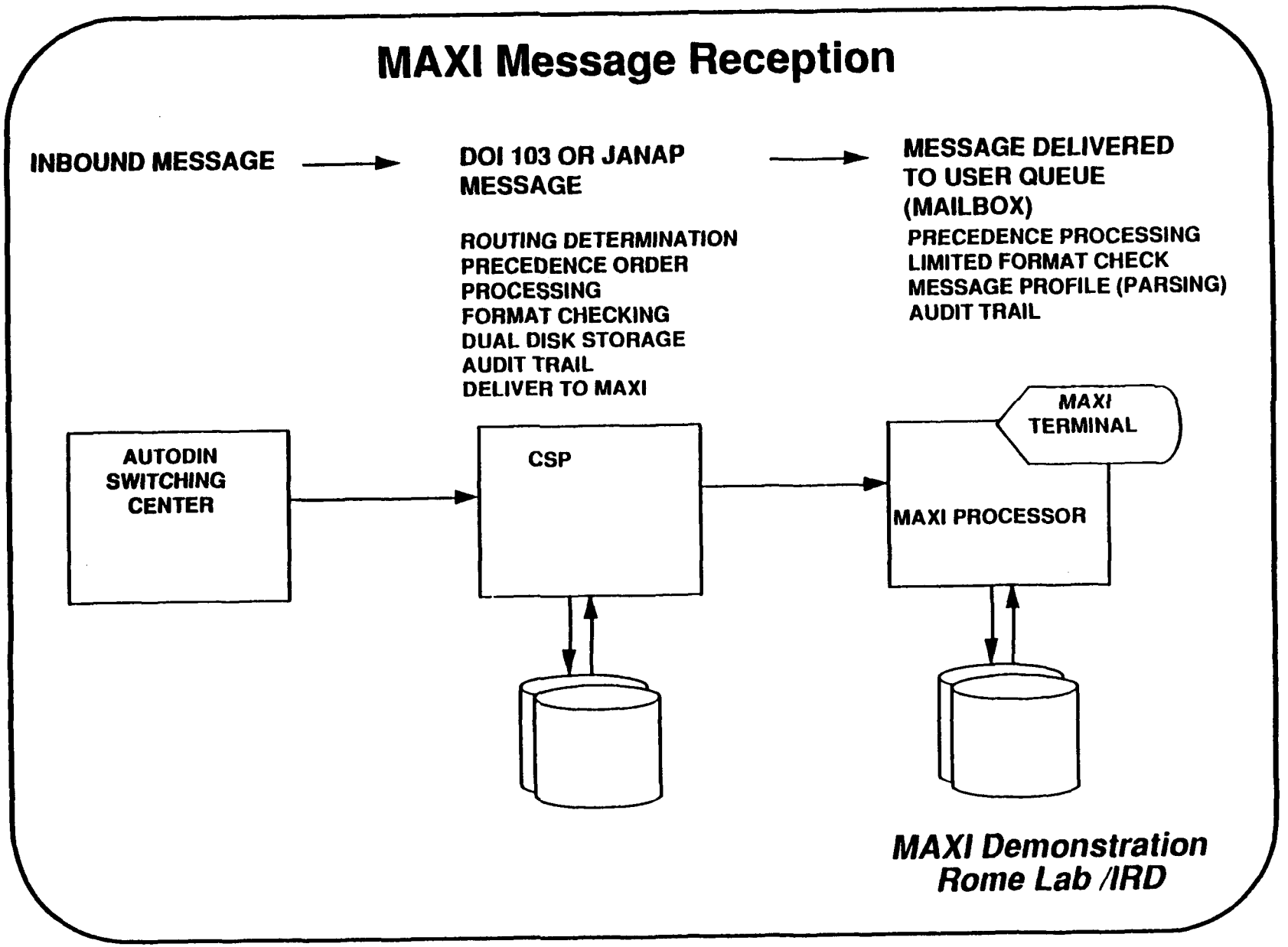


security

MAXI Demonstration
Rome Lab /IRD


System Overview
Inter-Computer Communication
MAXI
User Support
System
PDP-11/84
MAXI
Message
Support
System
PDP-11/84
CSP
system
D
PDP-11/84
MAXI
Dayfile
message
storage
DD8260
OJ389
MAXI
Workfiles
NAS
Micro VAX
ETHERNET LAN
MAXI
workstation
MAXI
workstation
MAXI
workstation
MAXI
workstation
MAXI Demonstration
Rome Lab /IRD

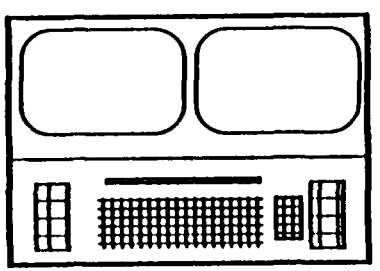
MAXI Message Reception



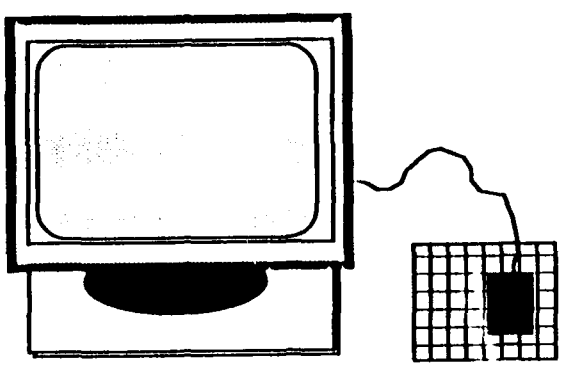
MAXI Man Machine Interfaces

Two distinct types: slaved terminals and workstations

OJ389



unix workstation

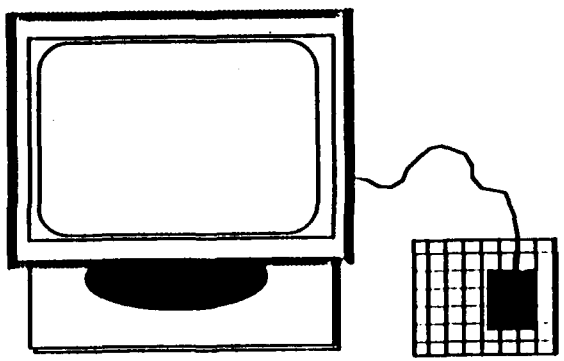


MAXI Demonstration
Rome Lab /IRD

MAXI Workstation

Currently supported:

- **SUN**
- **DEC 3nnn and 5nnn**
- **Xterminal**



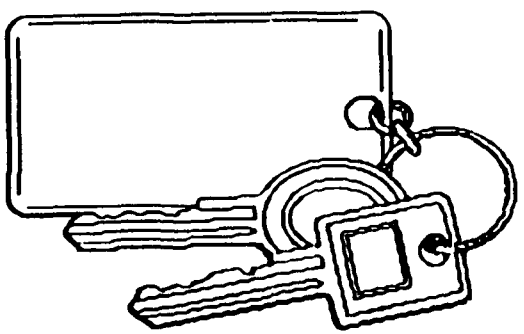
The MAXI Workstation software brings commercially available desktop workstations to the secure local area network

MAXI Demonstration
Rome Lab /IRD

Security

MAXI performs the following security tasks:

- audit trail
- password generation
- data integrity (validation)
- configuration control
- user authentication
- "deadman" timeout
- classification identification
- AMPE message integrity
- journalization

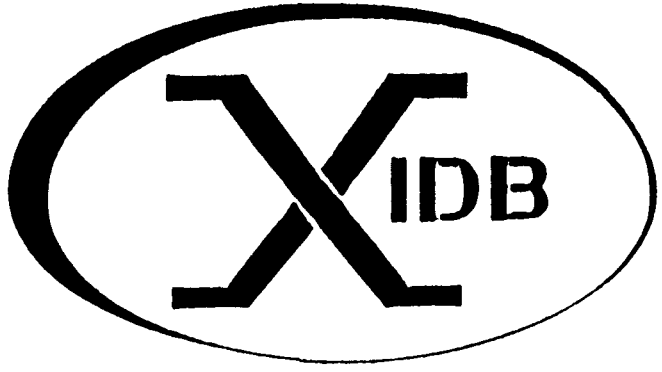


THE KEY SECURITY FEATURE: EXPERIENCED USERS.

MAXI Summary

- proven message handling system
- provides MAXI application in a client/server relationship
- migrating the intelligence analyst to an open archetecture

MAXI Demonstration
Rome Lab /IRD



Extended Integrated Data Base (XIDB)

OVERVIEW

Purpose

Background

Problems

Summary

PURPOSE

Discuss integrated database concepts

Discuss problems and implementation lessons

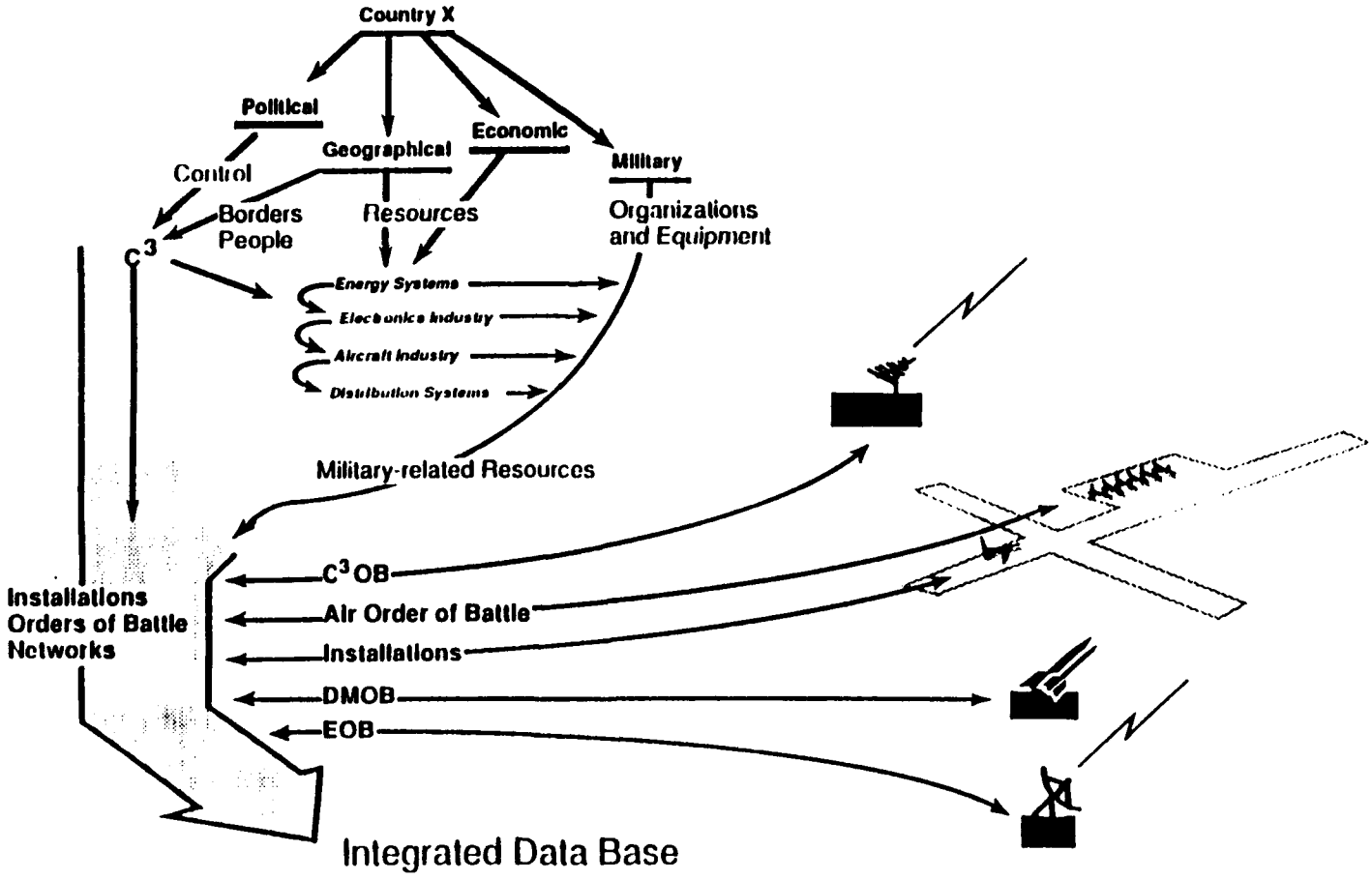
BACKGROUND

1981-1990	Development of MIIDS/IDB to replace AIF/DIOBS
1990	MIIDS/IDB IOC but rules of data production remain the same
1992	All DPP Producers to be IDB compatible
1993	All DPP Consumers to be IDB compatible

MIIDS REQUIRES CHANGE OF FOCUS REGARDING DATA

- FROM SOURCE ORIENTED TO FUNCTION ORIENTED
  - EMPHASIS ON RELATIONSHIP BETWEEN DATA ELEMENT
  - QUALITY IS A SOURCE FUNCTION
  - FUNCTIONS NOW DONE IN APPLICATION PROGRAMS DONE IN DB
  - INTEGRATED DATA BASE IMPLEMENTATION
  - APPLICATIONS EASIER TO DEVELOP
  - PERFORMANCE SHOULD BE BETTER
  - DATA BASE UPDATE MORE CRITICAL

Integrated GMI Data Base



ENTITY FILES

UNIT	EQUIPMENT
PERSONNEL	INDIVIDUALS
LOCATION	INSTALLATION
FAC LITIES	SITE
POPULATION	AGGREGATE NETWORK
SOURCE	REMARKS
EVENT	ORGANIZATION

EACH FILE HAS SPECIFIC STANDARDIZED DATA ELEMENTS AND DEFINITIONS.

RELATIONAL FILES

UNIT/UNIT

UNIT/FACILITY

EVENT/EVENT

NETWORK

UNIT/LOCATION

EQUIPMENT/EQUIPMENT

COMPLIX

AGGREGATE

UNIT/EQUIPMENT/LOCATION

SITE/EQUIPMENT/LOCATION

FACILITY/EQUIPMENT/LOCATION

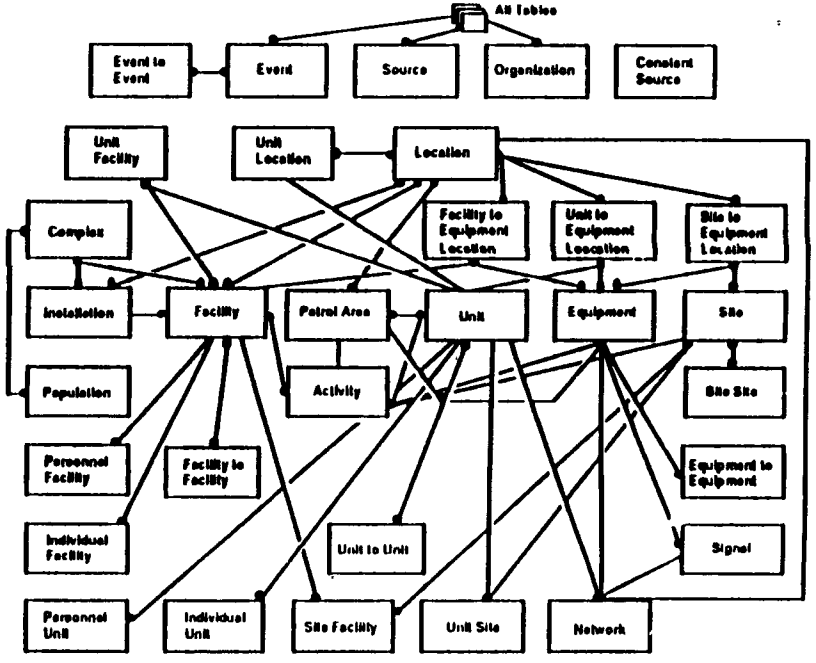
EACH FILE HAS SPECIFIC STANDARDIZED DATA ELEMENTS AND DEFINITIONS

Goals of XIDB Program

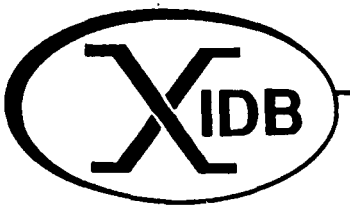
- Consolidate and Integrate General Military Intelligence across AF
- Implement MIIDS/IDB at Command Level
- Field a Working System at 10 Sites during 1992
- Protect Existing Command Software Investment
- Integrate XIDB with future AF IDHS Architecture
- Satisfy User Requirements

XIDB Data Core

- ☑ MIIDS/IDB and IDB/C3
- ☑ CONSTANT WEB
- ☑ RAILS
- ☑ SENTINEL BYTE
- ☑ Space Data
- ☑ Automated Air Facilities Information File (AAFIF)
- ☑ Current Intelligence (Manual Input)



1992 Baseline



Data Sources And Sizes

AAFIF	250.0 MB
CONSTANT WEB (Unique, Excluding MIIDS/IDB)	450.0 MB
Space (None Exists Now, But Estimates In Future	1.0 MB
MIIDB/IDB	2.0 GB
IDBC-3	35.0 MB
CONSTANT SOURCE (3 Days Of Data)	137.0 KB
World Data Bank II	120.0 MB
Worldwide Total	2.9 GB

PROBLEMS

Data Element Conflicts

Data Production Rules

Interoperability

Data Timelines

DATA ELEMENT CONFLICTS

Definitions

Size

Type

Edit values

Production Rules Types

Type	*Installation (BE Number)*	*Unit*	*Location (Coordinates)*	*Equipment/ Threat*
Source				
IMINT	Installation		Location	Equipment
COMINT		Unit	Location	Equipment
ELINT			Location	Threat (Signal Type)

Production Rules Types (Continued)

Type	*Installation (BE Number)*	*Unit*	*Location (Coordinates)*	*Equipment/ Threat*
Distributed Production Program				
Radars	Installation		Location	Equipment
SAMs	Installation		Location	Equipment
Aircraft		Unit (D)	Location	Equipment
Ships		Unit (D)	Location	Equipment
Tanks		Unit	Location (D)	Equipment (D)

* (D) indicates ability to "deploy" (i.e., change location without changing unit identifier)

Production Rules Types (Continued)

Type	*Installation (BE Number)*	*Unit*	*Location (Coordinates)*	*Equipment/ Threat*
DESERT SHIELD/STORM Procedures				
Situation Assessment	Installation		Location	Equipment
		Unit	Location	

Production Rules Types (Continued)

Type	*Installation (BE Number)*	*Unit*	*Location (Coordinates)*	*Equipment/ Threat*
Air Tasking Order (ATO Cycle)				
ATO Cycle ("Target")	Installation		Location	Equipment

Production Rules Types (Continued)

Type	*Installation (BE Number)*	*Unit*	*Location (Coordinates)*	*Equipment/ Threat*
Air Tasking Order (ATO Cycle)				
ATO Cycle ("Target")	Installation		Location	Equipment

Interoperability

- Data Maintenance/Production requirements differed between echelons (intelligence to intelligence)
- Inability to communicate between national, theater and tactical levels
- Could not take advantage of out-of-theater resource to support data production/maintenance burden
- Relevance of data at each echelon was different
- Lacked common understanding of problem
- No common view between Operations and Intelligence

Timelines

Type	*Condition*	*Updates*	*Dissemination*
DPP Cycle	Peace	Weekly	Weekly/Monthly
	Crisis	24 - 48 Hours	24 - 48 Hours
DESERT STORM		NRT	12 Hours
Air Tasking Order (ATO Cycle)			Multiple/Day

SUMMARY

Integrated Data Bases still evolving

- Rules of production require change
- Data maintenance/production critical

Timeliness of data from different sources must be addressed

Data standardization and distribution critical

480th
AIR INTELLIGENCE GROUP

A WARFIGHTING PERSPECTIVE

PURPOSE

- REVIEW REQUIREMENT
- OUTLINE IMPLEMENTATION STRATEGY
- ADDRESS ISSUES

WHAT WE DO

480TH AIR INTELLIGENCE GROUP

- PROVIDE 24 HOUR ALL-SOURCE INTELLIGENCE TO AIR COMBAT FORCES IN-GARRISON AND DEPLOYED
  - REQUESTS FOR INFORMATION
- APPLY INTELLIGENCE TO SATISFY A WIDE SPECTRUM OF UNIT AND AIR COMPONENT REQUIREMENTS
- DEPLOY TASK-ORIENTED TEAMS FOR SPECIALIZED INTELLIGENCE AUGMENTATION TO ACC
- HELP AIR COMBAT UNITS TRAIN AS THEY WILL FIGHT

WHAT WE DO

SERVICES AND PRODUCTS

- TACTICAL OPS INTEL
  - •• INTEL WATCH
  - •• OPS INTEL CELL
  - •• CURRENT INTEL SUPPORT
- DISTRIBUTED PRODUCTION
  - •• AOB/DMOB
  - •• AIF
  - •• 102 COUNTRIES
  - •• SWA, AFRICA / MED, LATIN AMERICA
- TARGET MATERIALS
  - •• BTGs
  - •• MOSAICS
  - •• TAILORED TARGET GRAPHICS

WHAT WE DO

- AIR COMBAT TRAINING MATERIALS
  - RANGE IMAGERY PRODUCTS
  - VIDEO WEAPON SYSTEM ID TAPES
  - WEAPON SYSTEM GUIDES
  - EXERCISE SUPPORT
- MISSION PLANNING/EXECUTION PRODUCTS
  - DIGITAL MAPS, CHARTS
  - TAILORED DATA BASES
  - MENSURATED COORDINATES
- INTELLIGENCE STUDIES
  - LOGISTICS ANALYSIS
  - CONTINGENCY PLANNING GUIDES
  - VIDINT PRODUCTS
  - CONTINGENCY REFERENCE BOOKS
  - IMAGERY INTERPRETATION KEYS

FUNDAMENTAL REQUIREMENTS

- INCREASED ALL SOURCE SUPPORT
- RAPID COMMUNICATIONS
- IMPROVED COLLECTION MGMT
- ENHANCED TRAINING SUPPORT
- QUALITY DISSEMINATION

DIGITAL NETWORK
MASS DIGITAL STORAGE
PHOTOLAB TO SOFTCOPY
CMS
NITF COMPATIBILITY
CMWS
2ID FOLLOW-ON
DSNET 1 CONNECTIVITY
SOFTCOPY STANDARDS
TRANSMISSION STANDARDS

ACC INTELLIGENCE NETWORK
(ACCINTNET)

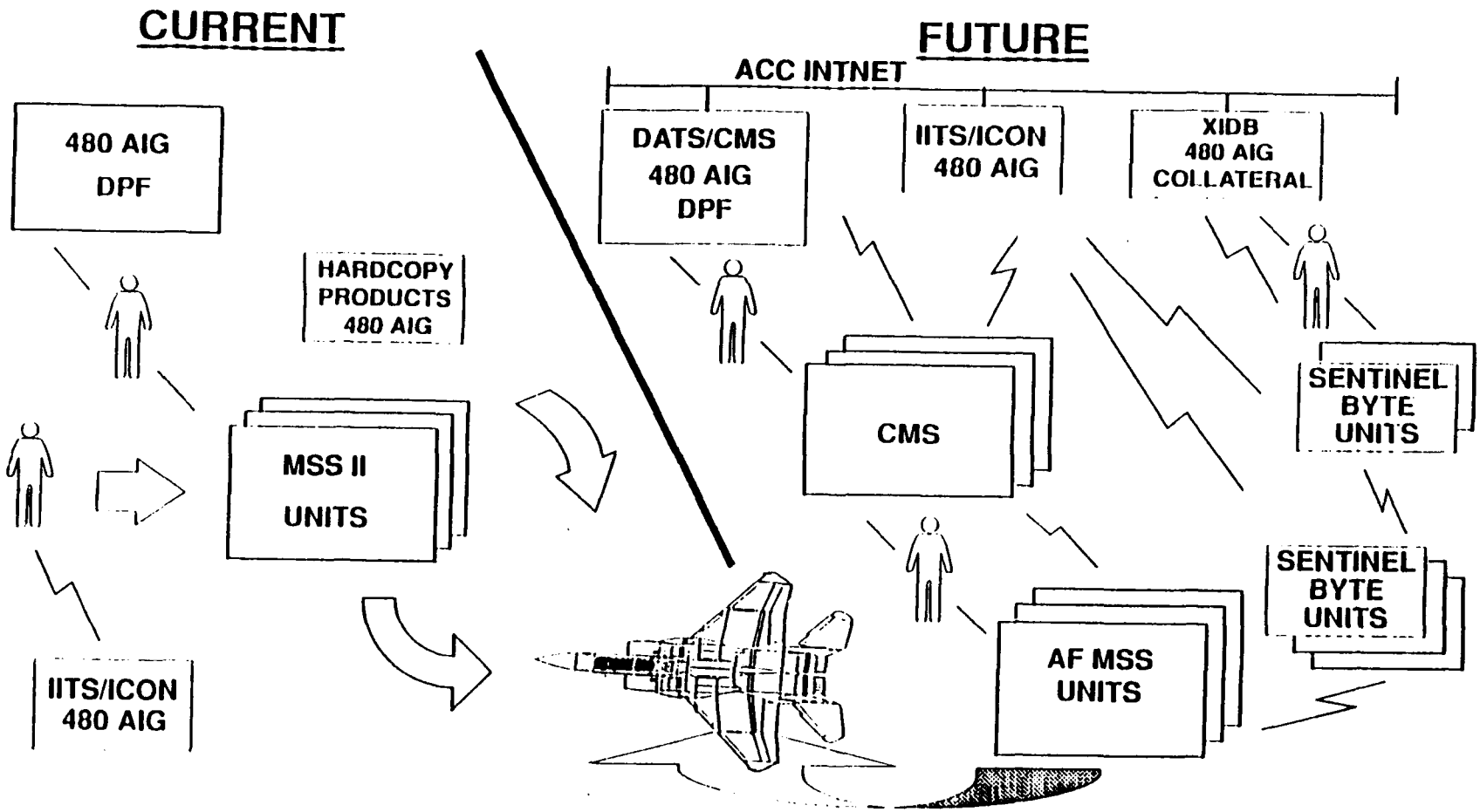
REQUIREMENTS

- ALL-SOURCE INTELLIGENCE WIDE AREA NETWORK THAT:
  - •• INTERFACES ALL ADP, IMAGERY, COMMS, DATA BASES
  - •• PROVIDES ENHANCED HIGH QUALITY DATA THROUGHOUT 480 AIG, HQ ACC, AND SUBORDINATE UNITS VIA THE ELECTRONIC FOOTLOCKER
  - •• SUPPORTS CORPORATE INFORMATION MODEL

LOCATION

- LANGLEY AFB, VA. (BLDGS 23, 602, 693)
- COMM INTERFACES TO ACC UNITS VIA SENTINEL BYTE

ACCINTNET
SUPPORT TO WARFIGHTING



SYSTEMS

CURRENT

- FUNCTIONAL SHORTFALLS
  - LACK OF INTEROPERABILITY
  - LACK OF COMMONALITY
  - LACK OF SOFTWARE INDEPENDENCE
  - LACK OF COST EFFECTIVENESS

FUTURE

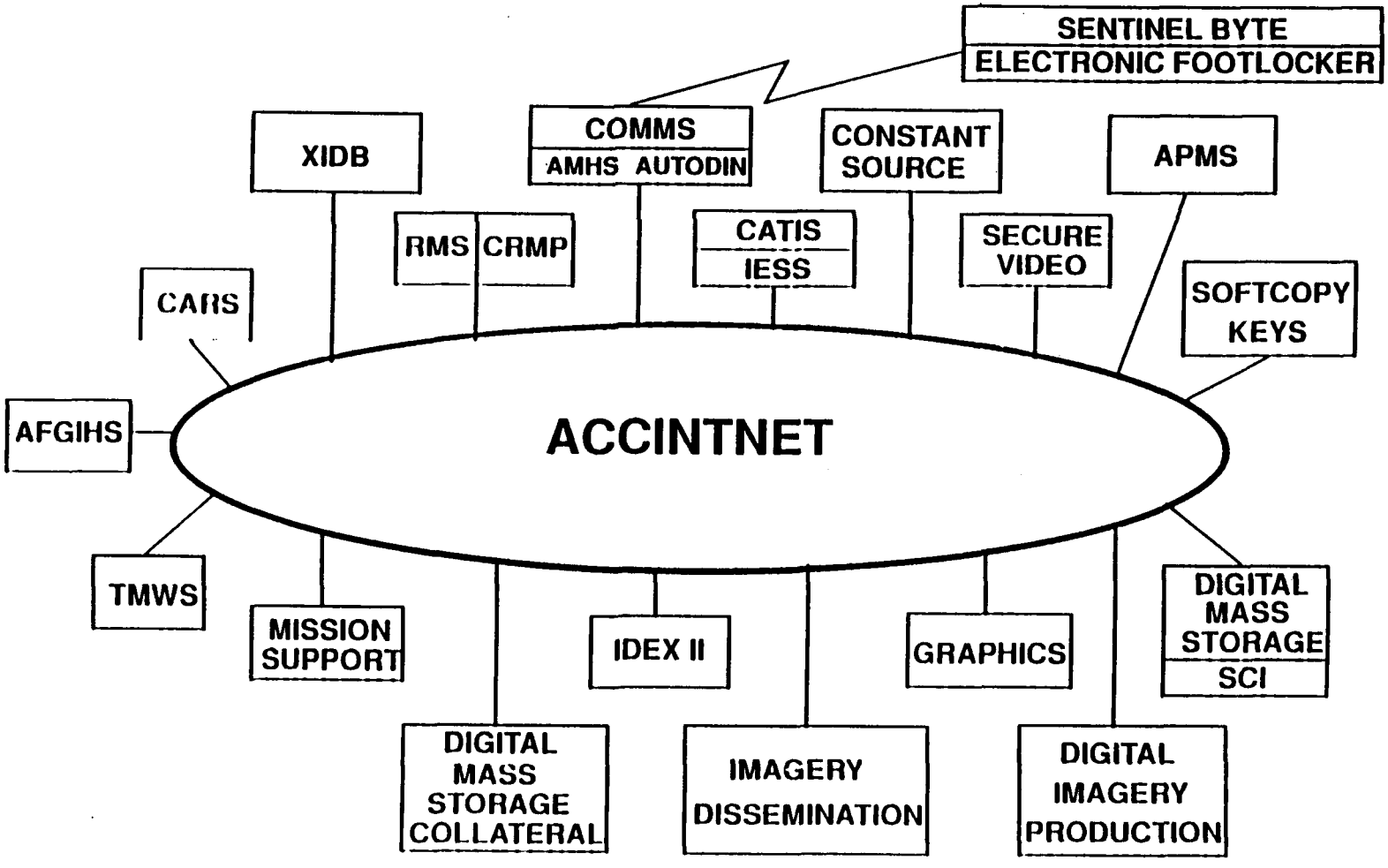
- DESIGN GOALS
  - INTEROPERABLE / NETWORKABLE
  - COMMON USER INTERFACE
  - OPEN SYSTEMS COMPLIANT
  - COTS / GOTS

480 AIG SYSTEMS

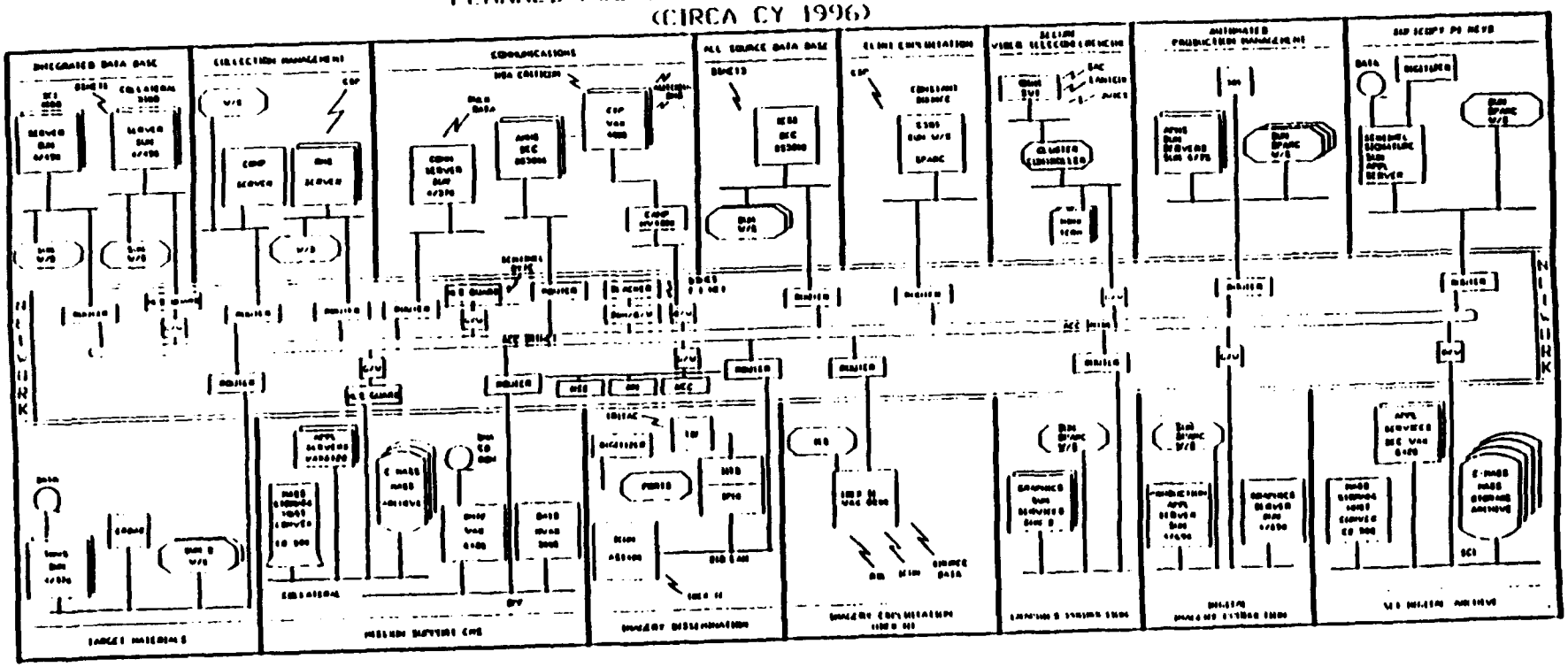
CURRENT		FUTURE
TAC IDHS	→	XIDB (COLLATERAL & SCI)
TAC LAN	→	TAC LAN UPGRADE
CATIS-88	→	IESS
DATS / DMTF	→	CMS
MAX I	→	AMHS
MANUAL PI KEYS	→	SENTINEL SIGNATURE
ICON (NITF 1.1)	→	ICON (NITF 2.0)
HARD COPY EXPLOIT	→	IDEX II
IWS	→	CMWS
TMWS (BTG)	→	TMWS (UPGRADE)
SWIFT HAWK	→	RMS / CRMP
TDF	→	IITS
CSP	→	CSP PUP
HARDCOPY DATA	→	SENTINEL BYTE
CONSTANT SOURCE I	→	CONSTANT SOURCE II

} ACCINTNET

ARCHITECTURE



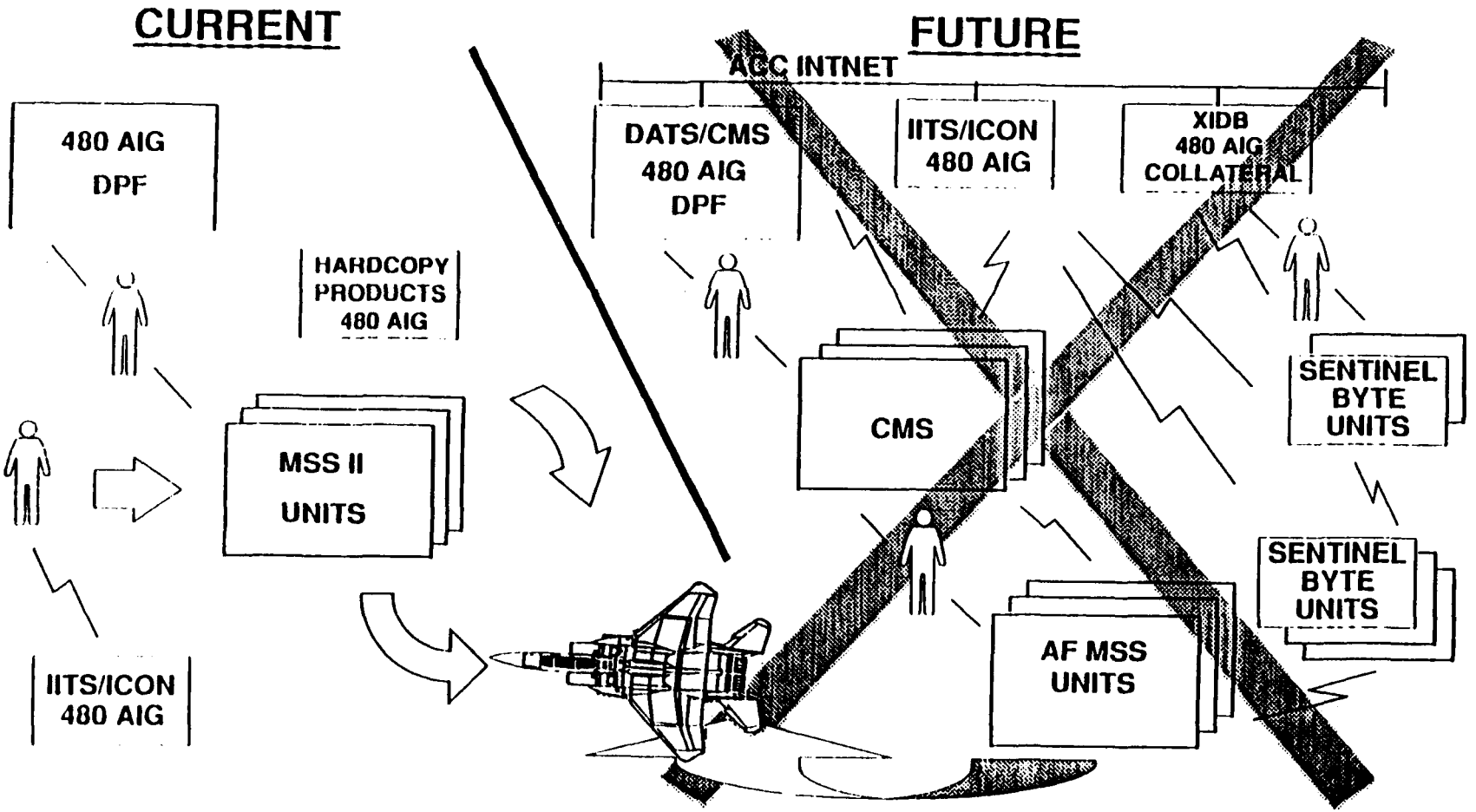
PLANNED ACC IDHS OPERATIONAL ARCHITECTURE
(CIRCA CY 1996)



ACCINTNET
PROPOSED APPROACH

- REQUIREMENTS VALIDATION NLT FY 2Q92
- FUNDING DECISION PRIOR TO FY 3Q92
  - INITIALLY FUNDS: TRAFFIC ANALYSIS
    SITE SURVEY
    INTEGRATION PLAN
    CONOPS
  - PHASED IMPLEMENTATION OVER 3 YEARS
  - CAPITALIZE ON EXISTING/PROGRAMMED SYSTEMS AND DATA BASES

ACCINTNET
SUPPORT TO WARFIGHTING



ACCINTNET
IMPACT IF NOT FUNDED

- CANNOT EFFICIENTLY AND EFFECTIVELY SUPPORT THE COCKPIT GIVEN THE REQUIREMENTS OF DIVERSE WEAPONS SYSTEMS AND TECHNOLOGIES
- CANNOT ACCOMPLISH ALL-SOURCE INTELLIGENCE FUSION, TIP-OFF, AND DATA EXCHANGE/VALIDATION - - - CANNOT FEED SENTINEL BYTE ELECTRONICALLY TO SUPPORT MISSION PLANNING AND EXECUTION
- CANNOT SUSTAIN ACC INTELLIGENCE MISSION IN DIRECT SUPPORT OF WARPLANNING AND WARFIGHTING PHASES OF COMMITMENT
- CANNOT TRANSITION TO AN INTEGRATED DIGITAL ENVIRONMENT AND THE CORPORATE RESOURCE BASE

BOTTOM LINE:

NO ELECTRONIC FOOTLOCKER

ROME LABORATORY

INTELLIGENT PREDICTIVE ASSESSMENT SYSTEM

IPAS 2000

PRESENTED BY
JOHN PIROG
RL/IRDS - 315 330-3222

PURPOSE

- DESCRIBE THE RL/IRD R&D PROGRAM
- PROVIDE A BASIC UNDERSTANDING OF THE PROGRAM
- GIVE INSIGHT INTO A FUTURE IDHS
- GUIDANCE TO ENGINEERS AND DEVELOPERS

INTELLIGENCE DATA PROCESSING
INTELLIGENT PREDICTIVE ASSESSMENT SYSTEM

TECHNOLOGIES

EXPERT SYSTEMS
NATURAL LANGUAGE UNDERSTANDING
NEURAL NETWORKS
DATA BASE VIEWS

FUNCTIONS

ESTIMATIVE INTELLIGENCE

- THREAT ASSESSMENTS
- PREDICITVE JUDGEMENT OF FUTURE
- LONG TERM TRENDS

CURRENT INTELLIGENCE

- SITUATION ASSESSMENTS
- TIMELY RESPONSE
- LIMITED ANALYSIS (TIME CRUNCH)
- PASS TO OPERATIONS

PREDICTIVE INTELLIGENCE

- INDICATOR ASSESSMENT AND MANAGEMENT
- SHORT TERM ANALYSIS
- SHORT TERM PREDICTIONS
- WARNING

METHODOLOGY

- APPLICATIONS ORIENTED

- LOW RISK / HIGH RISK

- MERGE POINTS

- BROAD BASED - ALL OF INTEL

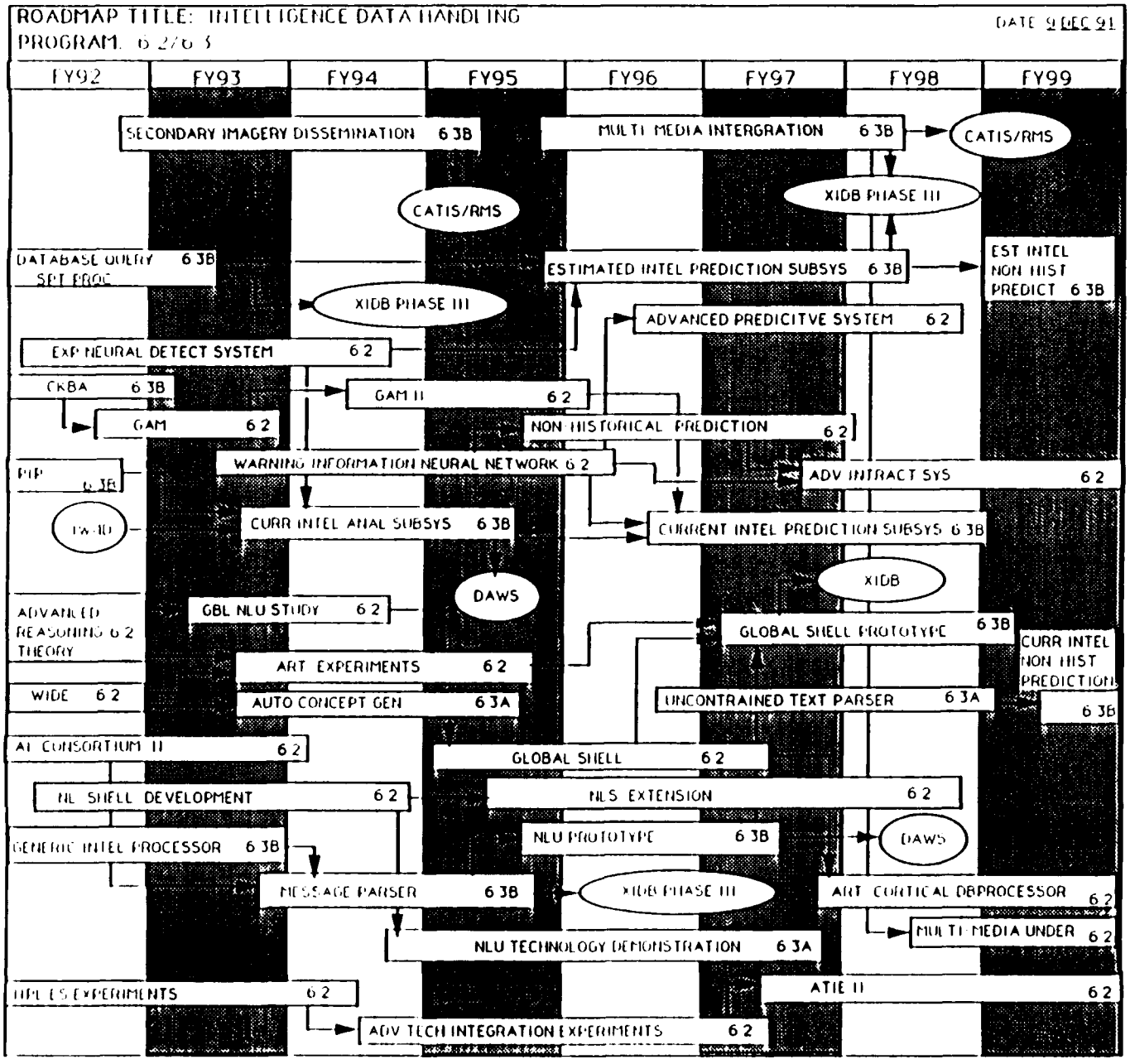
INTELLIGENCE DATA PROCESSING

ON GOING

AUTOMATED LIBARIAN
CIKB
CKBA
PIP
IW4D
GIP
ART
NLU/SPEECH INTEGRATION
IIPLESE
*ENDS
*GAM
*NLU SHELL
*SECONDARY IMAGE DISSEMINATION
DATA BASE QUERY SUPPORT PROCESSOR

COMING ATTRACTIONS

WARNING INFORMATION NEURAL NETWORK
ADVANCED REASONING THEORY EXPERIMENTS
GLOBAL NATURAL LANGUAGE PROCESSING STUDY
AUTOMATED CONCEPT GENERATION
MESSAGE PARSER
CURRENT INTELLIGENCE ANALYSIS SUBSYSTEM


ROADMAP TITLE: INTELLIGENCE DATA HANDLING
PROGRAM: 6.2/6.3
DATE 9 DEC 91
FY92
FY93
FY94
FY95
FY96
FY97
FY98
FY99
SECONDARY IMAGERY DISSEMINATION 6.3B
MULTI MEDIA INTERGRATION 6.3B
CATIS/RMS
XIDB PHASE III
CATIS/RMS
DATABASE QUERY 6.3B
SPT PROC
ESTIMATED INTEL PREDICTION SUBSYS 6.3B
EST INTEL NON HIST PREDICT 6.3B
XIDB PHASE III
ADVANCED PREDICITVE SYSTEM 6.2
EXP NEURAL DETECT SYSTEM 6.2
CKBA 6.3B
GAM II 6.2
GAM 6.2
NON HISTORICAL PREDICTION 6.2
WARNING INFORMATION NEURAL NETWORK 6.2
PIP 6.3B
ADV INTRACT SYS 6.2
CURR INTEL ANAL SUBSYS 6.3B
CURRENT INTEL PREDICTION SUBSYS 6.3B
XIDB
DAWS
ADVANCED REASONING 6.2 THEORY
GBL NLU STUDY 6.2
GLOBAL SHELL PROTOTYPE 6.3B
CURR INTEL NON HIST PREDICTION
ART EXPERIMENTS 6.2
WIDE 6.2
AUTO CONCEPT GEN 6.3A
UNCONTRAINED TEXT PARSER 6.3A
6.3B
AI CONSORTIUM II 6.2
GLOBAL SHELL 6.2
NL SHELL DEVELOPMENT 6.2
NLS EXTENSION 6.2
GENERIC INTEL PROCESSOR 6.3B
NLU PROTOTYPE 6.3B
DAWS
MESSAGE PARSER 6.3B
XIDB PHASE III
ART CORTICAL DBPROCESSOR 6.2
MULTI MEDIA UNDER 6.2
NLU TECHNOLOGY DEMONSTRATION 6.3A
ATIE II 6.2
ADV TECH INTEGRATION EXPERIMENTS 6.2

Generic Intelligence Processor

Sterling IMD KSC Operations

Technical Interchange Meeting
Rome Laboratory/ IRDS
February 11, 1992

Generic Intelligence Processor Contract

Team

KSC Operations

Subcontractors: GTE Government Systems
PRC Inc
Sterling Software IMD

Contract Number : F30602-91-C-0097

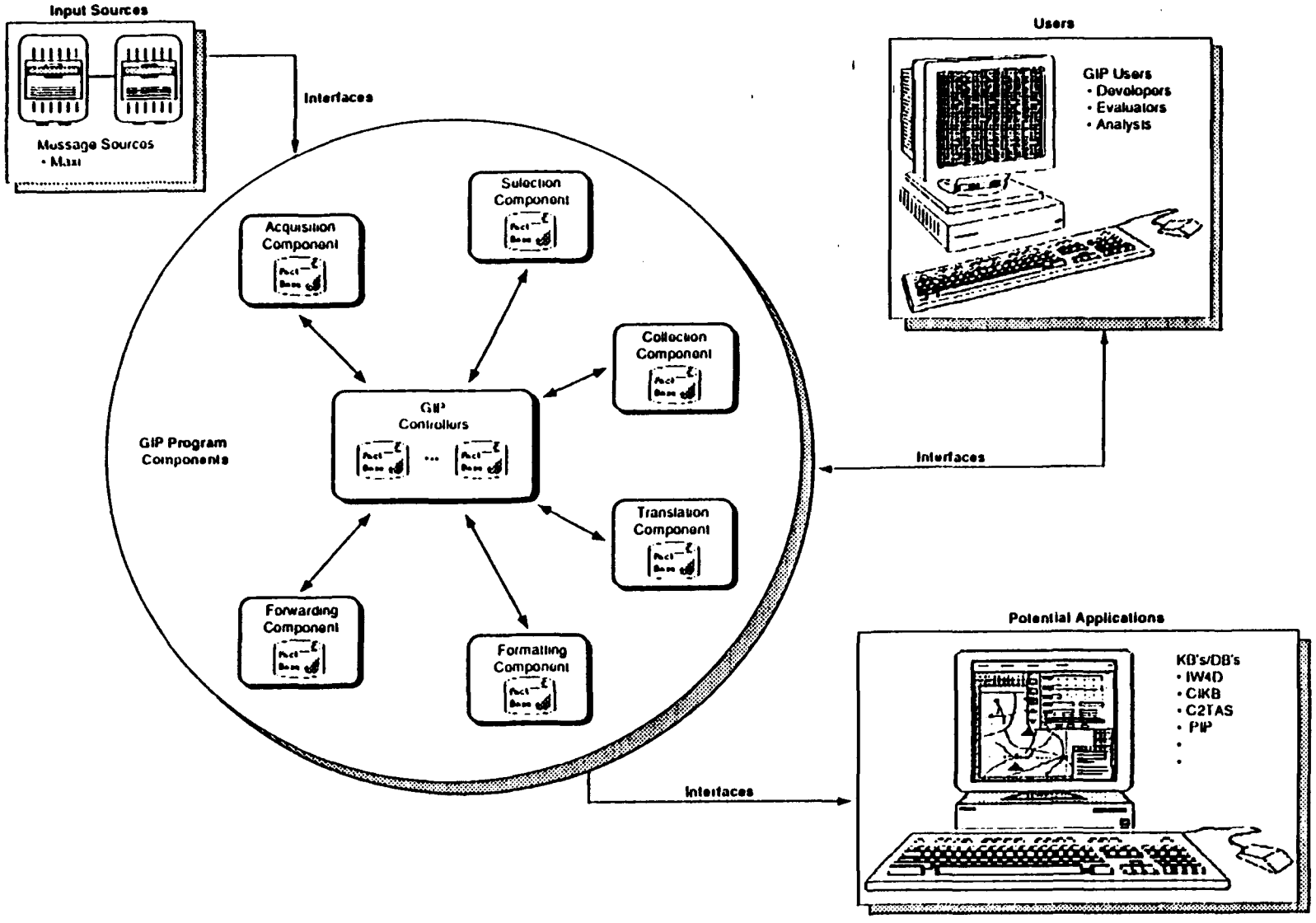
Duration: July 1991 - July 1993

GIP Project Team

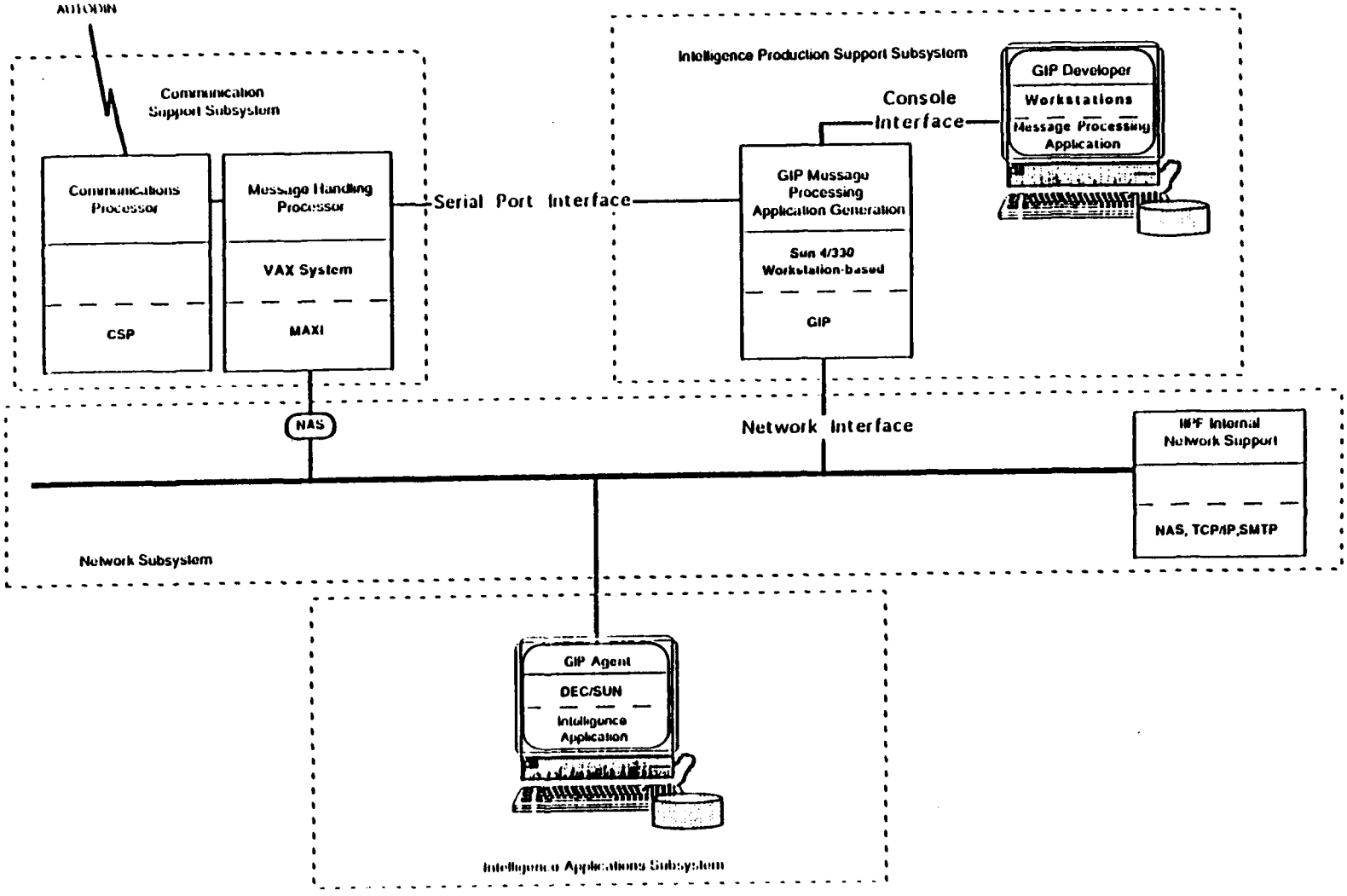
- KSC Operations
  - Dr. Michael Thomas, Project Manager
  - Mr. William Reid, Lead Systems Engineer
  - Mr. David Gray, Systems Engineer
  - Mr. John Pendergast, Independent Testing
  - Mr. David Quinn-Jacobs, Engineering Consultant
  - Mr. Allen Lazzara, Engineering Consultant
- GTE
  - Mr. Howard Melching, Project Manager
  - Mr. Steve Engsberg, Lead Systems Engineer
  - Mr. Jess Miller, Engineering Consultant
- PRC
  - Mr. Gary Dolsen, Project Manager
  - Ms. Cheryl Kariya, Engineering Consultant
- Sterling IMD
  - Mr. John Sautter, Project Manager
  - Mr. Mark McGee, Lead Systems Engineer

Key Technical Challenges

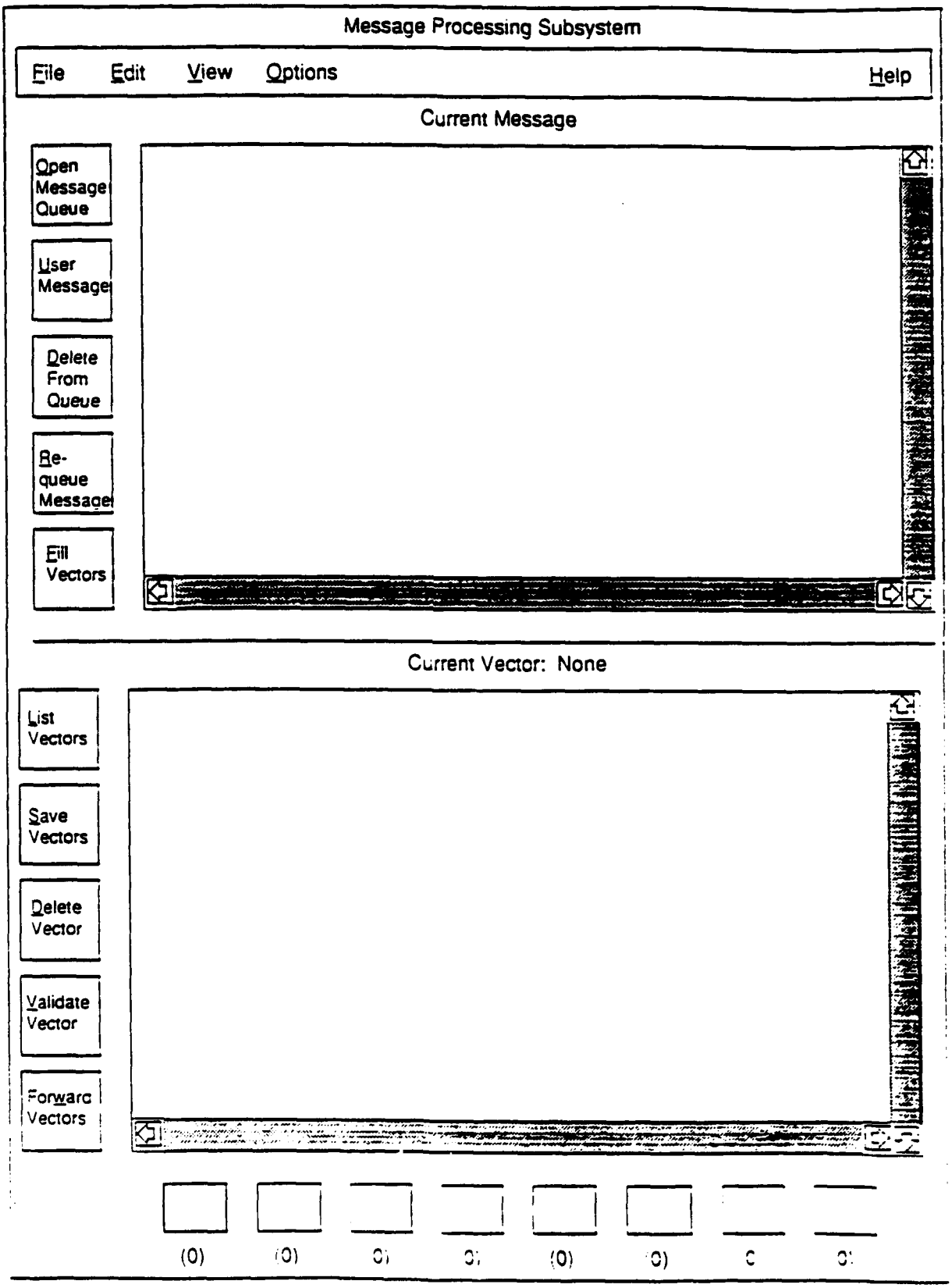
- Develop a Graphical User Interface in OSF/Motif™ to support operational use by non-computer scientists
- Manage external interfaces to message handling systems, test scenario files, and downstream databases and expert systems
- Develop a framework of cooperating processes that can be easily adapted to new input and output requirements
- Provide an environment for testing new technology under realistic conditions
- Facilitate the integration of new technology into operational settings with minimal disruption to the routine of intelligence analysts
- Be adaptable to a wide range of hardware and software environments

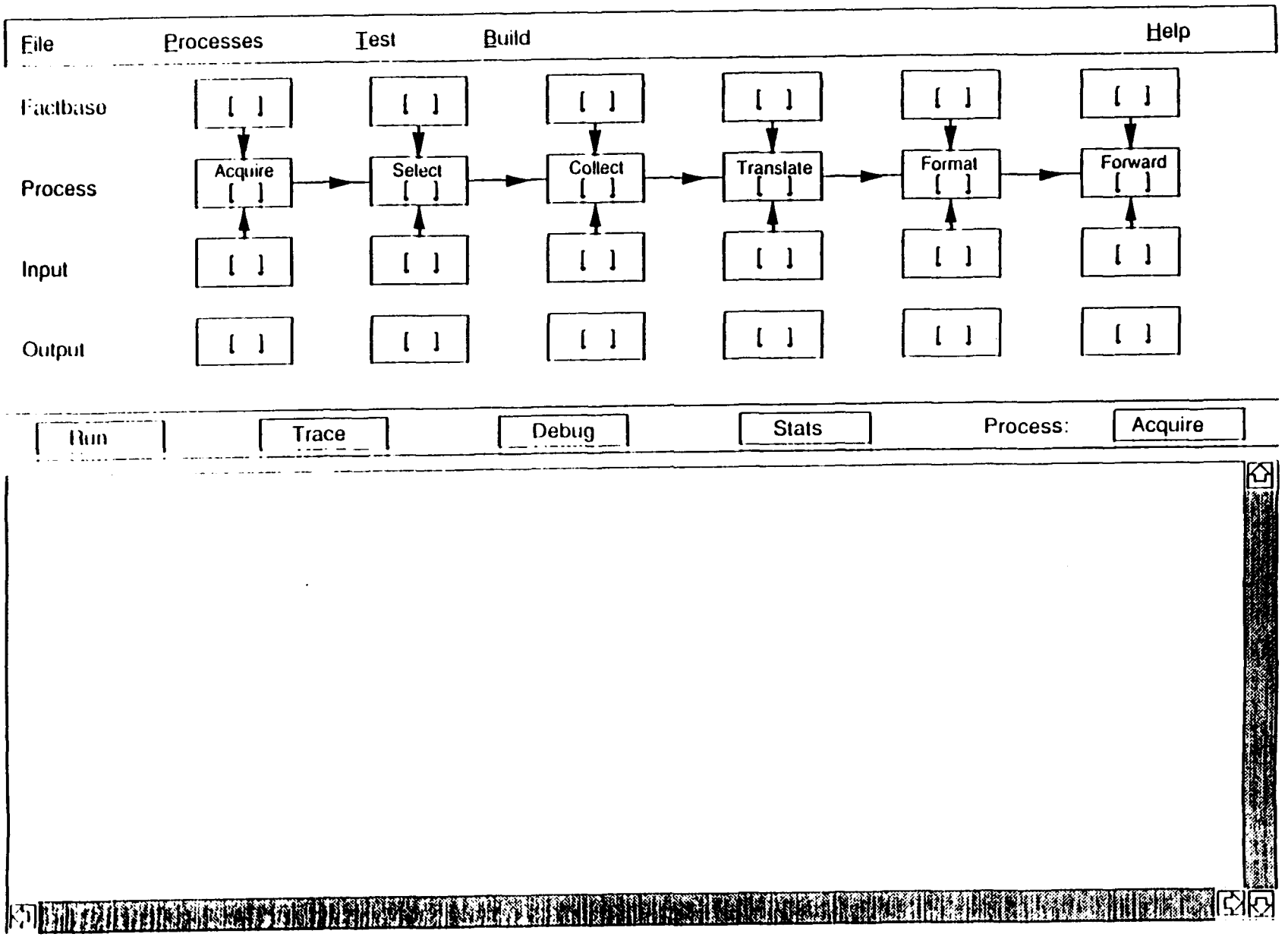


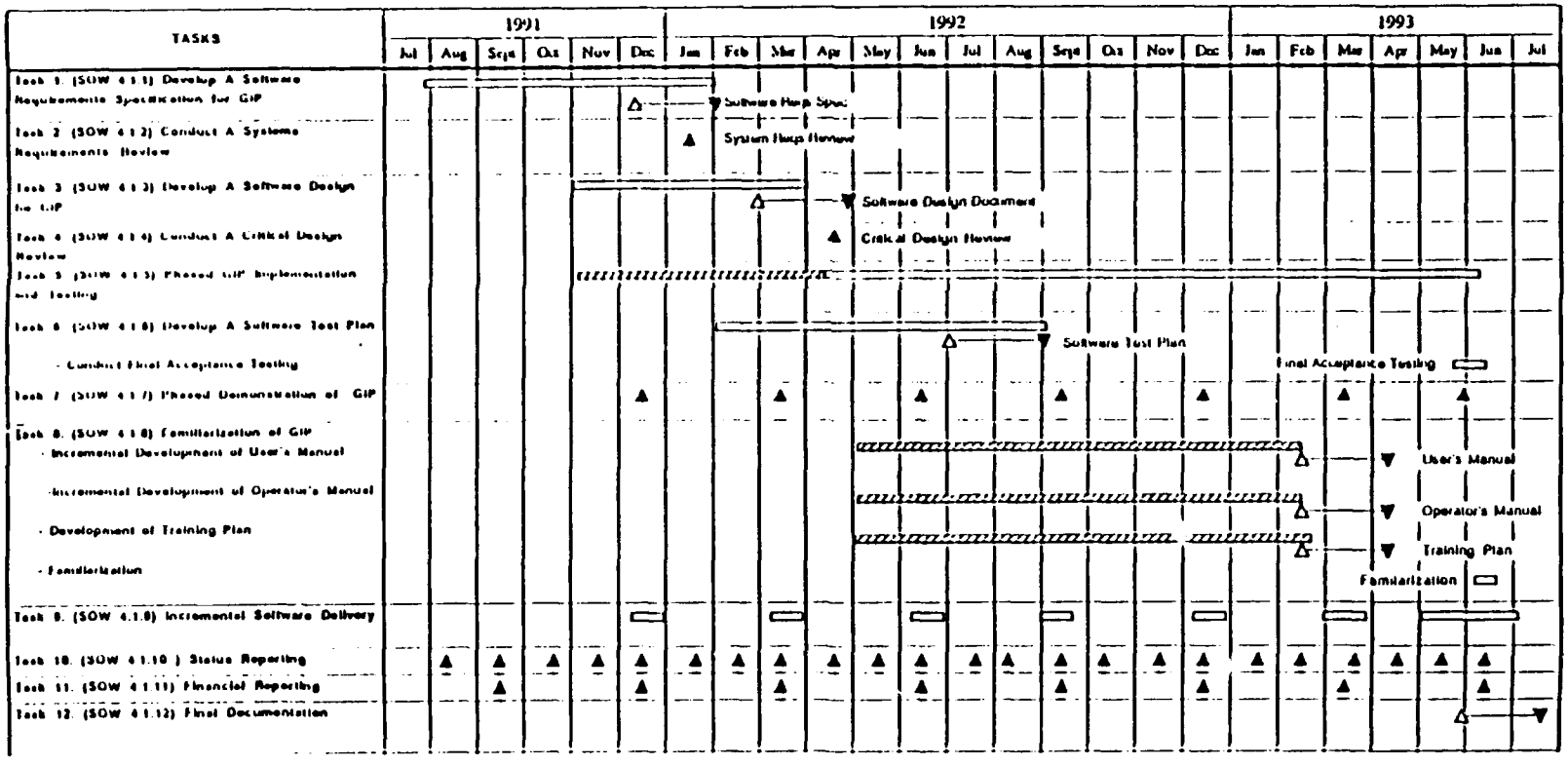
GIP Program Components



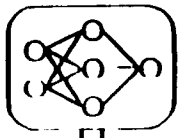
GIP/IIPF Architecture


Message Processing Subsystem
File
Edit
View
Options
Help
Current Message
Open Message Queue
User Message
Delete From Queue
Re-queue Message
Fill Vectors
Current Vector: None
List Vectors
Save Vectors
Delete Vector
Validate Vector
Forward Vectors
(0)
(0)
(0)
(0)


File
Processes
Test
Build
Help
Factbase
Process
Input
Output
Acquire
Select
Collect
Translate
Format
Forward
Run
Trace
Debug
Stats
Process:
Acquire



Development Schedule

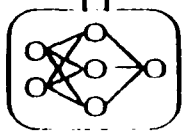


CONNIE

Connectionist Networks

for

Information Exploitation



CONNIE

CONNECTIONIST NETWORK FOR INFORMATION EXPLOITATION (CONNIE)

OBJECTIVE: STUDY THE APPLICATION OF NEURAL NETWORK TECHNOLOGY TO THE INDICATIONS & WARNING PROBLEM

INVESTMENT:	TYPE	PRIOR	FY91	TOTAL
($ IN K)	3600/6.2	300	50	350

CONTRACTOR: GRUMMAN DATA SYSTEMS

PERSONNEL:

RL/IRDS	AFSC/XTRT
MR J. PIROG	CAPT B. KASPAR

CONNIE

IN HOUSE EXPERIMENT W/PERCEPTRON (1987)

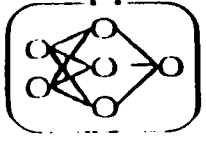
TANKS

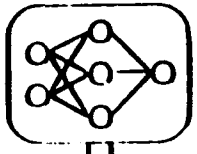
MILES

THREAT?

	TRAINING DATA							LIVE DATA			
TANKS	5	20	20	40	100	100	20	22	150	10	80
MILES	100	10	20	55	0	50	25	10	30	10	20
THREAT	N	N	N	Y	Y	Y	N	?	?	?	?

EXPERIMENT VERY SIMPLISTIC





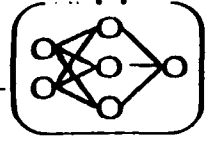
CONNIE

Goal

- DETERMINE FEASIBILITY OF NEURAL NETWORKS IN I&W

Tasking

- INVESTIGATE CURRENT NEURAL NETWORK APPROACHES/PRODUCTS
- INVESTIGATE LEARNING/TRAINING OF NEURAL NETWORKS
- DEMONSTRATE POSSIBLE APPLICATION



CONNIE

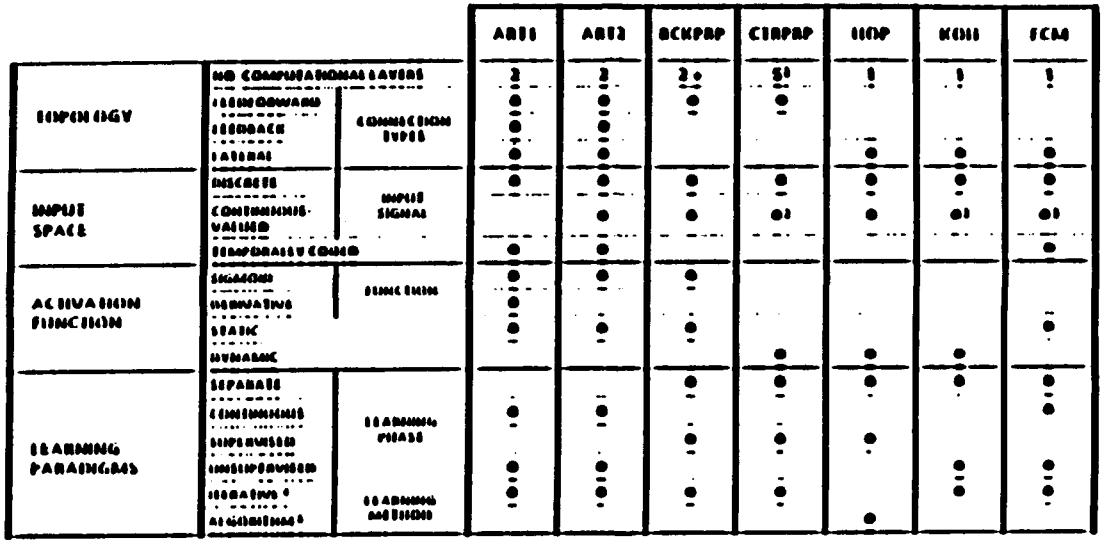
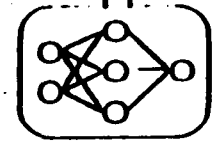
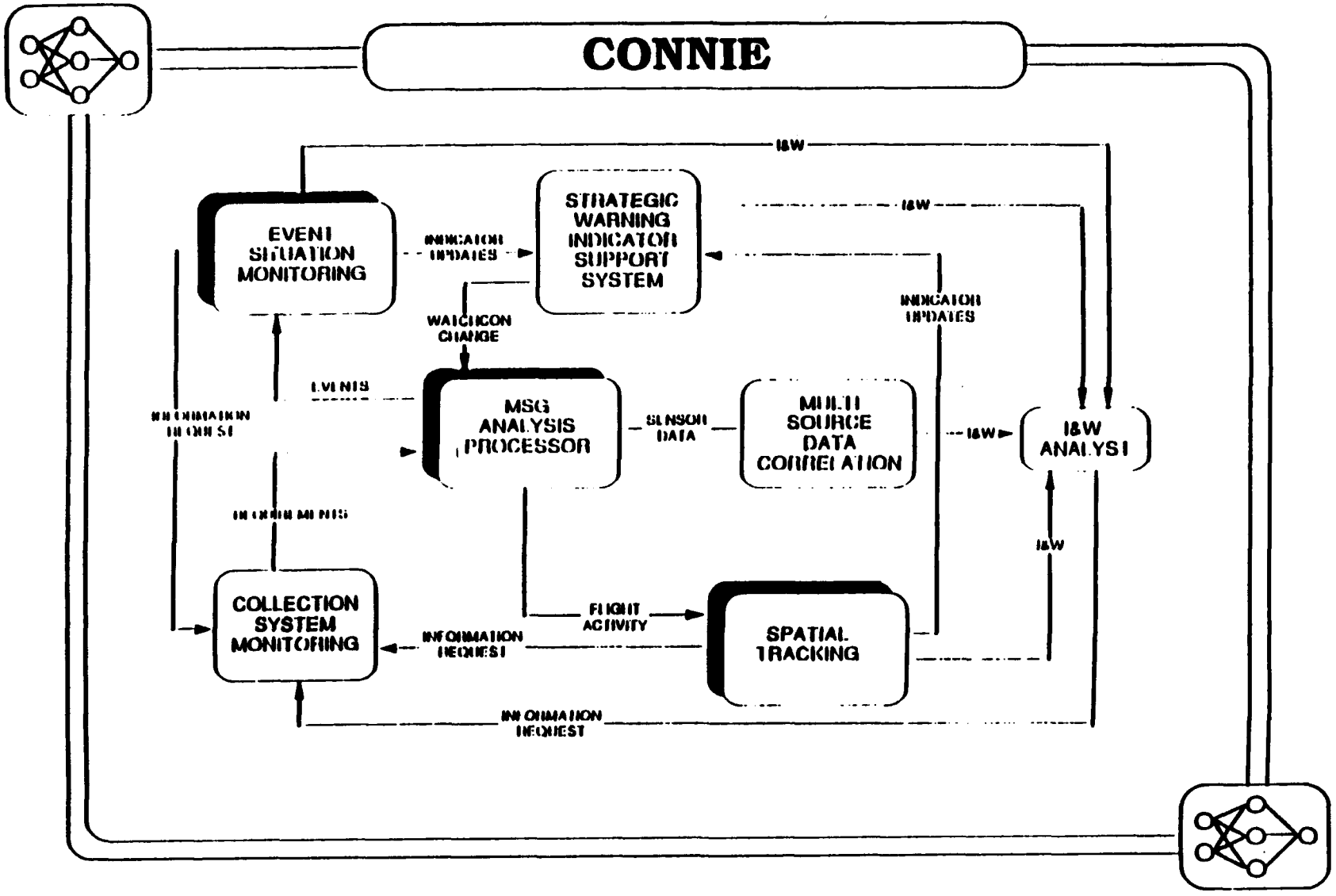
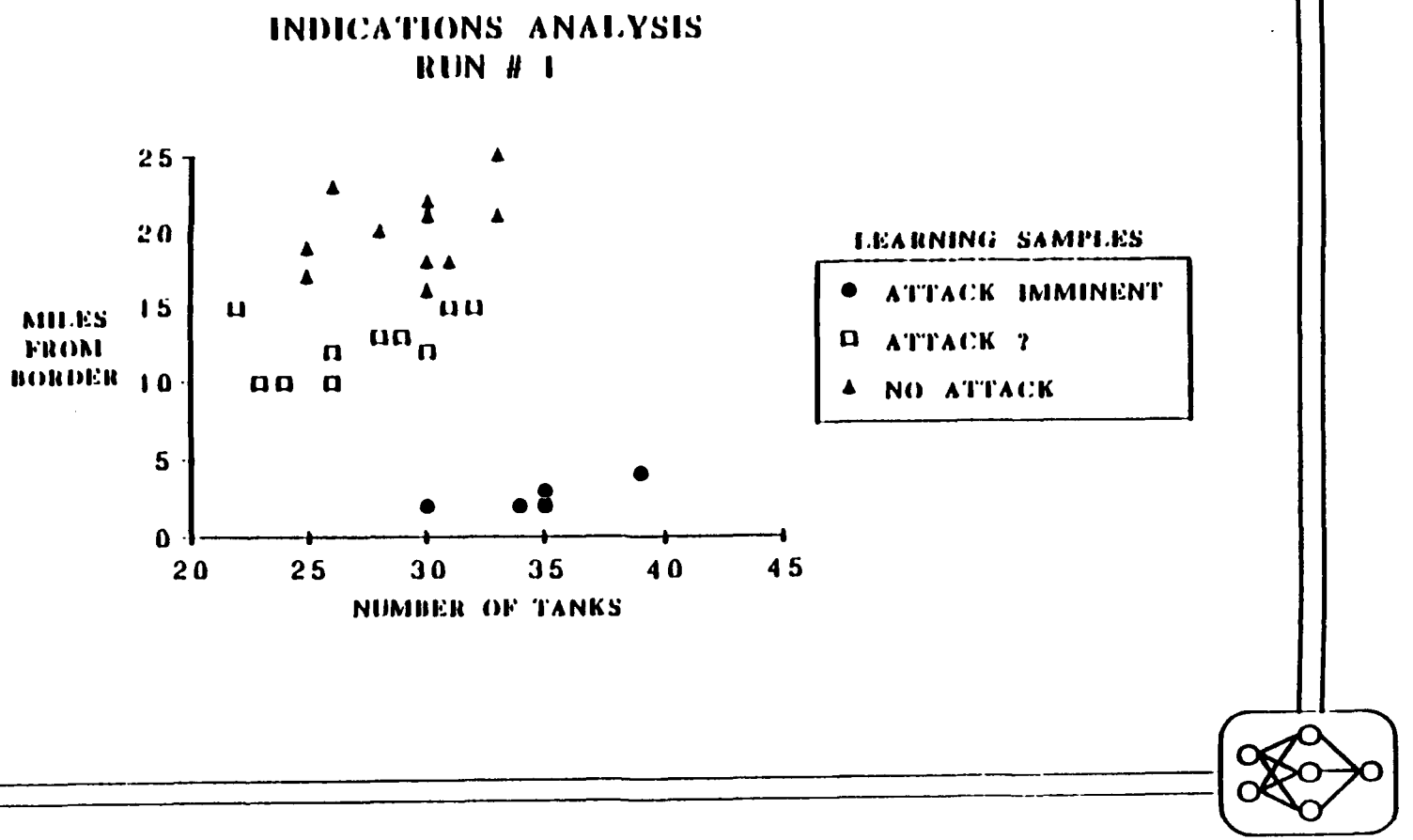


Figure 2.3.1-3 Neural Architectures and their Properties

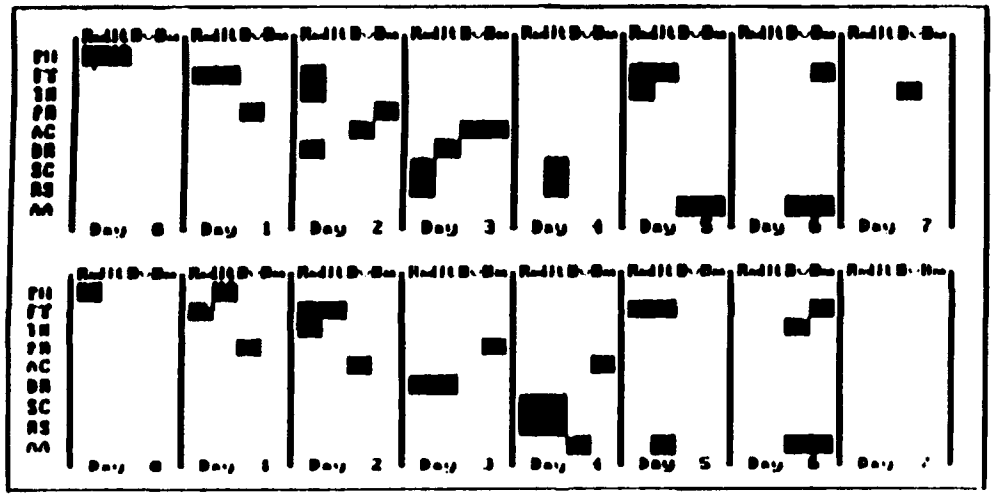



CONNIE
I&W
EVENT SITUATION MONITORING
INDICATOR UPDATES
STRATEGIC WARNING INDICATOR SUPPORT SYSTEM
I&W
INDICATOR UPDATES
WATCHCON CHANGE
EVENTS
MSG ANALYSIS PROCESSOR
SENSOR DATA
MULTI SOURCE DATA CORRELATION
I&W
I&W ANALYSIS
I&W
COLLECTION SYSTEM MONITORING
INFORMATION REQUEST
FLIGHT ACTIVITY
SPATIAL TRACKING
INFORMATION REQUEST

CONNIE


INDICATIONS ANALYSIS
RUN # 1
MILES FROM BORDER
25
20
15
10
5
0
20
25
30
35
40
45
NUMBER OF TANKS
LEARNING SAMPLES
ATTACK IMMINENT
ATTACK ?
NO ATTACK

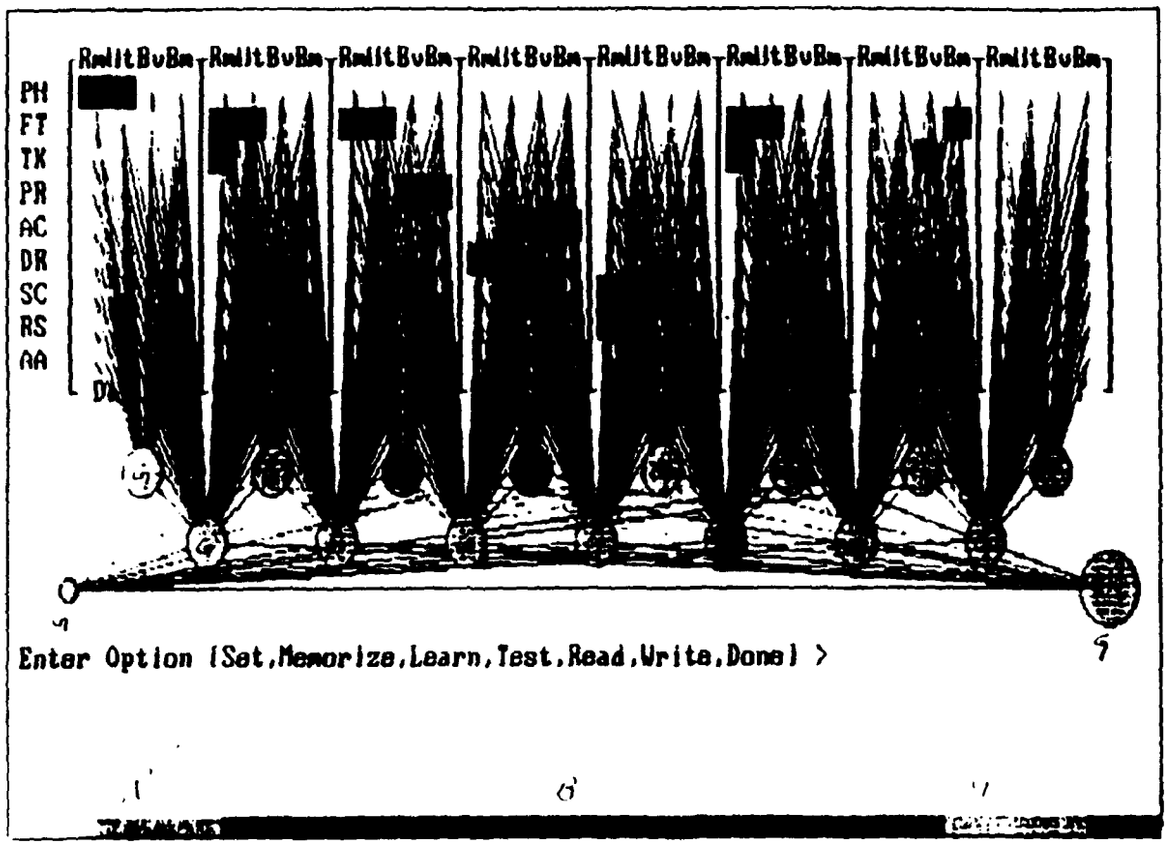
CONNIE



Event Code	Event
PH	Phone Call
FF	Fighter Flight
TK	Tanker Flight
PC	Preparation
AC	Activity
DR	Drill
SC	Security
RS	Rest
AA	Anti Aircraft

Location Code	Location
Hm	Home
Wk	Wkc
Bv	Boonville
Bm	Blue Mountain

CONNIE


PH
FT
TK
PR
AC
DR
SC
RS
AA
Enter Option (Set,Memorize,Learn,Test,Read,Write,Done) >

Database Query Support Processor

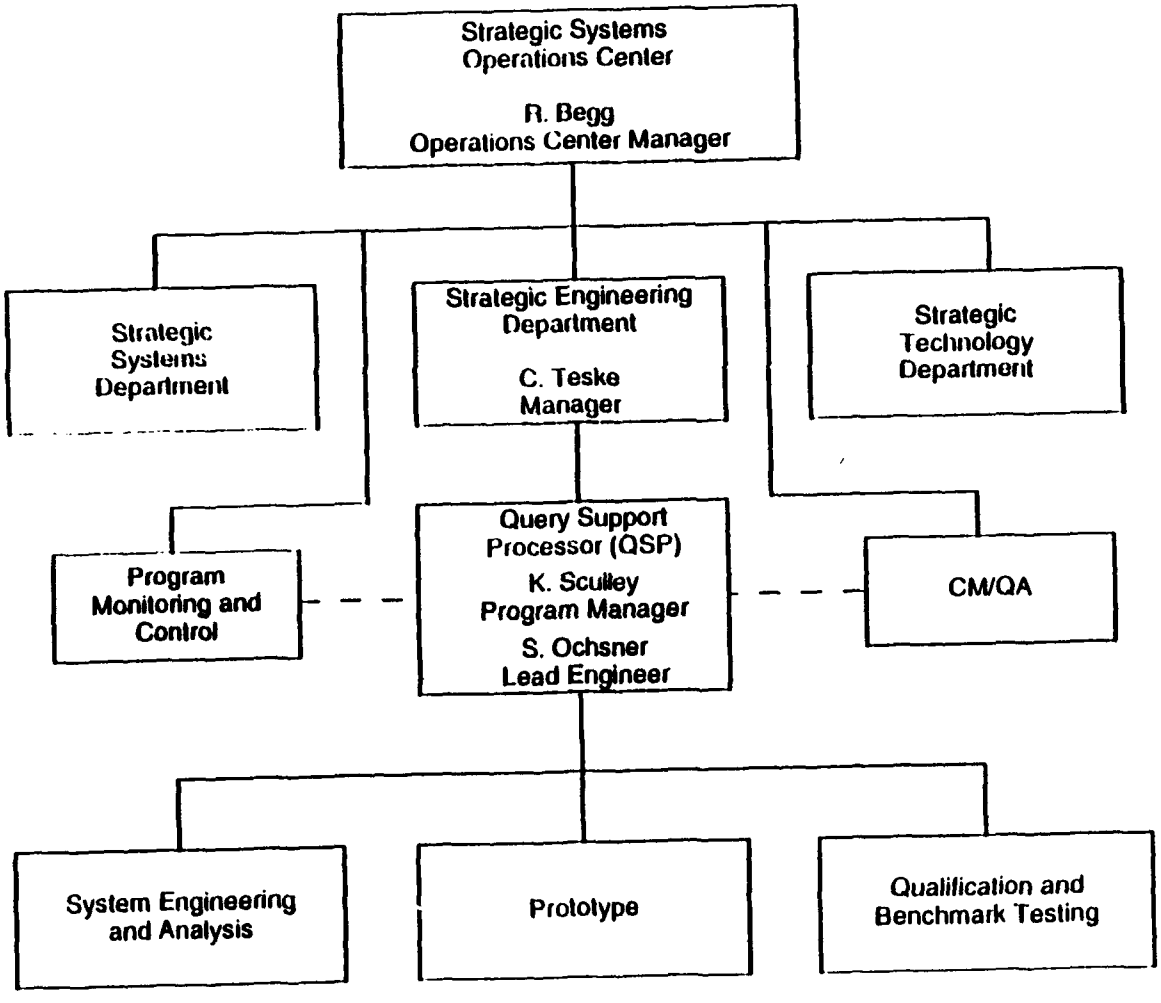
Technical Interchange Meeting

12 February 1992

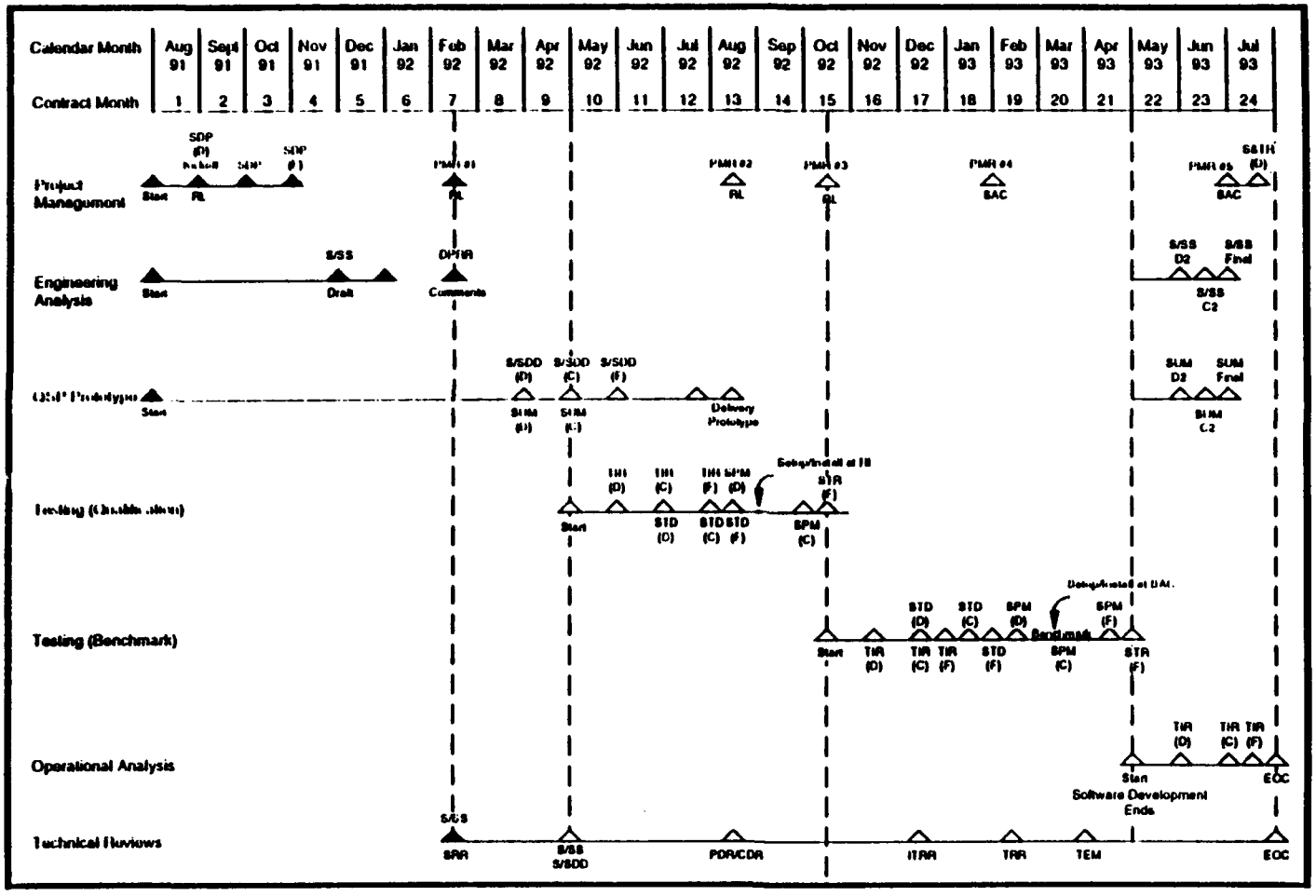
Database Query Support Processor

Period:	25 July 91 - 31 July 93
Type:	Fixed Price Incentive Fee Firm Target
RL/QSP LPM:	P. McCabe
RL/PKRM:	D. Masi
Contractors:	PRC Inc. (Prime) AOG Systems (Subcontractor)
Location:	PRC Inc. 1410 Wall Street Bellevue, NE 68005 (402) 293-3900
Project Manager:	K. Sculley
Deliverables:	QSP Software (None Proprietary, except DBMS) DoD Std 2167a Documentation (S/SS, SRS, S/SDD, STD, SPS, SPM, SUM, STR) Technical Reports - Implementation Plan for IIPF and IDHS Environments Support Laboratory and Field Prototype Testing

QSP Organization Chart



Database Query Support Processor (QSP) Master Implementation Schedule



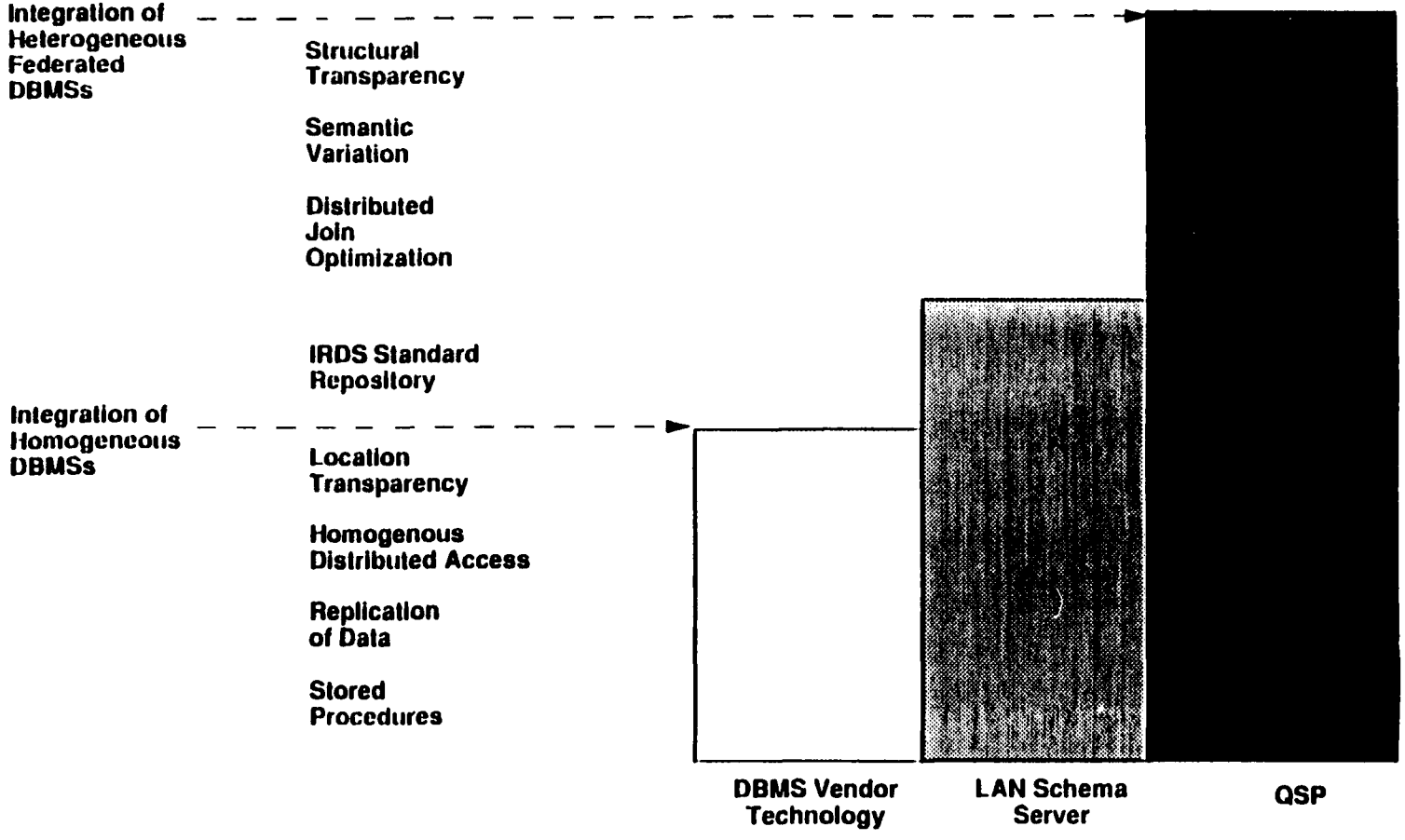
Milestone Legend

Past:		Future:	
▲ Made	◀ Missed or Improved	△ Projected to be made	◁ To Be Missed or Improved

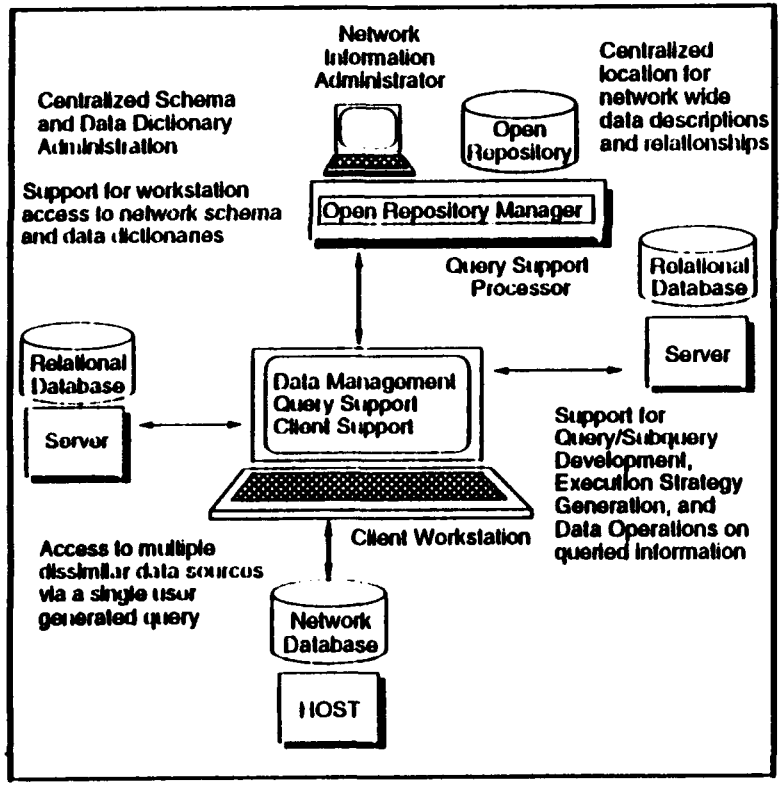
Database Query Support Processor (QSP)

- Provides an integrative solution to the problem of data access in an existing environment of federated databases
- Provides expanded query access for both ad hoc and application users with a minimum impact on current operations
- Based on the Information Resource Dictionary Standard (IRDS) for repository systems
- Built upon the work of the LAN Schema Server (LANSS) project which was previously sponsored by Rome Laboratory

QSP Overcomes Data Access Barriers in Existing Environments



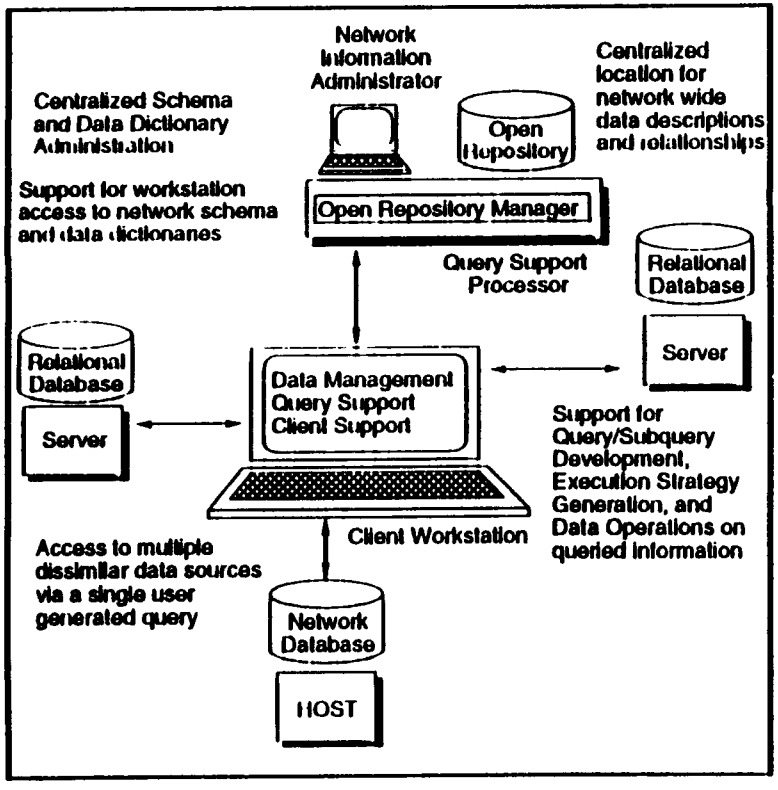
PROJECT DESCRIPTION: Database Query Support Processor



Functional OVERVIEW:

- Utilizes the IRDS standard in the Open Repository Manager (ANSI X3.138-1988)
- Capability to manage information from dissimilar databases and present uniform views of data independent of location
- Transparent access to multiple heterogeneous databases
  - Location (Node, Database)
  - Structure (Relational, Network)
  - Language (SQL, ADS/O)
- Allows for changes in database schema without forcing database application changes
- Centralized management of database schema and data dictionary information (metadata)

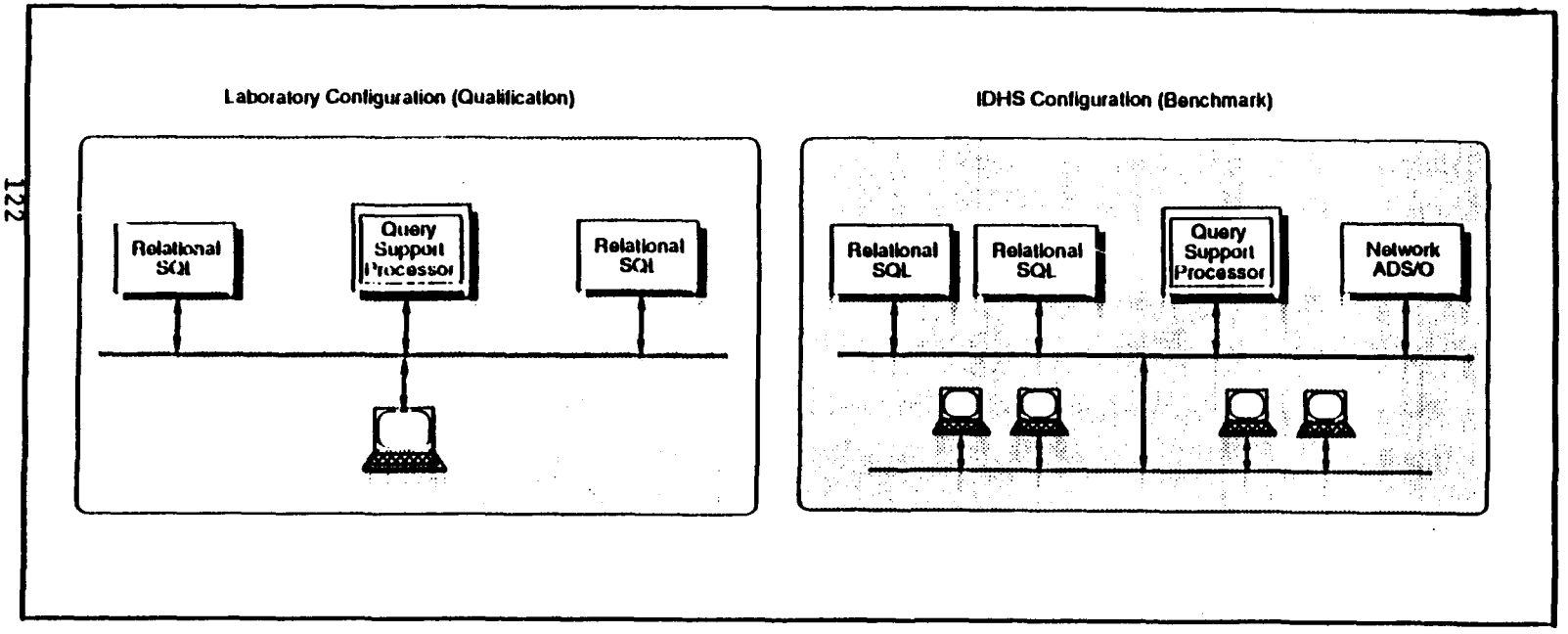
PROJECT DESCRIPTION: Database Query Support Processor



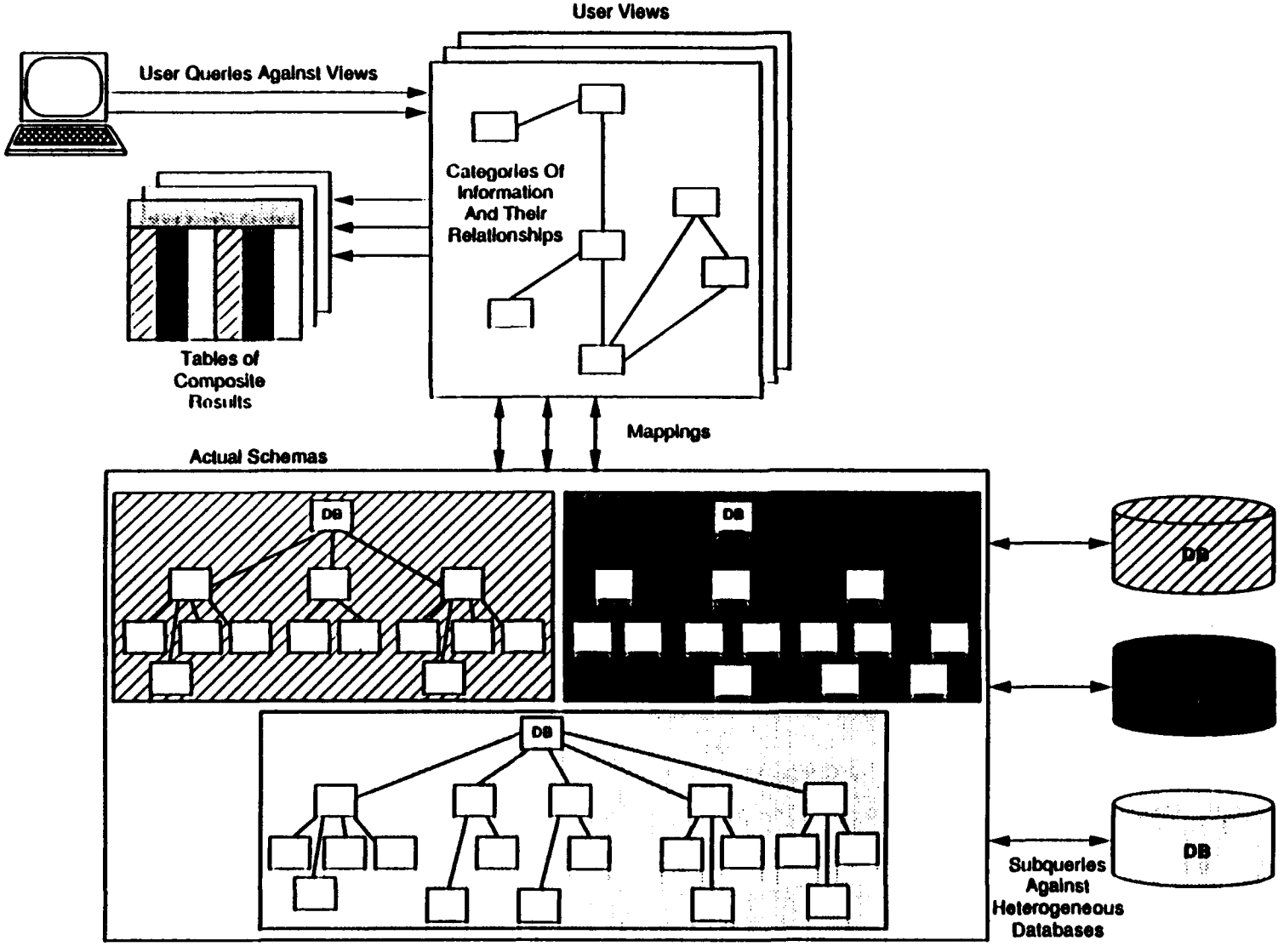
Functional OVERVIEW (con't):

- Centralized administration of network wide data elements and relationships
- Client support for query development
  - Query analysis and validation prior to execution
  - Automatic subquery generation
  - Join optimization
  - Generation of execution statistics for analysis
- Data operations to merge information from multiple sources via cross system joins
- Provide logical views of network data environment by individual user or group of users

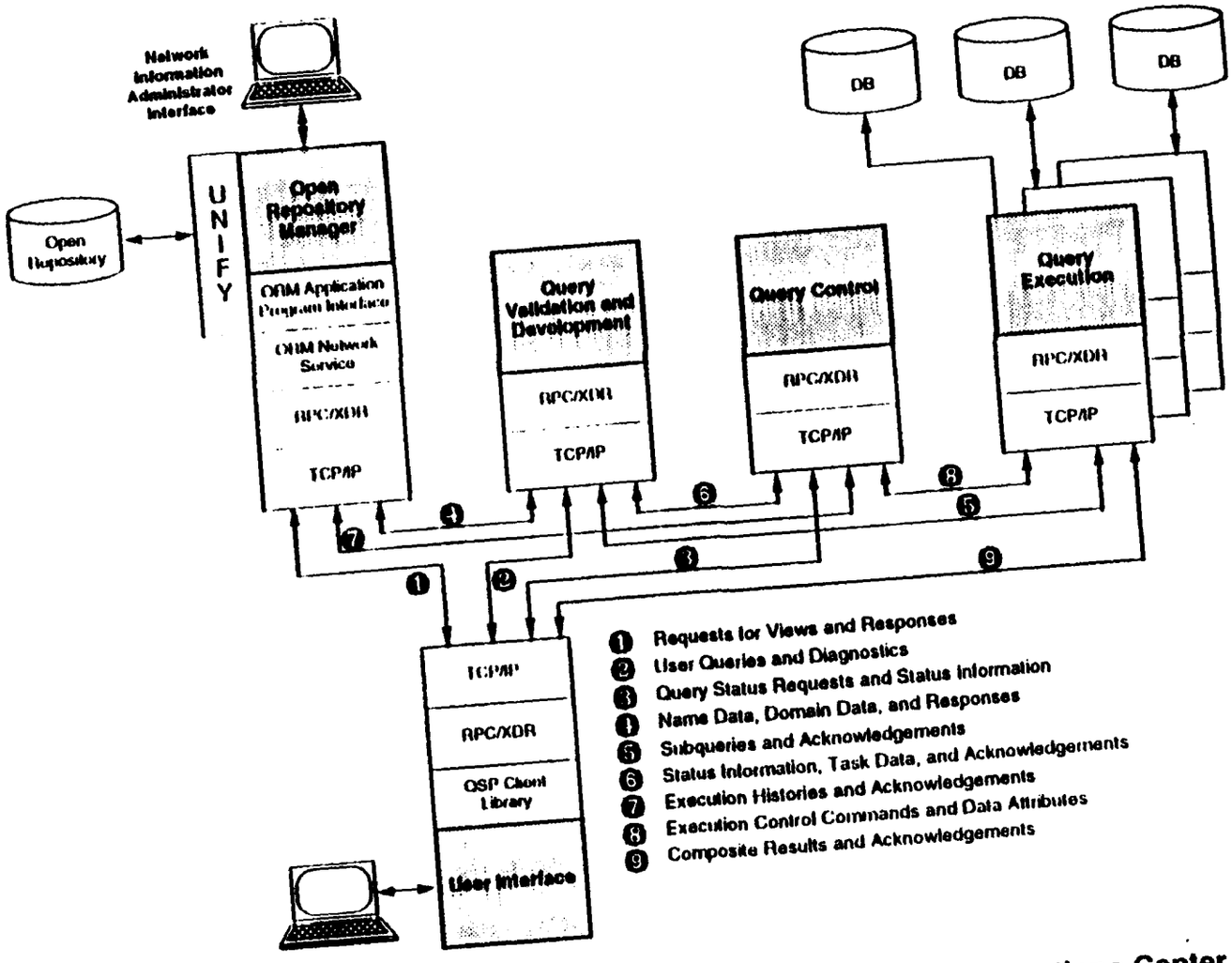
QSP Functional Environment



Logical View of QSP



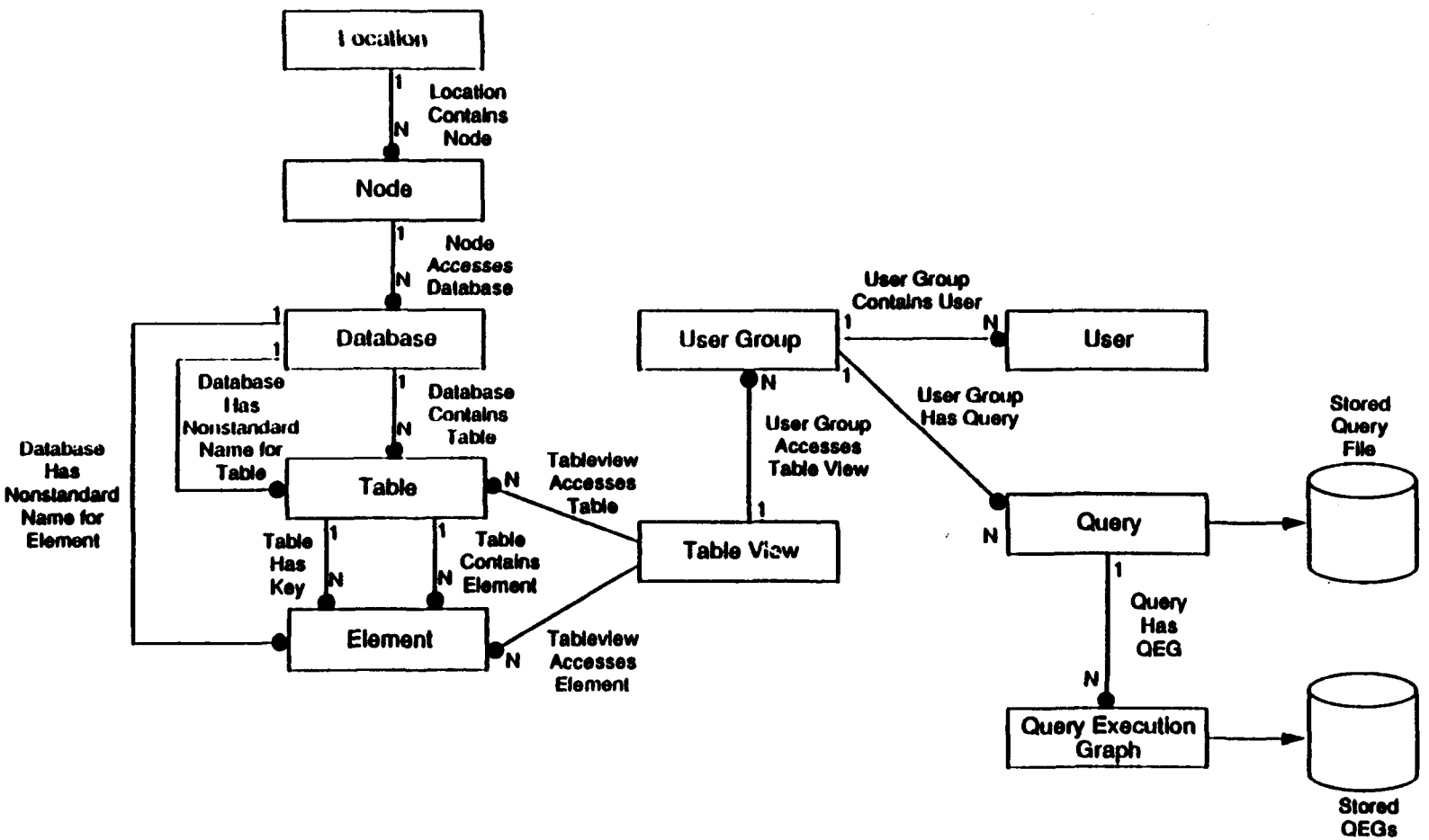
QSP Physical View



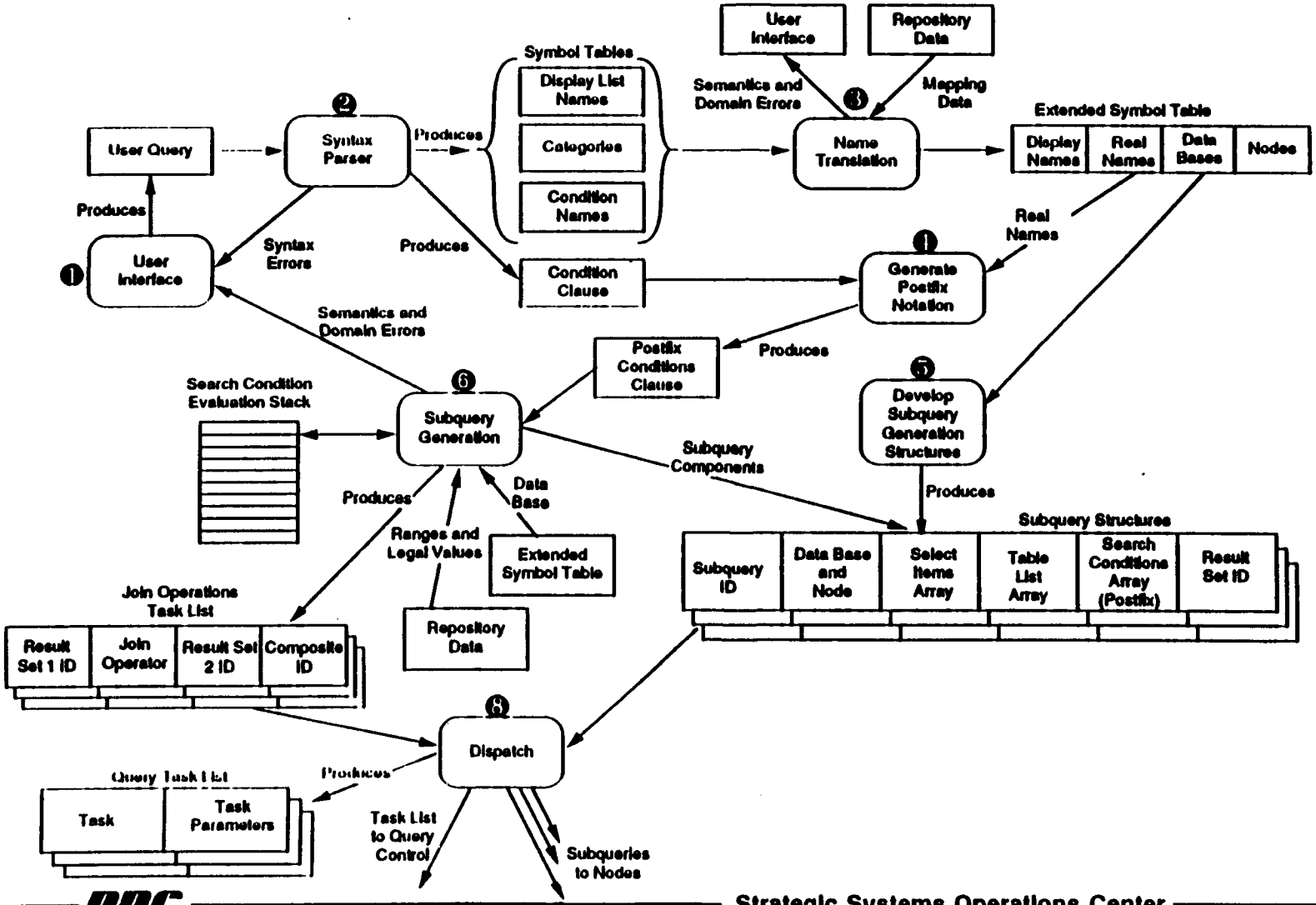
QSP Network Information Administration Capabilities

- Definition of QSP users and user groups
- Definition of table views to control user access to distributed data
- Definition of database schemas as a single repository managed information model
- Resolution of synonym and homonym ambiguities
- Definition of legal value parameters for elements
- Definition of information categories which may span tables or databases but are presented to the user as a related set of elements

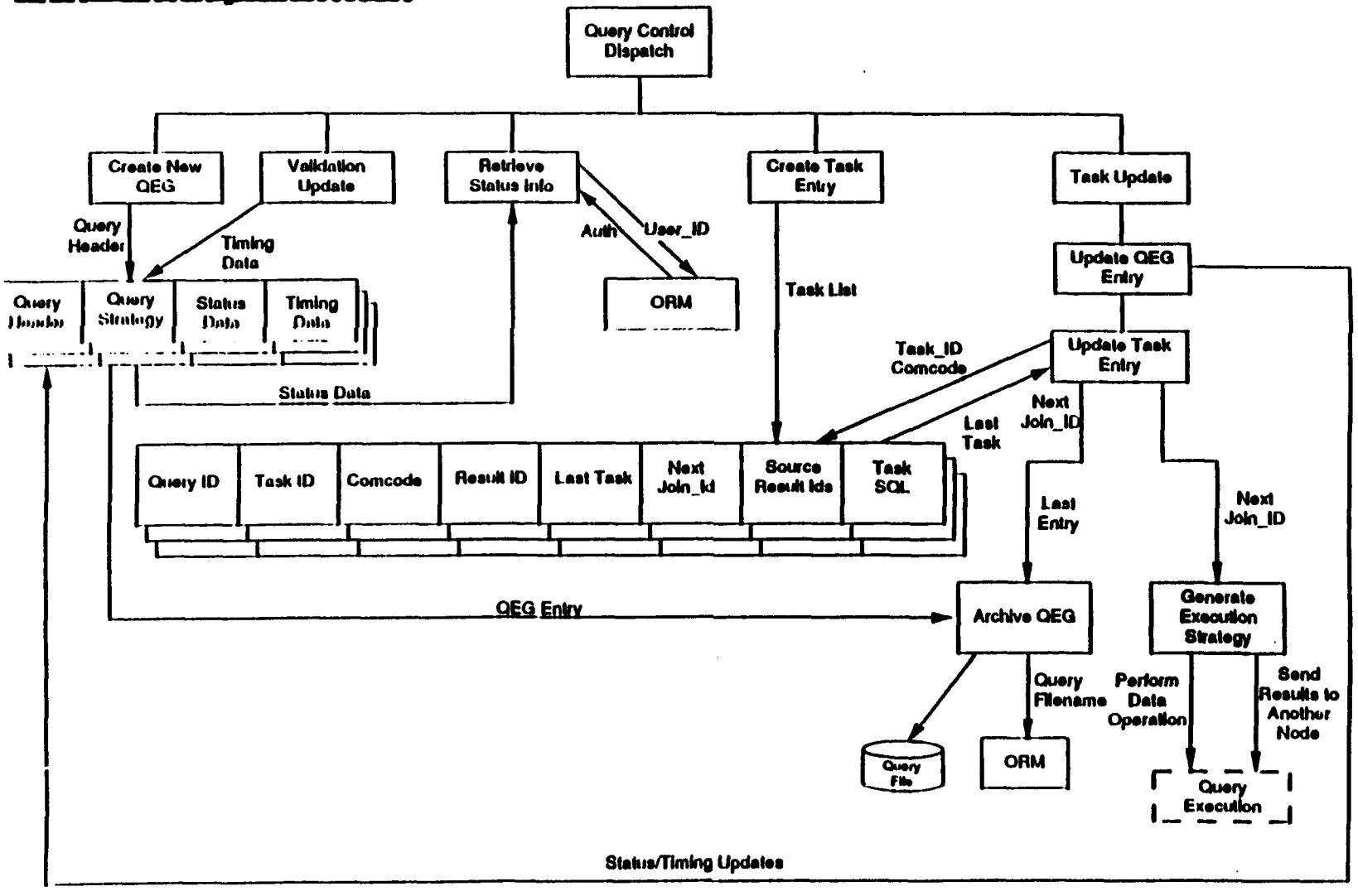
QSP Open Repository Schema



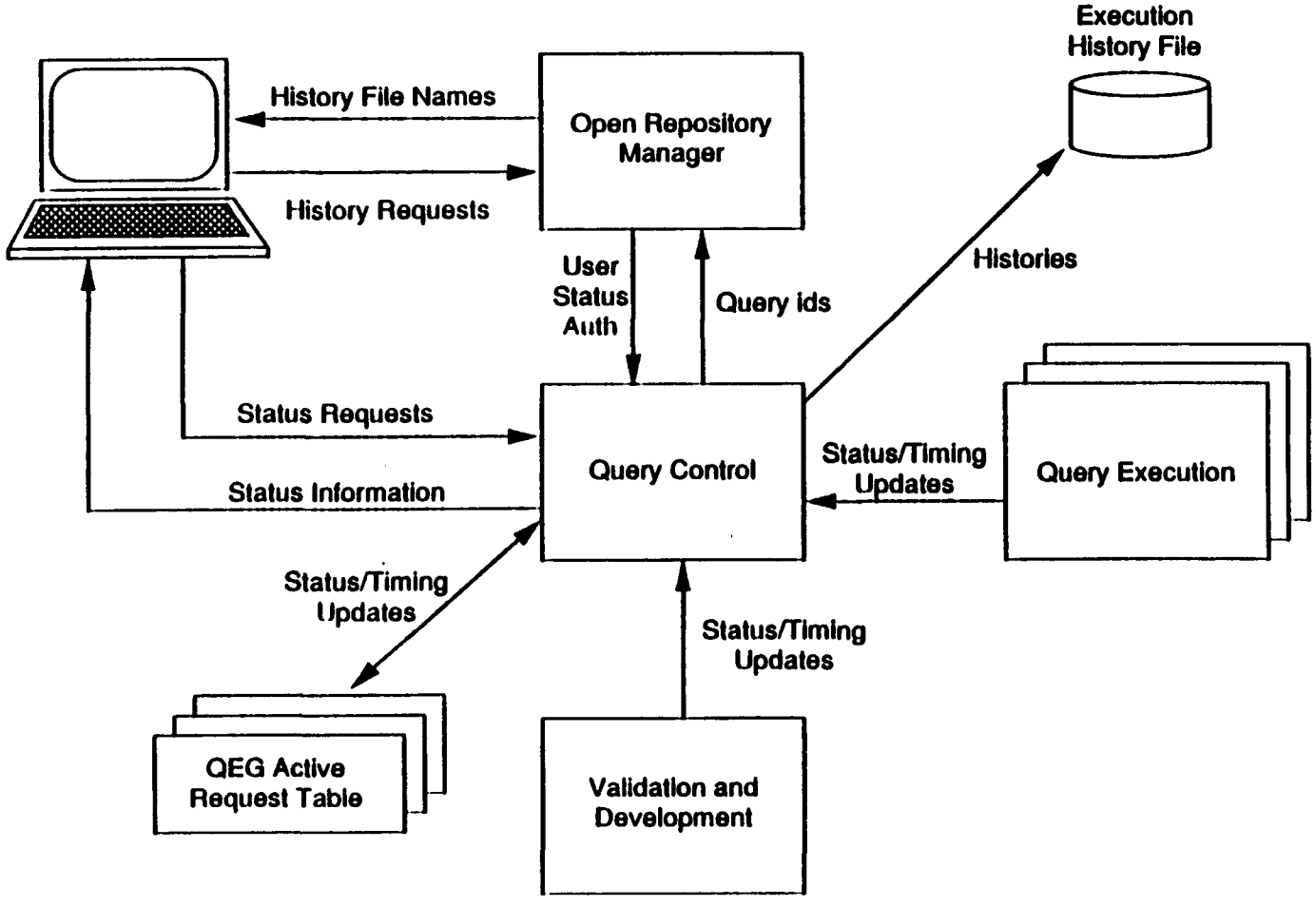
QSP Query Validation and Development



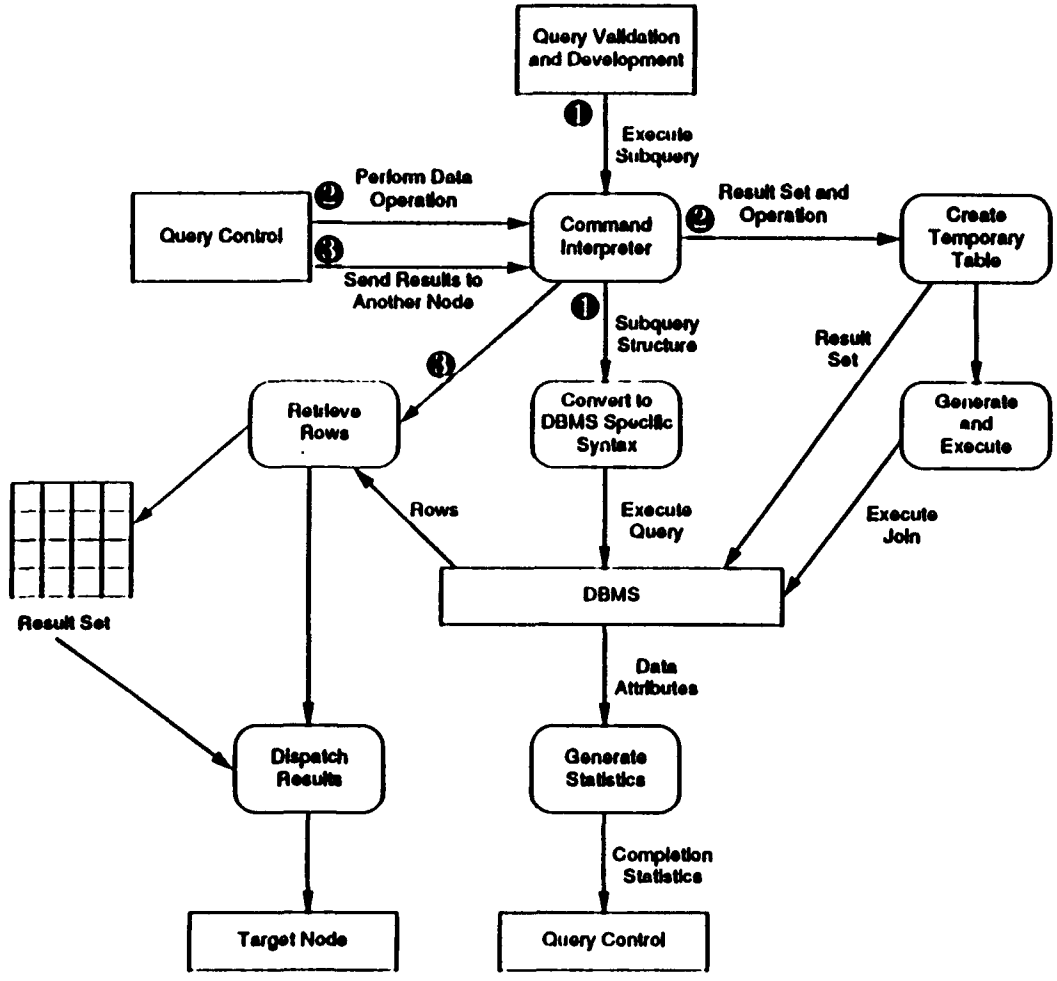
QSP Query Control



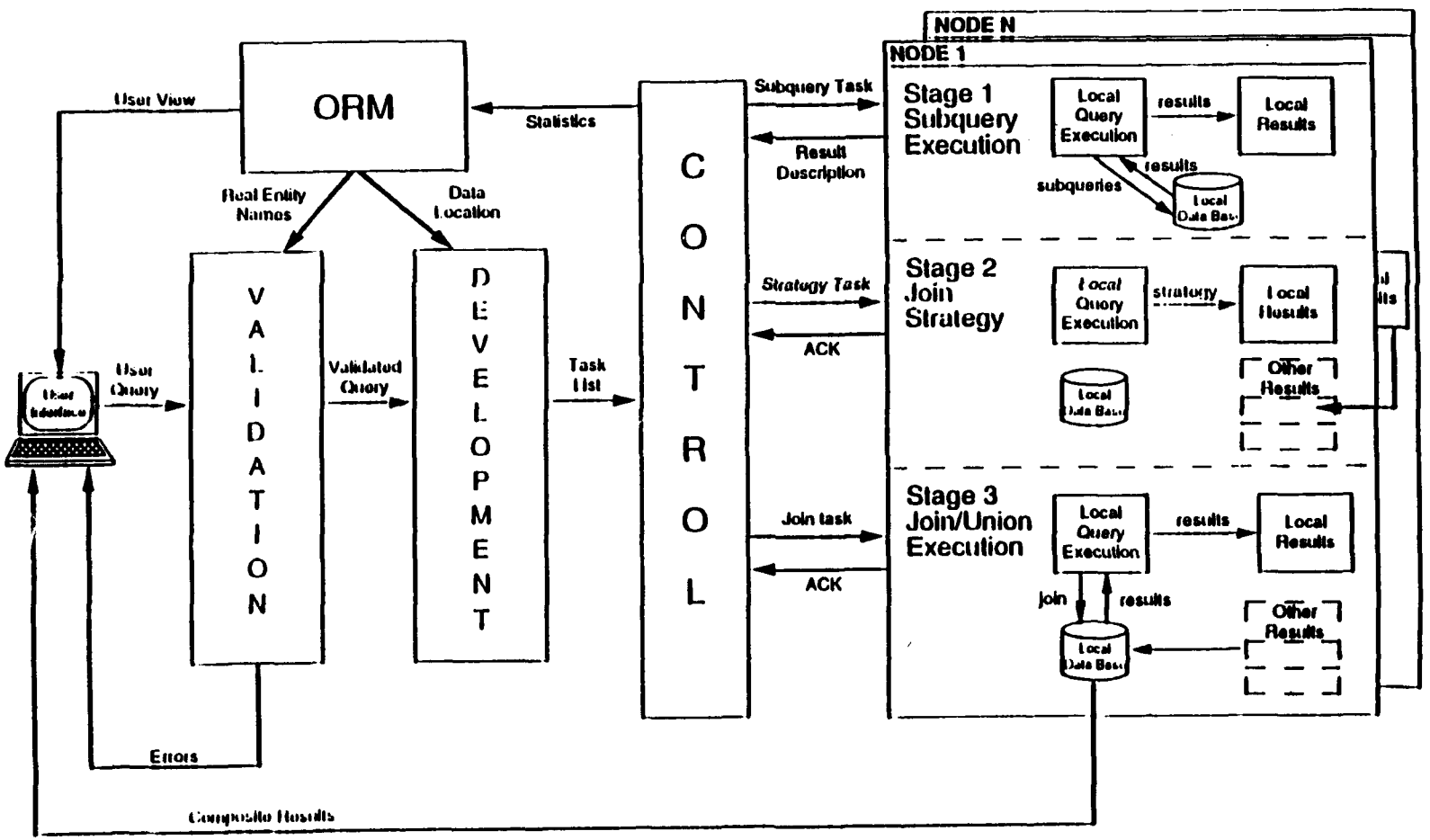
QSP Monitoring and Statistics System



QSP Query Execution



QSP Query Processing



Summary

- Based on an IRDS standard schema server
- Provides distributed access solution for federated environments where information integration is required
- Allows user queries to be generated against a logical view of the network database environment
- Organizes user views by categories of information rather than physical tables
- Maps user views to actual database schemas regardless of structure
- Derives subqueries from the original query and performs translation to actual database schemas
- Performs cross-system joins according to optimized join strategies based on subquery result size
- Returns a single composite result table

COOPERATIVE KNOWLEDGE BASE ARCHITECTURE (CKBA)

Brandon L. Buteau
PRC

PRC

Agenda

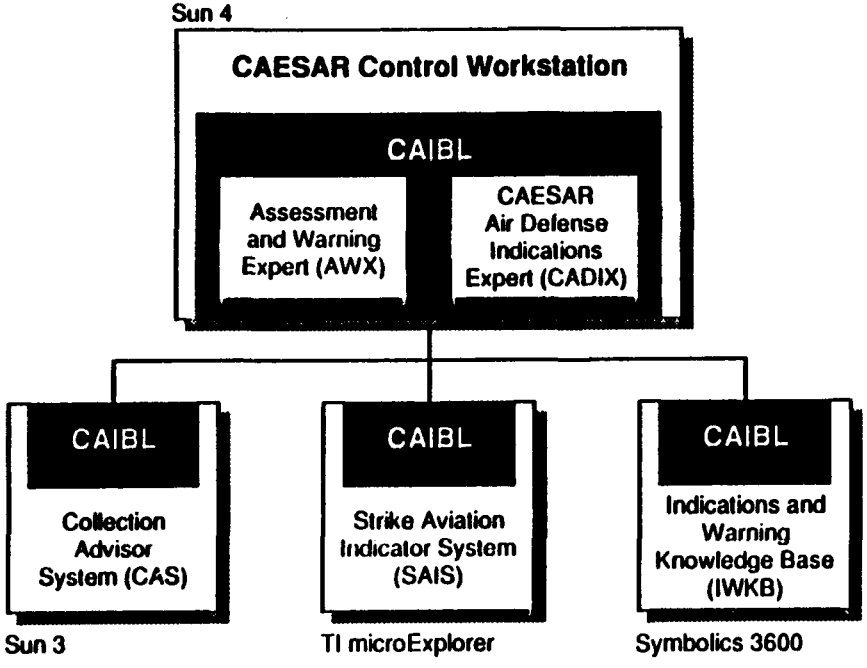
- Project objectives
- Architecture
- Communication framework
- Knowledge exchange language
- Current status
- Discussion of ICD

Project Objectives

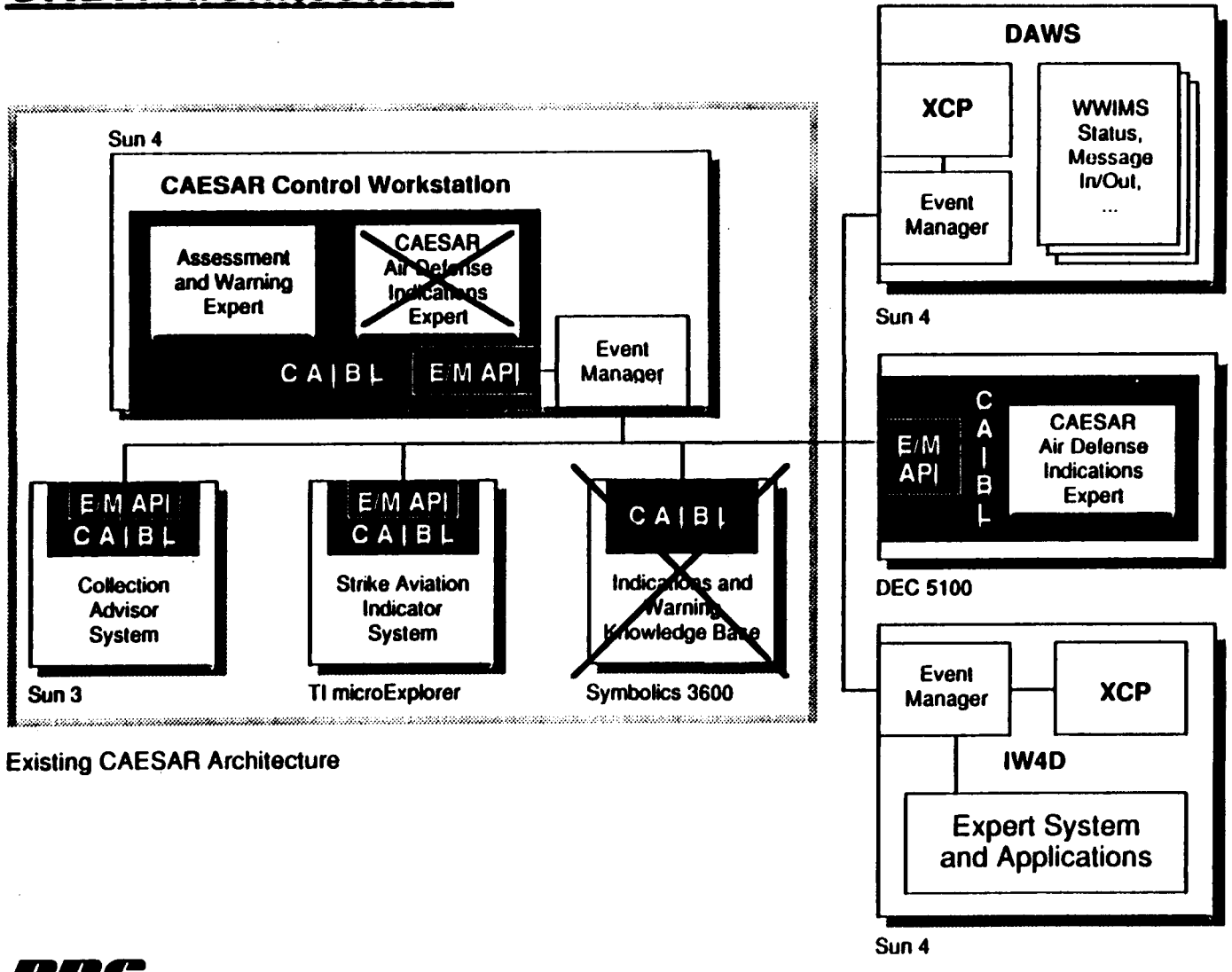
Extend results of prior research from the CAESAR project to include:

- Increased portability of communication facilities
- Development of a generic interface gateway
- Integrate new expert systems, IDHS software, hardware
- Improve existing CAESAR systems
- New scenario development

CAESAR Technology Baseline



CKBA Architecture



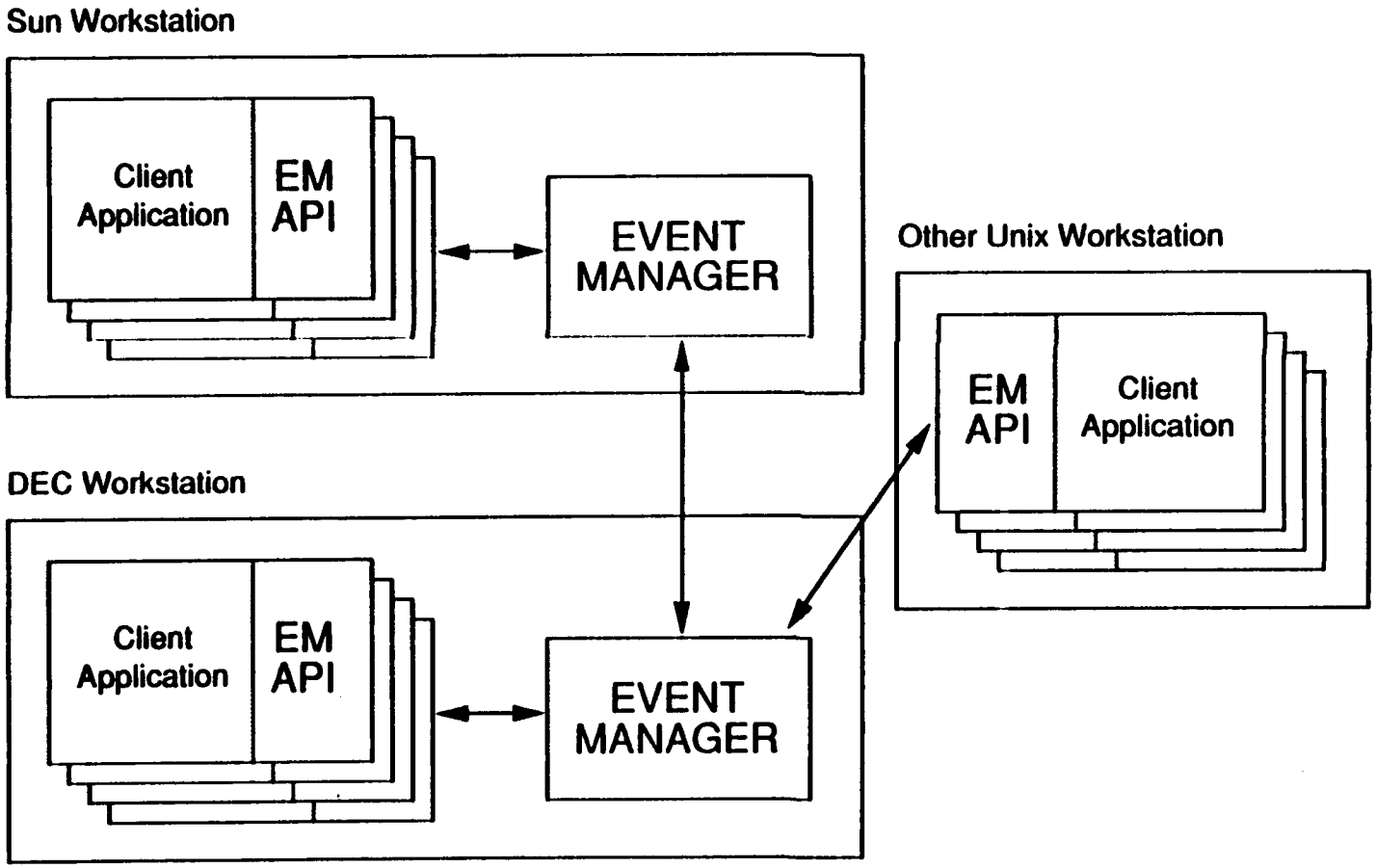
Existing CAESAR Architecture

PRC

Event Manager

- Distributed interprocess communication via a publish and subscribe paradigm
- IP socket-based communication between Event Managers and client applications
- Variable-size, opaque event structures containing world or system data
- Event domains, signatures, and subscriptions

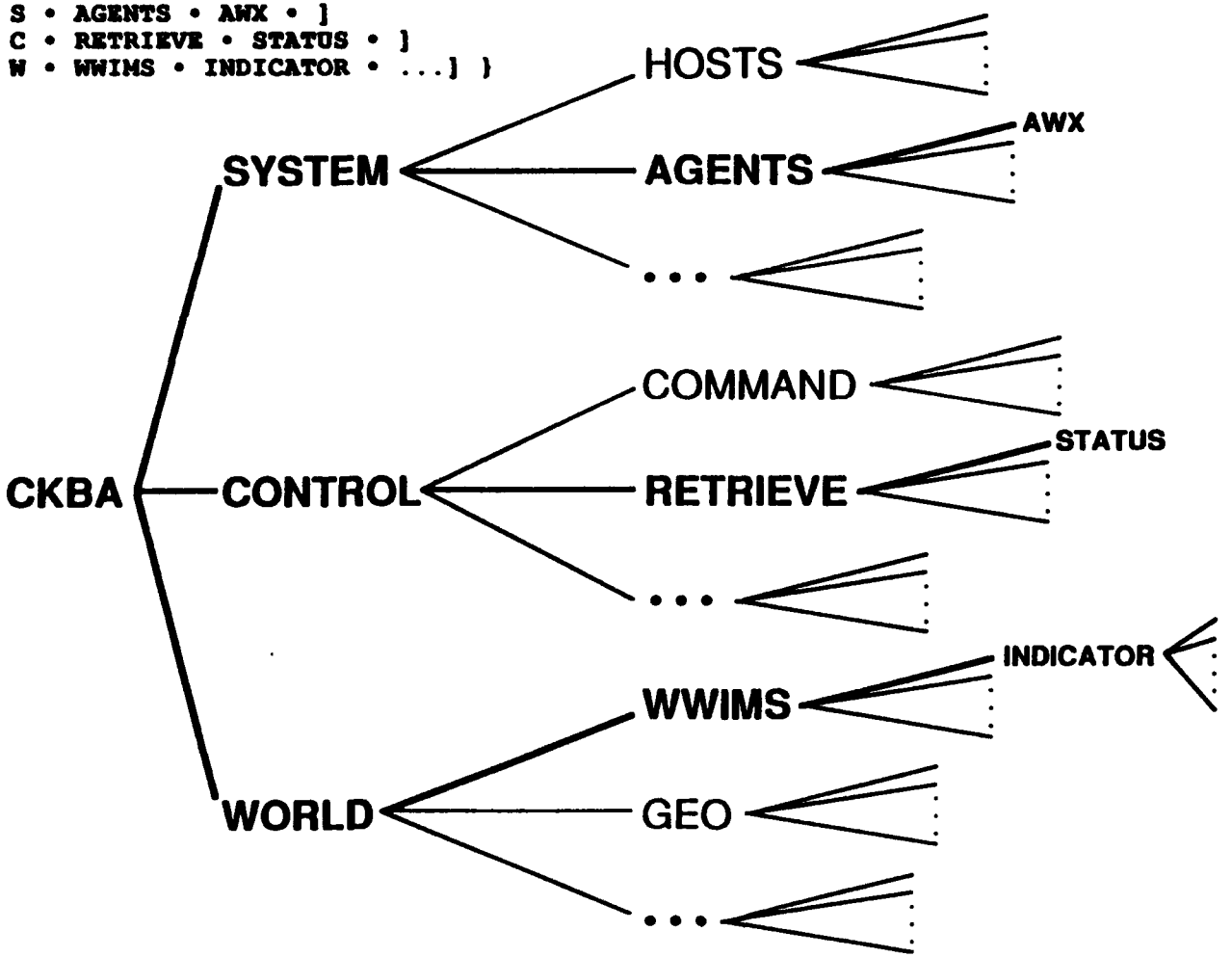
Event Manager Concept



PRC

Event Namespace

```
{ [ S • AGENTS • AWX • ]
  [ C • RETRIEVE • STATUS • ]
  [ W • WWIMS • INDICATOR • ...] }
```



PRC

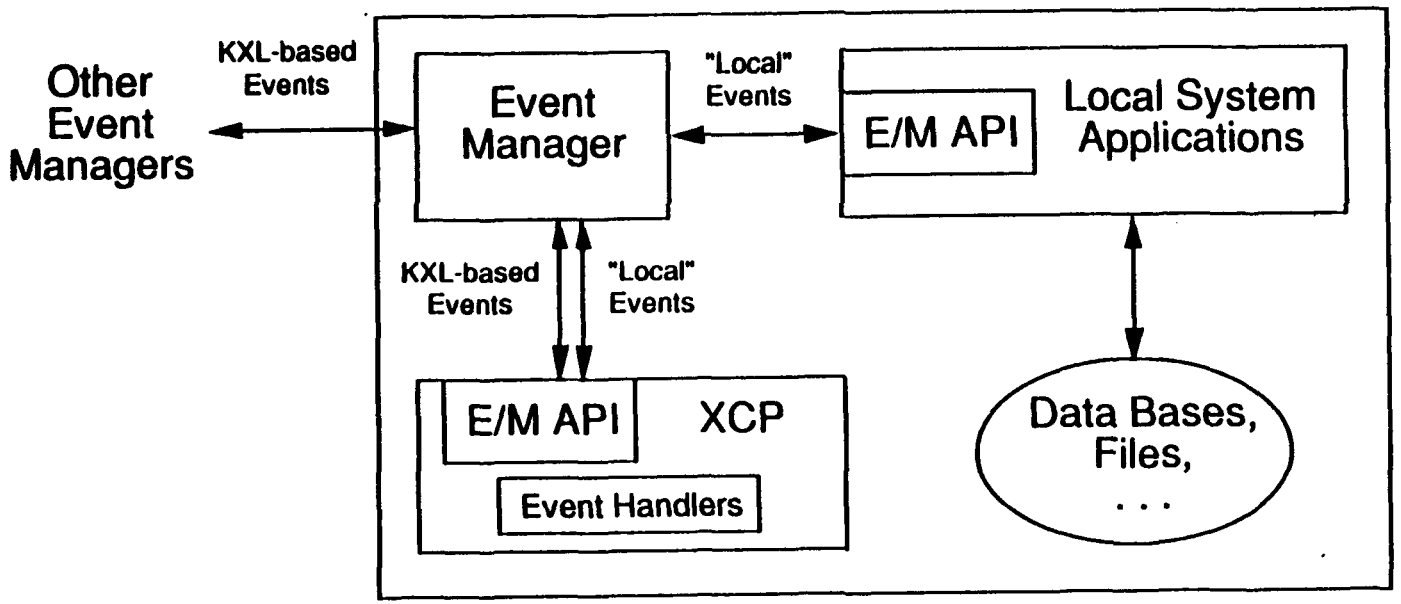
Event Manager Application Program Interface (API)

- InitEvents
- TerminateEvents
- WaitNextEvent
- PostEvent
- ChangeSubscription
- ChangeSubscriptionDomain
- ChangePostingDomain
- SetEmOptions
- Signature utilities

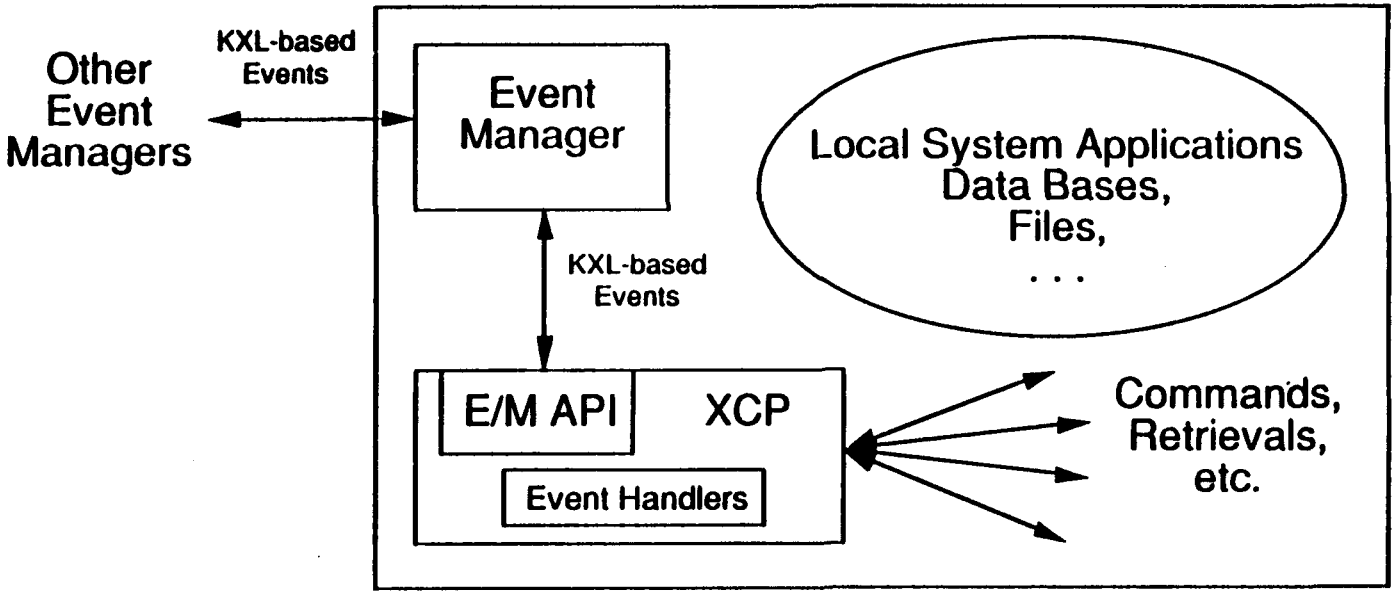
Expert Communication Process (XCP)

- Data normalization across heterogeneous platforms
- Translation services across heterogeneous knowledge representations
- Filtering services for more flexible subscription
- Control services for client surrogates
- Standalone process or callable library
- Dynamically constructed event handlers
- Event expression through a knowledge exchange language (KXL)

XCP as a Network Event Translator

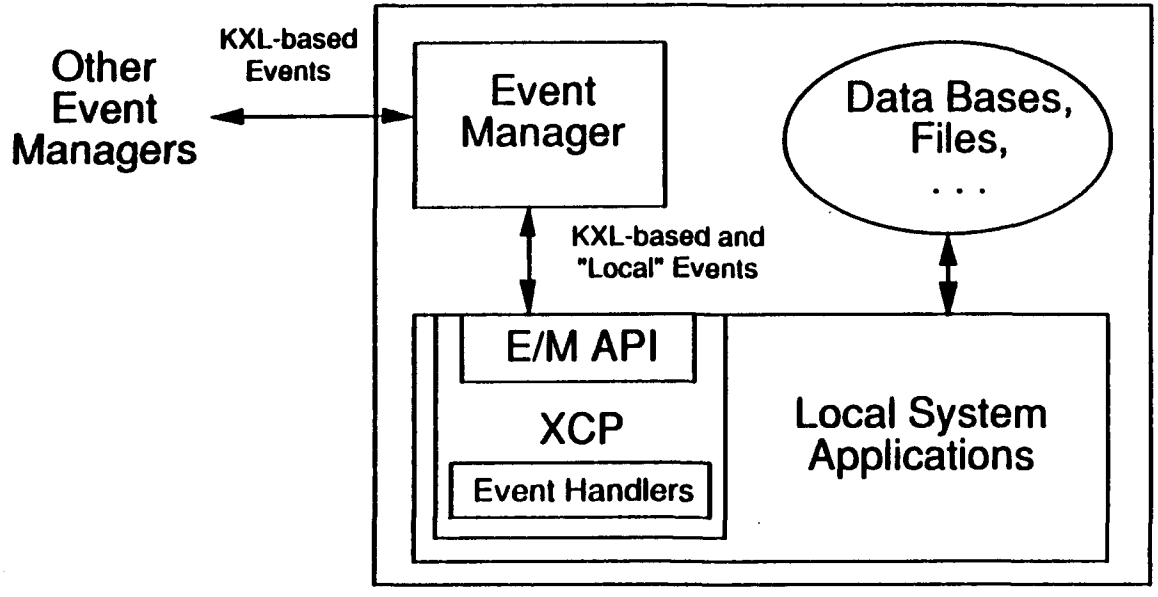


XCP as a Surrogate Client



PRC

XCP as an Embedded Event Handler



XCP API

- MakeEventHandler
- HandleEvents
- SuspendHandler
- ResumeHandler
- ParseKXL
- BuildKXL

KXL Requirements

- Facilitate real-time sharing of knowledge between cooperating expert systems
- Focus on knowledge that can be usefully shared
- Avoid contextually-dependent knowledge and predefined domain structures
- Recognize similarities among principal knowledge representations
- Reduce domain knowledge to two forms: objects and relations
- Explicitly represent control knowledge

KXL Encodings

- Transmission encoding — expresses KXL forms moving from one local environment to another
- Print encoding — expresses KXL forms in a human-readable fashion
- Local encoding — expresses KXL forms in a representation suitable for manipulation within a local environment

KXL Values

- Symbolic
  - Null — `NIL`
  - Boolean — `T`
  - String — `"FOO"`
  - Atomic — `FOO`

- Numeric
  - Integer (Long and Multiple) — `13452349`
  - Float (Single and Double) — `2.345567E+1`

- Special
  - Opaque — `FF00131A0000A4F0`
  - Default — `V`
  - Pattern Variable — `?X`

- Compound
  - Lists — (FOO 1 "A string")
  - Arrays — [6 145 137 NIL]

KXL Domain Knowledge — Objects & Classes

```
ObjectForm    ::=    (OBJ DeclaredEntityID
                      [CLS EntityID]
                      [DSP DisplayString]
                      [ATT AttributeList]
                      [REL EntityRelList]
                      [HYP HypothesisID]
                      [CER CertaintyValue])

ClassForm     ::=    (CLS DeclaredEntityID
                      [DSP DisplayString]
                      [ATT AttributeList]
                      [REL EntityRelList]
                      [HYP HypothesisID]
                      [CER CertaintyValue])
```

KXL Control Forms

- Commands — for achieving a side effect
- Retrievals — for ad hoc acquisition of information
- Monitors — for continuing information retrieval
- Guidance — for establishing task priorities
- Responses — for returning results
- Information — for notifying without commitment

KXL Command Syntax

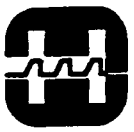
```
CommandForm     ::=  (CMD CommandType
                      ID IntegerValue
                      [PRM ParameterList]
                      [ABT IntegerValue])

CommandType     ::=  KXLIdentifier

ParameterList   ::=  (ParameterForm {ParameterForm})

ParameterForm   ::=  (KXLIdentifier KXLValue)
```

Complete KXL Form

```
(CTL (RSP (RTR 15)
      ID 22
      DOM ((OBJ TRK-25
            CLS FLIGHT
            DSP "Track 25"
            ATT ((LAT "2345N")
                 (LONG "12345W")
                 (TYPE (CONDOR/A CONDOR/C))
                 (QTY (5 2))
            ))
 SRC CADIX
 DIS (CCW)
 SIG (("W" "FLIGHT"))
 TIM ((TRANS "011705ZMAY91"))
 ONT CKBA-I&W
 VER 14)
```

Current Project Status

- CAIBL & CADIX port to DECstation
- Implementation of causal modeling for AWX
- Demonstration scenario
- KXL specification
- CAIBL / Event Manager integration
- XCP interfaces



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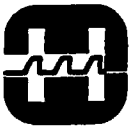
Advanced Reasoning Theory Program

Rome Laboratory/IRDS
Technical Interchange Meeting

February 11-12, 1992

Jonathan Reed
Noreen Heyda
Harris Corporation



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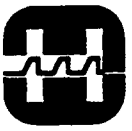
Agenda

1. Program Objectives
2. Program Status
3. ART-based Message Understanding System (AMUS)
4. AMUS Demo



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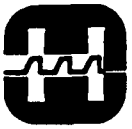
Objectives

Continue the research and development of a new, general architecture for natural language understanding.

(general = not-brittle + multi-domain = 14+ technical issues).

1. Rename architecture from Cortical Thought Theory (CTT) to Advanced Reasoning Theory (ART).
2. Port ART algorithms/software from Symbolics to Sun/Unix.
3. Redesign system based on:
   - lessons learned during NTDG (e.g. dictionary),
   - PGIP specification.
3. Simulate/measure parallelism in NL algorithms.
4. Apply to Long Range Air messages.
5. Formally test.
6. Investigate addition of imagery/speech inputs.



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Status

1. Software development completed (for the most part).
2. Program has been "on hold" while awaiting approval of new SCIF.
3. Soon to begin development of LRA knowledge bases.

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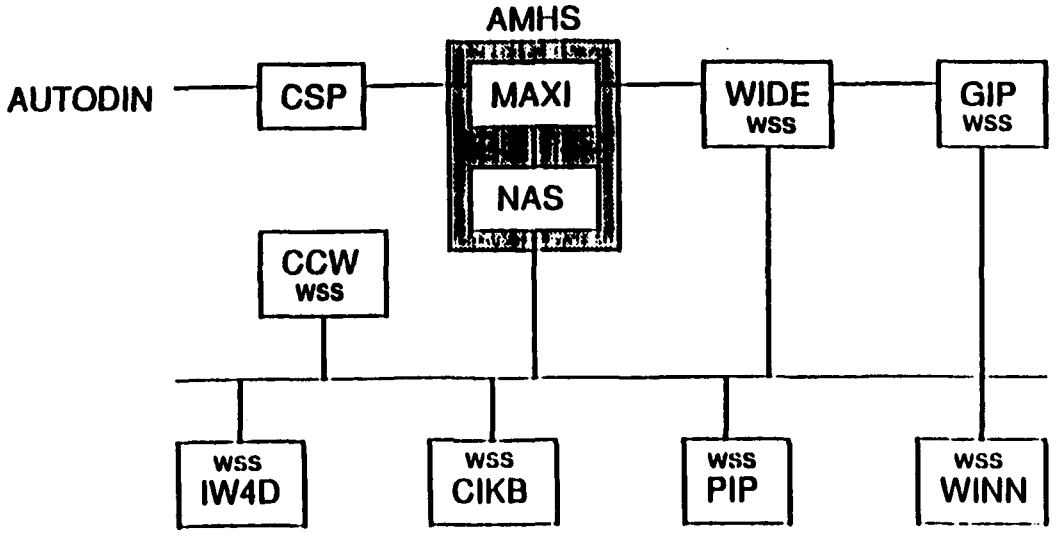
IPAS 2000

- Intelligent Predictive Assessment System
- Rome Laboratory/IRD
- Complete, Integrated, Intelligence Data Handling System
- Open systems, standards, expert systems, message understanding



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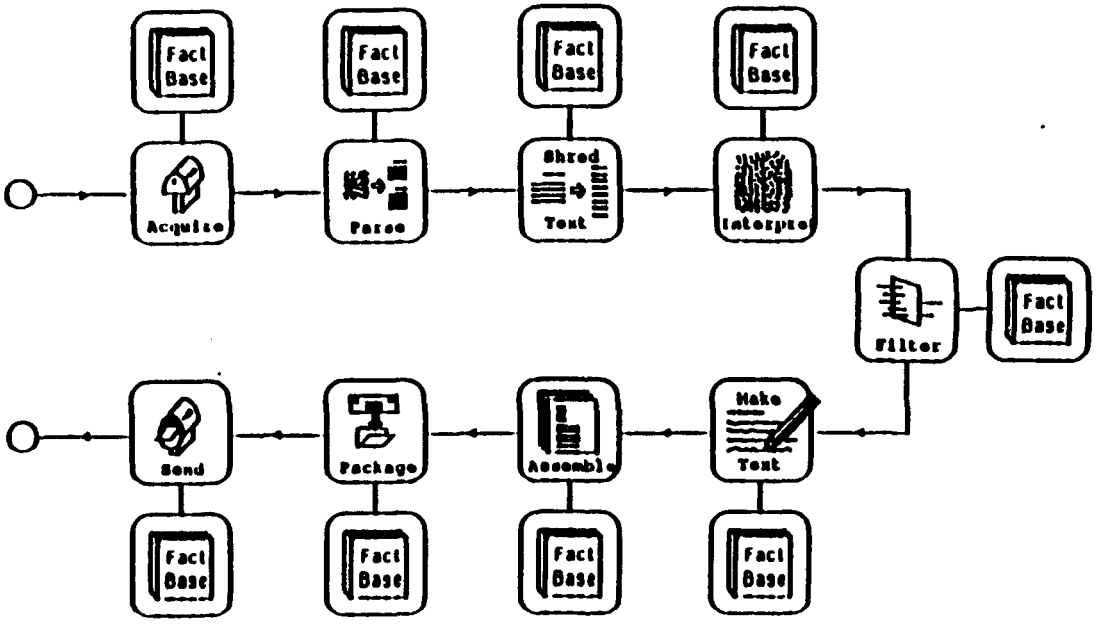
GIP Architecture

- Generic Intelligence Processor
- Knowledge Systems Concepts
- Message Understanding
- Broad Interpretation: acquisition, parsing, NLU, packaging, etc.



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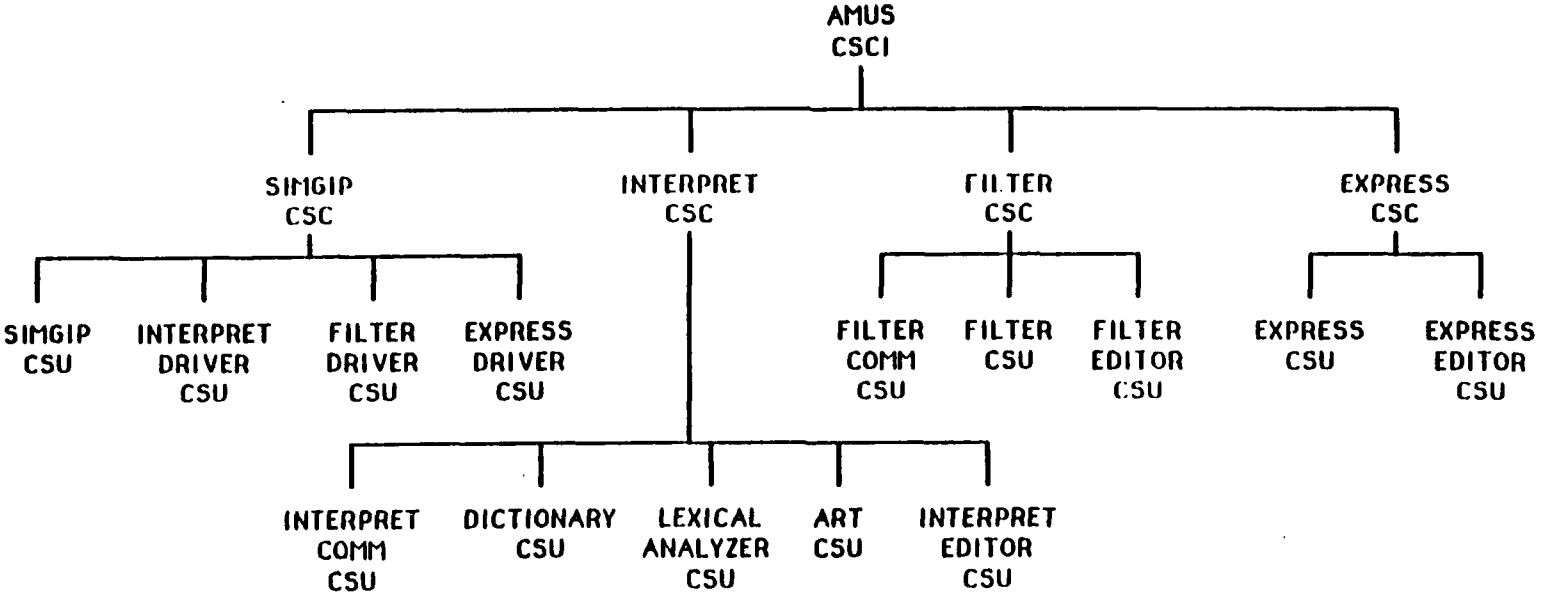
ART Message Understanding System
CSCI Structure



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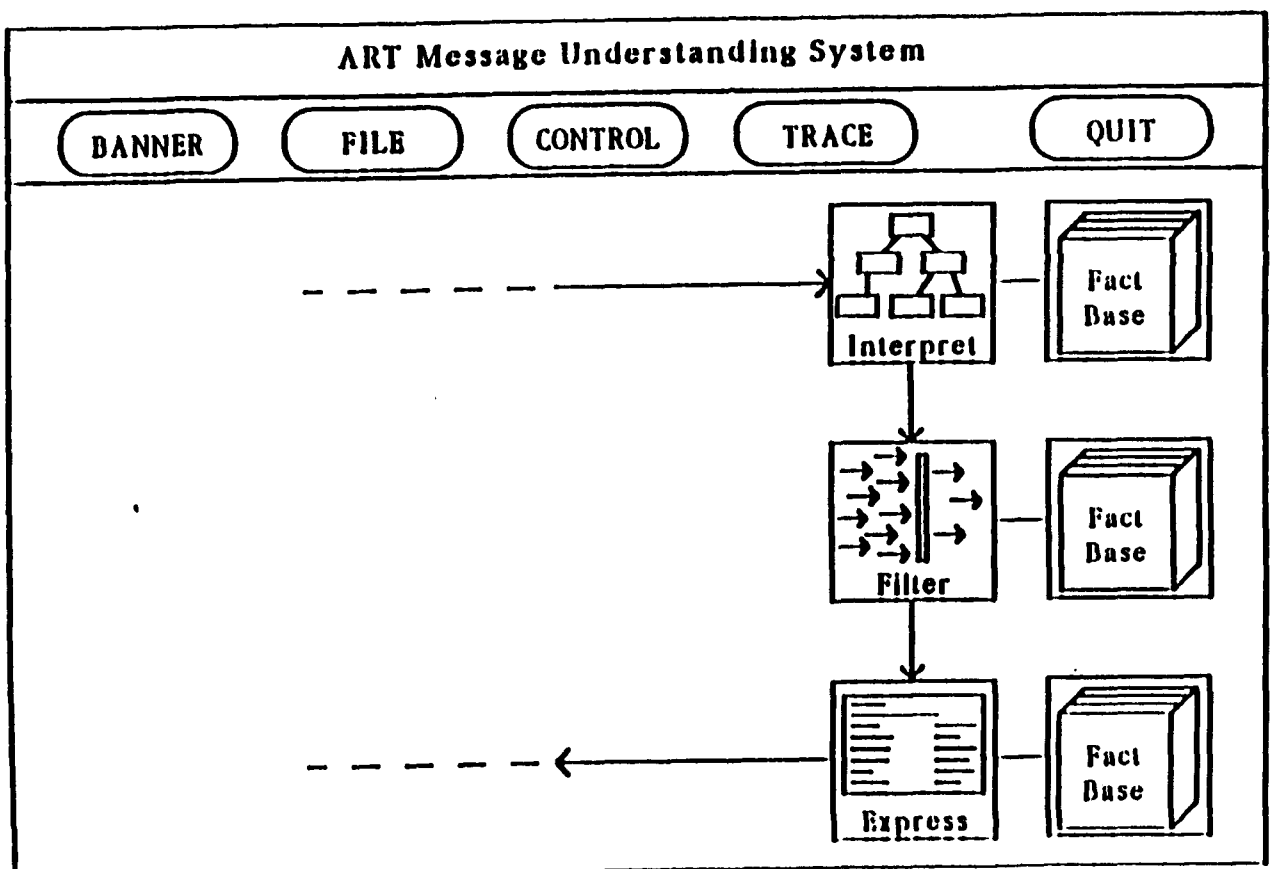
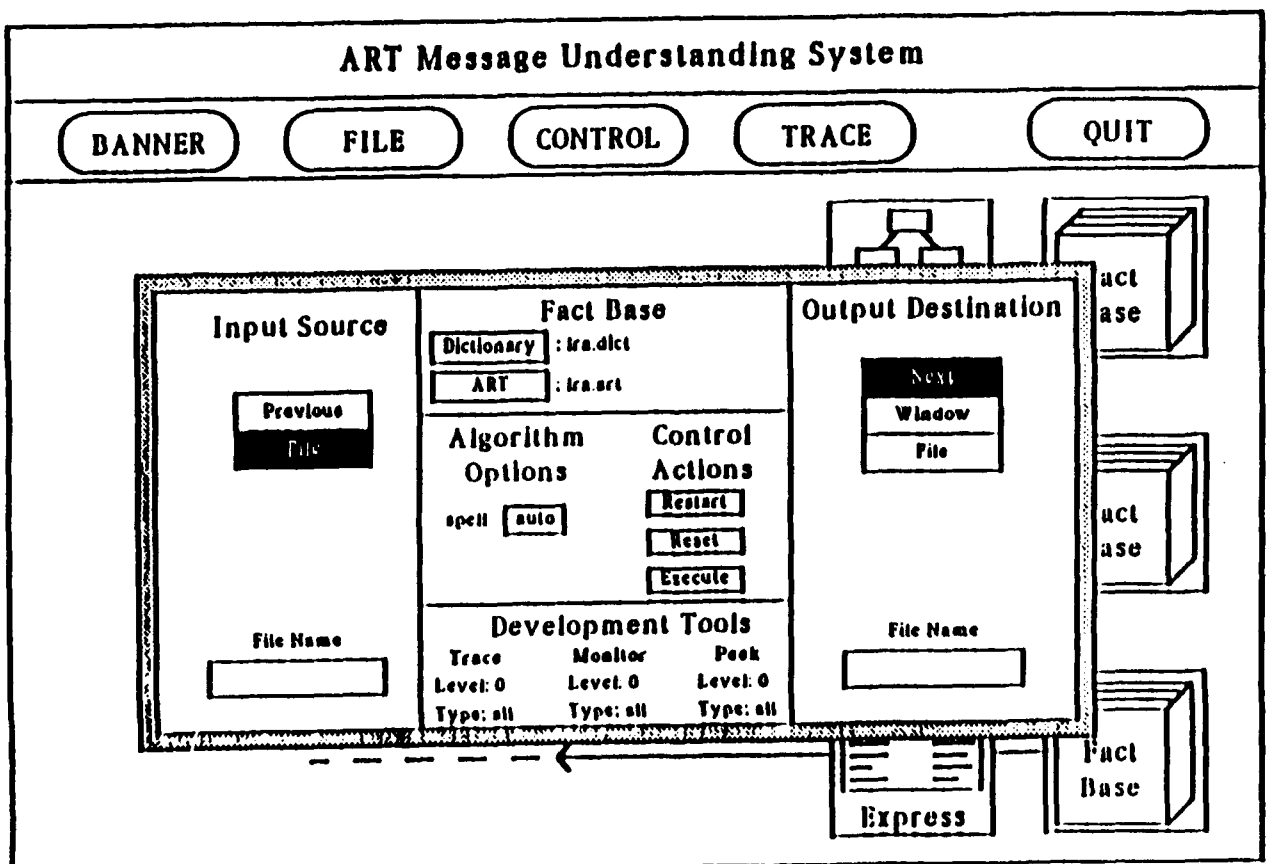
SIMGIP CSU



After the Interpret Icon button is selected.



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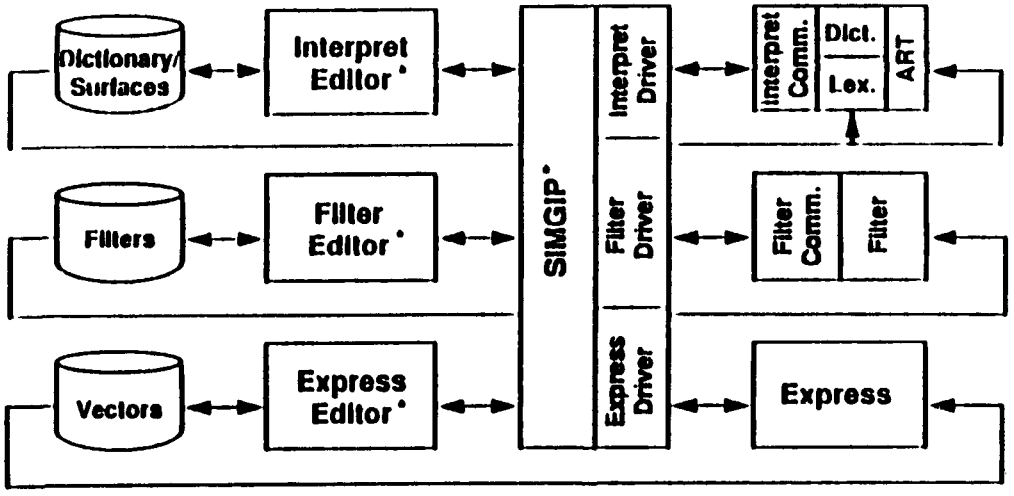
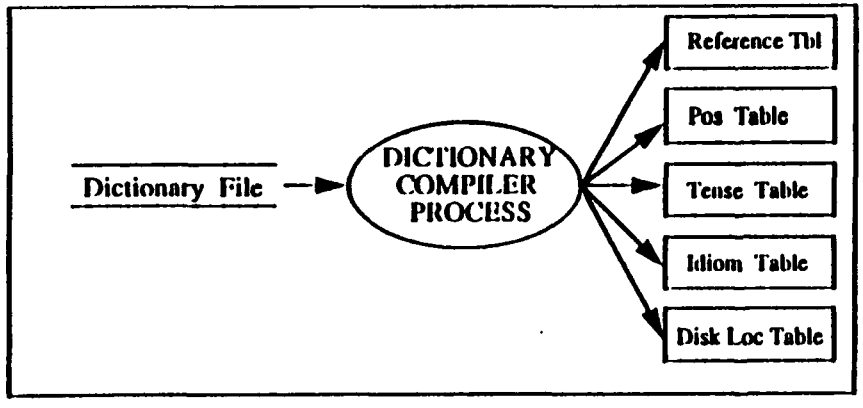
ART Message Understanding System Architecture



*Interfaces to user/developer.

DICTIONARY CSU

- Dictionary entries follow *Webster's New World Dictionary*
- Five tables generated from the dictionary to be used in lexical analysis



Reference Table (RT) - Contains references to other words eg: "BUFFC SEEB 60."

Pos Table (PT) - Contains possible parts-of-speech of words

Tense Table (TT) - Contains the possible tenses of words

Idiom Table (IT) - Contains idioms

Disk Location Table (DLT) - Contains disk locations for dictionary entries

#AIR FORCE: n. 1 the aviation branch of a country's armed forces %class:military-branch

#BASE: n. 1 the thing or part on which something rests %class:foundation; 2 a headquarters or a source of supply %class:base; 3 any of the four markers a baseball player must consecutively touch to score a run %class:baseball base; -v. (based, basing) 1 to make a base for %event:locate; %agent:reasoning; %object:locomotive; -adj. (baser, basest) 1 located at %class:location;

#BEGIN: v. (began, begun, beginning) 1 to start doing, acting, etc. %event:initiate; %agent:locomotive; %object:event; 2 to originate %event:locate; %agent:event; %object:location;

#BUFF-C SEE: B-60.

DISK LOCATION TABLE

AIR	0
BASE	55
BASED	55
BASING	55
BASER	55
BASEST	55
BEGIN	283
BEGAN	283
BEGUN	283
BEGINNING	283
...	

PART-OF-SPEECH TABLE

AIR	n
BASE	n,v,adj
BASED	v,adj
BASING	n,v
BASER	adj
BASEST	adj
BEGIN	v
BEGAN	v
BEGUN	v
BEGINNING	n,v
...	

TENSE TABLE

BASE	pres
BASED	past,part
BASING	pres,part
BEGIN	pres
BEGAN	past
BEGUN	part
BEGINNING	pres,part
...	

IDIOM TABLE

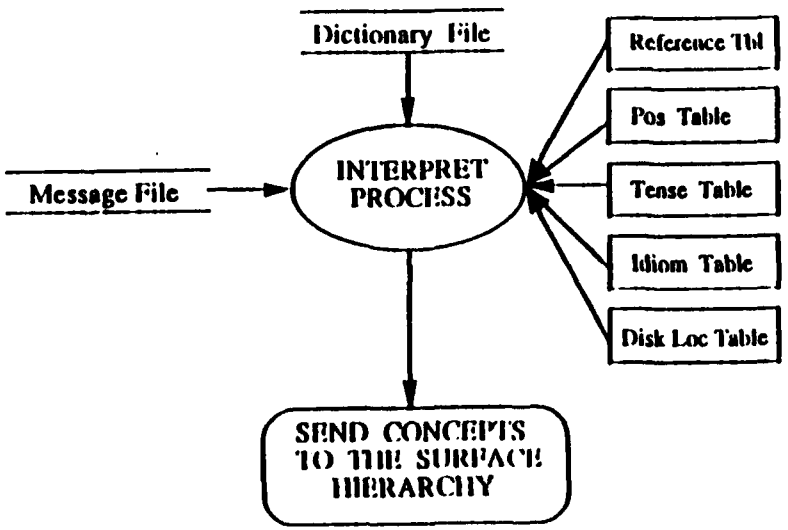
AIR	(FORCE)

REFERENCE TABLE

BUFF C	1260

LEXICAL ANALYZER CSU

- Uses the 5 tables generated from dictionary compiler
- Performs idiom preprocessing, spelling correction, morphological analysis, and dictionary look-up on the words in the message
- Projects concepts to ART surfaces



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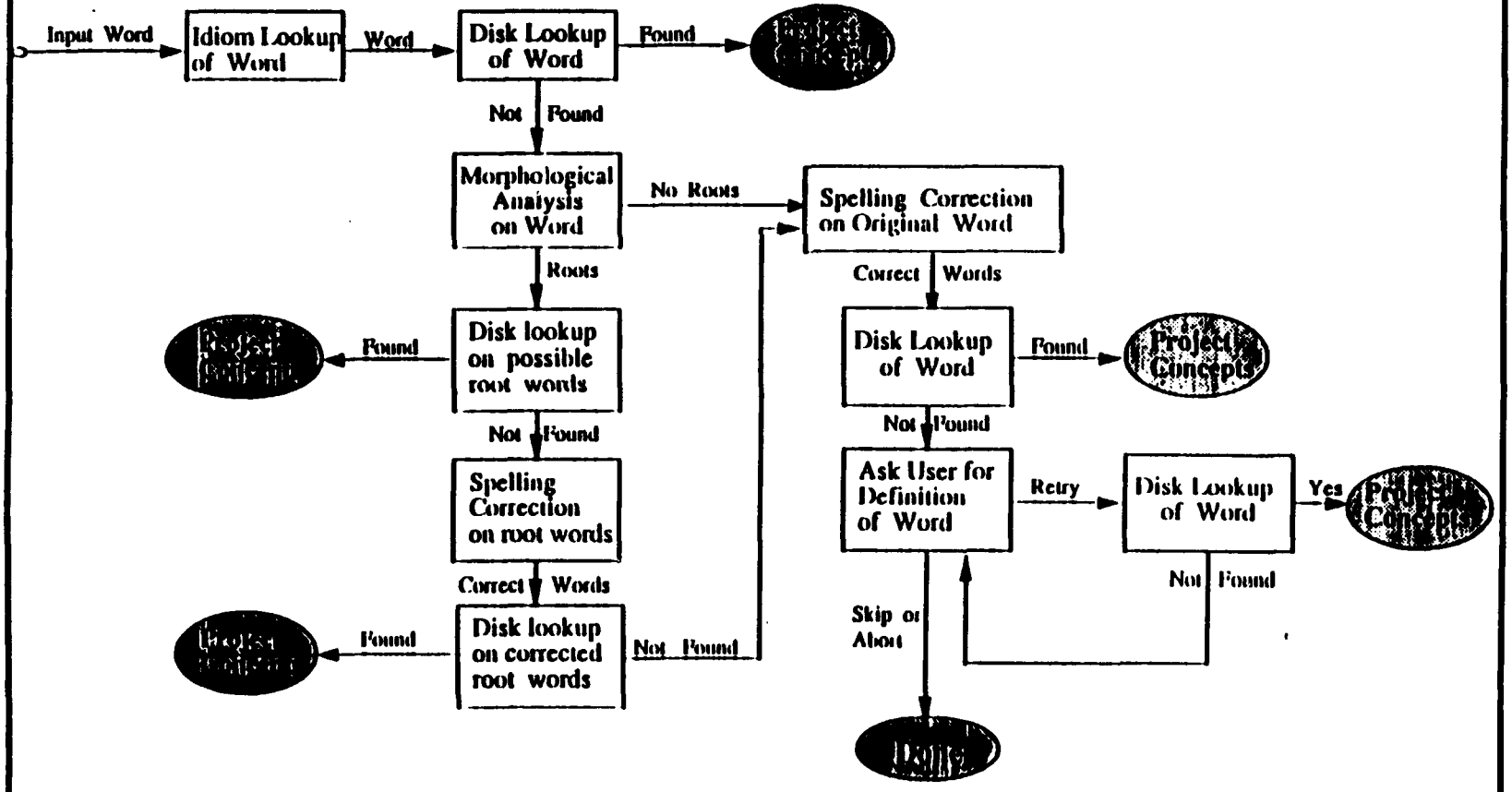
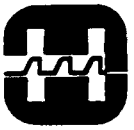
LEXICAL ANALYZER CSU





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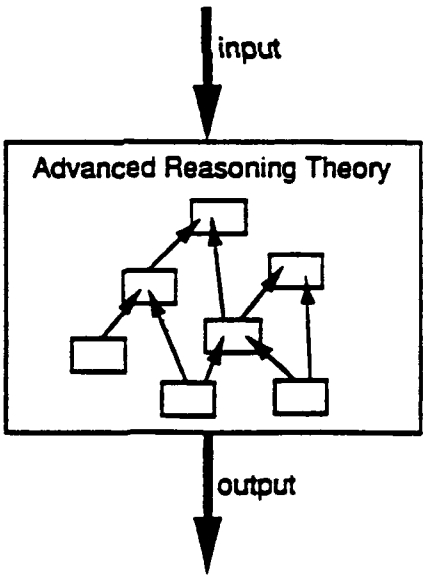
ART CSU

THE	CAPTAIN	FLEW	THE	PLANE
pos:art	pos:adj	pos:verb	pos:art	pos:adj
def:def	class:rank	event:move	def:def	class:level
	pos:noun	agent:human		pos:noun
	class:human	object:aircraft		class:airplane
	mod:rank	pos:verb*		pos:noun*
		event:move		class:tool
		agent:bird		
		pos:noun		
		class:insect		
		pos:noun*		
		class:ball		



EVENT-1
  VERB: VERB-1
  AGENT: OBJECT-1
  OBJECT:OBJECT-2

VERB-1
  WORD: FLY
  TYPE: (MOVE ACTION EVENT)

OBJECT-1
  WORD: CAPTAIN
  TYPE: (HUMAN ANIMAL AGENT)

OBJECT-2
  WORD: PLANE
  TYPE: (AIRPLANE AIRCRAFT VEHICLE)

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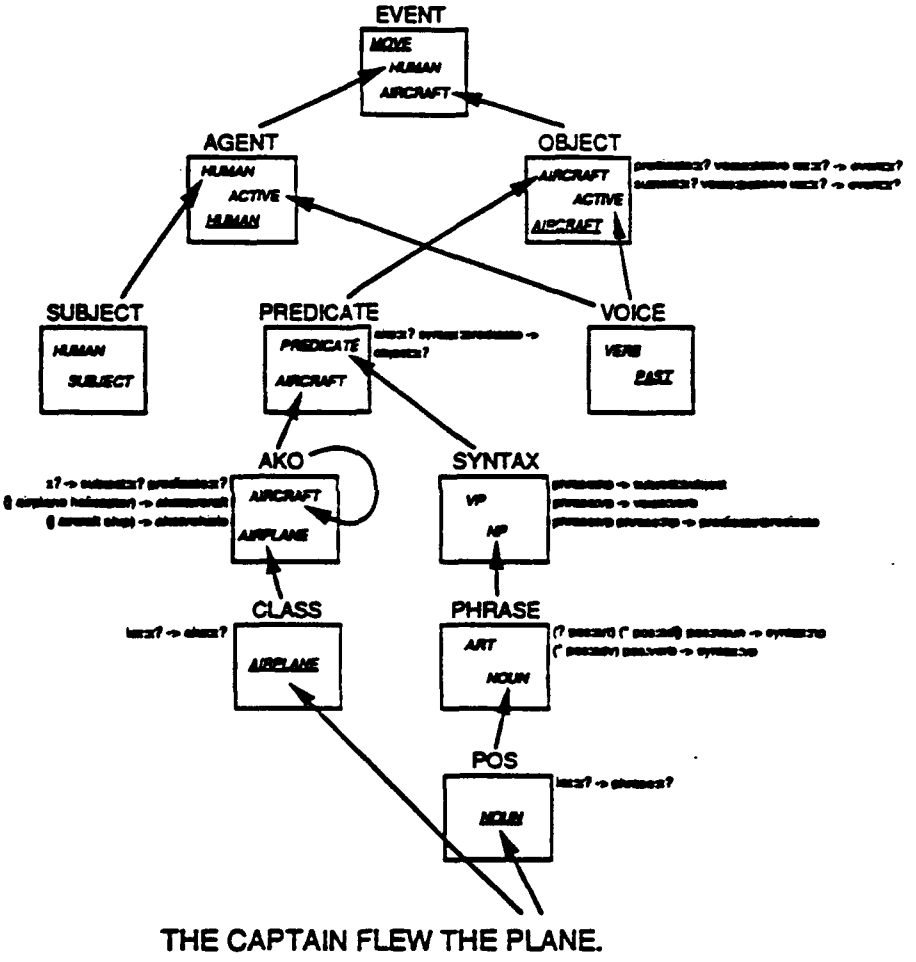
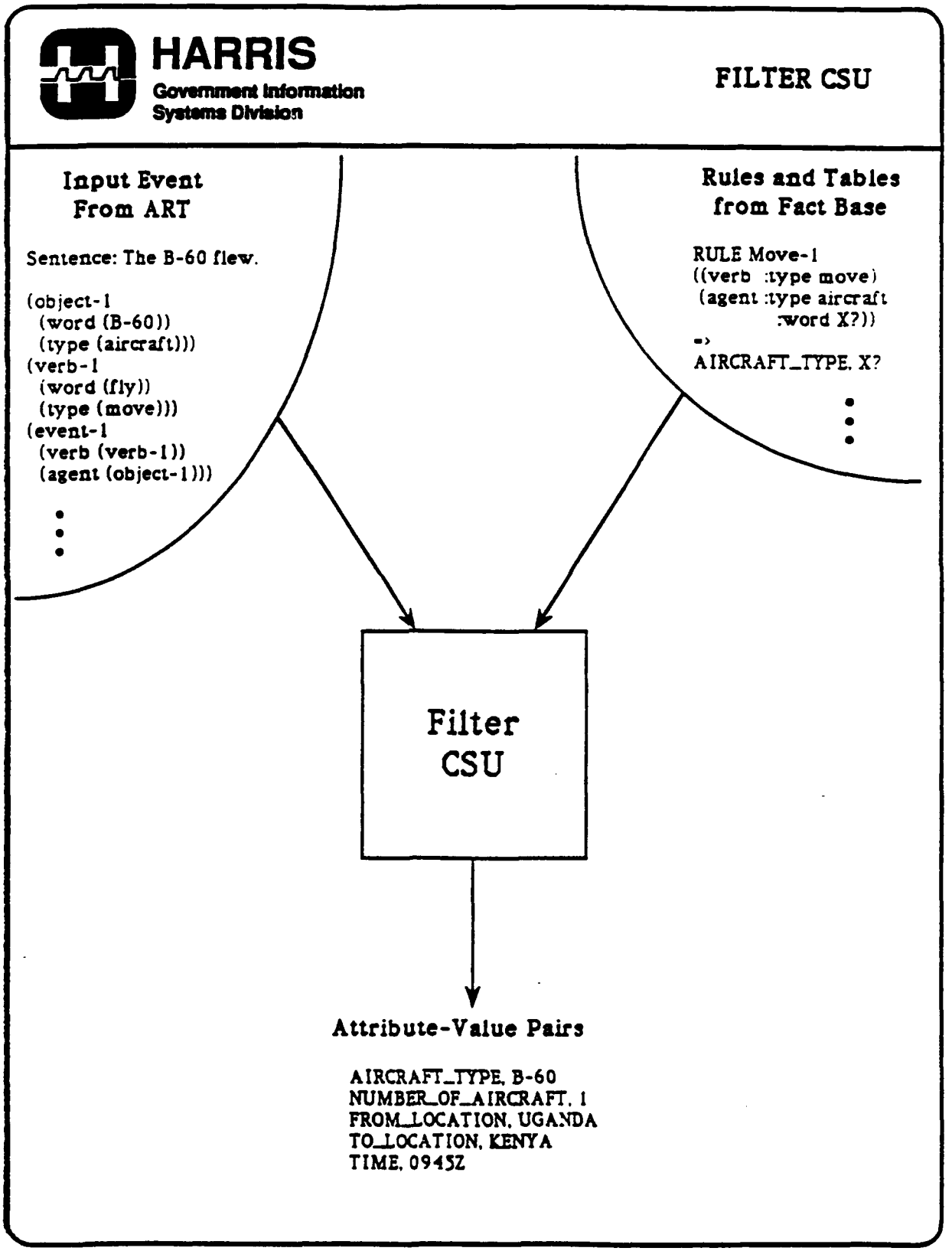
Example ART Hierarchy



#FLY v. (flew, flown, flying) %pos:*verb*; 1 to operate an aircraft %*event:move*; %*agent:human*; %*object:aircraft*; 2 to move through the air using wings, as a bird %*event:move*; %*agent:bird*; -n. (flies) %*pos:noun*; 1 any of a large group of insects with two transparent wings %*class:insect*; 2 a baseball batted high into the air %*class:ball*;

#PLANE adj. %*pos:adj*; 1 flat, level %*class:level*; -n. %*pos:noun*; 1 short for airplane %*class:airplane*; 2 a carpenter's tool for leveling or smoothing wood %*class:tool*;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FILTER CSU
Input Event
From ART
Sentence: The B-60 flew.
(object-1
(word (B-60))
(type (aircraft)))
(verb-1
(word (fly))
(type (move)))
(event-1
(verb (verb-1))
(agent (object-1)))
Rules and Tables
from Fact Base
RULE Move-1
((verb :type move)
(agent :type aircraft
:word X?))
=>
AIRCRAFT_TYPE, X?
Filter
CSU
Attribute-Value Pairs
AIRCRAFT_TYPE, B-60
NUMBER_OF_AIRCRAFT, 1
FROM_LOCATION, UGANDA
TO_LOCATION, KENYA
TIME, 0945Z

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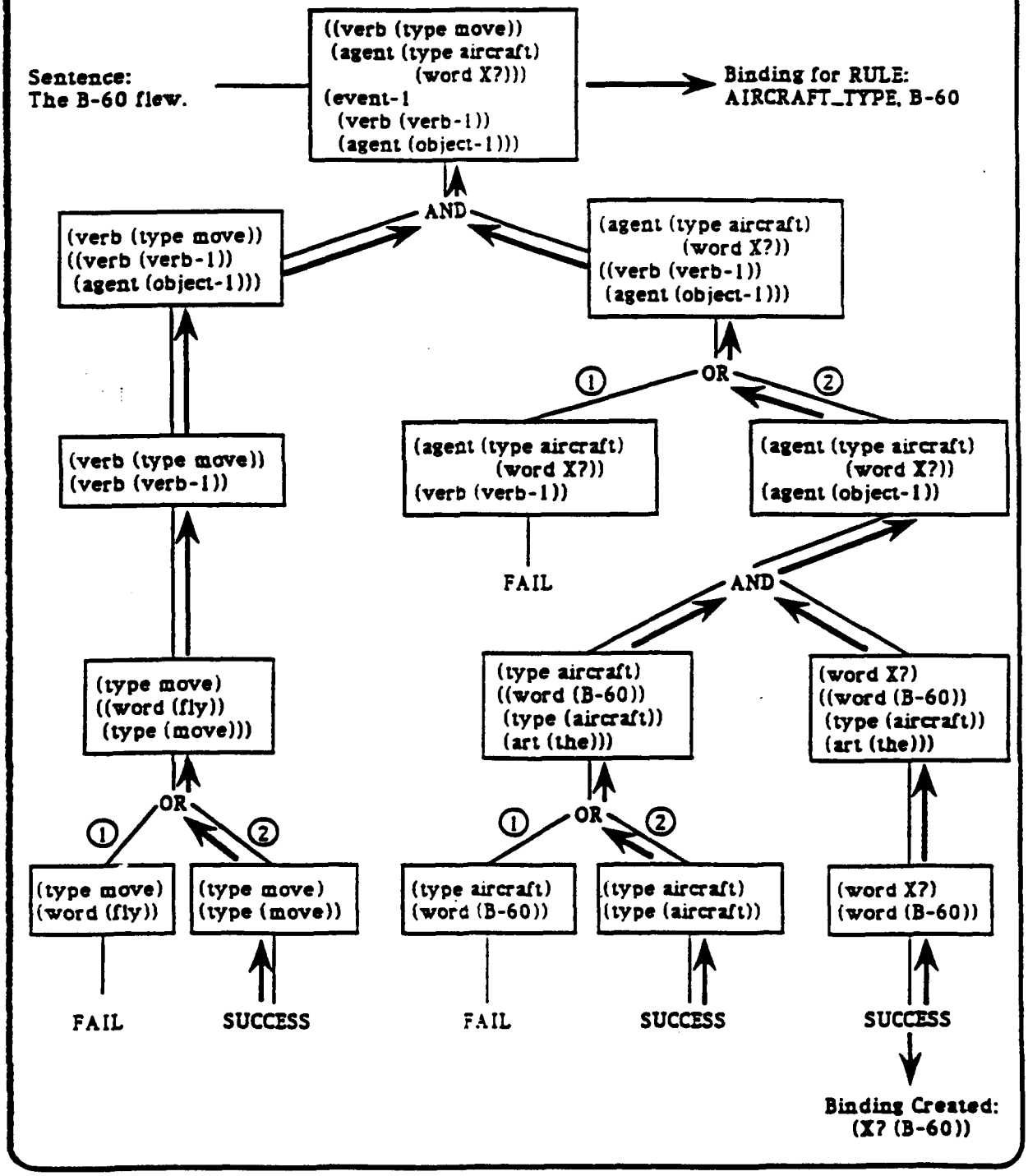
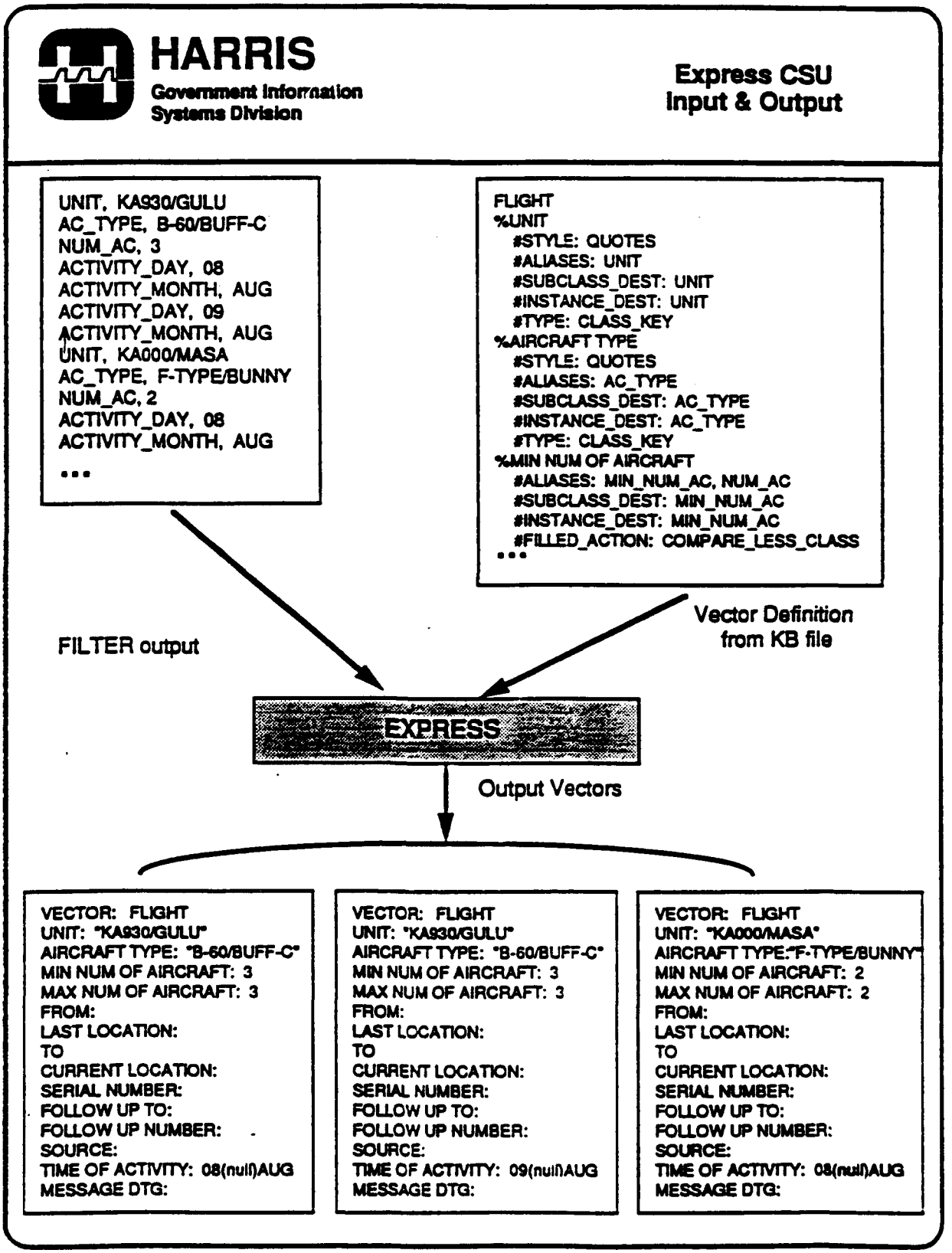
FILTER CSU

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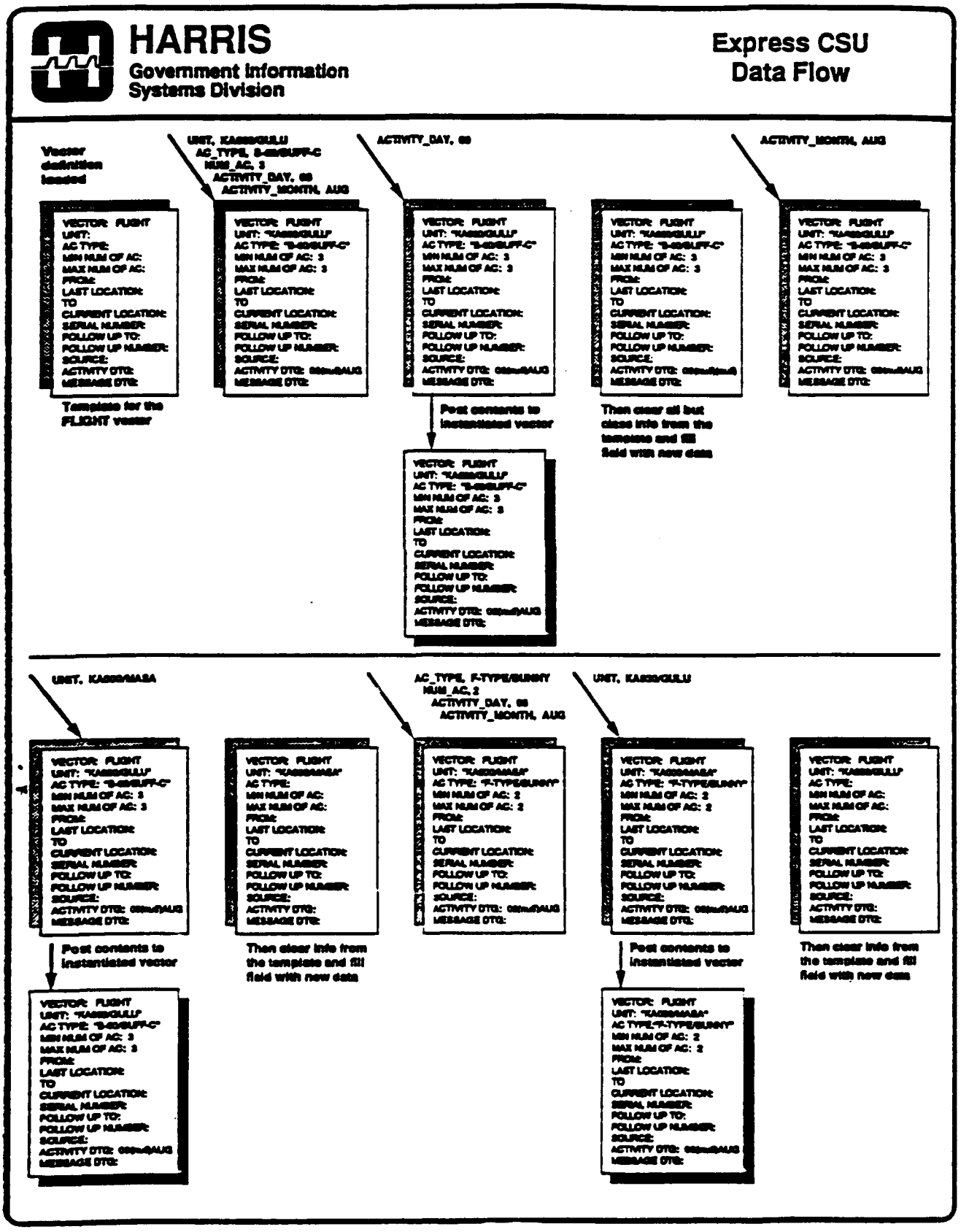
Express CSU Input & Output
UNIT, KA930/GULU
AC_TYPE, B-60/BUFF-C
NUM_AC, 3
ACTIVITY_DAY, 08
ACTIVITY_MONTH, AUG
ACTIVITY_DAY, 09
ACTIVITY_MONTH, AUG
UNIT, KA000/MASA
AC_TYPE, F-TYPE/BUNNY
NUM_AC, 2
ACTIVITY_DAY, 08
ACTIVITY_MONTH, AUG
...
FLIGHT
%UNIT
#STYLE: QUOTES
#ALIASES: UNIT
#SUBCLASS_DEST: UNIT
#INSTANCE_DEST: UNIT
#TYPE: CLASS_KEY
%AIRCRAFT TYPE
#STYLE: QUOTES
#ALIASES: AC_TYPE
#SUBCLASS_DEST: AC_TYPE
#INSTANCE_DEST: AC_TYPE
#TYPE: CLASS_KEY
%MIN NUM OF AIRCRAFT
#ALIASES: MIN_NUM_AC, NUM_AC
#SUBCLASS_DEST: MIN_NUM_AC
#INSTANCE_DEST: MIN_NUM_AC
#FILLED_ACTION: COMPARE_LESS_CLASS
...
FILTER output
Vector Definition from KB file
EXPRESS
Output Vectors
VECTOR: FLIGHT
UNIT: "KA930/GULU"
AIRCRAFT TYPE: "B-60/BUFF-C"
MIN NUM OF AIRCRAFT: 3
MAX NUM OF AIRCRAFT: 3
FROM:
LAST LOCATION:
TO
CURRENT LOCATION:
SERIAL NUMBER:
FOLLOW UP TO:
FOLLOW UP NUMBER:
SOURCE:
TIME OF ACTIVITY: 08(null)AUG
MESSAGE DTG:
VECTOR: FLIGHT
UNIT: "KA930/GULU"
AIRCRAFT TYPE: "B-60/BUFF-C"
MIN NUM OF AIRCRAFT: 3
MAX NUM OF AIRCRAFT: 3
FROM:
LAST LOCATION:
TO
CURRENT LOCATION:
SERIAL NUMBER:
FOLLOW UP TO:
FOLLOW UP NUMBER:
SOURCE:
TIME OF ACTIVITY: 09(null)AUG
MESSAGE DTG:
VECTOR: FLIGHT
UNIT: "KA000/MASA"
AIRCRAFT TYPE:"F-TYPE/BUNNY"
MIN NUM OF AIRCRAFT: 2
MAX NUM OF AIRCRAFT: 2
FROM:
LAST LOCATION:
TO
CURRENT LOCATION:
SERIAL NUMBER:
FOLLOW UP TO:
FOLLOW UP NUMBER:
SOURCE:
TIME OF ACTIVITY: 08(null)AUG
MESSAGE DTG: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Express CSU Data Flow
Vector definition loaded
UNIT, KA888/GULU
AC_TYPE, B-69/BUFF-C
NUM_AC, 3
ACTIVITY_DAY, 08
ACTIVITY_MONTH, AUG
ACTIVITY_DAY, 08
ACTIVITY_MONTH, AUG
VECTOR: FLIGHT
UNIT:
AC TYPE:
MIN NUM OF AC:
MAX NUM OF AC:
FROM:
LAST LOCATION:
TO
CURRENT LOCATION:
SERIAL NUMBER:
FOLLOW UP TO:
FOLLOW UP NUMBER:
SOURCE:
ACTIVITY DTG:
MESSAGE DTG:
Template for the FLIGHT vector
Post contents to instantiated vector
Then clear all but class info from the template and fill field with new data
UNIT, KA888/MASA
AC_TYPE, F-TYPE/BUNNY
NUM_AC, 2
ACTIVITY_DAY, 08
ACTIVITY_MONTH, AUG
UNIT, KA888/GULU
Post contents to instantiated vector
Then clear info from the template and fill field with new data
Post contents to instantiated vector
Then clear info from the template and fill field with new data

TECHNOLOGY INTERCHANGE MEETING (TIM)

Rome Laboratory
February 11–12, 1992

PROTOTYPE INTELLIGENCE PROCESSOR (PIP)

CONTRACT NO. F30602–90–C–0041

Howard Melching – Program Manager
Lisa Jesse – Lead Engineer

AGENDA

I. INTRODUCTION

II. PROGRAM MILESTONES

III. TECHNICAL APPROACH

GTE GOVERNMENT SYSTEMS / MILITARY CENTER
SYSTEMS DIRECTORATE
COLORADO SPRINGS, COLORADO

GTE Government Systems/MCSD

PROTOTYPE INTELLIGENCE PROCESSOR (PIP)

CONTRACT NUMBER: F30602-90-C-0041

CUSTOMER: ROME LABORATORY / IRDS

CONTRACT TYPE: FIRM FIXED PRICE

DURATION: 24 MONTHS (MAY '90 - MAY '92)

GTE Government Systems/MCSD

TASKS/TECHNICAL REQUIREMENTS

- DESIGN, DEVELOP, AND TEST PROTOTYPE
- EVALUATE EXISTING SYSTEMS
- PERFORM DETAILED INTELLIGENCE ANALYSIS
- DESIGN / DEVELOP ANALYSIS TOOLS
- CONDUCT KNOWLEDGE ACQUISITION SESSIONS
- ENCODE EXPERT SYSTEM
- DESIGN AND IMPLEMENT HMI
- ANALYZE MESSAGE INPUT REQUIREMENTS
- IDENTIFY CANDIDATE PATTERN RECOGNITION TECHNOLOGIES

MILESTONES

MAY 90: Contract Start.

JUN 90: Evaluation of expert systems / neural nets for C2 Analysis begun.

SEP 90: Classified USSPACECOM C2 Database loaded at RL SCIF at GTE.

DEC 90: White Paper / Task Plan for expert system functions delivered.

JAN 91: NEXPERT OBJECT software received from Neuron Data.

Initiated iterations with University of Colorado.

APR 91: Construction of unclassified models/scenarios for expert system begun.

MAY 91: PIP Review and demo with USSPACECOM and Rome Lab at GTE. Expert system approach endorsed.

JUL 91: Work initiated on classified models for expert system using USSPACECOM-supplied data.

GTE Government Systems/MCSD

MILESTONES

AUG 91: First classified iteration with USSPACECOM analysts.

SEP 91: Second classified iteration with USSPACECOM analysts.

OCT 91: Third classified iteration with USSPACECOM analysts.

NOV 91: Event prediction capability added. Expert system named Knowledge–based Prediction Analysis and Situation Assessment "K–PASA" system.

PIP demos/briefings to HQ SAC/INY, ESD/XRP, DIA, AFSPACECOM/INY, and JICPAC.

DEC 91: Expert system development completed.

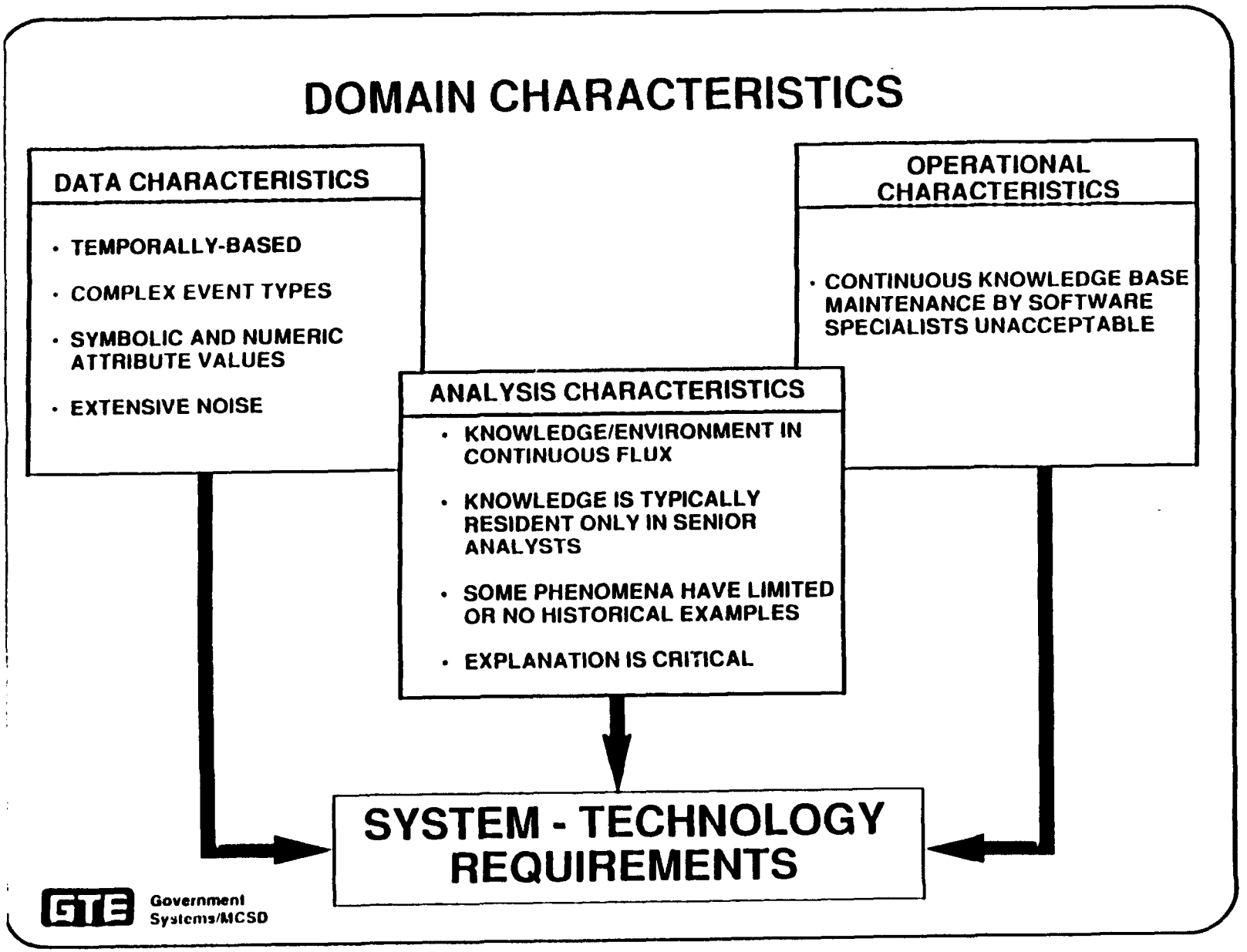
PIP installed in Cheyenne Mountain for user evaluation.

APR 92: Scheduled completion of user evaluation.

MAY 92: Contract completion.

PIP OBJECTIVES

- PROVIDE AUTOMATIC AID IN TEMPORAL ANALYSIS TASKS
  - SITUATION ASSESSMENT
  - EVENT PREDICTION
- FOREIGN COMMAND AND CONTROL DOMAIN
  - USSPACECOM - NSPJ-2F
  - OPERATIONAL ENVIRONMENT
- INVESTIGATE CANDIDATE TECHNOLOGIES
  - NEURAL NETWORKS
  - EXPERT SYSTEM KNOWLEDGE REPRESENTATIONS
- INTEGRATE INTO C2TAS TOOLSET


DOMAIN CHARACTERISTICS
DATA CHARACTERISTICS
• TEMPORALLY-BASED
• COMPLEX EVENT TYPES
• SYMBOLIC AND NUMERIC ATTRIBUTE VALUES
• EXTENSIVE NOISE
OPERATIONAL CHARACTERISTICS
• CONTINUOUS KNOWLEDGE BASE MAINTENANCE BY SOFTWARE SPECIALISTS UNACCEPTABLE
ANALYSIS CHARACTERISTICS
• KNOWLEDGE/ENVIRONMENT IN CONTINUOUS FLUX
• KNOWLEDGE IS TYPICALLY RESIDENT ONLY IN SENIOR ANALYSTS
• SOME PHENOMENA HAVE LIMITED OR NO HISTORICAL EXAMPLES
• EXPLANATION IS CRITICAL
SYSTEM - TECHNOLOGY REQUIREMENTS
GTE Government Systems/MCSD

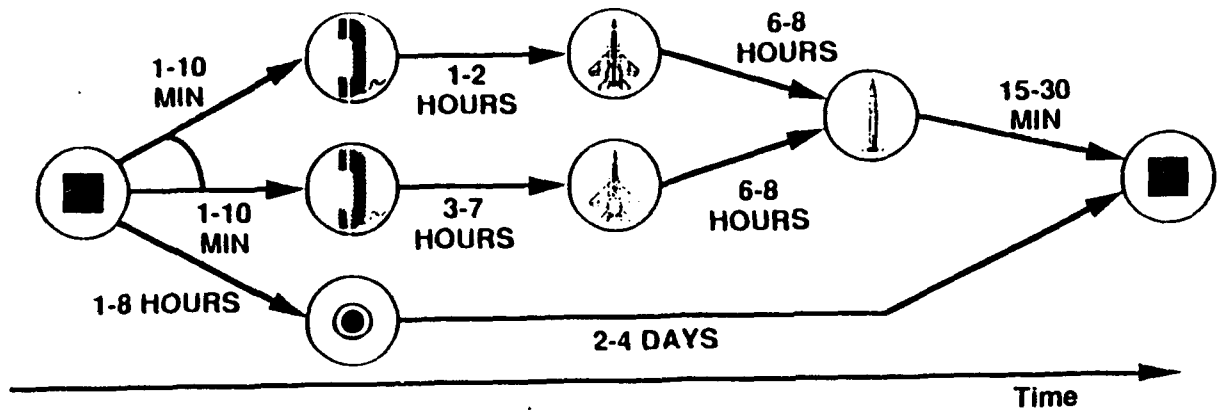
APPROACH

- TRADITIONAL EXPERT SYSTEM KNOWLEDGE REPRESENTATIONS TOO INFLEXIBLE FOR TYPICAL USERS

- NEW KNOWLEDGE REPRESENTATION - "MODELS"
  - TAILORED FOR TAS SITUATION ASSESSMENT/PREDICTION APPLICATIONS
  - DIRECTED GRAPH DESCRIBING GENERALIZED EVENT "SEQUENCES" WHICH TYPICALLY INDICATE OR ARE EXPECTED TO INDICATE A PARTICULAR PHENOMENON.
  - MIRRORS HOW THE USERS PERFORM THE ANALYSIS
  - USE WELL-DEFINED CONCEPTS FROM ATNS AND DECISION TREES
  - CREATED AND MAINTAINED BY ANALYSTS WHO ARE EXPERTS IN ANALYSIS DOMAIN BUT ARE COMPUTER NAIVE.

- CONCEPT OF DOMAIN-SPECIFIC META-KNOWLEDGE
  - PRUNE SEARCH SPACE
  - DERIVE HIGHER LEVEL CONCLUSIONS

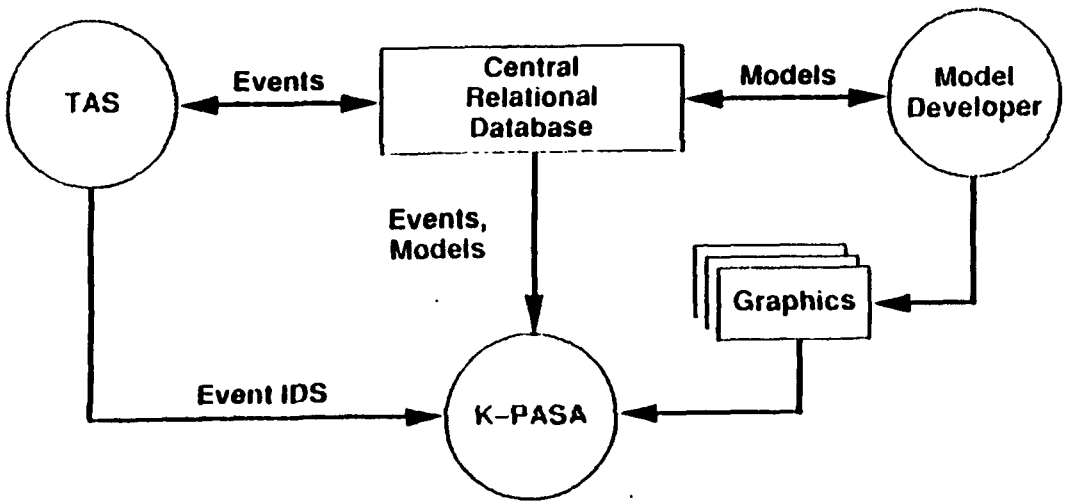
MODEL STRUCTURE



- STATES CORRESPOND TO EVENTS
  - CONSTRAINTS CAN BE PLACED ON EVENT ATTRIBUTES
  - VARIABLES ALLOW DYNAMIC CONSTRAINT SPECIFICATION
  - MULTIPLE INITIAL STATES SUPPORTED
- TRANSITIONS CORRESPOND TO THE TEMPORAL RELATIONSHIPS BETWEEN THE EVENTS
  - TIME PERIOD WHICH THE NEXT EVENT SHOULD OCCUR
  - CONFIDENCE THAT THE INPUT EVENT SEQUENCE IS REPRESENTATIVE OF THE PHENOMENA DESCRIBED BY THE MODEL AND THE VALIDITY OF THE MODEL
  - BRANCHES HAVE AND-OR SEMANTICS
  - PLANS FOR ABSOLUTE TIMING CONSTRAINTS (E.G. DAYS OF THE WEEK, HOLIDAYS, ETC..)
- NO LIMIT TO MODEL SIZE OR NUMBER OF BRANCHES

GTE Government Systems/MCSD

SYSTEM OVERVIEW



- MODELS MANIPULATED USING GRAPHICALLY-ORIENTED MAINTENANCE TOOL
- AT A HIGH LEVEL, PROCESSING PERFORMS A MATCHING BETWEEN THE EVENTS AND THE MODEL SPECIFICATIONS.
- SUPPORTS EVENT AGGREGATION AND DECOMPOSITION
- EXPLANATION USES A MIXTURE OF GRAPHICS AND LANGUAGE TEXT
- SYSTEM BUILT TO ALLOW EASY TRANSITION TO OTHER ANALYSIS DOMAINS

GTE Government Systems/MCSD

ENHANCEMENTS

- DEVELOPMENT OF REAL–TIME CAPABILITIES
- MODEL ENHANCEMENTS
  - LOOKING FOR THE ABSENCE OF EVENTS
  - ABSOLUTE TEMPORAL CONSTRAINTS
  - RECOMMENDATION STATE
- PRUNING OF SEARCH SPACE USING CBR INDEXING TECHNIQUES
  - USE OF CONTEXTUAL INFORMATION
  - POSSIBLE NEURAL NETWORK APPLICATION
- MACHINE LEARNING TECHNIQUES
  - COMBINATION OF INDUCTIVE AND EXPLANATION–BASED LEARNING SHOW PROMISE

Indications and Warning for Defense (IW4D)

February 12, 1992

Engineering and Technology Group
Technology Division

PRC

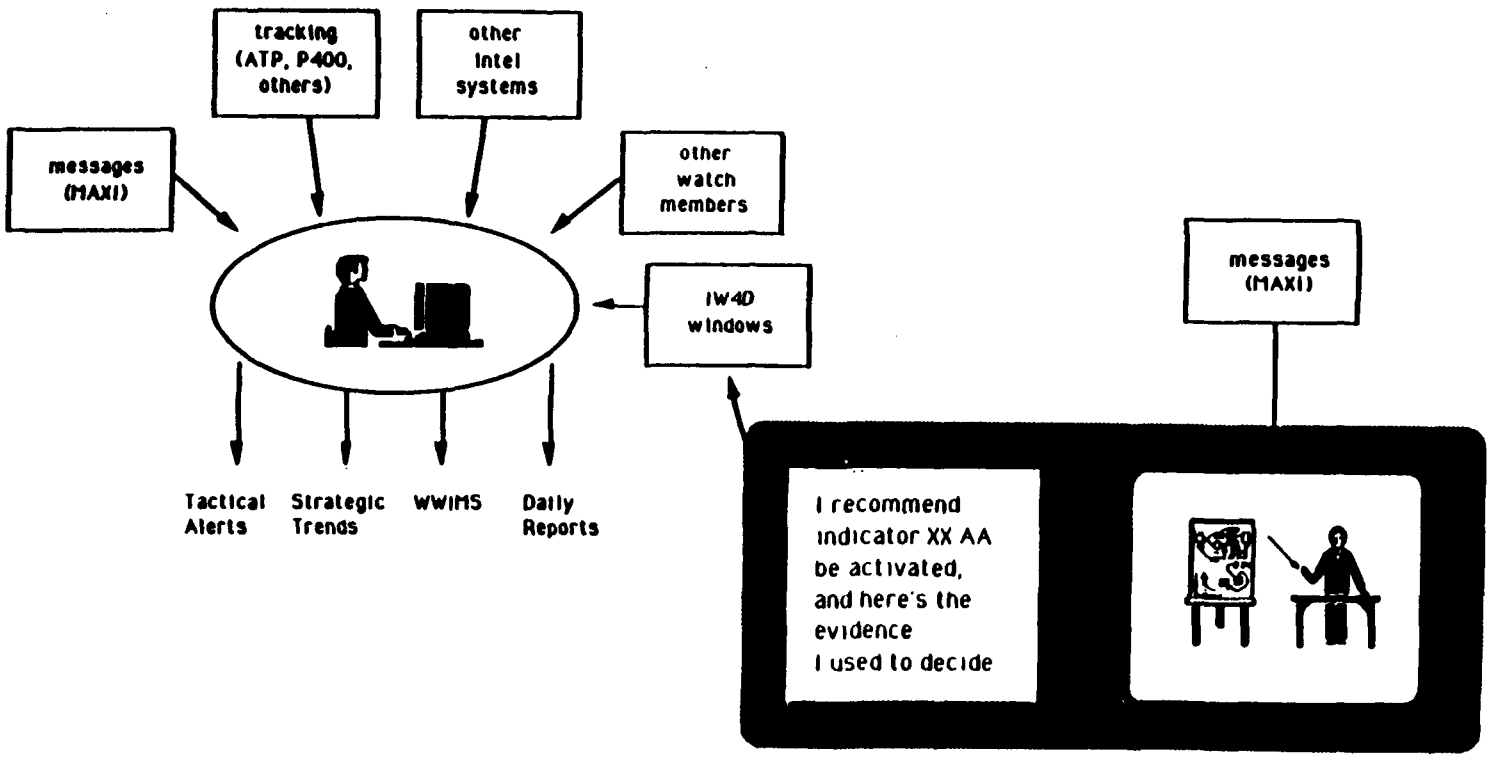
IW4D target

- construct versatile decision aids s/w architecture
- build indicator assessment expert system with intuitive, powerful interface
- provide user with lots of contextual data

IW4D specific functional objectives

- help analysts focus on indicator-related messages
- make indicator recommendations when something is happening
- stay out of the way when nothing is happening
- provide contextual data to evaluate recommendations
- keep user in control at all times

IW4D expert system positioning

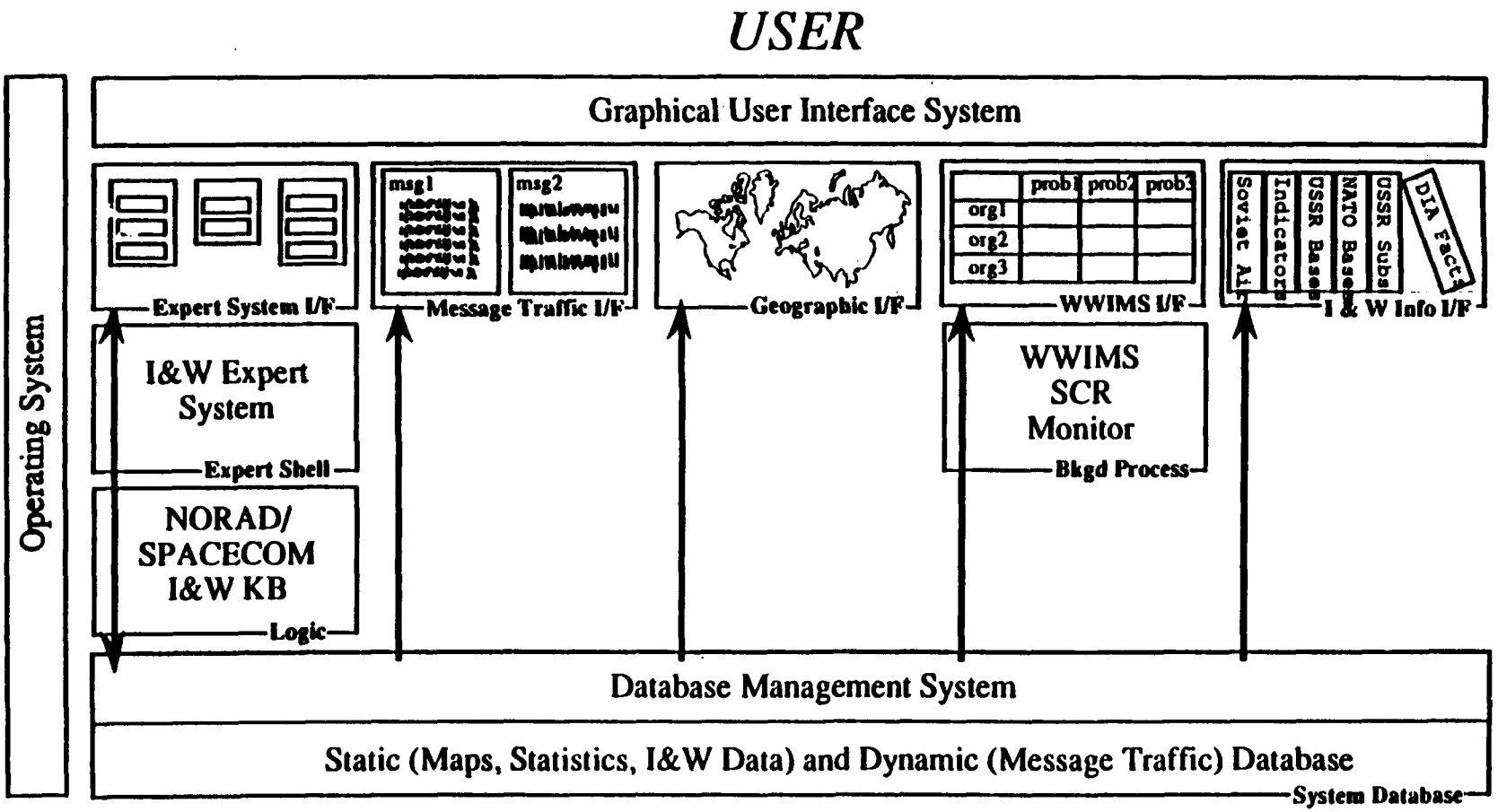


PRC

IW4D specific technical objectives

- provide generic framwork for threat assessment applications (IPC-oriented and data-driven)
- make the framework open and standards-based
- provide intuitive interface
- provide distributed multi-user capability
- keep software unclassified

IW4D through 1 Jan 91



PRC

Current phase tasking

- Convert to Motif
- Architecture improvements
- Expert system re-engineering / expansion
- New tool development

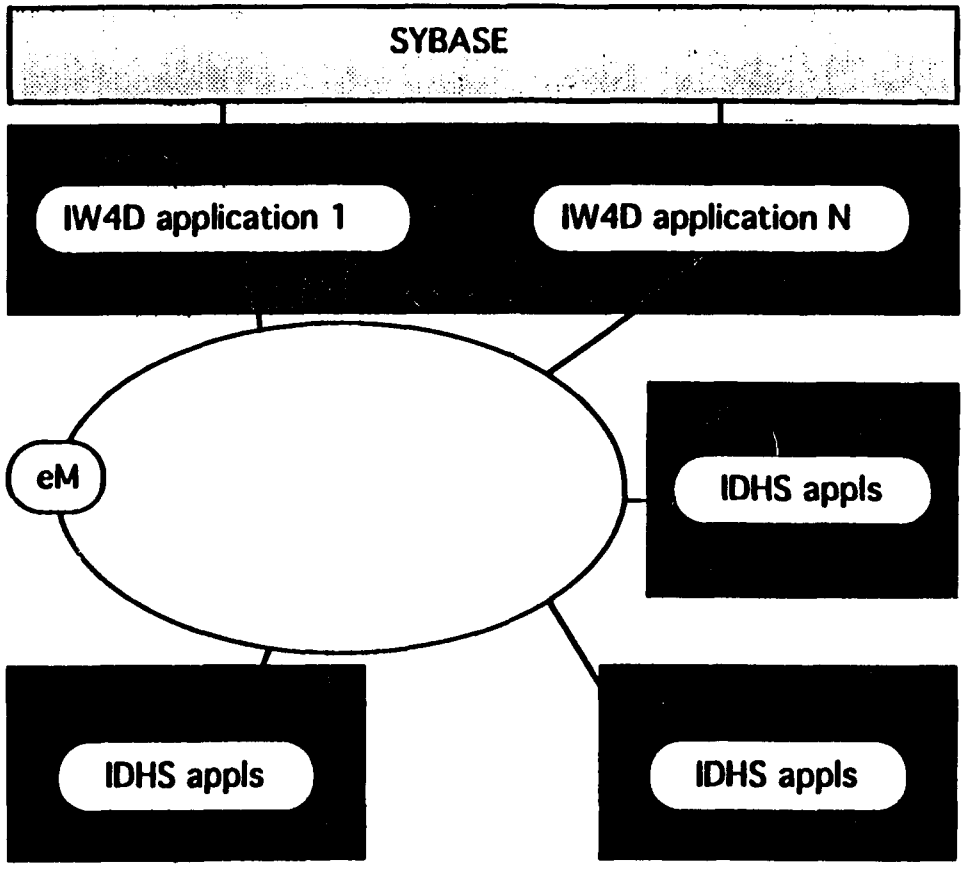
Convert to Motif

- Purchase builder tool
- Convert old applications
- Develop new applications in Motif

Architecture improvements

- Distribute system
- Relieve logical limit on event size
- Streamline databases

High-level architecture



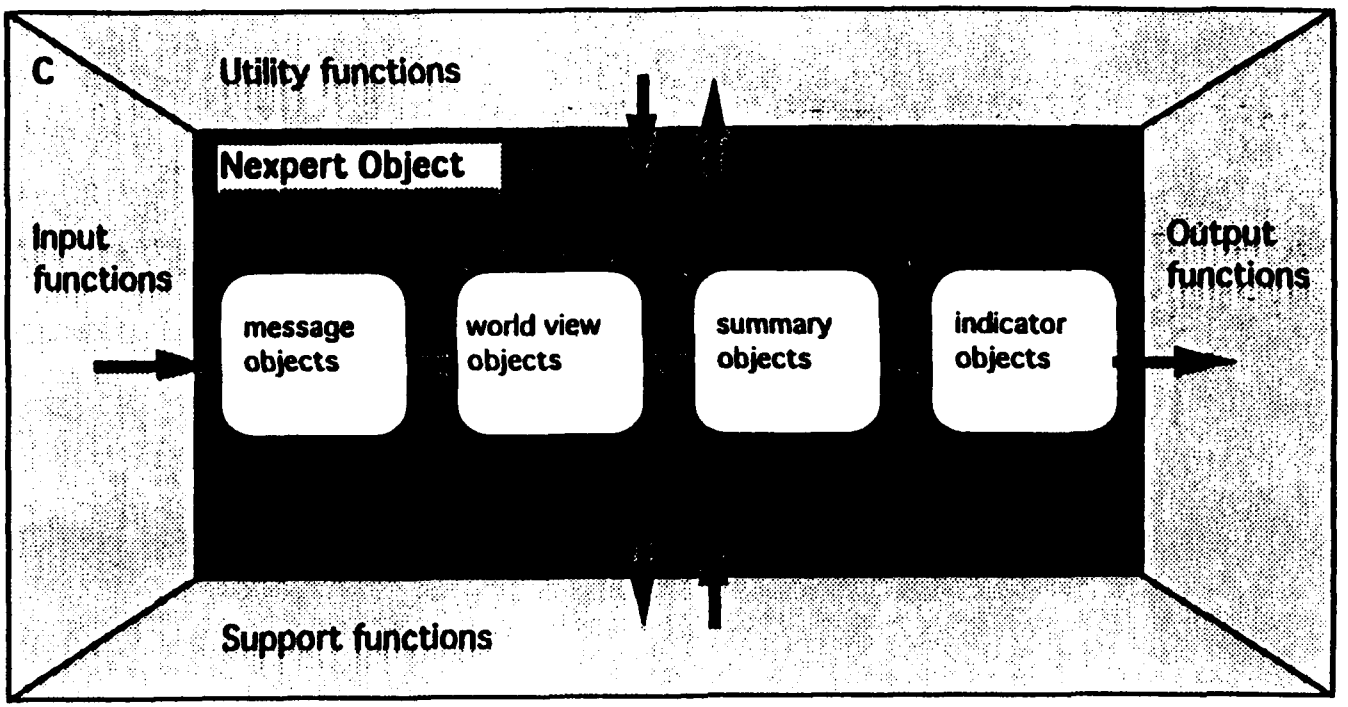
PRC

Expert system re-engineering / expansion

- 7 to 29 strategic air indicators
- Make generic as much code as possible (ease migration to new domains)
- Bulletproof
- Create hot backup scheme

PRC

Expert system architecture



PRC

New tool development

- Database entry tool
- Database maintenance tool
- Watchlog tool
- New Xpert version
- SCR text generation tool
- Printing capability
- Control panel

PRC

WARNING INFORMATION DISSEMINATION EXPERIMENT (WIDE)

February 12, 1992

Systems Research and Applications Corporation
2000 15th Street North
Arlington, Virginia 22201

SRA CORPORATION

OUTLINE

- GOALS
- CAPABILITIES
- WIDE AND IPAS 2000
- PLANNED APPROACHES

SRA CORPORATION

GOALS

- APPLY NLP AND KB TECHNIQUES TO MESSAGE DISSEMINATION
- SIMPLE BUT EFFECTIVE USER INTERACTION PARADIGM
- TESTBENCH FOR EVALUATION OF TECHNIQUES

SRA CORPORATION

CURRENT CAPABILITIES

- PART-OF-SPEECH TAGGING
- PROPER NOUN RECOGNITION
- PHRASES
- RELEVANT/IRRELEVANT MARKING
- CONCEPT STORAGE/RETRIEVAL

SRA CORPORATION

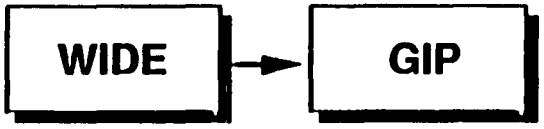
WIDE AND IPAS 2000

- FINE-GRAINED FILTER ON 1ST PASS OF MESSAGE TRAFFIC (GIP)
- MESSAGE-INTERNAL FILTER ON 2ND PASS OF A MESSAGE (NLU SHELL)

SRA CORPORATION

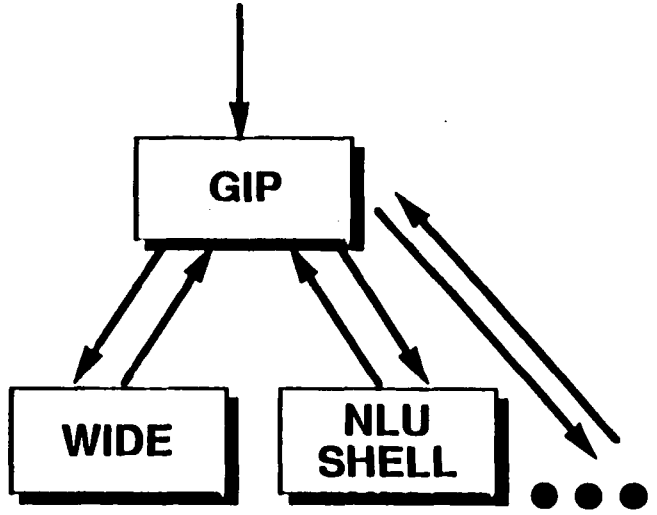
WIDE AND GIP – WHICH DOES ZONING?

PIPELINE



1. WIDE PASSES ZONED MESSAGE TO GIP
2. BOTH WIDE AND GIP ZONE EACH MESSAGE

DISPATCH

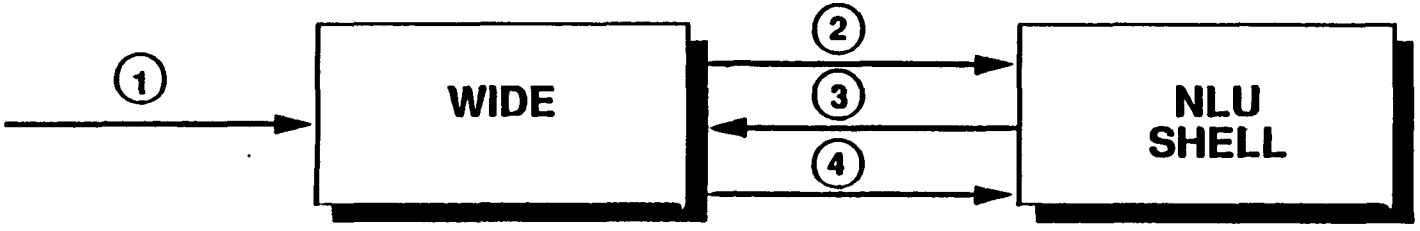


GIP PASSES ZONED MESSAGE TO WIDE, NLU SHELL, ETC.

11618-0001

SRA

MESSAGE – INTERNAL FILTERING



A POSSIBLE DATA FLOW:

1. **MESSAGE**
2. **RELEVANT SECTIONS OF MESSAGE**
3. **NEW PROFILE OF INFORMATION NEED**
4. **NEWLY RELEVANT SECTIONS OF MESSAGE**

SRA

11618-0002

FUTURE WORK

- MORE NLP TECHNIQUES
  - THESAURUS (part-of, type-of, metonomy)
  - CLUSTER ON VERB PHRASES
  - ROBUST PARSER (emphasis)

- WORLD KNOWLEDGE (alliances, conflicts, ...)
  - incremental improvement
  - no degradation when absent

SRA CORPORATION

SUMMARY

- SOME NLP/KB (I.E., NON-STATISTICAL) TECHNIQUES SHOW PROMISE
- GUI/AUTOMATED RANKING, CLUSTERING EASE USER INTERACTIONS IN STANDALONE MODE
- MODULAR CODE AND TAILORABLE FEATURES MAKE WIDE VALUABLE FOR IPAS 2000

SRA CORPORATION

Speech and Natural Language Integration for Intelligence Applications

(SPLINT)

Progress Report
February 12, 1992

Dr. Madeleine Bates

by BBN Systems and Technologies
for Rome Laboratory

Goals

- Integrate (commercial) speech recognition technology with natural language processing in an intelligence application (Year 1)
- Experiment with and evaluate different architectures for integrating Speech and NLP (Year 2)
- Evaluate human engineering aspects of speech interfaces, focusing on error detection and correction (Years 1 - 3)

Current Status

- Install hardware and system software
- Identifed application domain (unclassified spot messages)
- Developed and train a vocabulary (current size approx 430; target = 1000)
- Designed and developed prototype system:
  - The Dragon/Sun communication link
  - Initial Interface
- Started review of relevant human factors work

Sample Message

RTTCWDNS STRGZR 0001 0910800-MNSH - - STRIRS STRGIL
ZNY MMNSH
ZKZK RR OSD DE
R 010759Z APR 23 ZYH
FM USA-38
TO USA-38/CHARLIE TANGO
ZWM
UNCLASSIFIED
aaaa ZZMMENPnnaaa23089
SERIAL: SPOT 1
TAGS:

SUBJ:

U.S. FIGHTERS SIGHTED OVER DENVER (5520N 02630E) AND SAN FRANCISCO (6800N 0330E)

TEXT:

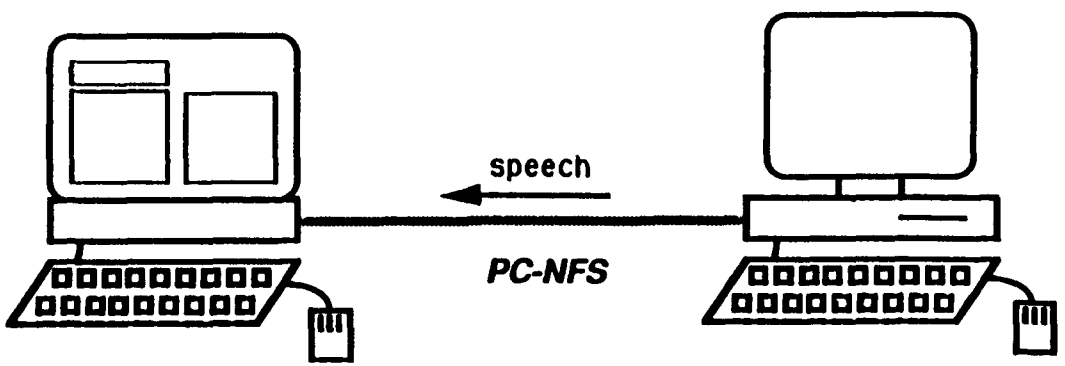
TWO F-15 (EAGLE) FIGHTERS WERE ACTIVE OVER DENVER (5520N 02630E) AND SAN FRANCISCO (6800N 0330E) ON 31 MARCH 2023.

ACCORDING TO WEST COAST TRAFFIC CONTROL, TWO F-15 EAGLES DEPARTED FROM DENVER (5520N 02630E) AT 1300Z, THEN FLEW TO SAN FRANCISCO (6800N 0330E) AT 1345Z FOR REFUELING. THE F-15S DEPARTED SAN FRANCISCO AT 1525Z, THEN LANDED AT DENVER (5520N 02630E) AT 1620Z.

The SPLINT System

Research NL System

Commercial Speech Recognition System



Sun Sparcstation (Lisp)
- NLP
- Communications software
- Interface

IBM PC clone (C)
- Dragon software
- Communications software

Approx. 400 words, speaker dependent, isolated words

Characteristics of Current SPLINT Interface

User can fill a template slot by

- typing
- speaking (initial implementation)

Words are recognized as spoken; if incorrect, an alternative can be chosen from the menu provided.

Thresholds for rejection can be set by the user.

Machine Configurations

PC is an IBM-compatible 386 machine: NEC PowerMate SX/20

Additional hardware:

- Dragon speech board and microphone
- Ethernet card
- Graphics monitor card
- Mouse

Software:

- PC-NFS (allows PC to access files over the network)
- Dragon Writer 1000 (includes DragonLab and utilities)
- Microsoft C
- Extended memory manager (for extra 1MByte)

Sun SparcStation 2

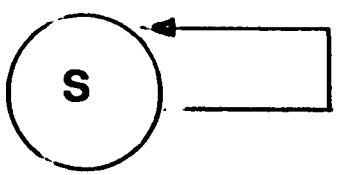
- 48 MBytes memory; 1GB external Fujitsu disk drive
- CD-ROM drive; internal disk drive
- Sun's Lucid Common Lisp (with CLOS and LispView)

Using Dragon Writer

1. **Design vocabulary and grammar,**

   Create a LAN file, compile it into LDF file with Dragon's VOCL compiler.

   Grammar is finite state, can be extremely simple:



any word

2. **Train vocabulary**

   Read each word 1 to 5 times

3. **Recognize speech**

   Isolated word, speaker dependent

Fast Partial Parser

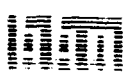
The BBN Fast Partial Parser is a derivative of the MIT Fast Parser (MITFP).

Advantages:

- produces a syntactic parse (or set of parse fragments) for virtually any input

Disadvantages:

- does not do semantics



Activities with Spot Messages

Collected a concordance from the Spot messages, to augment the FPP lexicon

Developed syntactic and semantic entries for the Spot vocabulary, and a domain model for Spot messages

Created a template structure for Spot messages

Wrote a pre-processor to read the Spot messages (parsing headers and passing text to be parsed to FPP)

Wrote a tokenizer for Spot that deals with latitude, longitude, zulu time, and other military expressions

Ran the 20 messages through PLUM (BBN's message processing system) to create templates with a recall of 46 and precision of 94

Definition of a Template for Spot Messages

Vector Type:	**the type of the db update (set fill)**
Unit:	**parent unit "/" country (set fill)**
Aircraft Type:	**type of aircraft spotted (set fill)**
Minimum Number of Aircraft:	**number**
Maximum Number of Aircraft:	**number**
Flight Path:	**a sequence of triples; each triple is a latitutde, a longitude, and a time**
Serial Number:	**message id (string fill)**
Source:	**the contents of the from field (string fill)**
Message DTG:	**the date and time of the message (string fill)**

Hand-Filled Template for Sample Message

Vector Type:	**FLT**
Unit:	**NONE/US**
Aircraft Type:	**type of aircraft spotted, e.g., F-15**
Minimum Number of Aircraft:	**2**
Maximum Number of Aircraft:	**2**
Flight Path:	**(5520N 02630E 1300Z) (6800N 03399E 1345Z) (6800N 03399E 1525Z) (5520N 026309E 1620Z)**
Serial Number:	**SPOT 1**
Source:	**USA-38**
Message DTG:	**010759Z APR 23******

Partial Domain Model

ANYTYPE (MAX-NUMBER-OF MIN-NUMBER-OF)

AIRCRAFT (HOME-BASE-OF AIRCRAFT-UNIT-OF AIRCRAFT-UNIT-DESCRIPTION-OF
AIRCRAFT-TYPE-OF)

AMOUNT (AMOUNT-UNIT-OF AMOUNT-SCALAR-OF)

ALTITUDE

ALTITUDE.MEASURE

GEOGRAPHIC-LOCATION

SEA

ORGANIZATION

MILITARY-UNIT

MOVEMENT

FLIGHT (FLIGHT-SEGMENT-OF)

INDIVIDUAL.CONCEPT

CANADA

COUNTRY

^CANADA

NATIONALITY

^CANADIAN

INTERVAL

FLIGHT-SEGMENT (SEGMENT-END SEGMENT-START)

STATE-OF-AFFAIRS

AIRCRAFT-SIGHTING (AIRCRAFT-SIGHTING-AIRCRAFT-OF AIRCRAFT-SIGHTING-DATE-OF)

^FLIGHT-SEGMENT (SEGMENT-END SEGMENT-START)

POINT-SIGHTING (POINT-SIGHTING-LOCATION-OF POINT-SIGHTING-TIME-OF)

Slot Fill Scores

SLOT	POS	ACT	COR	PAR	INC	ICR	IPA	SPU	MIS	NON	REC	PRE	OVG	FAL	
template-id	27	19	19	0	0	0	0	0	8	0	70	100	0		
vector-type	27	20	19	0	1	0	0	0	7	0	70	95	0		*
unit	27	3	2	0	1	0	0	0	24	0	7	67	0		
aircraft-type	27	10	10	0	0	0	0	0	17	0	37	100	0		
min-num	27	8	8	0	0	0	0	0	19	0	30	100	0		
max-num	21	7	7	0	0	0	0	0	14	6	33	100	0		
flight-path	77	42	36	0	5	0	0	1	36	0	47	86	2		
message-dtg	27	20	20	0	0	0	0	0	7	0	74	100	0		
MATCHED ONLY	193	127	120	0	6	0	0	1	67	4	62	94	1		
MATCHED/MISSING	260	129	121	0	7	0	0	1	132	6	46	94	1		
ALL TEMPLATES	260	129	121	0	7	0	0	1	132	6	46	94	1		
SET FILLS ONLY	27	20	19	0	1	0	0	0	7	0	70	95	0		*

PLUM-Filled Template for Spot Message

SERIAL NUMBER:	SPOT 1
VECTOR ID:	1
VECTOR TYPE:	FLT
UNIT:	-
AIRCRAFT TYPE:	"F-15"
MINIMUM NUMBER OF AIRCRAFT:	2
MAXIMUM NUMBER OF AIRCRAFT:	2
FLIGHT PATH:	"(5520N 02630E 1300Z)" "(6800N 03300E 1345Z)" "(5520N 26309E 1620Z)"
SOURCE:	"USA-38"
MESSAGE DTG:	"010759Z APR 23"

Human Factors Effort

Primary Thrust - To improve the usability of speech systems

Great Speech Recognition Isn't Good Enough

A speech system with 98% word recognition accuracy will present its user with a correction task in 1 out of every 5 sentences it processes (assuming 12 words / sentence on average)

Emphasis on Usability Analyses

time to learn

time to use

not "naturalness"

not just recognition accuracy

Reduce Task Time Devoted to Errors

Reduce the frequency of their occurrence

Design to speed their repair

Compare Alternative Methods for Error Control

time to learn

time to accomplish

frequency of correction errors

domain compatibility of modality requirements

Draw on Human Factors Research and Principles

Consider users' commission and omission errors.

Attend to feedback on system state.

Evaluate difficulty of correction tasks.

Contrast the usability of alternative I/O methods.

Review Conversational Linguistics Research

Will it emerge as relevant?

Will it provide conventions for fixing misunderstandings?

Can human-computer dialogs afford to be as vague?

Support NL & Speech Integration Decisions

What correction tasks will they present?

What I/O modes will need to be available?

- Consistent with the application domain?
- Compound errors with speech correction?

Can dialog analyses be used to predict usability?

Ongoing Activities

Perform human factors studies

Integrate NL system

Extend interface

- **Move text between windows**
- **Place recognized text directly in template**
- **Simplify choosing alternate words**

MISSION

OF

ROME LABORATORY

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