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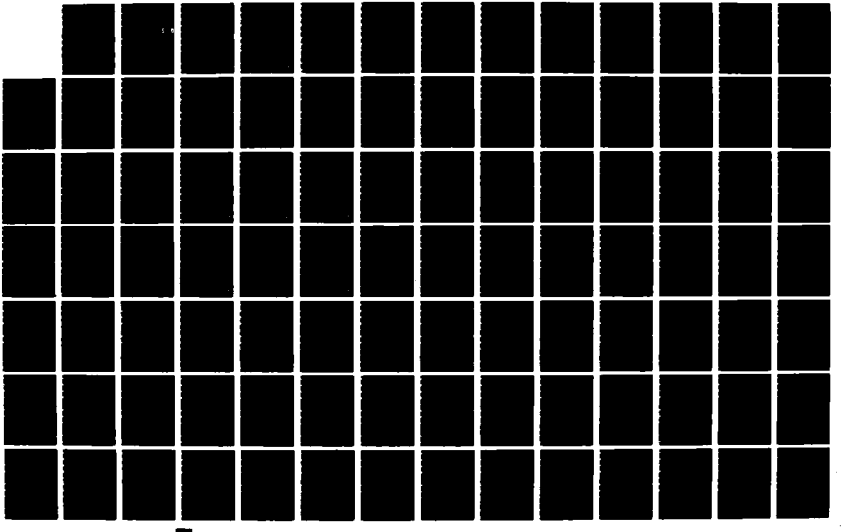

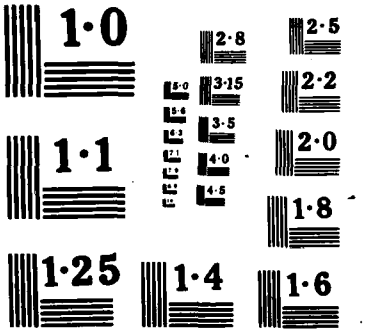
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AIR FORCE INTEGRATED READINESS MEASUREMENT SYSTEM (AFIRMS)

FUNCTIONAL DESCRIPTION

FINAL

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31 May 1985
Change 1
30 September 1985

Prepared for

United States Air Force
Readiness Assessment Group

Contract No. F49642-83-C-0022

CDRL 0023

PREFACE

Throughout this Functional Description (FD), every effort has been made to answer the central questions:

a. What is AFIRMS?
b. Where is AFIRMS now?
c. Where is AFIRMS headed?
d. How does AFIRMS get there?

The FD addresses "What is AFIRMS?" in detail. Its response to the question requires examination of many supporting questions. Where answers to these supporting questions are not clearly known, that fact is indicated. Specific implementation needs relating to these questions are identified in the Analysis Phase of the initial implementation for each major command.

The last three questions are addressed as conceptual needs in the FD. The AFIRMS Management Plan addresses these three questions in detail.

FUNCTIONAL DESCRIPTION

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SECTION 1. GENERAL

1.1 Purpose of the Functional Description. This Functional Description (FD) for the Air Force Integrated Readiness Measurement System (AFIRMS), (Contract No. F49642-83-C-0022), is written to provide:

a. The system requirements to be satisfied which will serve as a basis for mutual understanding between the user and the developer;

b. Information on performance requirements, preliminary design, and user impacts, including fixed and continuing costs; and

c. A basis for the development of system tests.

This ~~Functional Description~~ discusses AFIRMS as a fully operational system. Other documents describing AFIRMS are directed to the initial installation; that is, to a subset of the functions, as it will occur in the first major command (MAJCOM) implementations.

1.2 Project References. Accurate assessment of force readiness and sustainability has been a constant concern of Air Force commanders and their staffs. This concern has been supported by an intensified DoD-wide interest in capability. In response to this Air Force concern, the Directorate of Operations and Readiness initiated the AFIRMS Program. AFIRMS has been developed through a learning prototype and is structured to provide Air Force commanders with a complete, timely, and accurate assessment of their operational readiness and sustainability.

The Program Management Office (PMO) responsible for contract management of the AFIRMS Learning Prototype Phase (LPP) and this FD is the Data Systems Design Office (DSDO/XO), Gunter Air Force Station (AFS), Alabama; the Office of Primary Responsibility (OPR) is the United States Air Force Readiness Assessment Group (AF/X00IM). Three operational centers were used as LPP testbed sites: The Pentagon, Washington, D.C.; Headquarters United States Air Forces Europe (HQ USAFE), Ramstein Air Base (AB), Germany; and, the 52nd Tactical Fighter Wing (TFW), Spangdahlem AB, Germany.

References applicable to the history and development of the AFIRMS Program are listed below, along with references concerning documentation and programming standards.

a. AFIRMS Data Requirements Document, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

b. AFIRMS Economic Analysis, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

c. AFIRMS Evolutionary Implementation Plan, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

d. AFIRMS Functional Description, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

e. AFIRMS HQ USAF Database Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

f. AFIRMS HQ USAF Subsystem Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

g. AFIRMS HQ USAFE Database Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

h. AFIRMS HQ USAFE Subsystem Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

i. AFIRMS Product Descriptions, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

j. AFIRMS System Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

k. AFIRMS Transform and Model Descriptions, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

l. AFIRMS Wing Database Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

m. AFIRMS Wing Subsystem Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)

n. System Interface Design for the AFIRMS LPP and the Combat Fuels Management System (CFMS), SofTech, Contract No. F49642-83-C-0022, 28 February 1985. (Unclassified)

o. AFR 700-5, Information System Requirements Board, 9 November 1984. (Unclassified)

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r. Automated Data Processing (ADP) Security Policy, Procedures, and Responsibilities, AFR 205-16, 1 August 1984. (Unclassified)

s. AFR 300-4, Vol. 4, Air Force Data Dictionary, 1 May 1984. (FOUO)

t. Automated Data Systems (ADS) Documentation Standards, DoD-STD-7935.1, 24 April 1984. (Unclassified)

u. Department of Defense Dictionary of Military and Associated Terms, JCS Pub 1, 24 April 1984. (Unclassified)

v. AFR 700-1, Managing Air Force Information Systems, 2 March 1984. (Unclassified)

w. AFIRMS LPP ADP Security Plan, SofTech, Contract No. F49642-83-C-0022, 13 February 1985. (FOUO)

x. AFR 300-4, Vol. 3, Air Force Data Dictionary, 15 August 1983. (FOUO)

y. Sustainability Assessment Model (formerly CAC) Functional Description, Contract No. F33700-83-G-002005701, 8 April 1983. (Unclassified)

z. AFR 700-3, Information Systems Requirements Processing, 30 November 1984. (Unclassified)

aa. MIL-STD-480 Configuration Control-Engineering Changes, Deviations, and Waivers.

bb. MIL-STD-483 Configuration Management Practices for Systems, Equipment, Munitions, and Computer Programs.

* cc. USAF Operational Major Command Functional Area Requirement (FAR), SofTech, Contract No. F49642-82-C-0045, 15 December 1982. (Unclassified)

dd. Unit Combat Readiness Reporting (C-Ratings) (Unit Status and Identity Report (UNITREP), RCS:HAF-XOO(AR)7112(DD)), AFR 55-15, 22 November 1982. (Unclassified)

* ee. USAFE Annex to USAF FAR, SofTech, Contract No. F49642-82-C-0045, 20 August 1982. (Unclassified)

* ff. AFIRMS FAR, SofTech, Contract No. MDA-903-76-C-0396, 14 March 1980. Unclassified)

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gg. AFIRMS Data Analysis, SofTech, 15 February 1979. (Unclassified)

hh. User's View of AFIRMS, SofTech, 1 November 1978. (Unclassified)

ii. AFR 700-9, Information Systems Standards, 15 March 1985. (Unclassified)

jj. U.S. Air Force Glossary of Standardized Terms, AFM 11-1, Vol. 1, 2 January 1976. (Unclassified)

kk. AFIRMS Data Automation Requirement (DAR), Final, SofTech, Contract No. MDA-903-76-C-0396, 14 March 1980. (Unclassified)

ll. JCS Memorandum of Policy #172, 1 June 1982. (Unclassified)

mm. Military Airlift Command (MAC) AFIRMS Requirements Analysis, SofTech, Contract No. F49642-83-C-0022, 30 September 1985. (Unclassified)

nn. Analysis of Military Airlift Command (MAC) Capability Assessment Metrics, SofTech, Contract No. F49642-83-C-0022, 30 September 1985. (Unclassified)

oo. Strategic Air Command (SAC) AFIRMS Requirements Analysis, SofTech, Contract No. F49642-83-C-0022, 30 September 1985. (Unclassified)

pp. Analysis of Strategic Air Command (SAC) Capability Assessment Metrics, SofTech, Contract No. F49642-83-C-0022, 30 September 1985. (Unclassified)

1.3 Terms and Abbreviations.

1.3.1 Abbreviations and Acronyms.

AAC	-	Alaskan Air Command
AB	-	Air Base
A/C	-	Aircraft
AD	-	Air Division
ADCOM	-	Air Defense Command
ADP	-	Automated Data Processing
ADS	-	Automated Data Systems
ADTAC	-	Tactical Air Command - Air Defense
AF	-	Air Force
AFB	-	Air Force Base
AFCC	-	Air Force Communications Command
AFESC	-	Air Force Engineering and Services Center
AFIRMS	-	Air Force Integrated Readiness Measurement System
AFLC	-	Air Force Logistics Command
AFM	-	Air Force Manual
AFMPC	-	Air Force Manpower and Personnel Center
AFORMS	-	Air Force Operations Resource Management System
AFOSP	-	Air Force Office of Security Police
AFR	-	Air Force Regulation
AFRES	-	Air Force Reserve
AFS	-	Air Force Station
ALC	-	Air Logistics Center
ANG	-	Air National Guard
ARF	-	Air Reserve Forces
ARMS	-	Ammunition Reporting Management System (DO78)
ATC	-	Air Training Command
ATO	-	Air Tasking Order
ATOC	-	Allied Tactical Operations Center (NATO)
BLSS	-	Base Level Self-Sufficiency Spares
CAFMS	-	Computer Aided Force Management System
CAI	-	Computer-Aided Instruction
CAP Report	-	Capability Report

CAS	-	Combat Ammunition System
CBPO	-	Consolidated Base Personnel Office
CFMS	-	Combat Fuels Management System
CINC	-	Commander in Chief
COB	-	Collocated Operating Base
COMPES	-	Contingency Operations/Mobility Planning and Execution System
COMSEC	-	Communications Security
CONUS	-	Continental United States
CRT	-	Cathode Ray Tube
CSG	-	Combat Support Group
CSMS	-	Combat Supplies Management System
DAR	-	Data Automation Request
DBMS	-	Database Management System
DBS	-	Database Specification
DO	-	Deputy Commander for Operations
DO78	-	ARMS (Ammunition Reporting Management System)
DOC	-	Designed Operational Capability
DoD	-	Department of Defense
DRD	-	Data Requirements Document
DSDO	-	Data Systems Design Office
EIP	-	Evolutionary Implementation Plan
EMSEC	-	Emanations Security
FAR	-	Functional Area Requirement
FD	-	Functional Description
FEO	-	For Exposition Only
FMIS	-	Force Management Information System
FOCAS	-	Force Capability Assessment System
FORSCAP	-	Force Capabilities System
FRAG	-	Fragmentary Order
GLCM	-	Ground Launched Cruise Missile
HOL	-	High Order Language
HQ USAF	-	Headquarters, United States Air Force
HQ USAFE	-	Headquarters, United States Air Forces Europe
HTACC	-	Hardened Tactical Air Control Center (PACAF)

IDS	-	Interface Design Specification
IOC	-	Initial Operational Capability
IG	-	Inspector General
ICAM	-	Integrated Computer-Aided Manufacturing
IDEF-1	-	ICAM Definition Method One
IRB	-	Is Referenced By
JCS	-	Joint Chiefs of Staff
JCS MOP 172	-	Joint Chiefs of Staff Memorandum of Policy No. 172, "Military Capability Reporting," 1 June 1982
JOPES	-	Joint Operation Planning and Execution System
JOPS	-	Joint Operation Planning System
JRS	-	Joint Reporting System
LAN	-	Local Area Network
LCMS	-	Logistics Capability Measurement System
LIMFAC	-	Limiting Factor
LMC	-	Logistics Management Center
LOGFAC	-	Logistics Feasibility Analysis Capability
LOGMOD	-	Logistics Module
LPP	-	Learning Prototype Phase
MA	-	Deputy Commander for Maintenance
MAC	-	Military Airlift Command
MAJCOM	-	Major Command
MDS	-	Mission Design Series
MEI	-	Management Effectiveness Inspection
MOB	-	Main Operating Base
MTBF	-	Mean Time Between Failure
NAF	-	Numbered Air Force
NCO	-	Non-Commissioned Officer
OPlan	-	Operation Plan
OPR	-	Office of Primary Responsibility
OPSTAT	-	Operations Status Report
ORI	-	Operational Readiness Inspection
OSD	-	Office of the Secretary of Defense
OWRM	-	Other War Reserve Materiel

POL	-	Petroleum, Oil and Lubricants
POM	-	Program Objective Memorandum
POS	-	Peacetime Operating Stock
RCS	-	Reports Control Symbol
RM	-	Deputy Commander for Resources
SAC	-	Strategic Air Command
SADT	-	Structured Analysis Design Technique
SAM	-	Sustainability Assessment Module (Part of WSMIS formerly known as CAC)
SECDEF	-	Secretary of Defense
SITREP	-	Situation Report
SQ	-	Squadron
SOA	-	Separate Operating Agency
SS	-	System Specification
TAC	-	Tactical Air Command
TACC	-	Tactical Air Control Center
TACNET	-	Tactical Air Command Network
TAF	-	Tactical Air Forces
TBD	-	To Be Determined
TFS	-	*Tactical Fighter Squadron*
TFW	-	Tactical Fighter Wing
UNITREP	-	Unit Status and Identity Report
USAF	-	United States Air Force
USAFE	-	United States Air Forces Europe
WIN	-	WWMCCS Intercomputer Network
WIS	-	WWMCCS Information System
WMP	-	War Mobilization Plan
WOC	-	Wing Operations Center
WSAM	-	Weapon System Assessment Model
WSMIS	-	Weapon System Management Information System
WWMCCS	-	World Wide Military Command and Control System

1.3.2 Terms and Definitions.

Alert Sortie - A ground alert aircraft (or missile) fully generated for flight but held on the ground ready for an immediate launch on its assigned mission. (This assigns the airborne alert missions into the (flying) sortie category.)

Aircraft - A machine or device, capable of atmospheric flight, especially an airplane. Although a ballistic missile does not fit this definition, a cruise missile does fit it. However, AFIRMS will not exclude ICBMs from this definition.

Autonomous Operation - (CENTO, NATO) One mode of operation of a unit in which the unit commander assumes full responsibility for control of weapons and engagement of hostile targets. This mode may be either directed by higher authority or result from a loss of all means of communication. (JCS Pub 1)

Autonomous Operation - (DoD, IADB) In air defense, the mode of operation assumed by a unit after it has lost all communications with higher echelon. The unit commander assumes full responsibility for control of weapons and engagement of hostile targets. (JCS Pub 1)

Combat Capability - The readiness status of a unit to perform its tasked combat mission and its ability to sustain a required level of tasking for a specified number of days. The terms "Combat Capability" and "Readiness and Sustainability" are used interchangeably throughout the AFIRMS documents.

Data - (DoD) A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation or processing by humans or by automatic means. Any representation such as characters or analog quantities to which meaning is or might be assigned. (JCS Pub 1)

Decision - (CENTO, DoD, IADB, NATO) In an estimate of the situation, a clear and concise statement of the line of action intended to be followed by the commander as the one most favorable to the successful accomplishment of his mission. (JCS Pub 1)

Deployment - (CENTO, DoD, IADB, NATO) In a strategic sense, the relocation of forces to desired areas of operation. (JCS Pub 1)

Employment - The tactical usage of aircraft in a desired area of operation. (AFM 11-1)

Flying Hour(s) - One or more hours of operational flight by one aircraft.

Military Capability - The ability to achieve a specified wartime objective (win a war or battle, destroy a target set). It includes four major components: force structure, modernization, readiness, and sustainability. (JCS MOP 172, 1 June 1982)

a. Force Structure - Numbers, size, and composition of the units that comprise our defense forces, e.g., divisions, ships, airwings.

b. Modernization - Technical sophistication of forces, units, weapon systems, and equipments.

c. Readiness - The ability of forces, units, weapon systems, or equipments to deliver the outputs for which they were designed (includes the ability to deploy and employ without unacceptable delays).

d. Sustainability - The "staying power" of our forces, units, weapon systems, and equipments, often measured in numbers of days. (Note: This is the part 2. definition of sustainability, which is published alphabetically.)

Mission -

a. The task together with its purpose, thereby clearly indicating the action to be taken and the reason therefore. (JCS Pub 1)

b. The dispatching of one or more aircraft to accomplish one particular task (JCS Pub 1). An aircraft dispatched on a mission may fly one or more sorties; each sortie may be one or more hours in duration. In addition, an aircraft assigned to a mission may not fly but, instead, be on a ground alert for the mission. (Added)

Comment: The dispatching of an aircraft in b. above, typically involves at least one launch and recovery (i.e., AFIRMS Capability Assessment). In some specialized assessments, launch and/or recovery are not applicable, such as when the mission is an alert mission (no launch and recovery) or when the weapon system is a missile (no recovery). This AFIRMS usage correlates to the term "alert sortie." The type of mission is included in the sortie description, as in a "CAS alert sortie" or "SIOP alert sortie."

Shortfall - The absence of forces, equipment, personnel, materiel, or capability--identified as a plan requirement--that would adversely affect the command's ability to accomplish its mission. (Joint Deployment Agency's Joint Deployment System Procedures Manual, 1 January 82)

Sortie (air) - (CENTO, NATO) An operational flight by one aircraft. (JCS Pub 1)

Tasking - (NATO) The process of translating the allocation into orders, and passing these orders to the units involved. Each order normally contains sufficient detailed instructions to enable the executing agency to accomplish the mission successfully. (JCS Pub 1)

Ton-Mile - The movement of one short-ton (2000 lbs.) of cargo and/or passengers the distance of one nautical mile.

Turnaround (Turn) - (DoD, IADB, NATO) The length of time between arriving at a point and being ready to depart from that point. It is used in this sense for the loading, unloading, refueling and rearming, where appropriate, of vehicles, aircraft, and ships. (JCS Pub 1)

1.4 AFIRMS Synopsis.

1.4.1 Key AFIRMS Concepts. AFIRMS is an automated, tasking based, capability assessment system. As such, AFIRMS evaluates unit and force capability to perform tasked missions based on the availability of specific resources.

a. The conceptual requirements for AFIRMS are two-fold:

(1) Assessment of combat capability against specific tasking. The user can assess unit/force combat capability against any planned or ad hoc tasking, e.g., War Mobilization Plan (WMP), Operation Plan (OPlan), Fragmentary Order, Air Tasking Order (ATO), Contingency Plan, etc.

(2) Assessment of combat capability based on budget appropriations. AFIRMS provides a tool for computing long-term readiness and sustainability trends, spanning two to six fiscal years. This tool permits comparison of readiness and sustainability by fiscal year and can therefore highlight the impact of appropriation changes. Thus, changes in funding are related to changes in force readiness and sustainability. Also, senior Air Force decision makers are supported during budget deliberations and Air Force budget allocations.

b. AFIRMS implementation has two key concepts:

(1) Integrated approach to tasking based capability assessments. AFIRMS has two integrative dimensions. First, all applicable resources and their usage interactions are considered. For example, in sortie capability assessment, AFIRMS evaluates capability in terms of all four essential resource types (aircrew, aircraft, munitions, fuel), their interdependencies, and their generative components (such as spares for aircraft, training qualifications for aircrew, load crews for munitions,and hot pits for fuel). Second, other automated systems (such as the Combat Supplies Management System (CSMS), Combat Fuels Management System (CFMS), Weapon System Management Information System (WSMIS), etc.) outputs are integrated into capability assessment calculations through system interfaces between those systems and AFIRMS.

(2) Data Quality Assurance. Capability assessment is no better than the data upon which it is based. Therefore, AFIRMS emphasizes a user orientation toward quality assurance of source data. Unit and other data input level users are provided effective tools toaccomplish their daily activities and therefore develop a vested interest in AFIRMS data currency and validity. Capability assessment data can then be extracted for use by higher or parallel users with maximum confidence in its validity.

1.4.2 **AFIRMS Functions.** Four basic AFIRMS functions combine to assess readiness capability:

a. Translate Tasking. As a tasking based capability assessment system, tasking must be converted into a standard format recognized by AFIRMS. Tasking is defined in AFIRMS to the unit level and may consist of actual, hypothetical, standard, or contingency tasking. Any of these taskings can be defined within specified WMP or OPlan constraints, at the option of the user. Likewise, the tasking may be defined by the user for present, historic or future requirements.

b. Define Resources. The resource definition function of AFIRMS ensures that information about inventory status is available and accurate. Wherever possible, this data is obtained by interface with other functional systems. As with tasking, resource information can be defined for actual, hypothetical, standard, or contingency situations, either present, historic, or future.

c. Determine Ability to Perform. Determining the force's ability to perform is the essential function of AFIRMS. The tasking and resource data are processed to determine how much of the specified tasking can be accomplished with the resources available. Ability to perform is evaluated in terms of the task metric (sorties,etc.) and the cost metric (dollars) to provide readiness/sustainability and dollars to readiness assessments.

d. Aggregate, Analyze and Present Data. Aggregation, analysis and presentation ensure the proper grouping and display of data to provide useful information at the unit, major command and HQ USAF. Aggregation refers to the creation of a composite understanding of capability for several units.

1.5 AFIRMS Documentation. A set of nine types of documents describes AFIRMS. A list of these AFIRMS documents is provided below along with a short description of the particular aspects of AFIRMS which are addressed by each document.

a. Functional Description (FD). The FD provides the description of AFIRMS concepts in user terms. It is the baseline document which ties the AFIRMS documents together.

b. Economic Analysis (EA). The EA states AFIRMS estimated costs. It explains the cost factors of AFIRMS implementation alternatives and states the recommended alternative.

c. Management Plan. The Management Plan provides the top-level integrative frame of reference for the AFIRMS Program. The plan focuses on the processes which provide technical and administrative control of AFIRMS. Key annexes to the Management Plan are the Evolutionary Implementation Plan, the Configuration Management Support Plan, and the Systems Interface Support Plan.

d. System Specification. The AFIRMS System Specification adds the design requirements to the functional concepts in the FD. It divides the system into subsystems (HQ USAF, HQ USAFE (MAJCOM), and Wing (unit)) and assigns functions required within each subsystem. The system specification details the overall architecture, intersite interface gateways, processing logic flows and the communications network specifications.

e. Subsystem Specifications. There are three AFIRMS subsystem specifications: HQ USAF, HQ USAFE (MAJCOM/numbered Air Force), and the Wing (unit/squadron). Subsystem specifications detail the specific design and/or performance requirements of the system at that level. Design details cover the architecture, required functions, the functional users, intrasite interface gateways, and applicable processing logic flows.

f. Database Specifications. There are three AFIRMS database specifications: HQ USAF, HQ USAFE (MAJCOM/numbered Air Force), and Wing (unit/squadron). These specifications describe the database architecture, size, and content, as well as logical data relationships for the functions performed at each of the AFIRMS levels.

g. Data Requirements Document (DRD). The DRD identifies, categorizes, and groups the generic types of used in AFIRMS. It also defines each type of AFIRMS data element (attribute class).

h. Product Descriptions (PDs). The PDs visually portray the products which implement the AFIRMS functions as input and output tools.

i. Transform and Model Descriptions. The Transform and Model Descriptions Document defines how AFIRMS calculates the output data from the input data. Specific algorithmic calculations are provided. Logical groups of algorithms forming AFIRMS models and transforms are described.

SECTION 2. SYSTEM SUMMARY

This system summary provides a general description of the background of AFIRMS, system objectives, current relevant methods/procedures, AFIRMS methods, and their resulting implementation impacts.

First we expand on the definition of AFIRMS. AFIRMS is an automated system which:

a. Assesses and projects combat capability by realistically estimating each unit, theatre, and force's ability to perform specific taskings; basing all estimates on an integration of a variety of resources on-hand and on achievable plans for resupply.

b. Uses assessments of combat capability as a basis for decision support in the budget process, linking dollars to readiness.

Resources considered include aircraft (the number mission ready, available reparable spares, maintenance support), aircrews, munitions (whole-up rounds, components, load crews), and fuel.

The taskings considered are not limited. For example, they might be the War Mobilization Plan (WMP), ad hoc crisis plan, or a what-if plan.

The ability to perform is measured in units of measure suitable to the mission/tasking description. For example, ton-miles apply only to the airlift mission. Additionally, alert sorties apply only to those missions that generate but do not launch, and sorties and flying hours apply only to those missions that do launch and recover. On the other hand, the "mission" metric applies to all of the mission types Air Force-wide, i.e., the Tactical Air Forces (TAC, USAFE, PACAF, AAC), Strategic Air Command (SAC), and Military Air Command (MAC).

The primary reason for basing AFIRMS on the ability to perform specific tasking is to provide all levels of command with a measurement directly related to the job to be done. Integration of data is vital to this measurement.

These factors are examined in greater detail in the remainder of this document.

2.1 Background.

2.1.1 The Need. The question "are we ready?" has many dimensions. Exercises, inspections, evaluations, and other traditional techniques not only train a force, but inform the commander of the readiness of that force. The need for some measure of readiness has been recognized since the C-rating readiness measurement system was instituted in 1950. None have proven totally sufficient.

In 1976, the Air Force Chief of Staff developed Constant Readiness Tasking which tasked the Air Force to "... develop responsive means of assessing and reporting combat capability." The AFIRMS concept began with that tasking and has continued to evolve. Congress, through the FY78 Defense Authorization Act, tasked the Secretary of Defense to project the effect of appropriations on materiel readiness, i.e., "dollars to readiness." Defense Guidance since that time has directed the Services to develop methods to model the relationship of force readiness with associated manpower and dollar resources.

Readiness Assessment is needed:

a. At the Office of the Secretary of Defense (OSD) and Joint Chiefs of Staff (JCS) levels -- to respond to questions impacting national policy; to guide budget development; to assign forces; to apportion resources.

b. At HQ USAF level -- to guide budget development; to guide force assignment; to apportion and distribute resources; to respond during crisis.

c. At the MAJCOM and NAF levels -- to assist in force assignment; distribution of resources; and evaluation of tasking validity.

d. At unit level -- to direct forces; to best use resources; to indicate training needs; to accomplish the unit's tasked mission.

2.1.2 Related Efforts. Efforts to meet these needs in increasingly sophisticated ways have been underway not only in the Air Force but throughout the DoD. The realization of the need for a more meaningful expression of Air

Force capabilities led to the development of C-ratings in the mid-1950s. The C-ratings, in updated form, are in use today as part of the JCS Unit Status and Identity Report (UNITREP) System.

The AFIRMS effort and many others address one or more aspects of readiness and sustainability. These include: JCS MOP 172, Military Capability Reporting; Operational Readiness Inspections (ORIs), Management Effectiveness Inspections (MEIs); Exercises; Logistics initiatives including the Weapon System Management Information System (WSMIS), Logistics Capability Measurement System (LCMS), Ammunition Reporting Management System (ARMS) (DO78), Force Capability Assessment System (FOCAS), Logistics Feasibility Analysis Capability (LOGFAC), Air Force Operations Resource Management System (AFORMS), and JCS initiatives, especially the World Wide Military Command and Control (WWMCCS) Information System (WIS) and the Joint Operations Planning and Execution System (JOPES). Among these efforts, the AFIRMS approach is unique in the two types of integration required for AFIRMS capability assessments. These two types of integration are:

a. AFIRMS integrates key capability factors into one assessment. AFIRMS integrates a variety of factors and assesses unit capability to perform a specific task by using a common unit of measure such as sorties, flying hours, ton-miles, etc. In this way, users at all levels will be able to focus on what a unit or force is ready to do as well as the shortfalls which actually limit performance.

b. AFIRMS integrates selected data from a number of systems to prevent duplication of collection efforts. Relevant data from all other available systems is being reviewed and, where needed and feasible, used as source data for AFIRMS. This reduces redundant and contradictory data records and duplication of reporting efforts.

AFIRMS provides other unique advantages in the type of assessments provided and in the usefulness of the system to readiness analysts:

a. Ad hoc query capability.

b. Decision support via what-if capability.

c. Use in commanders judgment and potential work-arounds.

d. Identifying Limiting Factors (LIMFACS) and their respective impacts on readiness.

2.1.3 Terminology. Terms of particular importance in defining the purpose of AFIRMS include Military Capability and its components: Force Structure, Modernization, Readiness, and Sustainability (see Section 1.3.2).

As already noted, AFIRMS is designed to provide all levels of command with information about readiness and, through extensions of the readiness calculations, projections of sustainability.

Sustainability is closely related to readiness. Any system designed to answer the question "how many sorties can we fly today?" will surely be asked "how many sorties can we fly tomorrow?" ..... "oh, and the next day?" The point at which the discussion shifts from readiness to sustainability is not, and probably cannot be, delineated. As an example, the Air Force UNITREP definition of readiness includes the first 30 days of combat.

Because of the need to address dollars to readiness, and because readiness is so closely tied to sustainability, AFIRMS will consider areas of military capability beyond the narrowest definition of readiness.

2.2 Objectives. The AFIRMS Program objectives include action to be accomplished, a method for the accomplishment, and criteria to measure the accomplishment. They are defined as follows:

a. Action. Assess readiness and sustained ability to accomplish specific tasking. Use assessments to support "what-if" or "trade-off" studies such as:

   (1) Relating changes in funding to changes in force readiness and sustainability for budgetary exercises.

   (2) Assessing alternative proposals for allocation of resources or assignments of tasking.

b. Method.

   (1) Express measurement in terms closely related to taskings such as mission.

   (2) Provide alternate views for functional analysis and use of the capability assessments with additional metrics such as dollars, sorties, alert sorties, flying hours, and ton-miles. (Dollars is the obvious metric for budgetary analysis purposes. Sorties, alert sorties, and flying hours may be useful as a readiness metric to supplement the UNITREP C-rating system, while ton-miles would be pertinent to airlift planning and programming.)

   (3) Obtain reliable data from other systems or by providing incentives to human data sources in the form of products which serve day to day functions other than capability assessment.

c. Criteria. To be successful, AFIRMS must:

(1) Operate with historic, current, forecast, or hypothetical data.

(2) Function at unit, NAF, MAJCOM, and HQ USAF levels.

(3) Respond to orders such as WMP, Operation Plan (OPlan), or specific fragmentary tasking.

(4) Be useful in peacetime, crisis, or exercise.

(5) Apply to all weapon systems and missions.

2.2.1 Sub-objectives of the Functioning AFIRMS. The primary objective is composed of a number of sub-objectives:

a. To present clearly and concisely the readiness information needed by commanders and other users at all command levels in peacetime, crisis, and war (to the extent that AFIRMS is survivable).

b. To aid and expedite human calculation of the readiness of a unit to meet the tasking imposed upon it in real situations using a given set of resources.

c. To translate tasking so that it can be used in measuring ability to perform, i.e., convert tasking to aircraft, Petroleum, Oil and Lubricants (POL), munitions, crews, etc., required to accomplish that tasking.

d. To calculate force readiness and sustainability with a credibility sufficient to permit what-if exercises in support of budget deliberations and resource allocation planning.

e. To compute long-term readiness and sustainability trends, spanning two to five fiscal years, which compare readiness and sustainability by fiscal year and connect the impacts of appropriations by fiscal year.

f. To aggregate readiness and sustainability and the factors which impact readiness and sustainability over successively higher levels of command.

g. To track, recognize, report, and project trends in readiness and sustainability.

h. To take maximum advantage of data possessed by existing and developing systems dealing with assessment, logistics, personnel, etc.

i. To obtain local data elements on a timely and accurate basis, while presenting minimum inconvenience to the collector.

j. To give the data collectors some benefit of the information they provide; that is, to reward accurate and timely input with output of use to those responsible for the input.

k. To permit recalculation of historic readiness values on the basis of new or revised standards. This capacity is needed for valid comparisons between current and past levels of readiness and sustainability. To permit such calculations, periodic archiving of "raw" resource data is required.

2.3 Existing Methods and Procedures. There are many systems which, in one way or another, relate to capability. This section arbitrarily groups those systems into traditional systems, inventory systems, and rating systems. Each group is examined to the level of detail necessary to show why it does not meet the needs addressed by AFIRMS.

2.3.1 Traditional Systems. The category name "traditional" reflects physical observation, not obsolescence. ORIs, MEIs, and readiness exercises all test capability in an important and fundamental way. If, however, an answer is needed about the readiness or sustainability of a specific unit today, it is not feasible to conduct an ad hoc exercise or inspection to get that answer. Aggregating the results of such reviews to assess the readiness or sustainability of a unit or force at a given time is not feasible.

2.3.2 Inventory Systems. We use "inventory systems" in the broad sense of anything which tracks the supply of a resource on-hand at a unit. This supply information is fundamental to two kinds of functions: measuring capability and managing the supply of the resource.

Inventory systems which support the resource management functions include AFORMS which manages aircrew resources and their training requirements, and various logistics systems which manage munitions, POL, etc. Many of these inventory systems have been, or are being, automated. It would be easy to assume that these inventory systems hold the key to the function of measuring capability.

If capability consisted of the sum of our supplies of munitions, spares, personnel, training, etc., the systems supporting the management of each resource could report how much of that resource is available in total and, by summing all those totals, the capability of the Air Force could be calculated.

In practice, the integrated view of capability begins at the squadron level. Not only is capability information needed at every level of command, but the data summaries provided by the squadron level will increase the accuracy of assessments since macro calculations sometimes distort the readiness pictures. The aggregation mechanisms must prevent distortion of macro calculations. An example of this distortion occurs if one squadron short of aircrews and one squadron short of spares is counted as one squadron without shortages. Both squadrons lack the ability to perform. This understanding of ability to perform can be reached only from a bottom-to-top approach. AFIRMS will look at multiple resources, consider their interrelationships, and provide a measure of what each unit is able to do. At the MAJCOM level, wing readiness and sustainability will be rolled up and additional theatre factors added. MAJCOM theatre assessments will go to HQ USAF where other relevant factors will be merged to achieve an overall force capability picture.

2.3.3 Readiness Rating Systems. The term "readiness rating systems" refers to systems designed with the measurement of readiness as a specific objective. The UNITREP C-rating System exemplifies this type of system. Under UNITREP, each unit is required to report resource fill against four measured areas: personnel, training, equipment and supplies on-hand, and equipment readiness. In the simplest case, the percent fill of the amount of authorized resources for the unit's mission determines the C-rating (i.e., C1, C2, C3, C4) of that measured area. In practice, the ratings are more complex than in this simplest case, but follow the same concept of fully, substantially, partially, or not combat ready.

The unit's overall rating is the lowest rating of any of its four measured areas, unless, in the judgment of the commander, the overall rating is changed to reflect more accurately the readiness of the unit. The commander's subjective judgment may reflect elements such as shortages of critical spares or skills which were not highlighted by the resource fill percentages of the four measured areas. The basis of changes made by the commander are reported in plain text remarks.

Aggregation of unit readiness to higher levels is performed in each of the four measured areas and in the overall ratings. Aggregating is reported in terms of the percentage of units reporting each of the C levels and is done by weapon system, MAJCOM, and function.

Media used include punched cards and magnetic tapes. Additionally, considerable manual effort is required to derive the C1, C2, C3, and C4 ratings for each unit.

This system provides insight into readiness and is used heavily at HQ USAF. However, it is being asked to do many things for which it was not designed. Consequently, its users suffer because:

a. The system does not state what the unit is actually ready to do, e.g., number of sorties, or if it has capabilities in areas other than its primary Designed Operational Capability (DOC).

b. The system looks at the four measured areas as though they were independent rather than part of an integrated whole.

c. The system looks at unit assets only and does not consider the impact of fuel, munitions, and other combat support on the readiness of the combat unit.

d. The system depends heavily on human assimilation of the commander's plain text comments at the MAJCOM and HQ USAF level.

e. The system lacks flexibility.

f. The system has no what-if capabilities.

g. The wing, which must provide all of the information on which the system is based, receives no direct benefits from the system.

h. There is no projection capability.

i. The system is not continuous; updates are reported on an exception basis and information can be one to 30 days old.

j. Changes in capability over time cannot currently be evaluated.

k. The impact of changes in Air Force budgets cannot be forecast.

2.3.4 Existing Information Flows. Under current practice, many data flows carry information relevant to readiness through various Air Force channels. None, however, provides the explicit focused data actually required to provide all levels of command with a much needed planning and monitoring tool. The types of flow include:

a. UNITREP reports;
b. Commander in Chief (CINC) situation reports (SITREPs);
c. Functional area reports; and,
d. Inspector General (IG) inspection (ORI and MEI) reports.

Outputs from all of these sources of data are currently processed by staff personnel at MAJCOMs and HQ USAF. Figure 2-1 represents this data flow.

It is difficult to provide current, integrated readiness/capability assessments based on this mix of diverse, independent, and generally infrequent inputs. The flows of the four types of data differ. The following simplified drawings of Figures 2-2, 2-3, 2-4, and 2-5 indicate their basic structure. Note that support unit reports reach HQ USAF through several possible routes and are carried by a number of channels.

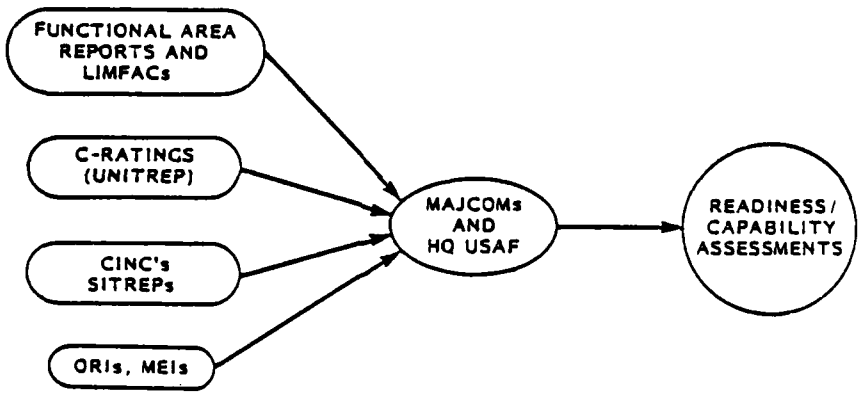


Figure 2-1. Existing Information Flow

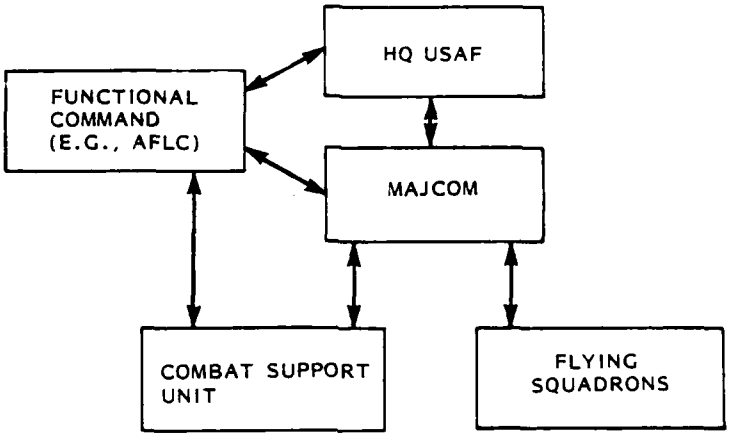


Figure 2-2. Flow of Information by Functional Areas

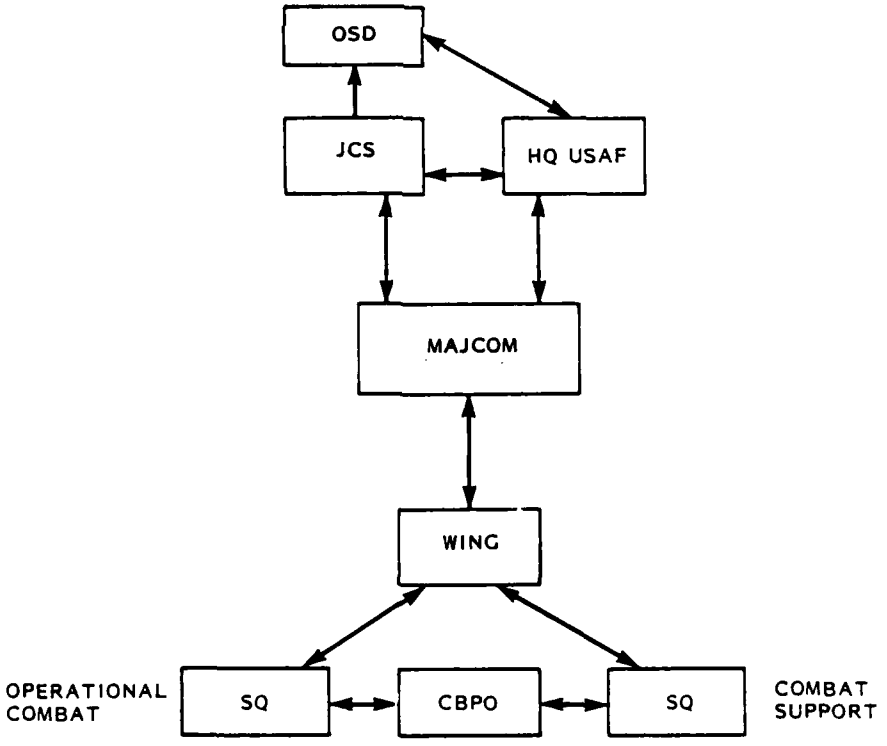


Figure 2-3. Flow of UNITREP Information

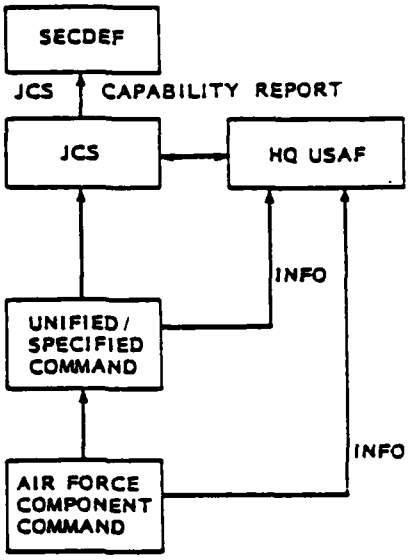


Figure 2-4. Flow of CINC SITREP Information

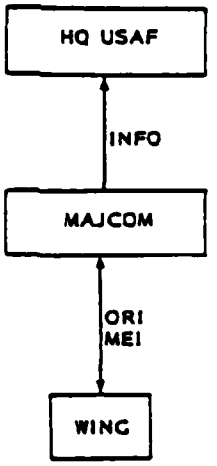


Figure 2-5. Flow of IG Inspection Information

2.4 Proposed Methods and Procedures. At the inception of AFIRMS in 1978, the "R" stood for a definition of readiness which today more closely corresponds to the 1982 JCS definition of capability. Hence, the readiness assessed by AFIRMS addresses wartime objectives as tasking, be it WMP, OPlan, or ATO. AFIRMS considers force structure with respect to numbers of aircraft, aircrews, etc., and their respective impact on readiness. Modernization is a consideration to the extent that AFIRMS will consider tasking match ups, e.g., aircraft performance factors or preferred munitions. The primary focus of AFIRMS is on the ability of forces, units, weapon systems to initiate and sustain operations against specified tasking. A detailed account of readiness assessment computations is presented in the Transform and Model Descriptions document. An operational AFIRMS readiness assessment methodology includes:

a. Incorporation of either objective or subjective evaluations.

   (1) Objective measurements against standard parameters.

   (2) Subjective measurements against parameters varied to reflect commander's judgment.

   (3) Incorporation of commander's judgment as comments to accompany either objective or subjective measures.

b. CINC's/CINC's staff judgment/policy reflected in MAJCOM inputs.

c. CSAF judgment/policy reflected in HQ USAF inputs.

d. Other systems which will feed AFIRMS readiness data and/or assessments.

e. Ability to perform what-if exercises in support of dollars to readiness assessments, force assignments, and resource transfer decisions.

f. Decision support techniques at all levels designed to provide high visual impact for the important (often exception type) data. These techniques allow the user to move between high level summarized data and detailed data within the same subject matter, as authorized for access at each echelon.

g. Capability "products" that are continuously available to decision-makers via graphic displays and hardcopy. These products are based upon the most current data.

2.4.1 Summary of Improvements. This section reviews the characteristics of the AFIRMS system, the benefits they provide, and the overall flow of the AFIRMS system.

2.4.1.1 Exploitation of Automation. The most readily observable fact of AFIRMS is that it is a highly automated system. This means that operational AFIRMS can provide:

a. Storage, updating, and retrieval of large volumes of data swiftly under the control of careful editing procedures, and in concert with other systems.

b. Data transmission for quickly reporting readiness and sustainability factors and assessments within and between command levels.

c. Swift computation using volumes of data to derive capability assessments.

d. Graphics for concise, easily understandable presentation of data which enables decision-makers to grasp complex capability issues quickly.

e. Automatic monitoring of selected database entities. If certain attributes take on values outside of predefined ranges, alarms can automatically be raised.

2.4.1.2 Current, Accurate Data. Based on the automation just described, AFIRMS uses four main approaches to ensuring the accuracy and the currency of the data. These are:

a. Provide benefits to the organizations which input data. If the unit inputs data and receives benefits from the system in peace and crisis, then the unit will be motivated to ensure that data input is current and accurate.

b. Simplify data input by using simple devices and by grouping inputs. For example, a bar code reader is a candidate device for entering a complex identification number that might be subject to error if entered via keyboard.

c. Use automated edit checks as well as checks for the reasonableness of input data against stored parametric values.

d. Obtain, edit, and incorporate data and/or assessments from other automated systems. The plan to obtain data is tailored in several aspects to the specifics of each system. These aspects include:

   (1) Relevance of available data.

   (2) Timeliness of data available at all levels.

   (3) The types of interfaces required:

      (a) Software required,

      (b) Impact on hardware platform selection,

      (c) Types of data flow, such as continuous, periodic or on-demand.

2.4.1.3 Measure by Ability to Perform. The AFIRMS wing level readiness assessment for fighter/reconnaissance units is based on the number of missions the wing is tasked to produce in a given time period. This measure is appropriate because the AFIRMS mission (e.g., sorties) is the elemental product produced by the wing/squadron. It is also the vehicle by which a wing/squadron is tasked by a higher authority. Using the mission as a unit of measurement, the wing's/squadron's ability to accomplish a task can be assessed in terms common to the wing/squadron task, e.g., a fighter wing can produce 130 (in the mission-sortie sense) sorties out of the 144 sorties it was tasked to fly (the mission is decomposed into the component sorties and flying hours for the assessment computations).

The use of a measurement scale based on missions provides the commander a decision support tool which:

a. Assesses the unit capability to accomplish the tasking within the response time with available resources.

b. Lists limiting resources.

c. Provides assessment of the impact of proposed work-arounds on readiness and sustainability.

The primary metric (mission) provides a common Air Force-wide vehicle to aggregate the diverse units, weapon systems, and missions/tasks into a total major command and Air Force capability assessment. The use of alternate metrics (sorties, alert sorties, flying hours, dollars, ton-miles), each of which can be derived from the primary metric (mission), provides the functional staffs with the functional views necessary for analyzing unit capability measurements.

The tasking used in these assessments may be either standard (such as the WMP-5) or ad hoc (either real or hypothetical). In either event it will be necessary to use an AFIRMS function called "Translate Tasking" to represent the tasking in a format and content which is standard to AFIRMS. For standard taskings, this content will be established once, and stored in the AFIRMS database for repeated reference. For ad hoc taskings, Air Force personnel will be prompted by AFIRMS to supply any information which AFIRMS itself cannot supply by table look-ups.

A wing/squadron's readiness to perform a task will be established on the basis of current (and/or projected) resources without reference to pre-established resource authorization and will not be limited to a unit's primary mission.

2.4.1.4 What-If Exercises. Because AFIRMS is an automated system, and because of the unit used to measure readiness and sustainability, it is possible to test hypothetical situations to determine the effect on capability.

a. What if a portion of a munition is reallocated from MAJCOM A to MAJCOM B?

b. What if some extra funds are spent on training in FY88?

c. What if this task is reassigned from Wing XXX to Wing YYY?

The capability for what-if exercises is provided through data replication in the AFIRMS database in the following way. When an AFIRMS user decides to perform a what-if exercise, he is assigned his own copy of the part of the standard AFIRMS database that:

a. He has access to, based upon his logon privileges.
b. Relate to his area of inquiry.
c. Will change under the conditions specified.

When first made available to the user, this copy of the database is identical in content and value to the relevant portions of the current AFIRMS database. The determination as to whether the copy is virtual, physical, or a combination will be made based on sizing considerations related to the what-if exercise. The Database Specifications contain database sizing information and fully specify assumptions related to instances of databases to be supported operationally.

As the what-if exercise progresses, the user will make changes to the what-if database allowing him to address the kinds of hypothetical questions identified above. Following the conclusion of a what-if exercise session, the user has the option of storing his what-if database for subsequent use (normally off-line) or simply deleting it. The number of what-if exercises in process at one time is defined by the System and Subsystem Specifications.

2.4.1.5 Reporting. In each of the areas just discussed, the result is a report to a user. To gain the full benefits of AFIRMS, users must be provided with information displays which:

a. Present what a unit or force is ready to accomplish under a given tasking.

b. Highlights out-of-limits (critical) conditions.

c. Identify the shortfalls limiting unit or force readiness and sustainability.

d. Provide a connection from dollars-in, to readiness-out for budget exercises.

e. Make trade-off/resource reallocations, or what-ifs before initiating actions to correct shortfalls.

f. Relate outputs in which the user can ask for more details about an area of concern ("Munitions are a problem; show me each kind of munition separately."), or ask for summary data ("POL is a problem; show me its status alongside those of munitions, aircraft, and aircrew.").

g. Exploit the advantages of color to present complex readiness concepts in a graphic form which focuses user attention on the central issues.

h. Complement and/or assist with UNITREP calculations.

2.4.1.6 Proposed AFIRMS Information Flow. The proposed AFIRMS information flow is shown in Figure 2-6. Squadrons are linked hierarchically to a wing, which is linked hierarchically to a MAJCOM, which in turn is linked to HQ USAF. Numbered Air Forces (NAFs) are being considered MAJCOM-like operation centers in the AFIRMS architecture. The role of the NAFs, and consequently the AFIRMS functionality required at the NAFs, will vary by MAJCOM depending on the MAJCOM use/tasking of the NAFs. Adjuncts to the hierarchy are the MAJCOM interfaces, which, through WWMCCS, share information among themselves (AFIRMS may require sharing of information at the MAJCOM level). The flows identified are hierarchical in nature. Since AFIRMS is a decision support system and not a command and control system, information flow is primarily bottom to top, although top to bottom requests for data are not excluded. Specific information flow requirements vary by MAJCOM as specified in the System and Subsystem specifications.

The right hand side of Figure 2-6 identifies some of the systems with which AFIRMS may interface at HQ USAF, MAJCOM, and wing levels. The extent of the interface, i.e., physical hookup, exchange of diskettes, exchange of tapes, etc., is yet to be determined.

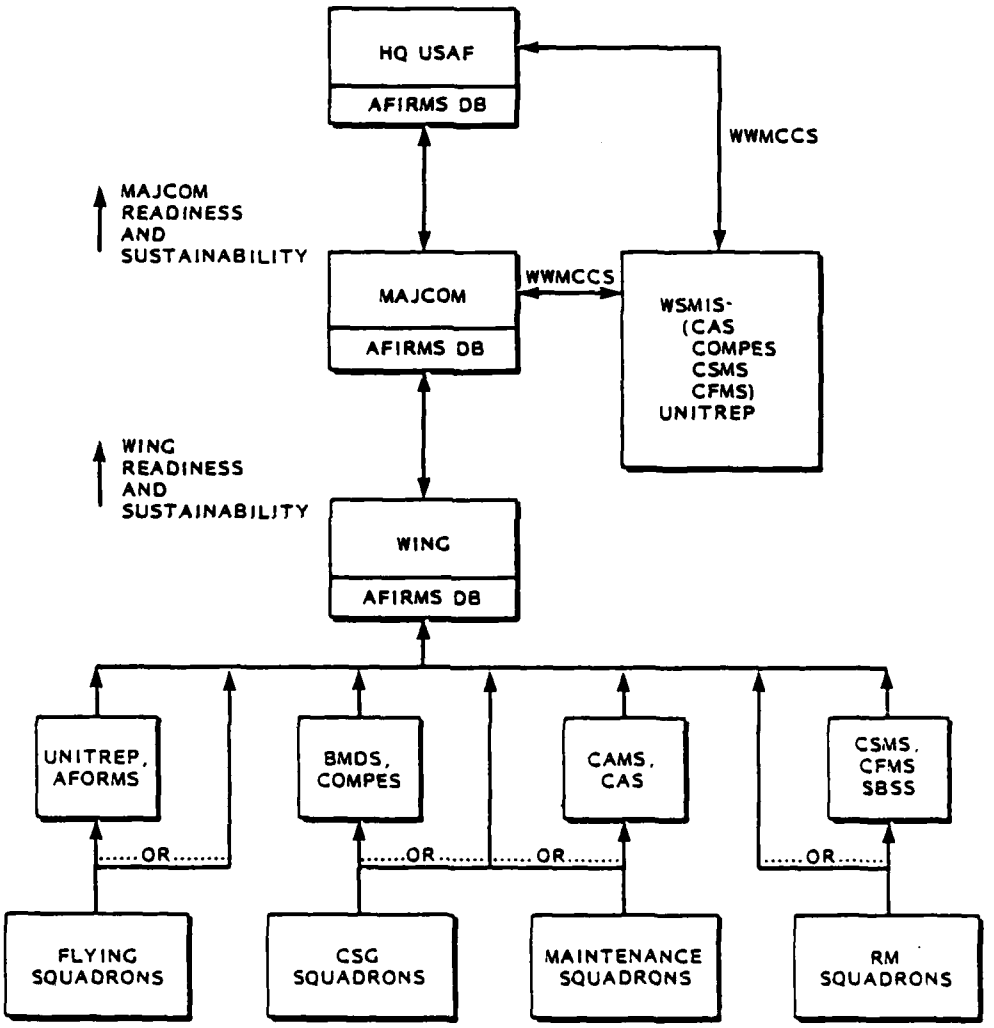


Figure 2-6. AFIRMS Information Flow

The squadrons currently supply data to a number of systems (or will supply data when the system becomes operational, e.g., Combat Ammunition System (CAS)), as is shown by the connection from the squadrons to these systems. Another view of the AFIRMS information flow appears in Section 2.4.3.2.

2.4.2 Summary of Impacts. This section examines three types of impacts which AFIRMS is expected to have. The impacts examined are discussed in terms of three questions:

a. Does the use of AFIRMS imply any changes in organization or manning?

b. Does the use of AFIRMS imply any changes in how things are done, by whom they are done, how often they are done, or when they are done? How do people interface with the computer?

c. What user efforts are required to prepare for and permit deployment of operational AFIRMS; what training, what advance data storage, what testing, what parallel operation?

2.4.2.1 User Organizational Impacts. No changes in organizational structure are anticipated at wing/base, MAJCOM, or HQ USAF, however, addition of some Automated Data Processing (ADP) personnel is anticipated. Refer to the AFIRMS Economic Analysis for estimates of ADP personnel requirements. AFIRMS terminals will be operated by operations people. Essentially, the people who use AFIRMS will be performing the same functions they historically performed without the assistance of AFIRMS. With AFIRMS, they can do their job faster, better, and more comprehensively, using more current data.

2.4.2.2 User Operational Impacts. There are many operational impacts, most of which involve a transition from manual to automated procedures or a more integrated perception of readiness problems. Given that, there are a few specific impacts that can be anticipated at this time.

a. Perhaps the biggest impact is the way that readiness information is used. Some examples are listed below.

At Present (UNITREP C Ratings)	Using AFIRMS
Measures each combat support unit individually.	Assesses unit and force readiness to accomplish a specific tasking and expresses it in an output such as sorties.
	Integrates effects of all combat support units in assessing the readiness of the combat unit in sorties.
Cannot tie readiness reporting to budget.	Provides dollars to readiness information.

At Present (UNITREP C Ratings)	Using AFIRMS
Uses the arbitrary readiness measures of fully, substantially, marginally, and non-combat ready.	Provides the wing commander with a current, usable quantitative measure of the wing's readiness to perform a given tasking.
Ties readiness measurement to the squadron DOC.	Assesses capability to perform taskings which need not be related to the DOC (e.g., ATOs or taskings created for what-if queries). Routine assessments will be based on fixed taskings such as WMP-5.
Reports readiness as changes occur or monthly.	Provides readiness measures which can be recomputed daily and are aggregated for use at HQ USAF within hours, subject only to delays in obtaining commander assessments.
Reports as-is readiness measures up the chain of command. No projection ability.	Allows what-if queries, projections into the future, and comparisons to the past.

b. A major impact is the change in the way data is recorded in the wing's flying squadrons and maintenance organizations. Most of the data needed for AFIRMS is already captured but a substantial amount is not captured on automated equipment. For example, in USAFE the integrated computation of a wing's capability for an ATO (called a flying schedule) is recorded on grease boards and paper. The status of an aircraft and aircrew changes throughout the day and they are also recorded on grease boards in the flying squadrons, the Wing Operations Center (WOC) and the maintenance Job Control Center. When that information is recorded on Cathode Ray Tube (CRT) terminals instead of grease boards, many data collection problems can be solved.

c. Given the above impact, the units need manual backup methods in case of system failures in peace, exercise or crisis. Since AFIRMS utilizes standard formats, these backup problems should be minimal. Avoidance of this possibility is desirable. Methods to limit degradation of performance and ways of providing a minimal subset of AFIRMS functions via other systems must also be specified.

d. Other user activity needed for operational AFIRMS is the requirement for additional duties for unit security officers/Non-Commissioned Officers (NCOs) to encode the communications encryption equipment needed wherever there are terminals with access to classified databases. In addition, those unit locations requiring such terminals and not meeting Air Force security requirements, will need to upgrade their facilities.

e. There is a need to maintain parametric data at each site. This is necessary to reflect judgement and because each wing and MAJCOM is different (aircraft mission, design, series (MDS) and mission).

2.4.2.3 User Development Impacts. All the impacts of developing an AFIRMS are not known at this time, however, the following impact can be anticipated. User effort required in the operational AFIRMS requires training to use the system. Approximately one week of training, including hands-on time, is expected for the initial system installation. As users change due to Permanent Change of Station (PCS) moves and/or duty changes, a computer-aided instruction (CAI) program provides a new user with the initial ability to use the system. New software releases, clear written documentation, and hardware changes accompany each update to the CAI program. A feature of the AFIRMS CAI program provides training that deals specifically with changes made to the system since the previous release. This makes it possible for an operator to avoid the duplication of reviewing material with which he is already familiar. Training courses, including CAI, are developed either by the Air Force (Air Training Command (ATC)), by the AFIRMS contractor, or by a support contractor.

2.4.3 AFIRMS Functions. The AFIRMS system consists of functions at three levels: Applications (User) Functions; Basic AFIRMS Functions; and, Support Functions. This section lists the functions at all three levels, but focuses on the Basic AFIRMS Functions in order to illustrate the flow of AFIRMS data in a functional sense. All of these functions must be performed. AFIRMS system attribute requirements are for: data fidelity, reliability, survivability, expandability, affordability, user friendliness, and uniqueness of source for each type of data.

a. Applications (User) Functions. The user's needs are directly based on measurement of readiness or sustainability. Enumerations at this level vary by:

   (1) Whether readiness or sustainability is considered

   (2) Whether the evaluations relate to the past, present, or future

   (3) Whether real or what-if conditions apply

   (4) The type of question in the case of what-if queries.

   These functions relate directly to the "action" level of Section 2.2.

b. Basic AFIRMS Functions. The building block functions which are specific to AFIRMS and which are used (in different forms) to construct and to provide a common framework for understanding and accomplishing the Applications (User) Functions. These functions are the focus of this discussion.

   These functions relate directly to the "method" level of Section 2.2. There are several secondary, or auxiliary, services which are not essential to the basic mission of AFIRMS but are supplied to the user in order to facilitate these primary functions. These functions, while secondary, are essential to the success of AFIRMS since they promote timely and accurate data. They also provide an avenue by which users at all levels can remain continuously familiar with, and accustomed to using, AFIRMS. Discussion of this is deferred.

c. Support Functions. The standard building block functions such as graphics or data management which might occur in any system and which, together with specially written subfunctions, are used to provide the Basic AFIRMS Functions.

2.4.3.1 Listing of Basic AFIRMS Functions. The Basic AFIRMS Functions are:

a. Translate Tasking

b. Define Resources

c. Determine Ability to Perform

d. Aggregate, Analyze and Present Data

2.4.3.2 Flow of Information Among AFIRMS Functions. The underlying flow of information among AFIRMS functions is best understood in terms of the four Basic AFIRMS Functions. The primary flow among those four functions, as shown in Figure 2-7, is consistent regardless of the Applications (User) Functions being supported. Note that this flow cuts across the interechelon flow depicted in Figure 2-6. That is, a wing site and a MAJCOM site may cooperate in executing any one of the four Basic AFIRMS Functions. For example, to fully "Define Resources," the system must examine the balances available at the HQ USAF, MAJCOM, wing, and squadron levels.

The central Basic AFIRMS function is "Determine Ability to Perform." Basically, the measurement of ability to perform is carried out by establishing a draft plan for meeting the tasking. The plan recognizes the limits imposed by shortfalls in the resources available and, thereby, both establishes the extent to which the tasking can be performed, and identifies the resources which limit performance.

The function "Determine Ability to Perform" is initiated by requests generated by users or regularly scheduled capability assessment needs. Its data is provided by two of the other functions: "Translate Tasking" -- a storer and formatter of taskings -- which provides the tasking for the measurement; and "Define Resources" -- an inventory system with look-ahead and look-back capabilities -- which establishes the resources available to carry out the tasking. The resources and the tasking considered may be real or what-if and past, present, or future.

A final function, "Aggregate, Analyze, and Present Data," aggregates the data, examines trends, and groups the data for presentation.

The two preparatory functions, therefore, may occur in diverse forms. For all Application (User) Functions, however, the same pattern occurs. This consists of establishing a tasking and a set of resource availabilities, and determining the ability to meet the tasking given the resources.

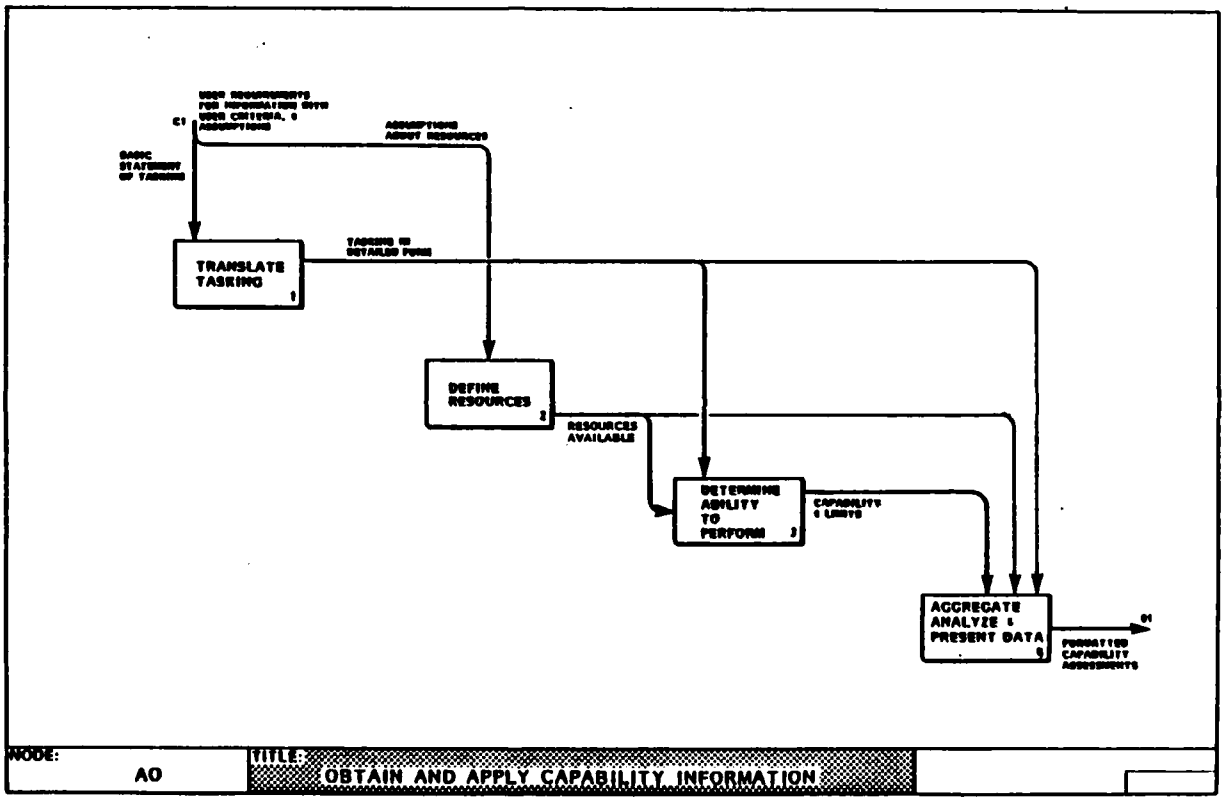


Figure 2-7. Basic AFIRMS Functions Information Flow

Table 2-1

SUMMARY OF INPUTS AND OUTPUTS BY FUNCTION

FUNCTION	MAJOR SOURCES OF INPUTS	MAJOR USERS OF OUTPUT
"Translate Tasking"	Users at all levels inputting real or "what-if" tasks either standard (e.g., WMP) or ad hoc.	"Determine Ability to Perform" plus secondary function outputs to inform users of status.
"Define Resources"	Personnel or automated systems responsible for inventory status and for resupply plans at all levels.	"Determine Ability to Perform" plus secondary function outputs to inform users of status.
"Determine Ability to Perform"	"Translate Tasking" and "Define Resources"	"Aggregate, Analyze, and Present Data" plus secondary function outputs to inform users of status.
"Aggregate, Analyze, and Present Data"	The other three modules.	Users at all levels who are interested in AFIRMS as a source of capability assessments and of analyses based thereon -- see Section 2.2 (a).

2.5 **Assumptions and Constraints.** The design of the AFIRMS system will be based on the assumptions and constraints listed here.

a. Assumptions. AFIRMS requirements and characteristics are satisfied by sharing hardware, support software, and communications with other ADP systems, wherever existing and planned facilities appropriately meet AFIRMS requirements.

(1) Communications.

(a) All intersite traffic is carried by communications links provided by the Air Force.

(b) Secure communications are provided by those links.

(c) Communications links may be land line, microwave, or satellite.

(d) Capacity requirements vary by MAJCOM and are specified in the System and Subsystem Specifications.

(2) ADP Physical Environment. Worst case environmental conditions provide the limiting conditions for ADP physical environment operating conditions.

(a) Area and ambient conditions at the Spangdahlem WOC are typical of worst case situations for AFIRMS sites worldwide, except those of deployed squadrons. These worst case conditions for AFIRMS, as represented by USAFE Main Operating Bases (MOBs) and Forward Operating Locations (FOLs) are:

1 Space:

a Ceiling height will be at least 8 feet.

b There will be no raised flooring.

c The access route to the equipment locations will usually be normal doorways.

d Lateral space will be limited in the operations centers of the various functional areas, i.e., WOC, Maintenance Operations Center (MOC)/Job Control, Munitions Control.

2 Power:

a Power may be 220 or 240 volts, 50 or 60 Hz.

b There will be frequent power interruptions on the base, requiring dependable, if not dedicated, power for AFIRMS.

3 Air Conditioning:

a The overall facility ambient temperature is maintained between 60 and 90 degrees F. However, the circulation of the air will often be restricted and the local temperature (immediate to the equipment) in an individual room may reach 100 degrees F.

b Relative humidity will be between 20 and 80 percent.

c No special dust, static electricity control, or chilled water facilities are available.

(b) The worst conditions to be encountered for AFIRMS at satellite operating bases and other deployment locations are not known in detail, but will be determined during the Analysis Phase of AFIRMS initial implementations. There are, however, some assumptions:

1 Space:

a Ceiling height will be at least 8 feet.

b There will be no raised flooring.

2 Power (usually provided by generator):

a Power is 220 or 240 volts, 50 or 60 Hz.

b There are frequent power interruptions.

c There is usually no backup power.

3 Air Conditioning:

a Air conditioning is not normally available at many satellite locations.

b Any air conditioning provided will be uncontrolled and equivalent to the air conditioning restrictions previously described.

c No special dust, static electricity control, or chilled water facilities are available.

(3) Existing Systems. Use of existing systems to host AFIRMS is desired. Such use will substantially reduce the overall cost of AFIRMS, help to minimize data system redundancies, and increase the utilization of the existing systems. However, no assumptions are made concerning whether or not existing systems can be used by AFIRMS. The feasibility of such use must be determined on a case by case basis, depending on the availability, capability, and capacity of target systems. The Segment Implementation Plans for each MAJCOM must identify target systems which are to be the subject of detailed analysis during the Analysis Phase of the initial block implementations. Specifically, this analysis covers the hardware, software, and database management availability at each site installation within the MAJCOM. Such availability is then evaluated against AFIRMS requirements.

b. Constraints.

(1) AFIRMS is subject to the Privacy Act and security requirements. The levels are documented in the Data Requirements Document (DRD).

(2) While AFIRMS can simplify and expedite the tracking of data, it cannot eliminate real world limits on the various methods in use today:

(a) Records of on-hand amounts maintained from reports of uses and receipts are inaccurate once the inevitable human error (transposition, misplaced decimal, etc.) has occurred.

(b) Measurements of actual levels (as with fuels) cannot be more current than the most recent reading.

(c) Complete recounts of stocks can be accurate, but (because of cost) tend to be infrequent.

These are not problems introduced by AFIRMS; they are problems with which AFIRMS must deal.

(3) The status of various hardware and software systems which may impact AFIRMS, as interfaces or hosts, changes within the phased approach to AFIRMS implementation. This means that development plans must include alternate interface components for AFIRMS. The elements must be designed so that one will be appropriate for an initial environment while another can be substituted to deal with a revised environment. The alternate elements must connect to a solid basic framework built on clear definitions of how capability is to be assessed, and how the command levels cooperate with each other to make full use of the assessments. The AFIRMS Management Plan, Volume 3 (System Interface Program), coordinates the evolving interface requirements.

(4) The environment and the requirements for AFIRMS will differ from MAJCOM to MAJCOM, and (to a lesser extent) from wing to wing. Again, a solid basic framework with flexible options is mandatory. The AFIRMS Management Plan, Volume 2 (Configuration Management Program), coordinates these differing requirements.

SECTION 3. DETAILED CHARACTERISTICS

This section discusses the detailed characteristics of AFIRMS. Sections are included that address performance, functional breakdown, inputs and outputs, database characteristics, failure contingencies, and security.

3.1 Specific Performance Requirements. AFIRMS performance requirements can be examined from three perspectives:

a. AFIRMS ability to adapt (flexibility). AFIRMS must provide a skeleton structure that matches the specific requirements of HQ USAF, each MAJCOM, and each wing to an AFIRMS site with compatible hardware/software capability. Additionally, it has the capability to grow; i.e., add/change system focus as time passes.

(1) An AFIRMS site is a complement of hardware (computers, black/white and color CRTs/cameras/hardcopy devices, communications/crypto, and data storage devices) and software (operating system, Database Management System (DBMS) data entry, models, menu selection, etc.).

(2) Sites (different echelons and different locations, same echelons) are constructed from modular hardware and software components. The modular software is written in a host independent high order language for transportability among different hardware configurations.

(3) This hardware/software building block approach, coupled with transportable software, assures that operational AFIRMS expansion in the future can follow a systematic pattern with an optimum amount of standardization among sites.

(4) Ease of developing new functions, i.e., if it is desired that information contained within the database be viewed in a "new way," it must be straightforward to provide the new data view.

(5) Ability for users with the appropriate password privileges to directly interrogate/update the AFIRMS database in accordance with prescribed access and security authorizations.

(6) Availability of standard utilities that allow the user to chart data entered from a keyboard or extracted from the AFIRMS database rapidly. This concept allows the user to process selected data through models that are part of an AFIRMS runtime library.

(7) Ability to interface an AFIRMS site to other Air Force systems after the AFIRMS site has been designed and installed. The central idea is that the AFIRMS information flows are sufficiently defined so as to ensure that new interfaces blend naturally into the existing system.

b. AFIRMS ability to meet the functional needs of the Air Force. AFIRMS ensures that the many users at each echelon are able to obtain the information that they require within the time frame in which they require it.

AFIRMS, because it consists of a collection of sites, provides a spectrum of functional performance quality that may be available at a given installation, depending upon current communication network status and the operational status of the interfaced systems.

The AFIRMS LPP established the value of the following services in relation to the readiness assessment function and value of payback to users.

(1) Manually enter/retrieve data into/from a database, using one or more of the device types listed below, in order of preference.

(a) CRT Keyboard

(b) Special Function Keyboard

(c) CRT Joystick Cursor

(d) Digitizer Pad (no proven requirement)

(e) Track ball or mouse type cursor control (no proven requirement)

(2) Automatically or semi-automatically enter/read data into/from a database using a magnetic medium such as tape, disk, or diskette.

(3) Generate selected CRT color and black/white displays that provide graphic capability-related data, human engineered for maximum information transfer to the user. User interaction with the AFIRMS system for these displays is through a guided menu and command language system. Display options range widely in scope, from simple displays of aircrew personnel charts, to sortie generation from ATOs, to historical/projected resource use (fuel, munitions, spare parts, etc.), over time. Displays are matched to sites in consonance with the site's specific requirements.

(4) Permit the user to ask what-if questions, i.e., how do changes in the values of user-selected database entities impact a particular product. This allows a user to perform his own sensitivity and trade-off analyses. User input interaction with the system is through a data entry device identified in (1); output is through displays, as defined in (3).

(5) Query his own database in accordance with access control and security mechanisms.

c. AFIRMS perception by the user (the individual working at an AFIRMS terminal). AFIRMS must be a "friendly" tool that is engineered to minimize user fear, fatigue, frustration, and the likelihood of user error.

AFIRMS is an information processing system that is user intensive, that is, in general, users enter data through a data capture device and users request capability status onto an output display. Thus, it is clear that much attention is given to providing effective and meaningful interactions between users and AFIRMS. The requirements are stated as follows:

(a) AFIRMS interactive CRT terminal response time to user requests is minimized. Response times will vary depending on the complexity of the queries and the types of processes involved with the query. For planning purposes, the following response times are used for a query limited to the local site:

1 Complex Query - 11 seconds or greater.
2 Medium Query - 4 seconds to 10 seconds.
3 Simple Query - 1 seconds to 3 seconds.

The terms complex, medium, and simple do not have precise definitions at this time. Specific definitions are determined in the Analysis Phase of each segment implementation block in accordance with the MAJCOM-specific requirements and their interactions with HQ USAF.

(b) The bulk of AFIRMS data entry is made through standardized forms that are presented on a CRT display. The user enters (types) data into selected, predefined fields within these forms just as if he were doing the job with paper and pencil. Each field is predefined in terms of its length, type of characters admissible, etc. The intent is to simplify data entry and make it less error prone.

(c) CRT data entry forms and AFIRMS products are human engineered to minimize eye fatigue while rapidly conveying the intent of the screen. Color choices, placement and size of figures, plot type(s), etc., play a role in AFIRMS product design that is as important as the information content itself.

(d) AFIRMS offers many choices to the user. Once these choices are mastered, it is necessary that the user can "get on to his job" rapidly. Therefore, AFIRMS has menus that lead a novice to the task he wishes to perform and a command language that allows the seasoned user to enter a single command which gives him immediate access to the task that he wishes to perform.

(e) Since AFIRMS databases store data at several classification levels, AFIRMS works through authorization codes to permit user access to the database(s) and displays. Menus and commands identified in (d) are tailored to authorization codes, thereby limiting the apparent extent of the system capabilities to users with limited privileges. It should be noted that TEMPEST, COMSEC, physical security, procedural controls, and software access techniques, are part of the AFIRMS Security Plan.

3.1.1 Accuracy and Validity. There are two categories of accuracy and validity that must be addressed. The first is related to electronic manipulation/storage/transmission of data in the AFIRMS system. The second is related to the interface between the user and the AFIRMS system.

a. Electronic Manipulation/Storage/Transmission.

(1) The nature of the models/displays created with AFIRMS are based primarily on integers (numbers of people, aircraft, sorties, etc.) and on near integers -- one or two decimals at most for supplies which are not simply counted (e.g., liquids). No displayed result need have precision of more than 6 digits. The required precision of intermediate variables is based on the end products to which they lead. When significant digits exceed 6 figures, a scaling factor with rounding is applied to limit the significant digits.

(2) Parity checks and/or cyclic redundancy codes ensure that the data actually used internal to the AFIRMS sites has an error probability well below minimum requirements as set forth in the System Specification.

b. User Interfaces to AFIRMS. The user interfaces of interest here are those interfaces that introduce new information into AFIRMS. The concern is that this information, which is destined to enter a database, be valid. Valid here means that:

(1) The individual entering the information is authorized to do so (i.e., only fuels shop personnel may be authorized to update fuels information, using fuels data forms).

(2) The information is as "error free as is possible." This suggests that input data must, in general, be entered through well engineered forms that prompt the user and check field contents. The forms must provide for easy identification and correction of errors and omissions.

3.1.2 Timing. The discussion of the AFIRMS user environment in the preceding material dealt with system response time as perceived by the user. This user response time, however, is only a limited topic in the general area of timing, which deals also with the following items:

a. Frequency of database updates, which are addressed in the System and Subsystem specifications.

b. Frequency of model runs, the question of whether the model should be run every time a piece of data that serves as input to the model is changed, whether the model should be run at fixed intervals, or whether the model should be run each time displays created from data within the databases and/or queries to the database require results provided by the model.

c. Data redundancy in distributed databases. This may be required to speed response time to queries and to ensure that the loss of an AFIRMS functional area with data critical to another AFIRMS functional area is backed up so that the surviving functional area can operate autonomously, or at least provide some functionality for degraded operations.

3.2 Functional Area System Functions. The AFIRMS system consists of functions at three levels: Applications (User) Functions; Basic AFIRMS Functions (including Secondary Functions); and, Support Functions. This section graphically illustrates the way in which functions at one level are dependent on, and use, the functions at other levels. Each function is then discussed briefly as an independent element. Finally, several overall requirements which apply to any AFIRMS function are addressed.

Figure 3-1 illustrates the three levels and portrays the relationships among these functions. The upward arrows indicate that the lower level functions support those above them. Only some of the supports are shown. In fact, any lower level function may support any function in the level above. Some intralevel support exists, although to examine it would add needless complexity to this discussion.

3.2.1 Applications (User) Functions. These are the functions of AFIRMS in terms which might be used by the user, that is, terms which might appear in a menu system defining the results to be provided. A limited subset of these functions is planned for in the initial operational AFIRMS in each MAJCOM. (See the Evolutionary Implementation Plan). The Applications (User) Functions are defined as follows:

a. Measure (and aggregate) readiness vs. standard tasking. This function is generally comparable to the regular measurement of readiness performed today by the UNITREP system. The measurement, however, rather than being based on counts of some of the resources held by the unit, will be based on the ability of the unit to execute the standard tasking.

b. Measure (and aggregate) sustainability vs. standard tasking. This function is an extension of the measurement of readiness. That is, once the ability to perform one day's tasking is completed, the resources available for the second day are computed and the ability of the unit to perform the second day's tasking is computed. This cycle is repeated until the capability of the unit for the complete sustainability period has been measured.

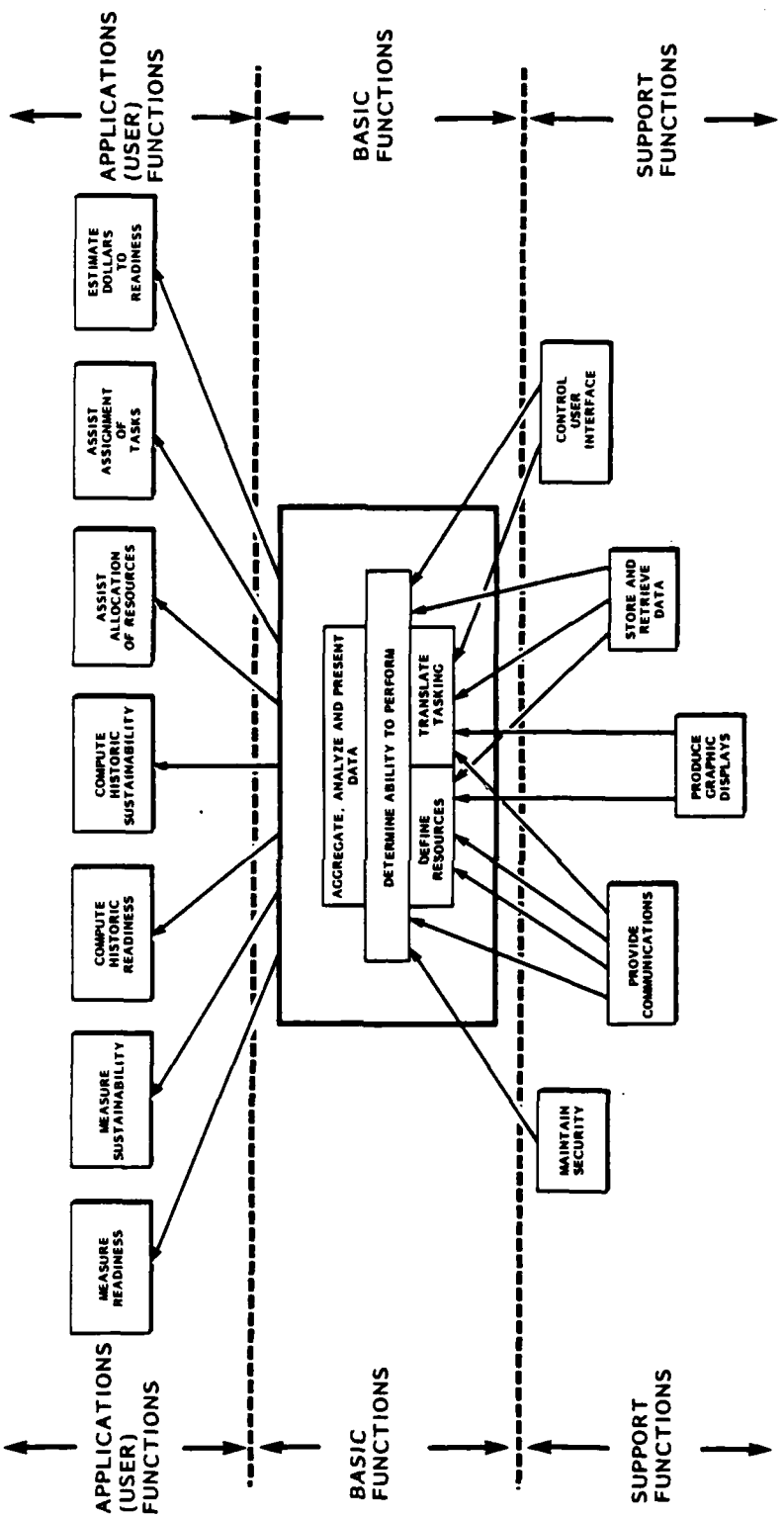


Figure 3-1 AFIRMS System Functions and Their Relationships

c. Measure (and aggregate) readiness vs. one-time tasking. This function is also an extension of the measurement of readiness. However, the tasking against which performance is to be measured will not be a standard tasking stored in the system, but a real or speculative tasking which is usually either real-time or related to a current situation. The tasking involved may be one which is not fully detailed.

d. Measure (and aggregate) sustainability vs. one-time tasking. This function is identical to the function on measuring readiness against one-time tasking which was just discussed, except for a difference in the time period involved.

e. Measure (and aggregate) readiness or sustainability vs revised standards, and/or revised standard tasking using historic data. This function addresses the need to compare present capability to past capabilities even though the standards of measurement used today differ from those used in the past. This function cannot be performed under current practices since, today, the raw data is converted to C-ratings which do not provide a basis for recomputing readiness under revised standards. To meet this need, AFIRMS provides for a procedure to capture snapshots of unit data on a preprogrammed, periodic basis. The data, which is normally held off-line, is available for recomputation from the ground up of readiness or sustainability against revised taskings or standards. Factors added to the evaluation procedure at any time in the future which were not considered prior to that time, are either assumed to be equal to some arbitrary value or this kind of comparison is not practical.

f. Assist in allocation of resources (physical or fiscal) -- forecast results of trial or final allocations. In the simplest case, AFIRMS is able to accept an input showing a proposed allocation of one or more resources and provide evaluations of the resultant changes in readiness or sustainability.

g. Assist in task assignment -- forecast results of trial or final assignments. This function is directly analogous to the function of assisting in resource allocation. A user input tasking assignment is evaluated or an internal search is made for a proposed tasking assignment which is presented to the user for his evaluation, acceptance, rejection, change or replacement before proceeding with the other option.

h. Assist in out-year budget plans (dollars to readiness) -- forecast results of trial or final allocations based on standard or user supplied assumptions. This is the congressionally mandated question of dollars in, readiness out. It can be related to the two preceding functions (which dealt with taskings and resources) in that, again, the user postulates a condition and AFIRMS is asked to evaluate the result. Since the congress has posed the question in terms of a change in an out-year budget, two evaluations must be made; one with the change, and one before the change. AFIRMS may participate in setting some of the many assumptions on which such an evaluation must rest.

3.2.2 Basic AFIRMS Functions. For any of the Applications (or User) Functions to be met, AFIRMS performs four characteristic functions. The central function is "Determine Ability to Perform." Two of the other functions prepare for "Determine Ability to Perform." The other function deals with trends, aggregation and reporting.

All four functions include various subfunctions, any of which may be used when the Basic AFIRMS Function is being used as a building block for a specific Applications (User) Function. These four functions are characteristic of the AFIRMS tasking based readiness measurement approach. Future evolution of AFIRMS is likely to lead to modifications of subfunctions within these major functions. For example, the degree to which AFIRMS gathers data on current resources from other systems could change significantly. At any one time, different AFIRMS at the same echelon may be operating in different ways in this regard. The basic role of the four functions, however, is likely to remain constant.

a. Translate Tasking can be a relatively simple function or it can be quite complex. The tasking may be current and known or part of a what-if exercise. In either case, anything which contributes to knowing the tasking to be used in the evaluation is part of "Translate Tasking."

   Simplicity arises when the tasking to be used is a standard which is stored in the system in the correct format. This assumes considerable work done in advance to develop the standard from a starting point such as, the WMP which does not provide details required by AFIRMS when it performs "Determine Ability to Perform."

   Complexity arises if a new tasking lacks the details required for the standard format. This occurs when the tasking is not a standard tasking stored in the system, but a real or speculative tasking which is usually either real-time or related to a current situation. Such taskings are not always fully detailed. In such cases "Translate Tasking" provides the prompts to help the users (possibly at more than one level) to add the needed detail. Possibly, some of the prompts will be based on resource availability or other factors.

   The reference to details here and in earlier discussions should not be misinterpreted. The details may include major decisions. This detailing deals with dividing the tasking over units and with selections of weapon systems and munitions.

   AFIRMS has a defined set of displays that allow users to enter and translate tasking requests efficiently and also allows users to view resulting schedules.

b. Define Resources, like "Translate Tasking," can be a relatively simple function or it can be quite complex. The resources may be current and known, or part of a what-if exercise. Whichever is true, anything which contributes to knowing the resources to be used in the evaluation is part of "Define Resources."

   Simplicity arises when the resources to be used are those currently on-hand at the unit. Complexity arises if the resources are those:

   (1) Which existed sometime in the past.

   (2) Which result from a reallocation of resources.

   (3) Which result from a change in the Air Force budget in the out-years.

AFIRMS captures data through manual entry, computer-to-computer direct communications, and storage media that can be physically transported between computers. It also creates data elements through internal computation (for example, a model creates a readiness assessment based on resources and tasking). AFIRMS also distinguishes between real inventoried items (actuals) and planned allocated items, and can provide an assessment of unit readiness if the wing had it's authorized resources.

One aspect of defining resources is important in the dollars to readiness arena. When complex decisions must be made, it is valuable to have the ability to examine alternatives and make trade-offs rapidly, with the intent of maximizing readiness on a fixed budget (ceiling number of dollars). Such a trade-off might deal with the relationship between the number of weapons of various types assigned to a wing as a function of the number and types of aircraft at that wing. The AFIRMS system, at the MAJCOM and HQ USAF sites, will provide the user with these capabilities.

c. Determine Ability to Perform is the least variable of the three Basic AFIRMS Functions. It includes: the generation of mission sorties and alert sorties, the adjustment of the result to account for discrepancies between automatic and human sortie generation, and the calculation of resources consumed. Given current and forecast environmental factors, AFIRMS transforms WMPs, ATOs, OPlans, and what-if exercises into measurable tasking, computes current readiness to perform the task, projects readiness into the future, calculates resources consumed in performing the task, and provides a time phased model of task accomplishment

d. Aggregate, Analyze and Present Data deals with the task of properly grouping data from various wings to provide meaningful, useful information at MAJCOM and HQ USAF levels. It also develops trend and variability data to facilitate exception type reporting on unusual developments in day-to-day data. Aggregation refers to the creation of a composite understanding of the readiness and sustainability of a number of units. Thus, a MAJCOM with many reporting wings, each with its own deficiencies and meritorious qualities, must assess the readiness (and sustainability) of all units taken as a whole.

e. Secondary AFIRMS Functions. These functions are necessary, but not sufficient to AFIRMS. For example, if AFIRMS were to obtain all of its resource data from other systems, the secondary function relating to resource status would remain with those other systems. So those services, and the others discussed in this section, may be part of AFIRMS as such, only temporarily. It is for this reason that, although these services play a vital role in AFIRMS as it is now constituted, they are referred to here as Secondary AFIRMS Functions.

The associated Secondary Functions and the Basic Functions to which they relate are:

(1) Display resource inventories and status (used in "Define Resources"). In order to encourage prompt and accurate input of resource data, AFIRMS provides graphic displays of unit resource status. Since these displays provide daily, visible uses for the data input to AFIRMS, regular and reliable input is encouraged.

(2) Report reduction of resources past thresholds (used in "Define Resources"). As another method of ensuring careful maintenance of resource data, AFIRMS provides warnings when user specified resources fall below established limits. This, like the resource displays, heightens interest on the part of wing personnel in maintaining a high level of timeliness and accuracy in the resource data provided.

(3) Display tasking (used in "Translate Tasking" and "Determine Ability to Perform"). The concept of making the AFIRMS resource data visible is comparable to the role of tasking displays provided by AFIRMS. These displays provide the same advantages of immediate update, base-wide consistency, and visual clarity found in the resource screens.

(4) Display information on an evolving schedule (used in "Determine Ability to Perform"). AFIRMS carries out some stages of the sortie generation process as part of its method of executing "Determine Ability to Perform." The products are provided to the user for his convenience so that the process under way becomes integrated into wing activities. (The procedure also helps to test the AFIRMS algorithms.)

3.2.3 Support Functions. At any stage in AFIRMS processing, it may be necessary to have in use several support functions such as, maintaining security, providing communications, providing displays to accepting input from a user, and storing and retrieving data.

These are functions which occur in many systems. They are so basic that operating systems and commercially available software packages are available to provide all or parts of most of them. The specific requirements which AFIRMS imposes in each of these areas is discussed once. The Support Functions are referenced (or simply assumed) throughout the discussion of Basic AFIRMS Functions. In such references, there will be no, or minimal, discussion of the implied Support Function requirements or how they are met.

a. Produce graphic displays. AFIRMS is an interactive system. It relies extensively on softcopy/CRT displays to aid in the manual capture of data and to present analysis results back to users. The majority of AFIRMS manual data entry is provided through "fill-in-the-forms" techniques in which a user interactively fills in fields of a form displayed on a CRT. The majority of AFIRMS readiness displays make extensive use of color graphics to permit the user to quickly grasp complex readiness issues. Critical products that signal out-of-bounds conditions are highlighted.

b. Store and retrieve data. Normal database services must be provided. Of particular interest is the degree to which AFIRMS must be capable of working with both real and supposed data. This capability is essential to operations in the exercise mode. The degree to which multiple suppositions are supported is identified in the Database Specifications.

b. Store and retrieve data. Normal database services must be provided. Of particular interest is the degree to which AFIRMS must be capable of working with both real and supposed data. This capability is essential to operations in the exercise mode. The degree to which multiple suppositions are supported is identified in the Database Specifications.

c. Provide user interface to AFIRMS services. This is the function that an AFIRMS user enters when he has successfully logged into AFIRMS. It leads the novice user to the AFIRMS service of interest by a series of easy steps, but allows the experienced user rapid access. The access provided will comply with the security provisions of Section 3.6. A HELP facility allows a user to familiarize or refamiliarize himself with how the system is used.

Most importantly, this interface function controls the structure of the system provided to the user. In many uses, this means that the software to extract a screen from a database is activated. However, for some purposes, it implies the activation and linking of the correct subfunctions from the Basic AFIRMS Functions at all three levels.

d. Maintain security. This subject is discussed in Section 3.6.

e. Provide communications (Intersite). It is anticipated that AFIRMS will rely on a common user network for cost, security, and survivability reasons. Operational AFIRMS is hierarchical, suggesting that information need flow vertically among sites at different echelons with limited need for communications among sites at the same echelon. This logical hierarchical structure places no restriction or limitation on the physical communications links that may be used to move information between sites. For example, there is no reason why a link from one wing site to its MAJCOM, cannot pass through a second wing site. The determination as to whether this does, in fact, occur is a function of available links and/or costs to provide direct links.

The distributed database structure of AFIRMS may impose additional requirements on AFIRMS site-to-site communications.

f. Provide communications (local).

g. Produce tabular displays.

h. Edit input data - check reasonableness.

i. Interface to other systems. Part of the charter of AFIRMS is to avoid data redundancy where possible. This means maximizing the use of USAF data systems to provide AFIRMS information. The following data systems are identified for potential interface to AFIRMS. The summary of each system is provided in the following pages. For a more detailed analysis, refer to the individual system studies.

(1) Combat Fuels Management System (CFMS). CFMS is currently operational as a standard USAF data system and runs on a secure H6000 series computer at the major command level. It is the only fuels system in use today and provides daily information on jet fuel, liquid oxygen and liquid nitrogen. CFMS does not allocate fuel by unit, which is required by AFIRMS. CFMS is projecting transition from keypunch card data entry to automated entry via tape in FY85. Similar input automation may be applicable at the unit level prior to data aggregation to the MAJCOM. CFMS is included as a potential interface for operational AFIRMS.

(2) Air Force Operations Resource Management System (AFORMS). AFORMS is operational on the B3500 on most bases and does have information relevant to AFIRMS in the aircrew training and availability areas. AFORMS is transitioning to Phase IV equipment. Skills of airmen can be tracked along with flight data on medical and training status. Since aircrews are a key resource to consider when assessing combat capability in a unit, and this information is available at the unit level, AFORMS has been highlighted as a good candidate for interface with AFIRMS.

(3) Combat Supplies Management System (CSMS). CSMS is currently operational on the H6000 and contains supply data for bases on a worldwide basis. Base Level Self-Sufficiency Spares (BLSS), Peacetime Operating Stock (POS) and Other War Reserve Materiel (OWRM), are tracked and updated on a daily basis. CSMS uses the Dyna-METRIC modeling technique at the major command level to provide capability assessment in a combat environment. Currently, only critical aircraft reparable spares are assessed for this purpose.

(4) Weapon System Assessment Model (WSAM). WSAM, (formerly the Ogden Prototype), is a spares modeling system for the F-16 and runs on a VAX/VMS minicomputer. The system has extensive data on the F-16 and can also run the Mini-Dyna-METRIC model for combat capability assessment. This has been a prototyping system used for experimental purposes by HQ Air Force Logistics Command (AFLC). Most of the work was accomplished in database development techniques. Current plans are to incorporate these initiatives into the Weapon System Management Information System (WSMIS). For this reason, WSAM was eliminated as an interface with AFIRMS.

(5) Weapon System Management Information System (WSMIS). Currently under development, WSMIS intends to incorporate information on spares (from CSMS) with consumables (fuel and munitions) to obtain an overall unit capability assessment. WSMIS is going to use the Dyna-METRIC model for spares and the Contingency Operation/Mobility Planning and Execution System (COMPES) for mobility and resupply information. Due to the broad scope of WSMIS and its location on the WWMCCS Intercomputer Network (WIN) (H6000), it is a natural candidate for interface with AFIRMS.

(6) Mini-Dyna-METRIC. Much of AFIRMS will run on small computers. Because of this, the full Dyna-METRIC model (17,000 lines of FORTRAN code) is not a feasible solution to spares modeling for AFIRMS. The Mini-Dyna-METRIC model was developed as an answer to limited computer space and was found to be reasonably accurate. However, the assumptions inherent in the full Dyna-METRIC model are also embedded in the Mini-Dyna-METRIC. These assumptions reduce the validity of combat capability assessment. The Mini Dyna-METRIC model is under consideration for inclusion into AFIRMS. Current projections are to install and validate Mini-Dyna-METRIC on a Z100 series microcomputer during FY85. This will enhance its applicability to AFIRMS.

(7) Logistics Capability Measurement System (LCMS). LCMS is a logistical planning and management tool used by HQ USAF for budgetary decisions and out-year projections. It uses summary data at only the highest level of the command structure and is not particularly suited to AFIRMS purposes. There are, however, areas within LCMS of interest to parts of AFIRMS. These are the dollars to weapon system calculations and munitions capabilities.

(8) Contingency Operations/Mobility Planning and Execution System (COMPES). COMPES is an Air Force unique automated system which uses standardized software and procedures that improve efficiency and effectiveness of Air Force contingency planning and execution. It provides a coordinated response to plans and execution actions by manpower and personnel, logistics, and operations functions. COMPES automates Air Force procedures at major commands and base levels to select, deploy, and monitor contingency forces. The system is currently operational and is used for contingency and crisis planning. This information is of direct relevance to AFIRMS and will be explored in more depth.

(9) Core Automated Maintenance System (CAMS). CAMS is an Air Staff directed project to improve management and utilization of maintenance resources by enhancing and standardizing the flow and availability of ADP logistics information. CAMS will support all base-level aircraft, engines, trainers, support equipment, test equipment, missiles, munitions, and communications-electronics maintenance.

(10) Combat Supply System (CSS). CSS, an Air Force system, is a small transportable computer system designed to deploy with and provide direct supply support to combat forces. It functions as an extension of the Standard Base Supply System (SBSS) to perform wartime essential processes at deployed locations.

(11) Vehicle Integrated Management System (VIMS). VIMS, an Air Force system, collects base level vehicle maintenance performance data. The information provided through VIMS is used in the vehicle management decision making process.

(12) Airlift Implementation and Monitoring System (AIMS). AIMS is an automated data system to support the operation and management of the active duty MAC airlift force. Additionally, AIMS is intended to support the MAC transportation organizations worldwide with current aircraft schedule and movement information.

(13) Military Air Integrated Reporting System (MAIRS). MAIRS is a MAC System to provide accurate reporting of mission movement to ensure effective command and control of active duty units. The reporting system is designed to provide HQ MAC with the basic data required to assist in effectively managing MAC airlift assets; provide MAC wings with the information required to flight follow their aircraft; enable the theater ALCCs and overseas RSS/JRCC to flight follow aircraft in their areas; and provide enroute stations with advance notification of aircraft arrivals and departures.

(14) Information Processing System (IPS). IPS is a MAC system being procured to provide automated support capabilities which will aid MAC personnel in performing the command and control functions associated with the execution planning, scheduling, and execution of MAC's airlift mission.

(15) Flow Generator, Version 3 (FLOGEN III). FLOGEN III is the automated mission flow generator that MAC uses to plan the mission flows for MAC Operational Plans (OPlans) and exercises.

(16) Airlift Deployment Analysis System (ADANS). ADANS is the planned replacement for FLOGEN III, described above, and will perform essentially the same functions.

(17) Theatre Airlift Management Systems (TAMS). TAMS is an in-theatre mission flow (scheduling) and tracking system for deployed MAC aircraft.

(18) Force Management Information System (FMIS). FMIS is a secure, MAJCOM-level ADP system containing SAC force status data and the SAC command and control database.

j. Transmit intersite messages. The AFIRMS System Specification details the intersite message requirements.

k. Collect trends and averages for use in computations. While this function may support the function "Aggregate, Analyze and Present Data," other uses are expected. The function is required chiefly for what-if exercises. For those exercises, AFIRMS supplies averaged rates of change, averaged prices, average performance to predicted ratios, etc. These may or may not, reside in a single routine. A generalized design is desirable.

1. Much of the data used by AFIRMS is stored in databases as is all of the current raw data. This data may be accessed by queries and processed by ad hoc models. The extent and methods for these applications are established in the System, Subsystem, and Database Specifications.

   (1) Provide user ad hoc queries (local).

   (2) Provide user ad hoc queries (intersite) as qualified in the System and Subsystem Specifications.

   (3) Provide user ad hoc calculations (local).

3.3 Inputs - Outputs.

3.3.1 Input Formats. Some of the formats available for data input are defined in the Product Description referenced in Section 1. The data involved in the screens is documented in the AFIRMS Data Requirements Document and Database Specifications. The intersite and intrasite interface specifications are detailed in the System and Subsystem Specifications, respectively.

3.3.2 Output Formats. The formats to be used for data output are defined in the Product Description referenced in Section 1. The data involved is documented in the AFIRMS Data Requirements Document and Database Specifications. The intersite and intrasite interface specifications are detailed in the System and Subsystem Specifications, respectively.

3.4 Database Characteristics. The material in the AFIRMS Data Requirements Document provides the fundamental description of the database data elements. The AFIRMS Database Specification provides design considerations related to the AFIRMS database. The database is physically characterized as follows:

	Bytes (Initial)	Number of Accesses/Day	% Growth /Year
Wing	2.9 megabytes	2500	10
MAJCOM	65 megabytes	500	15
HQ USAF	205 megabytes	300	20

3.5 Failure Contingencies.

3.5.1 Operational AFIRMS Redundancy. Operational AFIRMS redundancy refers to the precaution taken (redundant hardware, replication of databases at several locations, ability to reconnect hardware, etc.) to permit AFIRMS to continue operating at full or degraded capability when a failure(s) occurs.

It must be emphasized that operational AFIRMS is a hierarchical collection of individual sites and, therefore, barring the existence of alternate communication paths, the loss (or partial loss) of any particular site will have two impacts: partial or complete loss of AFIRMS at the site itself, and reduction in performance of otherwise unaffected AFIRMS sites higher in the operational system. For example, loss of a wing site means loss of (timely) data to a MAJCOM site.

The degree of loss is a function of the designs of the AFIRMS sites and of the ability of the sites to communicate with each other. As an example, suppose the design of each wing AFIRMS site was centered about a single computer with a single communications link to its MAJCOM AFIRMS site and that the wing and MAJCOM sites shared no data, i.e., their databases were non-overlapping. In this case, a computer failure at the wing would: cause complete loss of AFIRMS at the wing site (and provide no way for the MAJCOM to assist the wing); make access by the MAJCOM to any wing data extremely slow if not impossible, thereby rendering it difficult to perform aggregation and sustainability evaluations; and, impact wing timeliness to translate tasking, create schedules, launch aircraft, etc.

Clearly, the AFIRMS design concept proposed in the System and Subsystem Specifications has some limitations and suggests that a number of system considerations are necessary to achieve an acceptable level of redundancy within economic constraints. Some specific considerations which the AFIRMS Central Node Module (CNA) system architecture accommodates are:

a. Distribution of selected database entities, DBMSs, and processing power to one or more functional area workstations (FAWs) in addition to the central database at each site.

b. Use of several computers at a single site, with each computer sharing a portion of the AFIRMS processing for that site. If one computer fails, the application is redistributed among the remaining computers.

c. Redundant data storage provided by multiple on-line storage devices accessible by multiple processors at the CNM.

However, by specifying the data that is required to flow over these secondary information gateways, and by providing the system functionality required to implement these flows, two problems are resolved:

a. Wing functional areas can report directly to their MAJCOM USAF when their CNM is down. Similarly, functional areas at the wing level can report directly to HQ USAF when the MAJCOM site is down.

b. Deploying squadrons/wings also use these secondary information flows to report required data to the receiving command hierarchy.

In both of these cases, modems over dial-up lines, using encryption devices where necessary, can be used to effect communications redundancy and effect the secondary information flows.

3.5.2 Database Backup/System Backups. AFIRMS established policy for backup frequency differs from site to site. As a minimum, however, backups to tape are made every 24 hours. Furthermore, a journal log of database entries will be maintained to permit the entire database to be recreated if a computer or disk fails. The Database Management Systems selected for AFIRMS segment implementations will provide for automatic generation of the journal log. The procedure uses the most recent backup plus the journal log to recreate the database. Refer to the Subsystem Specifications for a more in-depth discussion of required DBMS support software functionalities.

3.5.3 Fallback. Fallback, as defined here, occurs after the AFIRMS redundancy mechanisms have failed, that is, AFIRMS is totally unavailable to the owning echelon. Under these circumstances, the decision support provided by AFIRMS would be lost.

Provision is made at each AFIRMS user echelon site to maintain the necessary equipment, skills, and hardcopy AFIRMS products to carry out their missions should AFIRMS fail totally. Therefore, the users of AFIRMS must provide:

a. Training of personnel in manual methods for satisfying basic mission needs.

b. Equipment to aid personnel in their manual effort (this includes greaseboards, markers, hardcopy AFIRMS products, etc.).

c. AFIRMS operational procedures that maximize the data available for a manual effort. That is, selected database entities must be hardcopied to ensure that data will be available if an AFIRMS failure occurs. The extent and frequency of hardcopy backup are parameters that are AFIRMS site dependent. They are related to the perishability of the data, physical accommodations for storage, etc.

3.6 Security. AFIRMS handles data up to and including the TOP SECRET classification level. It handles sensitive unclassified data. Due to the various environments and processing requirements at the wing, MAJCOM and HQ USAF levels of operation, the security modes of operation differ. HQ USAF operates in the TOP SECRET System High Security mode; MAJCOMs operate in the TOP SECRET System High Security Mode; and, wings operate in the controlled Security mode at levels of classification from unclassified through SECRET.

Security protection is provided for these environments by utilizing a combination of the following security measures in accordance with AFR 205-16.

a. Personnel Security. The personnel security program implemented for the AFIRMS Program adheres to the provisions in DoD Regulation 5200.2/AFR 205-32 USAF Personnel Security Program. Personnel access controls are implemented for the AFIRMS central computer facilities and remote terminal areas.

   (1) Central Computer Facility. Strict personnel access controls are implemented to ensure that only personnel who require access to the facility and possess a security clearance at least equal to the highest classification of information being processed or openly stored at the facility, are admitted.

   (2) Remote Terminal Area(s). Authorization for access to and use of remote terminals devices, is based on an individual's duties, his/her need to use the terminal, and possession of a security clearance of the required level.

b. Physical Security. Measures ensure external protection for AFIRMS against unauthorized access to the central computer facility, to the system from remote terminals, and to data storage media.

   (1) Central Computer Facility. Central computer facility physical security meets the requirements established for the highest classification and all sensitivity categories of data that are either in the ADPS or openly stored.

   (2) Remote Terminal Area. Physical security measures at remote sites fulfill the minimum requirements for the highest classification of information accessed from or stored at the site.

c. Hardware Security. AFIRMS system hardware meets all of the provisions recommended in DoD 5200. 28M, ADP Security Manual, for hardware security features.

d. Software Security. The operating systems selected for use meets the general software security requirements stated in DoD 5200. 28M. In addition to the security protection features contained in the operating systems, a combination of system and application software protection features provide the following security protections to comply with applicable DoD and Air Force security policies.

(1) Access Control to prevent unauthorized entry to systems, files, and programs.

(2) Error surveillance and Alerts to recognize, record, and indicate misuse of the system.

(3) File Security to prevent unauthorized access or alterations to files. An automated audit trail provides: file access record, how, and from where the access was initiated; the identity of the person or process that initiated the access; and, all unauthorized attempts.

(4) User Monitoring and Isolation to ensure the user has access to only the system information to which he is entitled.

e. System Stability. All AFIRMS components operate so that one can automatically or administratively detect and report system hardware and software malfunctions in time to reasonably prevent unauthorized disclosure.

f. Data Integrity. Each database, file, and data set/element are identified with an origin, use, and an explicitly defined set of access controls. These access controls are based on classification, sensitivity, user clearance, and established need-to-know.

g. Communications Security (COMSEC). Approved COMSEC equipment are used on all communications circuits passing classified information. These equipments are installed IAW AFR 100-45 and NACSIM 5203 and secured IAW AFKAG-1. NBS or NSA approved data encryption devices may be required for transmission of sensitive unclassified data depending on the nature of the data.

h. Emanations Security (EMSEC). ADP and communications equipment utilized to process classified material at AFIRMS sites is TEMPEST approved. All equipment will be installed IAW the guidelines stated in NACSIM 5203.

i. Procedural Security. Security operating procedures meet the requirements of AFR 205-1 and 205-16 and include the following:

(1) System Access Controls

(2) File Access Controls

(3) Personnel Access Controls

(4) Security Markings

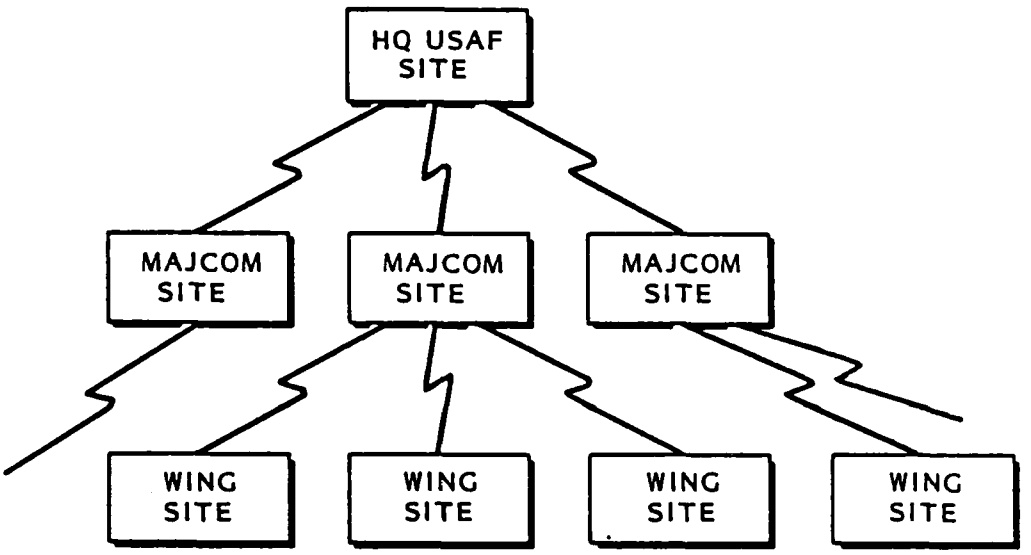
(5) Protecting Classified Output

(6) Physical Security

(7) Protection of Residual Information

SECTION 4. DESIGN DETAILS

4.1 System Description. The worldwide operational AFIRMS, is a hierarchically structured system which can be visualized as a pyramid of distinct operational sites.



Each operational site performs a set of distinct, yet similar functions and transmits information upward to a parent site. There are three basic levels within the AFIRMS pyramid, each level being considered as an AFIRMS subsystem. The highest level subsystem, the apex of the pyramid, is the HQ USAF. The second level of the pyramid consists of the MAJCOM subsystems. Each MAJCOM contains an AFIRMS MAJCOM subsystem. The base of the pyramid is composed of a set of wing subsystems. Each type of wing within a MAJCOM contains an AFIRMS wing subsystem which is connected logically to the parent MAJCOM.

4.1.1 General Description. AFIRMS consists of three subsystems that interrelate and communicate to provide the AFIRMS capability. The subsystems, named in accordance with the command levels they are to serve, are the HQ USAF, MAJCOM and wing subsystems.

Each subsystem provides appropriate functionality to the users in order to support their primary functions. The following functions are provided, to some degree, to users at each subsystem level:

a. Provide for entering/retrieving data into/from an AFIRMS database.

b. Display information concerning readiness and/or budget analysis (not provided at wing level).

c. Provide hardcopy outputs of displayed data on request.

d. Provide capability to conduct what-if or trade-off exercises related to readiness questions and/or budgetary questions (not provided at wing level).

e. Provide capability to execute ad hoc queries against the database at the local site. (This capability will be for special users only.)

4.1.2 AFIRMS System Architecture. The general system architecture for AFIRMS sites is based upon a centralized site database and a set of functional area databases. For a full discussion of the AFIRMS system architecture, refer to the AFIRMS System Specification. This architecture can be accomplished through dedicated or shared equipment software and facilities with other ADP systems.

The centralized database is accessed via the CNM. Each CNM will service one or more functional areas and will share the centralized database with any other CNM comprising the central node.

4.1.3 Central Node Modules. Each CNM possesses the following characteristics:

a. A full duplex high band width communications path to each on-line storage device that has any part of the centralized database resident upon it.

b. One or more high band width full duplex communications paths to one or more other CNMs comprising the central node. If only two CNMs comprise a central node, two communications paths between the two will be provided.

d. A copy of the DBMS being used for the system. The processing of the updates or retrievals from the centralized database will be distributed between the CNMs.

Each CNM updates the databases of the functional areas serviced by it as required. Each CNM also transmits the data updates made by one or more of its attached functional areas to all other CNMs for update of their associated functional area database as required.

4.1.4 Functional Area Workstations. Each functional area has an intelligent device containing its own database and copies of software for that functional area's is requirements.

The data resident on the functional area database consists of update/read and/or read only data elements. The specific resident data is determined by the data needed for a functional area's normal use. When a functional area update is made, the update transaction is sent to the central node to allow update of the centralized database and for synchronization of the databases of other functional areas.

4.1.5 Communications. A communications path is provided for normal communications with a higher/lower level site. In addition to this normal channel which is shared by all CNMs at a site, each CNM has an alternate on call path to the higher level site. This alternate path is variable in nature and contains software capable of communicating via a variety of protocols and data transmission speeds.

A communications path is provided for normal communications between a functional area and a CNM. In addition to this normal channel, each functional area has an alternate on-call path of communications (such as a dial-up phone line). Each CNM maintains the required transceiving equipment to accept the alternate path transmission. It is possible for the functional area to use the alternate transmission path to link directly to a CNM at a higher/lower level site.

4.1.6 AFIRMS Readiness Assessment Overview. The AFIRMS methodology is based on the use of four Basic AFIRMS Functions to carry out various Applications (User) Functions. This section summarizes the roles of the Basic Functions and the ways in which they support each of the Applications (User) Functions.

The same diagram will be repeated for each of eight different Applications (User) Functions. In each of the appearances of the diagram, emphasized words and arrows will indicate the ways in which basic functions are tailored to provide that specific user function.

a. Measure (and aggregate) readiness vs. standard tasking. The current UNITREP system routinely performs the function of reporting and aggregating readiness of C-ratings. This procedure is well established and tested. Unfortunately, it has been found to have serious shortcomings, largely because it is limited in the factors considered. AFIRMS will provide an approach which overcomes several of the problems which are associated with the approach of the C-rating system to this task. That is, it will measure readiness in terms of ability to perform tasking.

As Figure 4-1 illustrates, the procedure is a simple application of the Basic AFIRMS Functions. That is, a simple tasking and a simple statement of resources are compared to create a measure of readiness based on ability to perform the tasking. The following paragraphs examine how each of the AFIRMS Basic Functions apply to this Applications (User) Function.

(1) Translate Tasking. The tasking used as a standard for regularly scheduled measurement of readiness is derived from the current WMP or other standard tasking. The WMP, however, does not include all of the information which AFIRMS needs to process tasking. It will be necessary, therefore, to provide detailed information to the wing and squadron levels on mission type, mission priority, and preferred load requirement. Note that this data does not need to accurately forecast actual missions since the objective is to provide a consistent standard of measure for repeated use. The identification of this addition of data is made outside the mainstream of AFIRMS, with interactive assistance from AFIRMS. The results are stored once in the appropriate AFIRMS sites and recalled and used on a regularly scheduled basis.

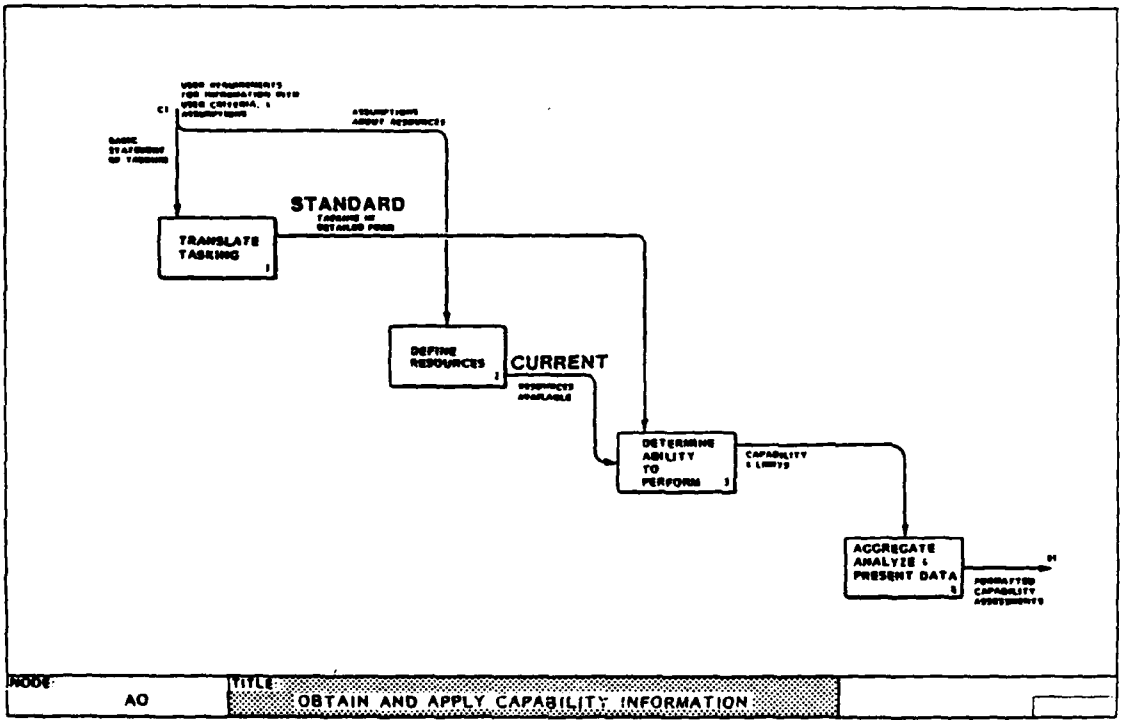


Figure 4-1. Measure (and Aggregate) Readiness vs. Standard Tasking

(3) Determine Ability to Perform. The process of determining ability to perform (for Tactical Fighter Squadrons) starts by developing a draft schedule to meet the tasking. The missions (sorties) which can be scheduled within the resources available constitute the basic measure of readiness. Since this development is inherently subject to error, AFIRMS regularly stores both the forecast number of sorties and the number of sorties actually generated during exercises. The ratio of these numbers provide a measure of validation and a basis for adjustment for the measure resulting from the direct forecast of the schedule.

(4) Aggregate, Analyze, and Present Data. Various ways of stating readiness are required depending on the functional perspective. At each level, these measures are based on aggregation over subordinate units to each next higher level, while maintaining the maximum granularity which is needed by any higher level. To complete the development of useful measurements, each echelon maintains histories of the results of these calculations to permit the plotting and analysis of trends in readiness.

For the regularly scheduled measurement of readiness, the Basic AFIRMS Functions consist of: the retrieval of a stored standard task in detailed form; the use of data on current inventories; the calculation and adjustment of the number of sorties which can be flown; and the aggregation of measures to higher echelons and the tracking of trends in readiness.

b. Measure (and aggregate) sustainability vs. standard tasking. AFIRMS measures not only readiness, but sustainability. As with readiness, sustainability is measured on a regularly scheduled basis against standard taskings. The important elements appear in Figure 4-2. A discussion in terms of the four Basic AFIRMS Functions follows.

(1) Translate Tasking. The process of translating tasking for sustainability follows that for readiness. That is, it requires external interpretation to produce a standard formatted multi-day tasking which is accessed each time that sustainability is to be evaluated.

(2) Define Resources. The resource balances used for the measurement of sustainability will initially be those used for readiness measurement. Two additional factors, however, will apply. Expected resupply will be added to resource balances at the end of each day and the balances will be reduced by the expenditures of resources as calculated in the measurement function. These changes are reflected in the change of name of the arrow from box 2 to box 3 and in the introduction of a new arrow from box 3 to box 2. The calculation of consumption may be executed in part by other systems. For example, after AFIRMS develops a schedule for the day, the calculation of spares consumption, and of the resultant shortfalls may be performed by a copy of Dyna-METRIC resident on another system.

(3) Determine Ability to Perform. The measurement of the ability to perform will be exactly as described for measuring readiness except:

(a) Provisions will be made for calculating resource usage and reporting the results to the Define Resources module.

(b) The complete procedure will be cycled for the number of days over which sustainability is being measured.

(4) Aggregate, Analyze, and Present Data. The aggregation and tracking of data for sustainability is equivalent to that for readiness except for the added dimension of "day of performance."

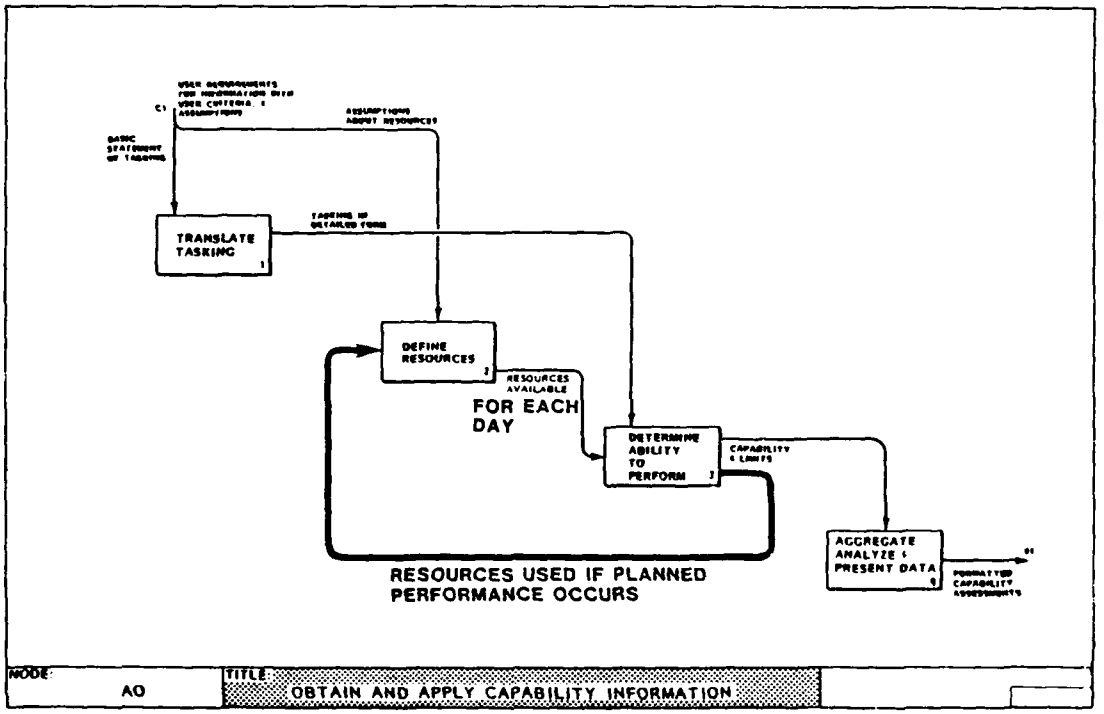


Figure 4-2. Measure (and Aggregate) Sustainability vs. Standard Tasking

(4) Aggregate, Analyze, and Present Data. The aggregation and tracking of data for sustainability is equivalent to that for readiness except for the added dimension of "day of performance."

c. Measure (and aggregate) readiness vs. one-time tasking. The tasking used by AFIRMS will not always be a standard such as the WMP. For planning purposes, it is necessary to measure readiness for actual or what-if taskings. A discussion in terms of the four Basic AFIRMS Functions follows.

(1) Translate Tasking. The translation of one-time taskings cannot be retrieved from predefined plans as with standard taskings. Instead, AFIRMS will prompt the user for:

(a) The way in which a task is to be subdivided and detailed to the wing level.

(b) Missing elements which could include priorities, choices of munitions, etc.

AFIRMS makes maximum use of a "building block" approach to constructing tasking scenarios. This approach speeds the what-if tasking definition by permitting judicious mixing and matching of task components. Refer to the Transform and Model Descriptions document for a detailed discussion of this flexibility.

Figure 4-3 illustrates the feedback of lessons learned from capability assessments to the redefinition of tasking for sensitivity analysis and/or analysis of alternative tasking.

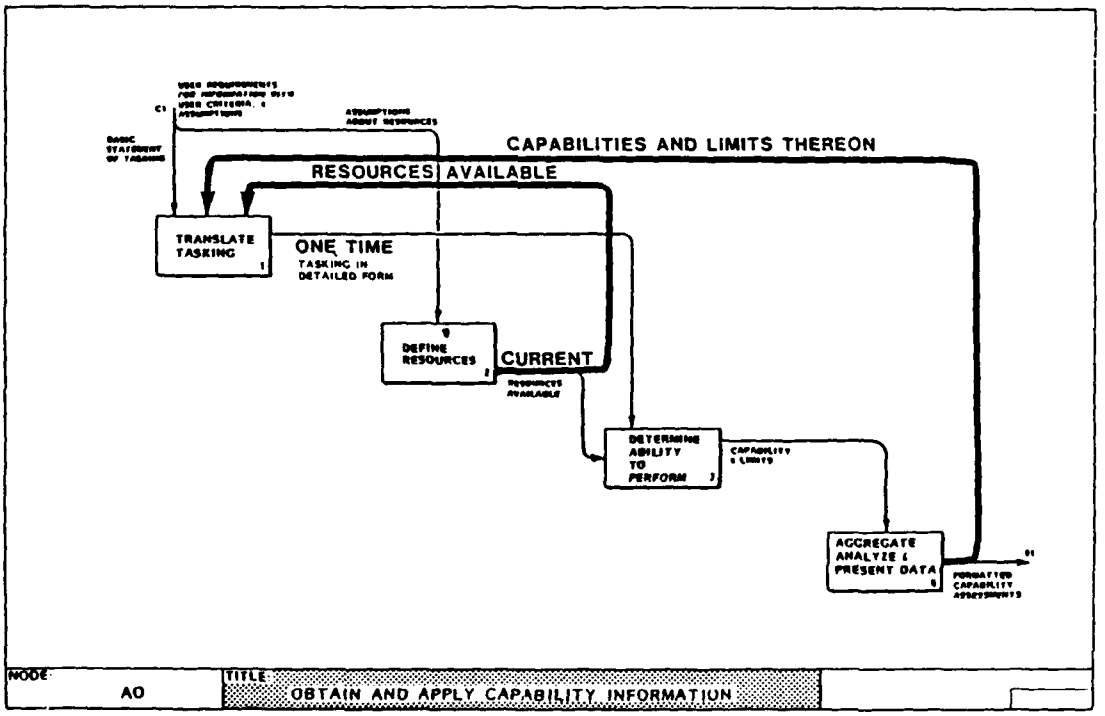


Figure 4-3. Measure (and Aggregate) Readiness vs. One-Time Tasking

Once the tasking is in a form which can be evaluated, the other two Basic AFIRMS Functions are performed. Under some circumstances, AFIRMS will perform predefined reporting functions based on the type of objective originally specified by the user, (see Figure 4-3 - arrow from box 4 to box 1), and will prompt the user to see if the user wishes to repeat the evaluation after modifying the original detailing of the tasking based on this new data.

(2) Define Resources; Determine Ability to Perform; Aggregate, Analyze and Present Data. These other Basic AFIRMS Functions are performed as for readiness measurement against standard tasking except that no trend data is collected or processed.

d. Measure (and aggregate) sustainability vs one-time tasking. The purpose is essentially the same as for the measurement of readiness vs. one-time tasking discussed above (see Figure 4-4). A discussion of the four Basic AFIRMS Functions follows.

Translate Tasking for this function is equivalent to that for the measurement of readiness except for the need to process multiple days. The same distinction applies to the other three AFIRMS Basic Functions. Those three functions are completely analogous to those used to measure sustainability against standard tasking.

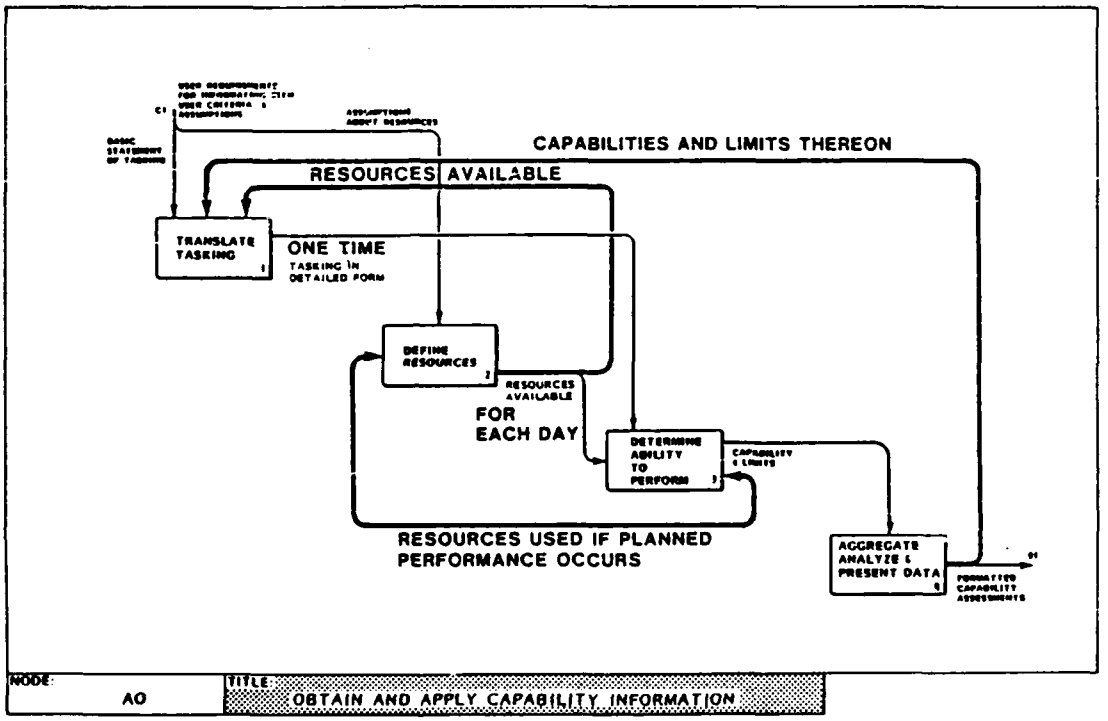


Figure 4-4. Measure (and Aggregate) Sustainability vs. One-Time Tasking

e. Measure (and aggregate) readiness or sustainability vs. revised standards, and/or revised standard tasking using historic data. As the Air Force improves its posture, several factors can distort the comparisons of current to past readiness. Two of these are that the standards of measurement tend to be revised upward and that standard taskings are subject to annual, or more frequent revisions. When such changes have occurred, answers to the question of whether the Air Force is in fact improving its capabilities are more complicated. Under the UNITREP system, it is impossible to use the recorded C-ratings to recompute the capabilities of the past.

To overcome these difficulties, the AFIRMS system retains snapshots of summary resource data at the end of regular periods. Some of the data is retired on a regular schedule so that the coverage of recent history is more frequent than that for the more distant past. Whether the retention of this historic data is off-line and manual, on-line and automatic, or some procedure between those two limits depends upon the needs of the functional user and the AFIRMS organizational level. This retention and recall is a subfunction of the Basic AFIRMS Function "Define Resources." Figure 4-5 shows that the arrow from box 2 to box 3 is concerned with this historic data, and also notes that the software performing the function "Determine Ability to Perform," may have been altered to conform to new standards.

The retention of historic data cannot provide for the data requirements introduced by fielding of new resource types. Only types of data which have been collected and stored can be recalled. Procedures for using default values in such cases will require consideration in individual cases. In extreme cases, the problem of new data requirements could prevent the successful execution and comparative reviews of historic capabilities.

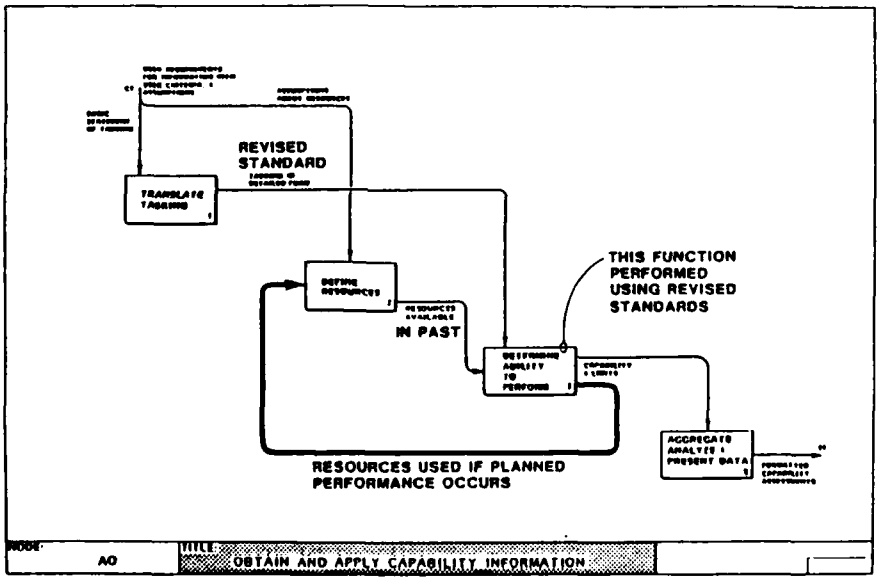


Figure 4-5. Measure (and Aggregate) Readiness or Sustainability vs. Revised Standards, and/or Revised Standard Tasking Using Historic Data

f. Assist in allocation of resources (physical or fiscal)--forecast results of trial or final allocation. This function focuses on a modification of the way in which resources are defined. In this case, a user wishes to determine the impact on capability of one or more ways of allocating either dollar or material resources. Figure 4-6 shows that the focus in this case is on the proposed allocation and on a feedback of the capability measurement resulting from each trial.

The essential function for AFIRMS is to enable the user to input assumptions, evaluate the result and report the capability results to the user and, if desired, iterate until a satisfactory result is obtained. It would increase the utility of AFIRMS if it were able to offer an initial allocation as a starting point for subsequent evaluation, rejection, alteration, or acceptance by the user. It is important to note that the only correct role for AFIRMS is that of a computerized tool which is available for use when the user wants assistance. AFIRMS itself is a decision support tool, not a decision maker.

The Transform and Model Descriptions document details procedures to allow AFIRMS to suggest a near optimal allocation of newly available resources to subunits. This may be used to provide the user with a starting point if he desires one. The algorithm is discussed further in Section 4.2.6.

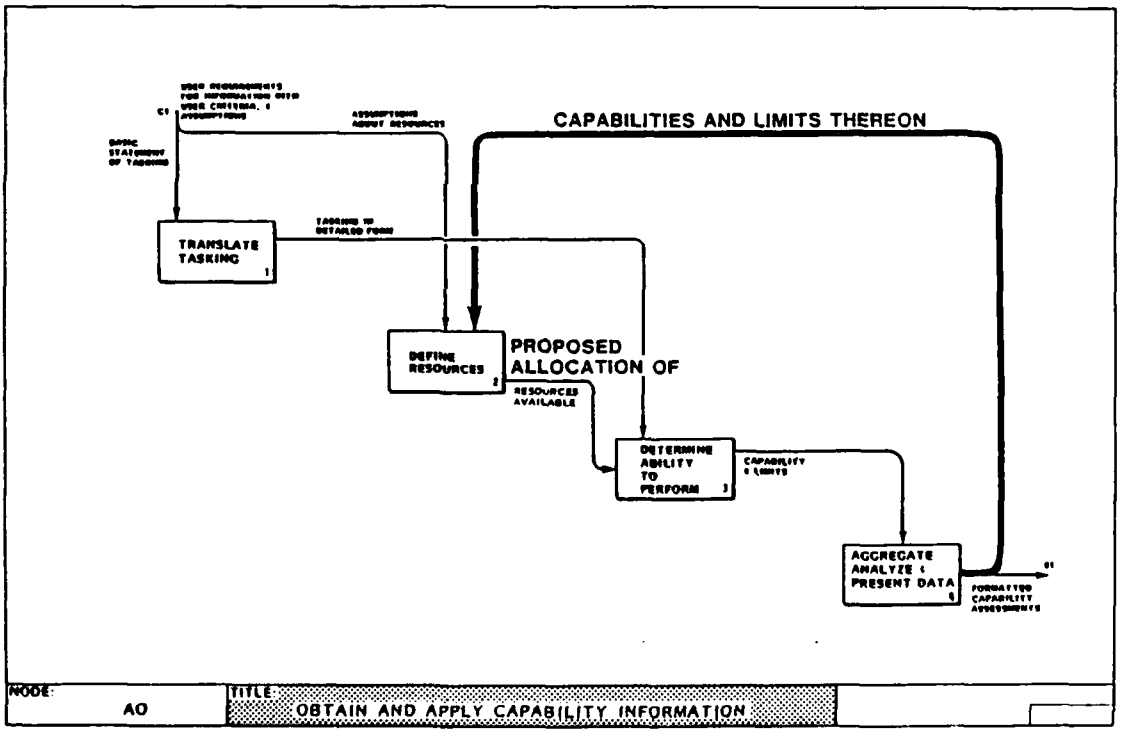


Figure 4-6. Assist in Allocation of Resources (Physical or Fiscal)

g. Assist in task assignment. The role of AFIRMS in task assignment is directly comparable to its role in resource allocation. That is, AFIRMS offers initial responses to problems posed by the user, but only when requested to do so by the user. In all cases, AFIRMS evaluates solutions posed by the user, whether or not they relate to an initial response developed by AFIRMS. Figure 4-7 illustrates the elements of this function.

In this function, the tasking, rather than the resources, are being tested. for that reason, the "Translate Tasking" function now provides the what-ifs to be tested and receives the feedback of resulting capabilities. Thus its role is analogous to the role played by "Define Resources" in the Resource Allocation task.

Proposed taskings in detailed form are provided and, after the ability to perform is determined, the capabilities and the resource limitations on them are fed back for another iteration of tasking assignment. Again AFIRMS prompts the user for desired changes, and may, at the user's request, provide strawman solutions.

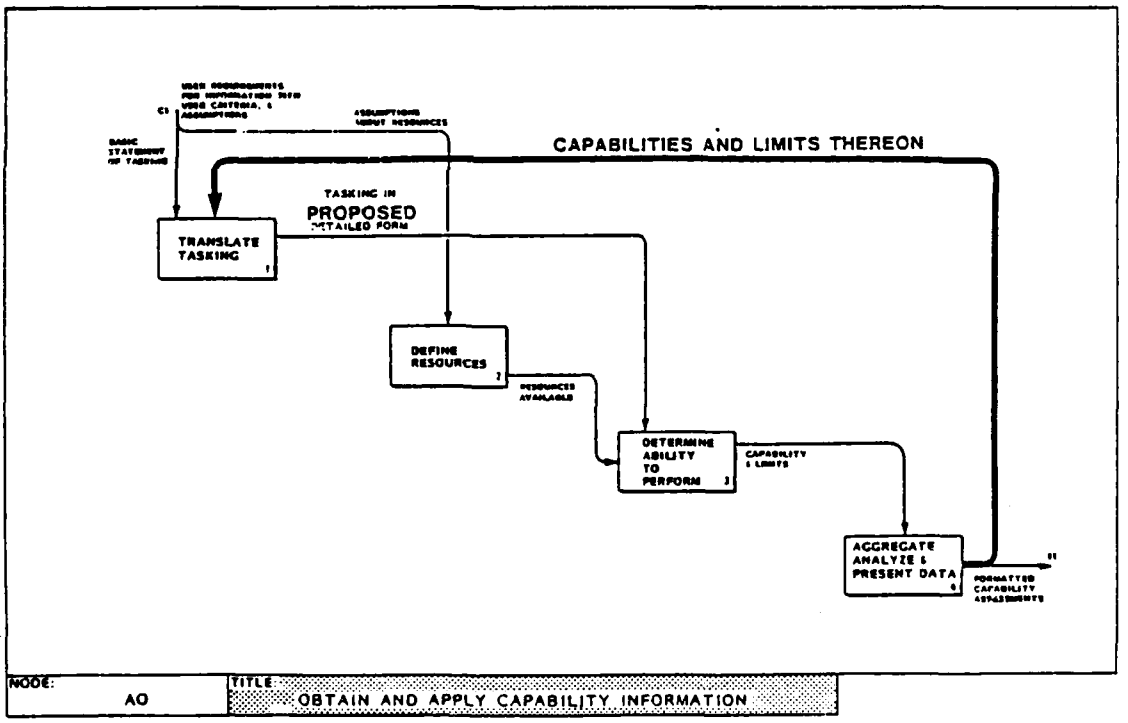


Figure 4-7. Assist in Task Assignment

h. Assist in out-year budget plans--forecast results of trial or final allocations based on standard or user supplied assumptions. There are a number of questions related to out-year budgets which can be posed. The questions are listed in the order of increasing complexity. In fact, each of the last two questions subsumes the preceding question. Each of these questions requires that the user specify the standard tasking to be used as a basis of measurement. They include:

(1) Based on existing budget plans, what capability levels will be obtained in the year X?

(2) Assuming an increase or decrease in the budget for year X of amount Y, what is the best use of the new funds available?

(3) Assuming an increase or decrease in the budget for year X of amount Y, what changes in capability levels will result in the year Z (where Z may or may not equal X)?

Each of these questions has embedded in it another more basic question, "Under the assumed conditions, what will the resources available be?" As Figur 4-8 indicates, the emphasis is on the output arrow from box 2, "Define Resources." If the resources can be forecasted, AFIRMS will perform "Determine Ability to Perform" and provide the desired capability levels, based on the selected standard tasking. This provides the answer for question 1 above.

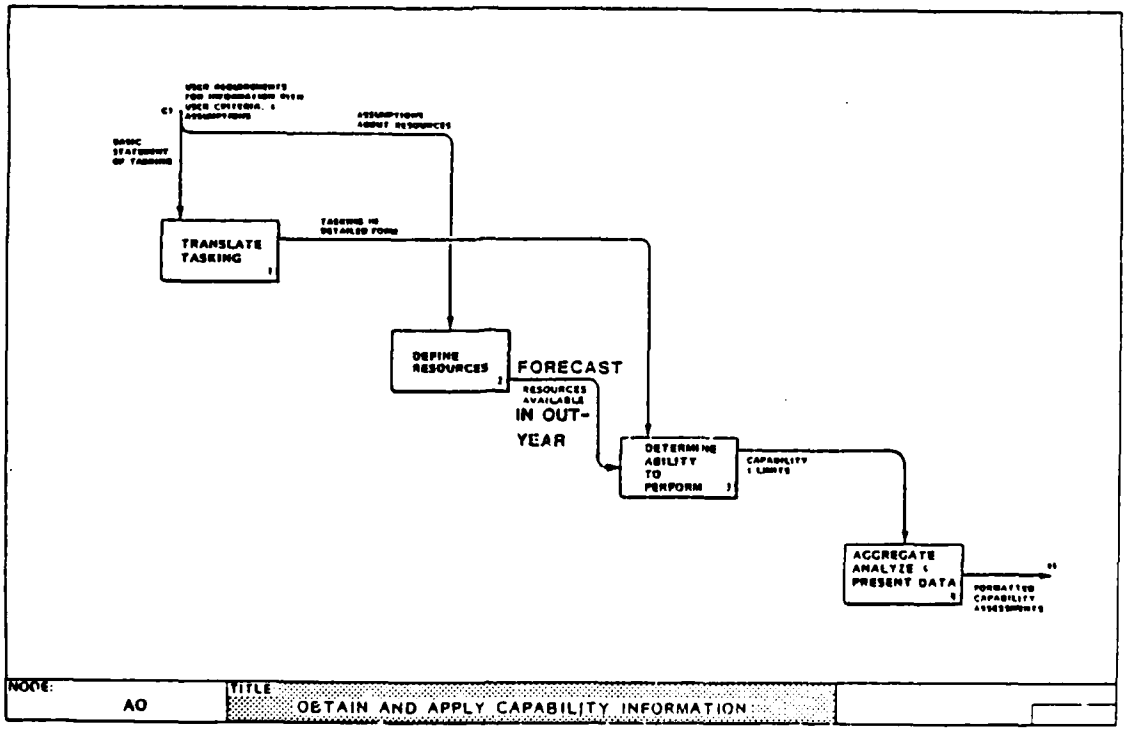


Figure 4-8. Assist in Out-Year Budget Plans

A complicating question arises concerning the degree to which AFIRMS will provide the estimated resources available. As part of the POM process, estimates of resources are developed for the out-years. However, it is not clear that the kind of detail needed for a valid assessment is available before Congressional budget revisions, or that, if it is, it will survive Congressional actions. For purposes of clarification, assume that the answers differ for different types of resources. For example, the data on aircraft may be quite accurate and quite detailed (down to the squadron level) while other items, such as levels of POL by type, may be less accurate and less detailed, especially in terms of distribution. Where the precise, accurate levels are available, they must be fed to AFIRMS. Where such answers are not available in the existing systems, the ability to generate them must either be added to other systems or added to AFIRMS.

As noted above, once AFIRMS has the detailed data, it directly computes the capability level needed to respond to Question 1 via "Determine Ability to Perform."

Question 2 builds on the data needed for Question 1. Again, it is necessary that the user has specified the standard tasking. Given the tasking, and the detailed data on resources available, AFIRMS can calculate which resources limit capability. With that base, AFIRMS can calculate the resources which will yield the greatest increases in capability per dollars expended. (Or the least loss per dollar for a loss situation.) This statement also assumes that guidance has been provided to overcome the question of diverse units of measure (sorties, ton-miles etc.).

For any of the questions, the user interaction can be on-line and real-time. For example, a total funding can be divided among the MAJCOMS by the user (with bookkeeping assistance from AFIRMS). After AFIRMS provides data on proposed resources to be purchased and the effect on capability for each MAJCOM, against that MAJCOM's basic unit of measure, the user can then provide the human judgement as to desired shifts of dollars among the MAJCOMs. Again, it is assumed throughout this section that anything AFIRMS provides is a starting point subject to change, rejection, replacement or acceptance by the user.

Question 2, is comparable to the resource allocation problem discussed in an earlier section. However, the process is applied to an out-year resource status base rather than to the existing resource status base.

There are other caveats required. The first caveat is that the discussion so far has implied that the prices of the resources in the out-years can be accurately estimated. This is a hazard which any planner faces and is assumed to be acceptable. The second caveat concerns the assumption that the resources can be caused to flow in immediate response to the expenditure ot dollars. For most purposes this is probably true for out-years if the user applies appropriate budgetary "front loading" to accommodate the procurement logs.

The third caveat concerns the implied assumption that dollars spent always translate directly into more resources in a linear way. This is a more serious matter. If more trained airmen are to be available, there is a presumption that there is a complex interrelationship with consumption of other resources used in training.

As noted earlier, AFIRMS may be able to refer such problems to other systems already used in the POM process.

Question 3 can now be examined on the basis of Questions 1 and 2. First the starting capability is determined as discussed for Question 1. Then the user, with help from AFIRMS if desired, establishes assumptions about: prices of each resource, dollars to be changed (added or removed) for each resource so that the total equals the required change in the total budget and, distribution of each resource. This provides a new "resource available status" and the new capability can be measured. The difference between the old and the new capability compared to the difference in dollars provides the answer to the Congressionally mandated dollars to readiness question.

All of the caveats noted for Questions 1 and 2 apply. There are presumably other caveats not yet noted. One is known and deserves brief mention.

If the responses to such questions in one year are to be comparable to those given in another, the year-to-year changes in the "standard tasking" such as those which occur in the WMP need to be accounted for. This question requires close examination.

An interesting point arises with question 3. It concerns the distribution of resources. It seems unlikely that a user will ever settle for a distribution that shows any imbalance due to either *mislocation or over/under procurement of* some items. This would seem likely to lead to answers which always have an optimistic bias since such perfection is unlikely in the actual event. This is not a question of human failure, but rather of the unpredictability of the events which cause disruptions in balance despite any conceivable human effort.

Operational AFIRMS provides one method of dealing with this problem. The method is based on the regular computation of the ratio between actual capability (from AFIRMS looking at the details at each unit) and the theoretical capability if all resources were in balance. It might be found that the ratio stays in a limited range. If this were true, the ratio could be used as an adjustment to counteract the optimistic bias.

It should be noted that other variations on these basic questions can be posed. For example, they can be asked in reverse. For question 3, the reverse question is "To obtain a given set of changes in capability, what changes in the budget must occur?"

Further analysis is required to establish how AFIRMS will obtain the required budgetary data, the accuracy of that data, and the precise models needed to process the data. The systems to which AFIRMS might be interfaced have not yet been identified. The significance of the answers when the data available is

used for this purpose has not been tested as yet. The questions requiring further analysis during the evolutionary implementation include the handling of:

(1) Complex interrelationships among variables.

(2) Maintenance of standard taskings so that if AFIRMS is asked any one of the three questions in each of two different years, the response will be comparable despite the difference in time.

(3) Procurement lead times.

4.2 System Functions. The Basic AFIRMS Functions which the preceding discussion was based upon are reviewed in Sections 4.2.1 through 4.2.6. Accuracy, validity, and timing considerations accompany the discussions of each of the component functions.

4.2.1 Overview of the Basic AFIRMS Functions. Figure 4-9 below condenses the Basic AFIRMS Functio ⁻ into a single summarized function. That is, this single box represents THE Basic AFIRMS Function. This diagram indicates both:

a. The basic nature of AFIRMS -- the factors which differentiate it from other systems.

b. The absence from this view of the Secondary AFIRMS Functions such as providing displays of inventory status and the Support Functions such as user interfaces, communications, etc.

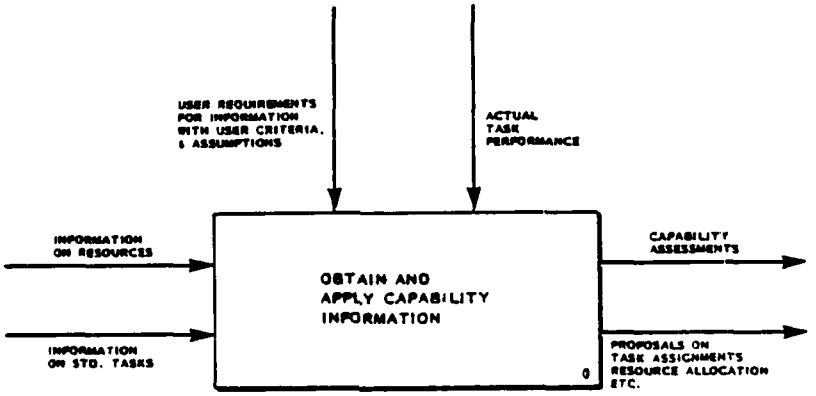


Figure 4-9. View of Single AFIRMS Function

4.2.1.1 What This View of AFIRMS Is. It is important to understand the specific nature of the view discussed in this section. This view attempts to isolate and focus on the functions which carry out the fundamental objectives and concepts of AFIRMS. While there are many objectives of AFIRMS, most of them are supportive of the central objective which is to improve the Air Force's ability to measure capability and apply the resulting measures to serve the Air Force.

The need to measure traces back to the Air Force Chief of Staff's tasking to "develop responsive means of assessing and reporting combat capability." The need to apply the results is exemplified by the Congressional mandate to deal with dollars to readiness.

The fundamental concepts of AFIRMS are:

a. Ability to perform must be measured in terms of assigned tasking.

b. Ability to perform must be measured in terms of resources available to the individual units and must take into account as many of those resources as possible.

c. Capability must be measured in terms of ability to perform.

These concepts translate directly into three of the four Basic AFIRMS Functions: Translate Tasking, Define Resources, and Determine Ability to Perform.

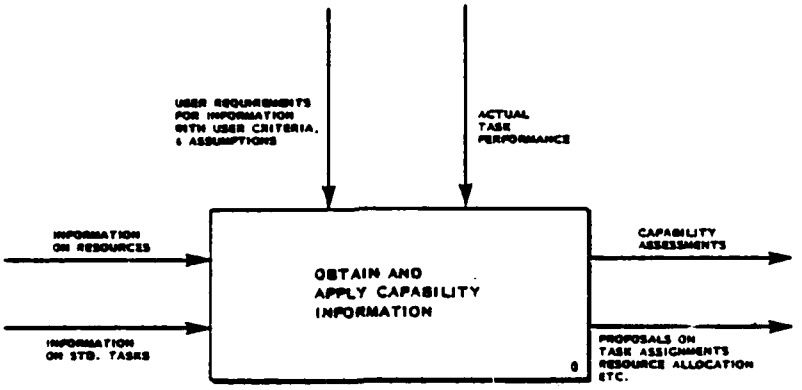
4.2.1.2 What This View of AFIRMS Is Not. An earlier section discussed Applications (User) Functions. In the same way, this section focuses on the Basic AFIRMS Functions. In order to maintain that focus, other types of functions are not stressed. Functions such as providing security or providing communications, referred to elsewhere as Support Functions, are generally ignored. This is not because they lack importance, rather, it is to permit this section to maintain its focus. As part of this effort to maintain focus, only some of the user interfaces which may occur are mentioned. None of them are made specific in the diagrams which illustrate this section. In particular, the fact that AFIRMS provides prompts in obtaining "Information on Resources" or "User Assumptions," is taken for granted in order to focus on what is done with, or about, those kinds of information once they are available.

4.2.1.3 Review of the Overall AFIRMS Function. Figure 4-9, View of Single AFIRMS Function, is repeated below. As already stated, this view sees AFIRMS as a system devoted to obtaining and applying capability information. This is reflected in the title of the box. It is also reflected in the two outputs:

a. The output "Capability Assessments" (top arrow on the right of the box) is driven by "User Requirements" (left arrow to the top of the box) accompanied by "User Criteria and Assumptions." It is based on the two inputs, "Information on Resources" and "Information on Standard Tasks."

b. The other output "Proposals on Task Assignments, Resource Allocation etc." (bottom arrow on the right of the box) is the result of the various "assist" type functions discussed in the last section. The proposals are the result of applying the capability information AFIRMS develops.

The following pages detail this view in a non-rigorous way. A more rigorous presentation of the material on which this section is based appears in Appendix A.



4.2.2 Breakdown of the Overall Basic AFIRMS Function "Obtain and Apply Capability Information." As Figure 4-10 indicates, the single overall function just discussed is detailed into the four Basic AFIRMS Functions which have been discussed in preceding sections. The lower diagram is a "plug compatible" substitute or detailing of the upper box. The complete diagram is presented here to provide the complete, coherent system structure which underlies the interfaces shown in the earlier diagrams. In fact, some interface arrows are shown which were not discussed as part of the simplified diagrams.

Since several variations of the lower diagram have been discussed on earlier pages, this discussion will focus on the nature of the diagram used, rather than on the details of the diagram.

At first sight, the lower diagram appears to be (and is) quite complex. It is, however, an overlay of the more simple diagrams presented earlier. A few interface arrows which were omitted there as not central to understanding the process have been added. For any given AFIRMS site, it is unlikely that all of the arrows or boxes shown in Figure 4-10 would ever be activated simultaneously. AFIRMS is, however, intended to be a worldwide system. That system will consist of many computers. At any moment, each of those computers may be involved in one or more of the overall system functions which implies that any of the arrows may be active. It is important that subordinate views, such as those used when discussing the Applications (User) Functions, be drawn from a complete, coherent functional architecture of the system.

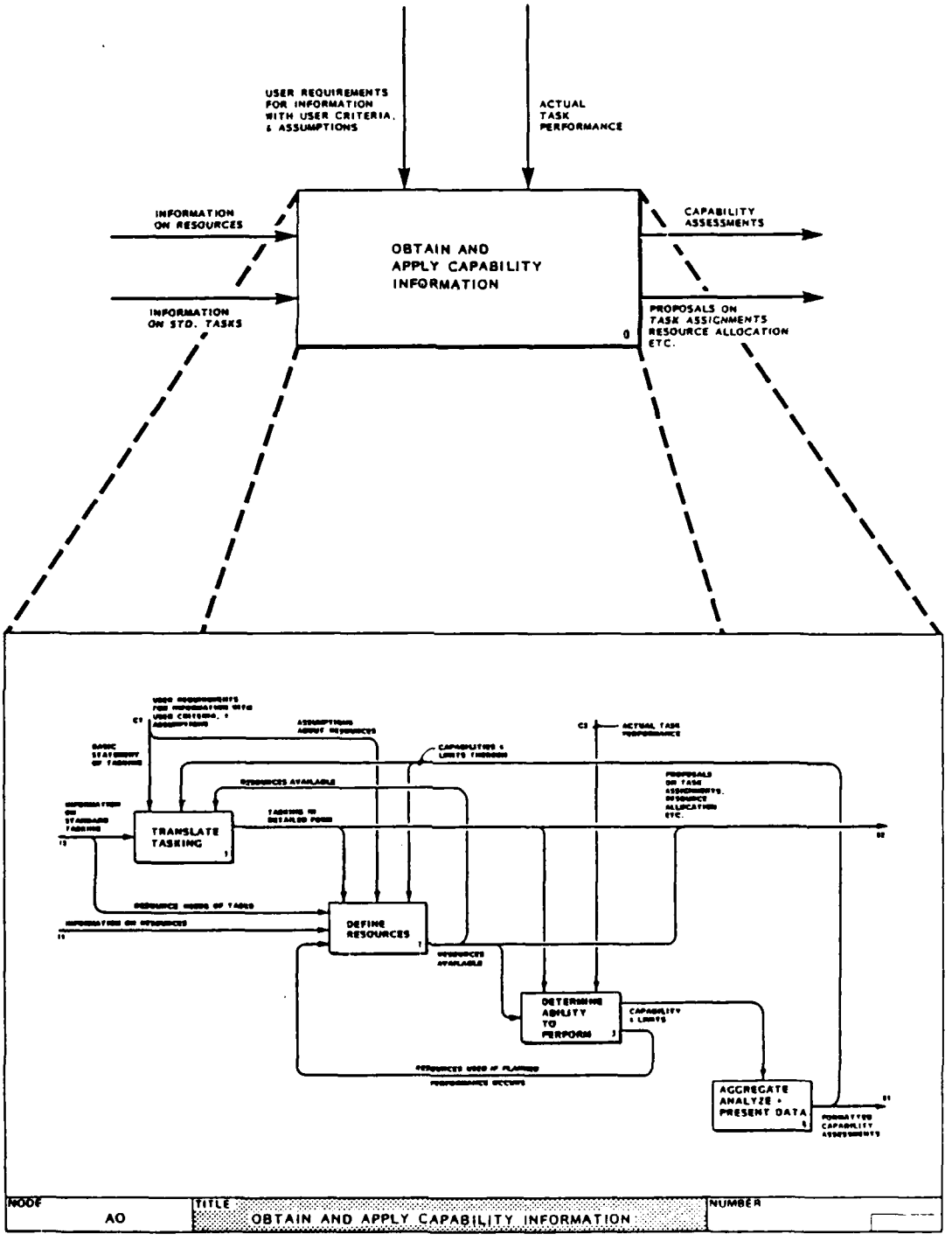


Figure 4-10. Detailing of Single AFIRMS Function into Four Basic Functions

The architecture shown does not focus on either the echelons involved or the hardware selected. The intent is to clarify the overall functions first, and only when that clarification is complete, to assign portions of each of the functions to appropriate levels for implementation. While some of the assignments are obvious, the ultimate location of performance for some of the subfunctions will be determined during the final design process.

The type of projection shown graphically in Figure 4-10 reflects a requirement that the lower diagram must display all of the subfunctions of the upper box. This type of projection is not shown graphically in the rest of this section. It is however, to be inferred. The function "Translate Tasking" is a detailing of box one in the lower diagram of Figure 4-10, the function "Define Resources" is a detailing of box two of Figure 4-10 and so on for the other two Basic AFIRMS Functions.

4.2.3 The Basic AFIRMS Function "Translate Tasking." As Figure 4-11 indicates, the Basic AFIRMS Function "Translate Tasking" consists of four subfunctions. For many applications, only one of them will be active. Figure 4-12 shows that condition.

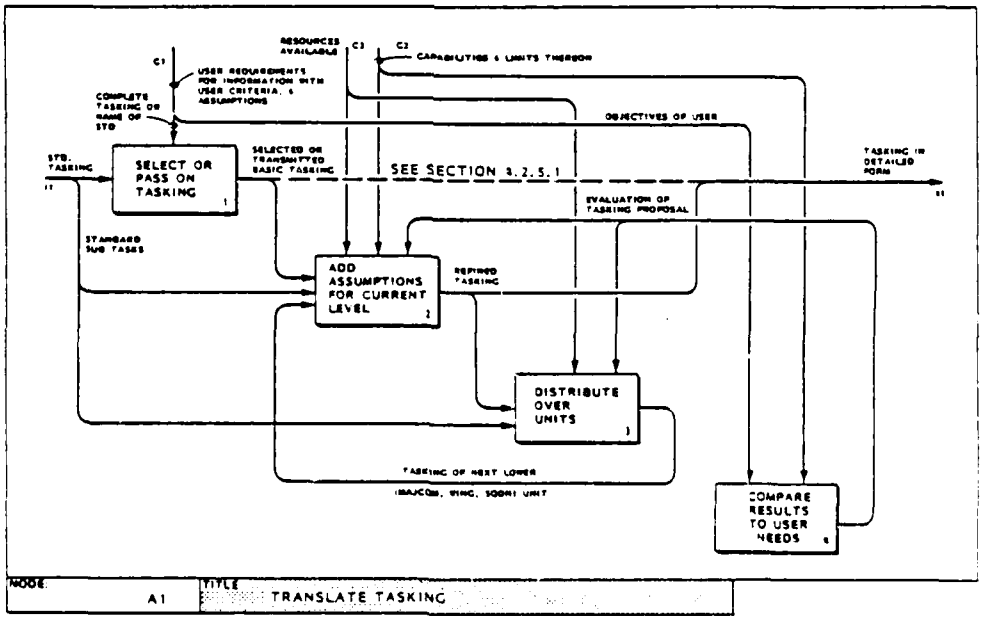


Figure 4-11. Translate Tasking

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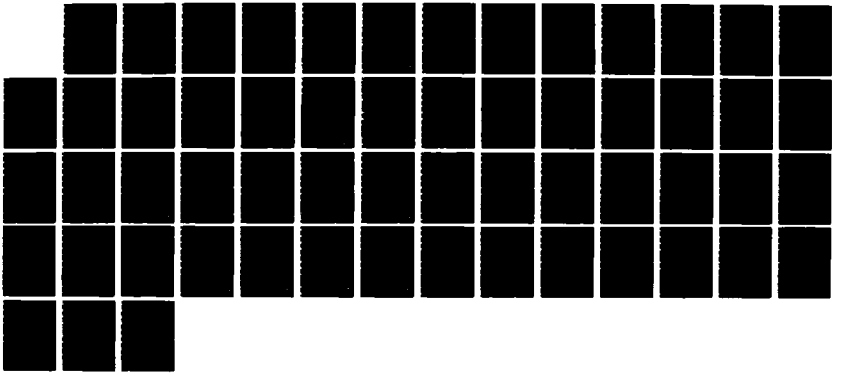

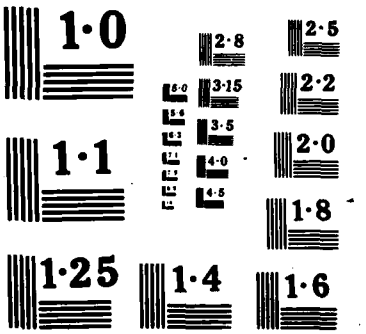
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Figure 4-12. Select or Pass on Tasking

4.2.3.1 Processing of Detailed Tasking. The subfunction represented by Figure 4-12, always begins by performing the steps necessary to ensure a valid initiation. That is, any prompting and editing necessary to establish an acceptable tasking input followed by a review of the user authority to be sure the user may submit such a task. Some of these initiations may have a stored schedule as a user. The wings, for example, are expected to evaluate their capability regularly without requiring a special input by any user. Depending on the application, this step may occur at any echelon.

If a valid initiation provides a tasking in one of the formats expected by AFIRMS, all or parts of the tasking, are distributed to the relevant sites. At that point, the subfunction represented by Figure 4-12, can play either of two roles.

The first role, "Select Tasking," occurs whenever the user specified tasking is a standard tasking known to the system. In that case, a prestored, detailed form of the standard as it applies to each unit, is retrieved from storage and presented to the "Determine Ability to Perform" function for processing.

The second role, "Pass on Tasking," occurs whenever the user specified tasking is a one-time tasking presented in the detailed format necessary for processing by AFIRMS. In that case, the detailed form of the tasking supplied is presented to the "Determine Ability to Perform" function for processing.

When the box 4 function "Compare Results to User Needs," is to be activated, the result of the assessment is fed back and compared to the user's objectives (box 4). The resulting evaluation of the existing detailing of the tasking is fed back as assistance for deciding whether to accept the existing detailing or, if not, what revisions are to be made before the next trial. This subfunction may, or may not be fully or partially automated.

4.2.3.3 **Performance Requirements.** Tasking is expressed in numbers of missions, sorties, and sortie duration. These facts establish that integer precision is required. Data accuracy is critical. Elements of the input function occur at all echelons. Some standard tasking data will be in use for as much as a year. AFIRMS recognizes and questions normal annual dates at which new standard tasking is to be expected. Ad hoc tasking is retained on-line for a period established by the System Manager in accordance with local operating procedures. During peacetime, AFIRMS provides assistance with tasking based on training needs.

4.2.4 **The Basic AFIRMS Function "Define Resources."** As Figure 4-13 indicates, the Basic AFIRMS Function "Define Resources" can be detailed in five subfunctions. The five subfunctions can be seen as three groups; one dealing with the past; one dealing with the present; and, one dealing with the future.

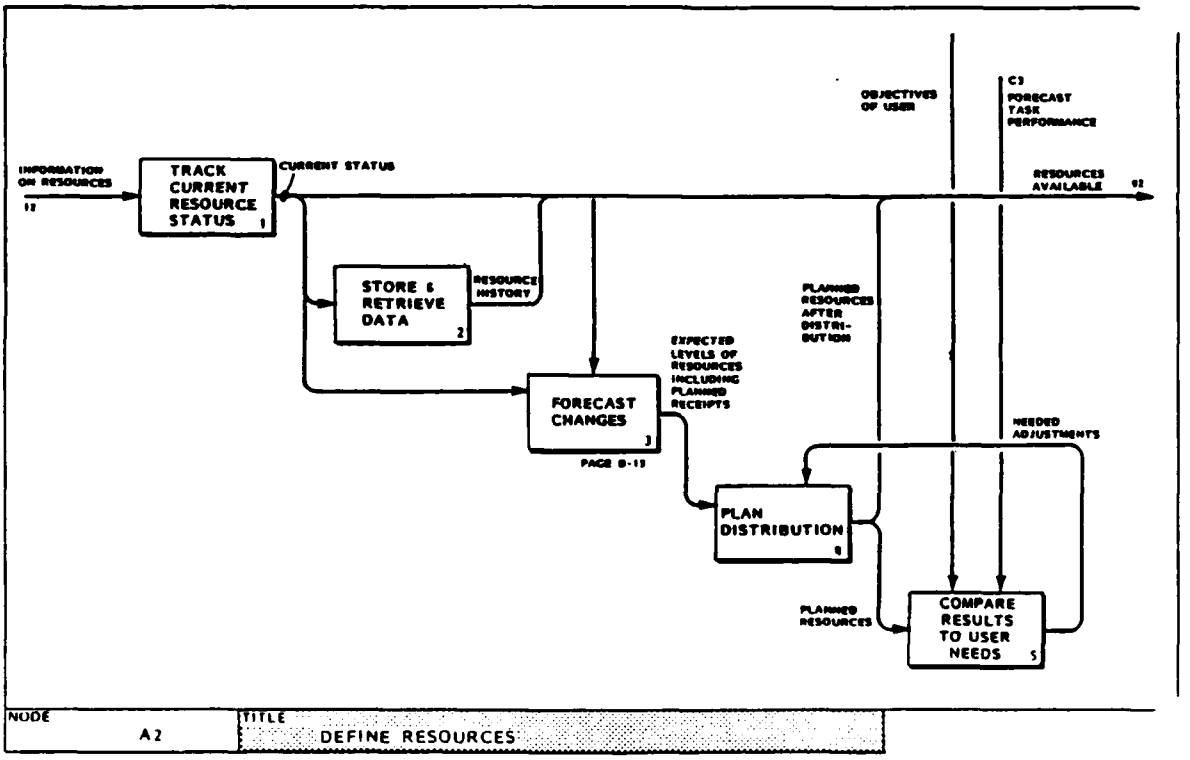

Figure 4-13. Define Resources

SOFTECH

a. The Present. The simplest group deals with the present. It is represented in Figure 4-14 by box 1, "Track Current Resource Status." This is a complete inventory system for the types of resources considered by AFIRMS. The system must know, not only the current balances on-hand at the wing, but also resources at all echelons as well as the "pipeline" of planned movements and repairs. Wherever possible, AFIRMS uses the services of other systems to provide this inventory, collecting only the current or projected status as it is needed. Note that the inventory information may change over the life of AFIRMS. That is, as new systems become available, data on resources which AFIRMS once tracked is obtained from these new systems.

Where AFIRMS itself does the inventory tracking, every effort is made to make the information retained useful to those who supply it. This is done to encourage prompt and accurate updates.

b. The Past. Another simple group deals with the past. It is shown in Figure 4-14. On a regular basis, the current data from box 1 is captured by box 2. Upon user request, the data is recovered and provides the "Resources Available" interface supplied to "Determine Ability to Perform."

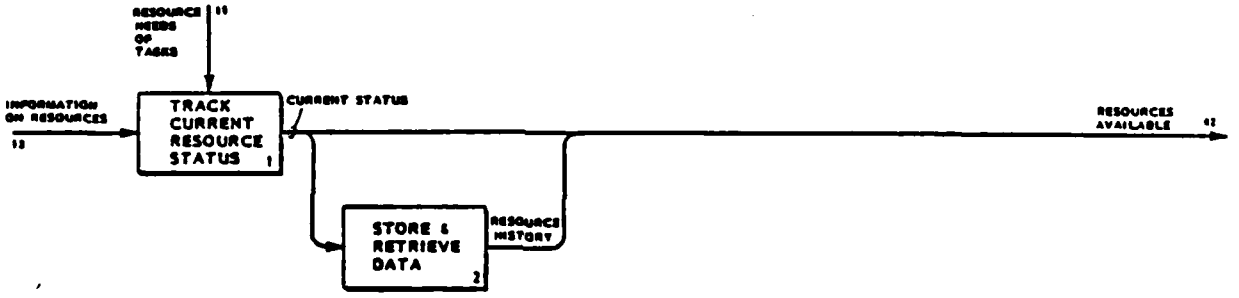

Figure 4-14. Subfunctions of Defined Resources

c. The Future. The final group deals with the future and, consists of all the boxes except box 2. Starting with the current status from box 1, AFIRMS first forecasts the changes to occur in total inventory before the start of a future capability assessment. The expected distribution over units is then determined to provide the distributed "Resources Available" to be available to the "Determine Ability to Perform" function. The final subfunction, box 5, is comparable to the final box discussed for "Translate Tasking." That is, it is concerned with noting areas of possible improvement should further iterations be desired.

Section 4.1.6 mentioned an algorithm to generate an initial proposal. The discussion in that section on the proper role for AFIRMS is repeated here as a preliminary to the discussion of the algorithm.

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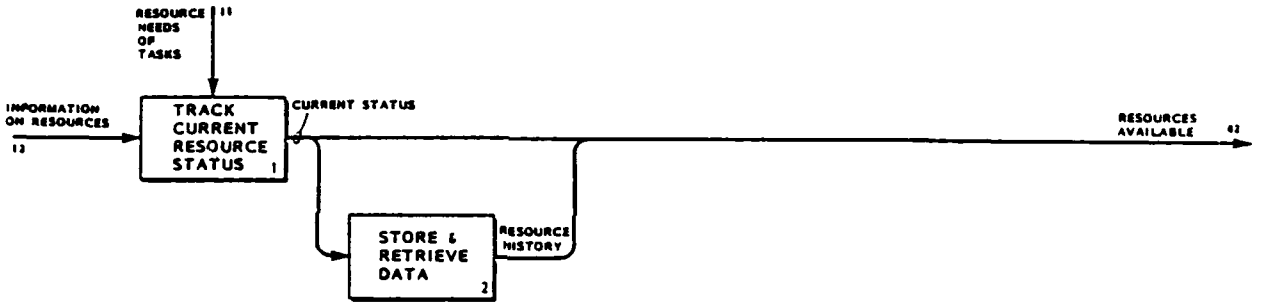

Figure 4-14. Subfunctions of Define Resources

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The Transform and Model Descriptions document details a procedure to allow AFIRMS to suggest a near optimal allocation of newly available resources to subunits. A discussion of the algorithm follows.

The resources to be allocated are over and above the amounts currently considered to be on-hand or in the pipeline. The resources are "hard," that is, dollars are not considered. Assume for example that a supply of fuel and a supply of munitions has just become available (perhaps diverted by a higher command from another theatre). The question, then, is given a number of resources and an amount of each, what is a near-optimal allocation?

The optimization criterion is the number of sorties giving greatest weight to the earliest day (and within each day to the highest priority). Each priority is assumed, by implication, to have only one sortie type per subunit per priority.

This algorithm is intended to illustrate one of many that could be used, and is subject to possible refinements. Refinements include:

(1) Adding user constraints (send no fuel to Wing X).

(2) Allowing for storage and/or transportation limits.

(3) Allowing delays in first deliveries to account for time in transit.

(4) Differentiating between consumable resources (e.g. fuel) and non-consumable resources (e.g. aircraft).

(5) Major changes in the algorithm would occur for changes and additions such as:

   (a) Changing the optimization criterion, perhaps optimizing total sorties without priority rating or another alternate objective.

   (b) Providing for interunit transfer of resources.

(6) Dealing with dollar resources in addition to, or instead of, only considering hard resources.

When dollars only are allocated, the algorithm would be simplified to one which determines the shortfalls and allocates money to their removal in priority order.

The algorithm for the stated problem starts by providing resources for all of the days in which other constraints (tasking limits or shortfalls in other resources) prevent exhaustion of the available supplies. The resources are simply allocated to the units to fill their added consumption.

When a day and priority is reached for which one or more resources would be exhausted, a simplifying assumption is made to establish a linear problem. The resultant problem is a classic case of contention for resources among possible uses. A simplex array is constructed and solved. Since the real situation involves nonlinear consumption, the solution may be suboptimal. The saving in computation appears intuitively to be worth any loss of theoretical optimality. Should that assumption prove inaccurate, a step-wise solution will provide a precise solution.

Under the control of the user interface system, the user is offered a variety of algorithms. The first is to omit any machine generated suggestions. Others match various possible user objectives and the varying amounts of time users may wish to devote to the topic. For example, stopping at the end of the first step in the algorithm just discussed, determining what distribution can occur before contention arises, may be more useful than continuing through an effort to optimize the last part of the distribution.

The distribution of resources can be processed at a central site, or to take advantage of distributed human knowledge and distributed processing power, it can be processed by command level. That is, HQ USAF will pass assumptions or questions about distribution to the MAJCOM which, in turn, will pass questions and its added assumptions to the wing.

4.2.4.1 Performance Requirements. As noted, this function requires information of wing, MAJCOM, and HQ USAF stocks. For major what-if exercises processed in distributed mode, coordinated inputs by many users may be desired to avoid a bottleneck caused by entering all of the data and assumptions at one site.

The precision required is usually integers. The accuracy varies by type of resource, and is be detailed in the DRD. Timeliness is addressed in the System and Database Specifications, however, it is to be expected that data which is brought to a current state twice daily will meet the normal needs of AFIRMS. It is also expected that other uses in the wing will gradually lead to data being available which is more current than that just specified.

4.2.5 The Basic AFIRMS Function "Determine Ability to Perform." The Basic AFIRMS Function "Determine Ability to Perform" is the center of the AFIRMS system. As Figure 4-15 indicates, this function includes three subfunctions.

The first function is the generation of some level of schedule for the wing. The generation of the schedule requires that the actual condition of the wing be considered, and thereby enforces a realistic evaluation of the wing's capability.

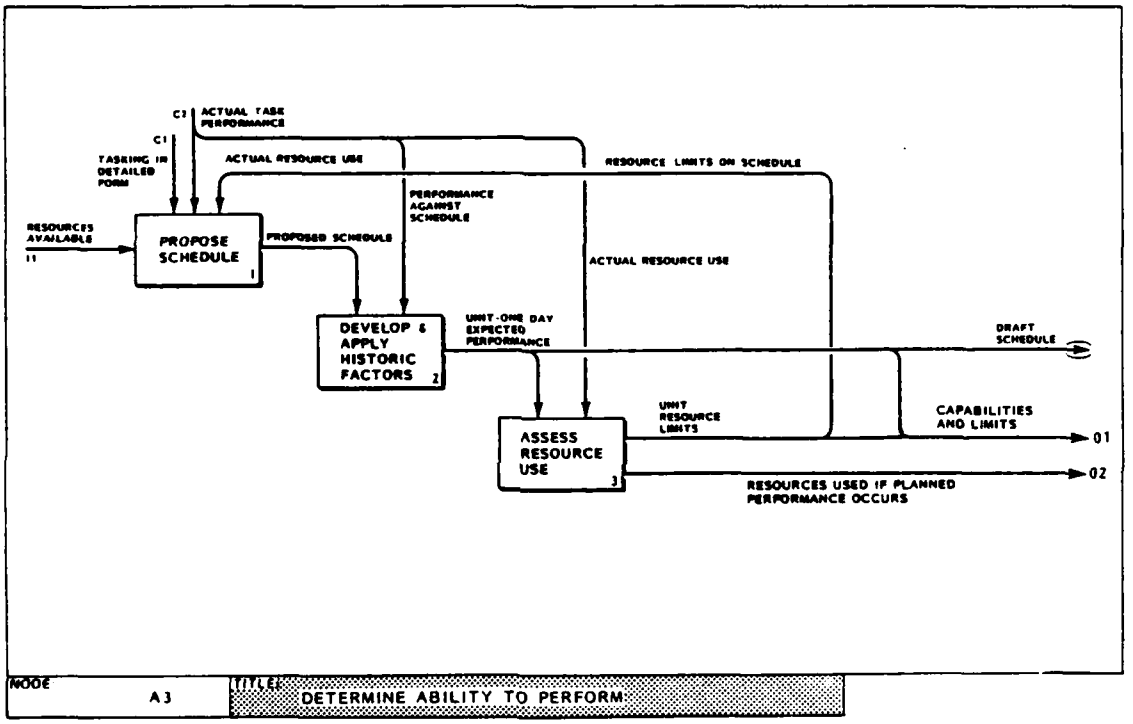

Figure 4-15. Determine Ability to Perform

The process of scheduling is performed automatically to allow regular assessments of wing capability which may cover spans of up to 90 days each with an individual schedule. The results for the current day against current tasking will, however, be made available to the wing as a starting point for iterative improvement. This is done both as a service to the wing and to evoke comments on the reality of the scheduling being done by AFIRMS.

The "Analyze" function stores capability assessments, computes statistics such as trend lines, moving averages or standard deviations, and provides exception type reports based on changes which are considered significant to the functional users.

The "Aggregate" function deals with the accumulation of wing capability data to provide measures at the MAJCOM level and of MAJCOM data to provide measures at the HQ USAF.

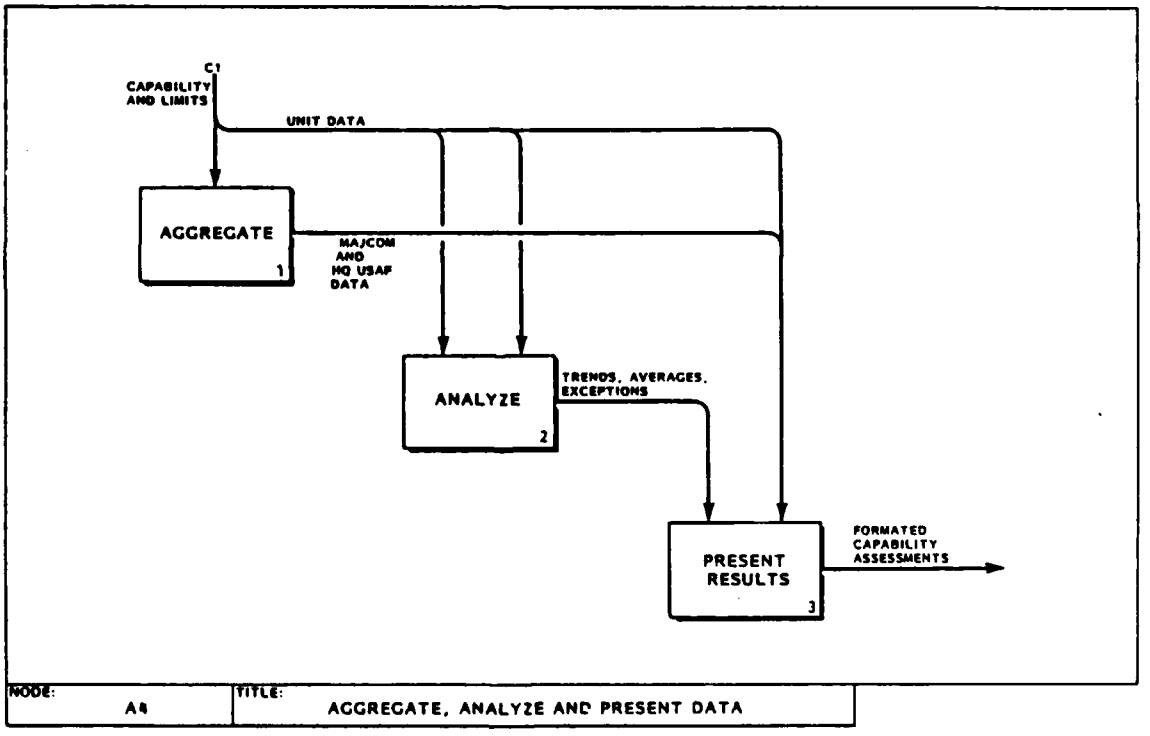

Figure 4-16. Aggregate, Analyze and Present Data

a. Aggregation. It is part of our folklore that adding is simple, but that adding apples and oranges is impossible. So the question for AFIRMS is, "How are results added when the units of measure considered are not identical?" The primary AFIRMS capability assessment metric was specifically selected to address this issue. There are two components to this issue.

(1) The first step deals with, "How can AFIRMS aggregate nearly identical units of measure which occur in subcategories (such different missions within a "mission area" category such as tactical fighter/reconnaissance). In this case, capability assessments can be aggregated along mission lines. This approach provides visibility of capability with an aggregation appropriate to the needs of each command level.

At the unit level, capability can be viewed at the discrete sortie level for generation assessments by mission type, i.e., at the AFIRMS mission metric level. At MAJCOM or other intermediate headquarters, this "atomic" unit of measure for combat capability can be aggregated as unit mission capability assessments. For example, assessments can be evaluated at the ATO/frag level (with multiple concurrent sorties in a mission at one unit) for fighter/reconnaissance units, or at the system mission level for MAC (multiple, sequential missions with portions of the tasking accomplished by different units). Finally, at the Air Staff level, the AFIRMS assessments can be aggregated for assessment of mission area capability, such as strategic bombers, strategic airlift, or tactical fighter/reconnaissance.

Note in this approach that the capability assessments must be available to each command level as assessments at the lowest level of AFIRMS metric detail so that the capability aggregation at each level can be decomposed for analysis into their component parts by command, mission type, and so forth.

(2) The second component of the aggregation issue deals with aggregation of various kinds of capabilities such as very different types of missions. For disparate capabilities such as fighter/reconnaissance and strategic airlift capabilities, aggregation should consist simply of reporting both (or all) numbers. This maintains the tasking orientation of the capability assessments. If, however, an overall rating is desired (such as a readiness rating supplementing the C-rating system), mission capabilities can be added as sorties across missions to provide mission independent capability assessments independent of the mission area.

The AFIRMS capability assessment metric "mission" is uniquely defined to accommodate both roles as well as provide the basis for derivation of any functional views (metrics such as sorties, alert sorties, flying hours, ton-miles, and dollars).

4.3 Flexibility.

a. AFIRMS is flexible in several senses:

(1) Over MAJCOMs. MAJCOMs manifestly differ in missions, objective measures of performance, and organizations. Systems which might interface with, or perform functions of AFIRMS vary. User attitudes also vary.

(2) Over geography. Locations of sites imply different requirements. At a minimum, maps used in displays require adjustment.

(3) Over organization. As with MAJCOMs, the organization within which each site is located requires:

(a) Availability of options to adjust to the unit's "way of doing things";

(b) Adjustment to the systems in use by the organization which can serve as data sources; and,

a. Aggregation. It is part of our folklore that adding is simple, but that adding apples and oranges is impossible. So the question for AFIRMS is, "How are results added when the units of measure considered are not identical?"

The first step deals with, "How can AFIRMS aggregate nearly identical units of measure (such as sorties) which occur in subcategories (such as sorties using different weapon systems or sorties of different mission types)? Most particularly, is it possible to plan a general approach which will be adaptable to the inevitable future changes in needs?"

The current approach for the reporting of sorties on operational AFIRMS is that, for sustainability measurements, the data passed would include:

(1) "Unit," "Tasking Identification," "Day of Measurement," "What-if classification of the data passed," and, "Time of Evaluation." This data would be defined once for each evaluation.

(2) "Day within tasking period," (This element would not have a value greater than one for measurements of readiness), "Weapon System," and "Sortie Type."

The discussion points out that a way of providing flexibility in this regard can be established. In view of the changeable environment in which systems exist, AFIRMS must possess that flexibility.

The second step deals with aggregation of various units of measure such as sorties and ton-miles. For disparate measures such as sorties and ton-miles, aggregation should consist simply of reporting both (or all) numbers.

4.3 Flexibility.

a. AFIRMS is flexible in several senses:

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(2) Over geography. Locations of sites imply different requirements. At a minimum, maps used in displays require adjustment.

(3) Over organization. As with MAJCOMs, the organization within which each site is located requires:

(a) Availability of options to adjust to the unit's "way of doing things";

(b) Adjustment to the systems in use by the organization which can serve as data sources; and,

(4) Over time. To make AFIRMS as economical as possible, the following adjustments are accommodated:

(a) Running additional systems (non-AFIRMS) on AFIRMS equipment or vice versus;

(b) Using equipment "belonging" to other systems to host AFIRMS.

(c) A phased implementation is planned.

(5) Over equipment. AFIRMS is impacted by several kinds of equipment changes:

(a) Replacement (at some bases) of obsolete equipment used for other systems to which AFIRMS is interfaced; and,

(b) Moves of AFIRMS to other equipment to make way for other new systems or to take advantage of new equipment capabilities.

(6) Over interfaces with other systems. AFIRMS is impacted by:

(a) Variations between systems at different installations.

(b) Modification of source systems in the future.

(c) Budget constraints and practicality of using already produced hardware (e.g., Local Area Networks (LANs) to accomplish its mission).

(7) Over changes in requirements to readiness assessments and reporting procedures.

(8) Over means of displaying data, i.e., pie charts, viewgraphs, line graphs, etc.

b. To achieve these types of flexibility, AFIRMS provides for:

(1) Analysis of user requirements over all MAJCOMs.

(2) Data organization that stresses similarities among site types.

(3) Use of portable languages.

(4) Modular structuring of programs.

(5) Well controlled interface gateways between external systems, database managers, etc.

4.4 System Data.

4.4.1 Inputs and Outputs. The products by which the data are entered into the system as well as the products by which the data are provided to the user are identified in the AFIRMS Product Descriptions. A detailed description of the data used in the AFIRMS system data is provided by the AFIRMS Data Requirements Document.

AFIRMS data can be viewed as consisting of four categories, each consisting of several "kinds of things" of classes of entities. For each of the entity classes, in turn, several kinds of data (or appearance classes) are defined. It is important to note that this is a logical, abstract view of the data. The term "appearance class" is roughly equivalent to the more commonly used "data element." The categories and their major entity classes follow:

a. Standards for types of things and for the relationship among them. Entity classes include:

   (1) Resource Type. (A list of the kinds of resources AFIRMS considers.)

   (2) Task Type. (Kinds of tasks referred to in taskings or used for support of those primary task types.)

   (3) Skill Type. (Kinds of skills used.)

   (4) Need for Resource Type by Task Type. (What does it take to do the job?)

   (5) Resource Sum or Assembly. (What resource types are components of other resource types?)

b. Orders and their resource needs. Entity classes include:

   (1) Order Header. (The elements common to all copies of the order.)

   (2) AF Unit's Piece of Order. (That order gives what tasks to my unit?)

   (3) Task. (All the tasks due to an order, both primary and support tasks.)

   (4) Missions. (The tasks which are, in fact, missions.)

   (5) Role of Resource Type on Task. (How much of what resources are needed to accomplish this task; A.4 may be used to calculate this.)

c. Units, Bases, Resources. Entity classes include:

(1) Air Force Unit (A squadron, wing, MAJCOM, or the total Air Force.)

(2) Base.

(3) Unit's supply of resource. (How much of what item does each unit have?)

(4) Aircraft. (A tally of individual items as opposed to the total count provided by C.3.)

d. Planning to Carry Out a Task. Entity classes include:

(1) Sortie. (The response to the tasking of a mission.)

(2) Allocation to Task. (How much of each resource is committed to the sorties planned? Note that this quantity must not exceed the amounts available.)

These categories, for which only partial lists of entity classes are provided, reflect the basic AFIRMS approach. Category B, orders, are compared to Category A, resources, to develop Category D, the capability to carry out the tasking. Category A, standards, are used at various stages in the process.

4.4.2 Database. The AFIRMS Database Specification discusses the factors considered in designing the AFIRMS databases and identifies the data to be stored at each of the levels and functional areas within levels. Significant issues include: security, the need to provide easy ad hoc queries to users, handling of what-if databases, speed, data consistency, integrity, restoration of historic data, and deployability. A central and critical issue is the number of copies of the database which are maintained. The LPP experience suggested a limit of six copies of the database is sufficient to handle exercise, peace, crisis, historic and what-if requirements.

An overall AFIRMS database architecture has been developed. Development of the specific design depends on the final selection of hardware and system software for the MAJCOM AFIRMS system components. These selections, in turn, depend on specific detailed functional requirements definition efforts accomplished in the Analysis Phases of the initial segment implementations.

4.4.2.1 Number of Copies of Each Database. AFIRMS requires support for databases to serve three functional purposes: day-to-day peacetime operation; support of crisis operations and contingency exercises; and support of what-if queries (e.g., POM/Budget). For each of these, in addition to local backup procedures, there is a need for off-site replication and storage of the database in whole or in part. The following comments ignore the need for off-site replication:

a. Each site, (wing, MAJCOM, HQ USAF), will have a single copy of its own day-to-day operational databases.

b. Each site may need one or more exercise databases to support exercises initiated at its own site or at other levels.

c. Each site may need one or more what-if database(s).

Databases containing other than real data supporting day-to-day operations are classified as a what-if or historic database. This includes exercise, ad hoc, what-if, and historical data. Exercise data may support simulation of a real crisis. Ad hoc what-if data supports hypothetical situations (e.g., POM/Budget), and historical data supports the need to review any of the other types of data for trend analysis purposes. A total of five on-line copies of these databases are allowed on-line at any time in any combination for each AFIRMS functional user.

Each site has a centrally located database. All functional areas of that site have databases locally resident on their hardware which is a subset of the central database. It is anticipated that all functional areas may not need the capability to view historical or what-if data in five copies. However, for planning purposes, this functionality is uniformly distributed over all functional users. Specific data requirements for what-if and historical usage will vary by MAJCOM and so must be identified in the Analysis Phases of the initial MAJCOM implementations.

4.4.2.2 Basic Size of One Copy of a Database. The size of a database depends on the items set forth in the sample table below. (Entries are intentionally irrelevant.)

Item	Length (bytes)	Quantity	Total Space (K bytes)
Airman	180	250	45
Aircraft	92	80	7
Total Storage Space			52

Such tables using all items and real numbers are provided in the Database Specifications. Total database size requirements are given by functional user in these specifications as well as for the central database.

Each replication of a site's database increases the site's database size. Thus, if the basic size of one database were 52 K bytes and 6 copies are required to satisfy peacetime operations and simultaneously supporting a mix of exercises and what-if questions, the actual database size would be 312 Kbytes (6 x 52K).

SECTION 5. ENVIRONMENT

5.1 Equipment Environment. Equipment is provided to each AFIRMS site on an "as needed" basis. AFIRMS uses existing facilities and equipments wherever possible. Each site in the operational AFIRMS has the potential for having a different configuration, dependent upon site-unique requirements and existing computing assets. However, at a minimum, each AFIRMS site contains the equipment required for the CNM. The CNM contains the AFIRMS database for that site as well as the communications support for site-to-site communications. The System and Subsystem Specifications developed with the Evolutionary Implementation Plan, address detailed equipment requirements. In general, however, two basic hardware options are available to AFIRMS:

a. Implement AFIRMS on existing hardware with additional AFIRMS equipment added as needed, e.g.:

   (1) WWMCCS Honeywell H-6000 now installed at all AFIRMS targeted MAJCOMs/HQ USAF.

   (2) Phase IV Sperry 1100/60 Computer(s) to be installed at all bases.

   This approach appears to be a cost-saving idea. At the MAJCOM/HQ USAF echelons, the WWMCCS computers could be a viable choice. They offer the security protection* and standardized modular hardware; however, they are already heavily loaded.

   At the wing level, the Phase IV system does not provide a viable choice for AFIRMS due to security issues - the Phase IV system handles unclassified data only.

   Note that this approach will most certainly require that existing equipment be supplemented with AFIRMS hardware - database machines, color and black/white terminals, etc. This opens a whole new area of hardware/software interfaces, user priorities, and so forth.

b. Implement AFIRMS on dedicated hardware. This second approach implements AFIRMS sites on dedicated hardware.

*All users, however, must have Top Secret security clearances.

5.1.1 General Equipment. The AFIRMS system and subsystem architecture is designed to be easily reconfigured for different sites as the requirements for each site becomes known, and as they change. The architecture consists of at least two classes of computer equipment: central node equipment and functional area equipment.

5.1.1.1 Central Node Equipment. Each AFIRMS site consists of a Central Node containing the central mass storage devices for that site, a network controller, and one or more Central Node modules. The mass storage devices consist of devices to hold an on-line central database and load/store data and software. These devices have data paths to all of the Central Node resident modules. A Central Node module has a data path to one or more other Central Node module. The Central Node module's primary use is to synchronize the site's central database with other databases. The other databases consist of those at other sites and those at the other functional area workstations. For a more detailed description of Central Node equipment components, refer to the AFIRMS System Specification.

5.1.1.2 Functional Area Equipment. Functional area workstations provide the human interface to AFIRMS. Each functional area which needs to enter or examine AFIRMS data has a functional area workstation to communicate with the Central Node. These functional area workstations are microcomputers with a hard disk capable of running a local database and data manipulation software for the users at the functional area. This workstation may support one or more terminals with complex color graphs or simple monochrome (standard black and white) displays.

Functional area workstations with color graphics terminals are provided to support the decision-makers and are expected to be located at the major decision points around the AFIRMS site. Functional area workstations with monochrome CRT terminals will function primarily as input and output devices located to support the middle managers in day-to-day system operations. The CRT terminals will not have a graphics capability, but can present data in a tabular format. See the Subsystem Specifications for details on the terminal distributions.

5.1.2 Wing Equipment. Wing sites architectures are identical. The specific design may vary. For example, the number of input and output devices may vary as well as the number of disks required for database storage. The wing AFIRMS site has an equipment core that typically serves the wing headquarters and command post. In addition, each squadron affiliated with the wing has additional functional area workstations that "plug into" the core wing hardware.

Functional area workstations with color graphics terminals are expected to be located at the major decision points around the wing such as the WOC, the maintenance Job Control Center, the Munitions and Fuels Control Centers, wing headquarters, and the flying squadron(s) operations area. Some of the locations for the monochrome CRT include the WOC, Aircraft Maintenance Units (AMUs), fuels branch, and base supply.

5.1.3 MAJCOM/HQ USAF Equipment. Hardware configurations for these AFIRMS site types are expected to be architecturally identical.

Analogous to the wing level, color graphics workstations are provided for at the MAJCOM and HQ USAF sites to support decision-makers, and are located at each site's major decision points. Similarly, monochrome CRT workstations function primarily as input and output devices and are located to support MAJCOM/HQ USAF middle managers. For a detailed breakdown of CRT terminal locations, refer to the appropriate AFIRMS Subsystem Specification.

5.2 Support Software Environment. The AFIRMS subsystem applications software interfaces with the following support software:

a. Operating System
b. System Utility Routines
c. Communications Software
d. Database Management System (DBMS)
e. Display/Graphics Software
f. Restart/Recovery Software
g. Transaction Control Software

For more detailed AFIRMS subsystem support software requirements, refer to the corresponding AFIRMS Subsystem Specification.

5.3 Interfaces. AFIRMS is a set of subsystem sites requiring data transfer between and within the various sites. In addition, an AFIRMS interface with existing and future automated systems is required. The AFIRMS philosophy for data collection is to collect no more than is needed and not to collect data if it is already collected in automated systems. If it is in other systems (and meets AFIRMS criteria for accuracy and timeliness), then AFIRMS where feasible, interfaces with those systems to obtain the data.

5.3.1 Systems Interface Candidates. AFIRMS interfaces with MAJCOM unique, Air Force standard, and DoD systems in order to collect the resource summary/status data necessary, and to produce the AFIRMS readiness tools. These interfaces are also required to communicate between and within the Air Force organizational structure of AFIRMS. Interfaces with communications systems, logistics management systems of the Air Force Logistics Command (AFLC), personnel management systems and command/control (tasking) systems, provide necessary AFIRMS data while minimizing data system redundancies. Systems with which AFIRMS is likely to interface/integrate, include:

SYSTEM	INTERFACE AREA
Airlift Deployment Analysis System (ADANS)	Replacement for FLOGEN III.
Air Force Information System Architecture Efforts	AFIRMS architecture and environment
Air Force Operations Resource Management System (AFORMS)	Aircrew status
Airlift Implementation and Monitoring System (AIMS)	MAC aircraft schedule and movement information
Base Level Data Automation Program (Phase IV)	Data integration
Combat Ammunition System (CAS)	Combat ammunitions inventory and status
Combat Fuels Management System (CFMS)	Combat fuels inventory and status

SYSTEM	INTERFACE AREA
Combat Supplies Management System (CSMS)	Spares status
Combat Supply System (CSS)	Standard Base Supply System (SBSS) data
Contingency Operations/Mobility Planning and Execution System (COMPES)	Tasking and force structure
Core Automated Maintenance System (CAMS)	Spares, maintenance support personnel status
Dyna-METRIC/mini Dyna-METRIC Model	Spares capability
Electronic Information Command and Control System for Operational Readiness of the Luftwaffe (EIFEL)	Tasking and force structure (in USAFE)
European Distribution System (EDS)	Spares status (in USAFE)
Force Generator, Version 3 (FLOGEN III)	MAC automated mission flow generator
Flow Management Information System (FMIS)	SAC force and resource status data
Information Processing System (IPS)	MAC command and control data
Local Area Network (LAN) Efforts	Communications (local)
Logistics Capability Measurement System (LCMS)	Spares status
Military Air Integrated Reporting System (MAIRS)	MAC mission movement data
Standard Air Force Small Computer Requirements Contract Efforts	Hardware
Standard Base Supply System (SBSS)	Spares, fuels, personnel status
Technique for Assessing Comparative Force Modernization (TASCFORM)	Force modernization
Theatre Airlift Management System (TAMS)	In-theatre mission flow and tracking data for deployed MAC aircraft
Vehicle Integrated Management System (VIMS)	Base Level vehicle maintenance performance data

SYSTEM	INTEGRATED AREA
Weapon System Management Information System (WSMIS)	Spares capability
WWMCCS Information System (WIS/AFWIS)	Communications (long-line)

A number of programs are working in the direction of data automation standardization. In large measure, the progress of AFIRMS interface with other systems will hinge on the pace of the Defense Data Network (DDN), Automated Message Processing Exchange (AMPE), LANs, and SCOPE EXCHANGE/DIAL, PHASE IV base-level automation and other programs associated with the USAF Information System Architecture. These efforts will form the ideal AFIRMS interface mechanism as other systems evolve to conform to the architecture.

5.4 **Summary of Impacts.** This section addresses the expected ADP organizational, operational, and developmental impacts introduced by AFIRMS.

5.4.1 ADP Organizational Impacts. General observations are made at this time based upon impacts that often occur with any new ADP system.

a. Additional ADP support personnel are needed at each wing, HQ MAJCOM, and HQ USAF to maintain the system and/or provide program maintenance support and other programming support as the system evolves.

b. DSDO will support the operational system as is now done for other Air Force ADP systems.

c. An AFIRMS Users Group is established to make recommendations regarding product enhancements and identify new and improved ways to use products in their daily jobs. The group meets to exchange viewpoints and publishes proceedings within the Configuration Management Systems.

d. A "Super User" or resident expert within each MAJCOM (perhaps the MAJCOM OPR for the AFIRMS Users Group) who can assist wing and MAJCOM level users with their questions/problems could also be beneficial to ensuring good use of the AFIRMS system.

5.4.2 ADP Operational Impacts. Impacts on operational procedures of the data processing center(s) when AFIRMS is implemented depends upon the nature of the ADP installation. It is expected that when an Air Force ADP system interfaces with AFIRMS, that interface will increase/complicate the system/program maintenance workload for each system and/or program interfacing with AFIRMS. The specific impacts generated by specific implementations are identified, reviewed, and accommodated in the Analysis Phase of the implementation block.

5.4.3 ADP Developmental Impacts. Air Force personnel and ADP development resources needed to develop and test AFIRMS are discussed in the AFIRMS Economic Analysis. Contractor support is expected to predominate in the initial analysis, design and programming effort for the first block of each MAJCOM segment. Additionally, Air Force ADP support is required for the following efforts during the first block of each segment:

a. Participate in integration testing of the contractor system installation, as a transition to operation and maintenance of the system.

b. Assist Air Force users in initializing the database at each AFIRMS site after the systems are installed.

c. Assist in defining interface methods for automated information systems that are identified as interface candidates. Develop any software required of Air Force information systems with which AFIRMS is to interface.

5.5 Failure Contingencies. This section deals with restart of an AFIRMS site after it has been reintroduced into service either from a nonoperating or a partially operating state. It does not address the issues of fall back and backup as discussed in Section 3.5 of this document.

The decisions as to how an AFIRMS site should be brought back on-line are complex, closely related to how the system is designed, and closely related to the kind of failure.

At one end of the spectrum of complexity is the loss of a dumb input/output terminal. In this case, if the problem is communications or the terminal itself, the terminal is simply unavailable for input or output and users must time share with other nearby terminals, use a temporary replacement terminal, or do without a terminal until the fault is corrected. If the lost terminal were a smart device, the range of possibilities increases, possibly to the point of entering database update transactions (this latter capability is a function of the system design). At the complex end of the spectrum is the case in which the portion of a site that controls the database has been unavailable for a period of time. When it does become available, other AFIRMS sites, smart terminals within the site, and other system interfaces, may have database updates or requests pending. Furthermore, a journal file of historical transactions (since the last database backup) must be used to bring the database current to the time when the system failed if a disk failure (head crash) occurred.

The specific failure modes of each AFIRMS site type and the sequence of steps for restart depend upon the specific failure, and the design of the AFIRMS site. The AFIRMS site designs assure that failure recovery is systematic and deterministic. Flow diagrams are developed to identify the sequence of actions that must be initiated to bring the system to a full on-line state from each failure condition.

In any event, the Analysis Phase for block one of each segment will determine the failure contingencies, degraded mode capabilities required, and all fallback modes of operation.

5.6 **Security.** The security environment for the operational AFIRMS varies at the wing, MAJCOM, and HQ USAF sites. AFIRMS wing sites generally operate in a controlled security mode with a mixture of classified and unclassified terminal users. HQ USAF, MAJCOM, and SAC wing sites operate in the system High Security mode. Each AFIRMS site, and collectively the AFIRMS network, will be accredited for processing classified data in accordance with AFR 205-16 and other DoD and Air Force security directives. Refer to Section 3.6 for additional information.

5.7 **Assumptions and Constraints.** The following assumptions are made in regards to the AFIRMS operational system architecture:

a. Technical risk factors inherent in the architecture must be low to medium.

b. Technology assumed in architecture must be currently applied technology. (Near state-of-the-art but no extensive R&D.)

c. The useful life inherent in the architecture must be a minimum of ten years.

d. Peacetime reliability/availability must be high. Wartime survivability requirements were considered, but deemed too costly. AFIRMS will operate as long as possible in wartime, but it is not a wartime survivable system.

e. Deployed units must have the capability (as a minimum) to report to the AFIRMS system.

f. Peacetime includes crisis situations.

g. The system is designed in such a manner as to minimize the difficulty in interfacing to other systems in the future.

h. Data currency is defined as the maximum amount of time allowable before data resident at multiple locations are updated after the data at one location is changed.

   (1) Local site: data currency must be achieved within 3 minutes for mission related data. This must occur 90% of the time with the system operating in a normal mode. Data currency must be achieved within 1 hour for non-mission related data. This must occur 90% of the time with the system operating in a normal mode.

(2) Intersite: data currency must be achieved within 6 hours for data shared between a wing site and a MAJCOM site. This must occur 90% of the time with the system operating in a normal mode. Data currency must be achieved within 12 hours for data shared between a MAJCOM site and the HQ USAF site. This must occur 90% of the time with the system operating in a normal mode.

i. Data age is the time allowable between prescribed data updates between sites regardless of intermediate changes in the data.

(1) A 6 hour update cycle is required for data between a wing site and a MAJCOM site. A 12 hour update cycle is required for data between a MAJCOM site and the HQ USAF site.

j. Response times vary depending on the complexity of the queries and the types of processes involved with the query. For planning purposes, the following response times are used for a query limited to the local site. (Automatic system intersite queries are not permitted.)

(1) Complex Query - 11 seconds or greater.

(2) Medium Query - 4 seconds to 10 seconds.

(3) Simple Query - 1 seconds to 3 seconds.

The definition of the terms complex, medium, and simple vary by functional user, or at least by MAJCOM. Specific definition will be determined in the Analysis Phase of each segment implementation block.

k. The operational AFIRMS operates in a secure controlled mode across all sites.

l. A site system must be easily expandable without major modification to the software and without requiring replacement of all or most of the existing hardware.

SECTION 6. COST FACTORS

6.1 General Process. This section describes the breakdown of costs and benefits used to analyze the economic life of alternatives for building the operational AFIRMS. The estimated life-cycle cost of the recommended alternative is discussed briefly and itemized in terms of the generic cost and benefit factors. Costs are stated in current dollars (the total of the expenses in each of the years). The total cost is then restated in terms of present value (the amount which, if invested today, would provide the needed dollars over the years of the program assuming that both capital and interest were spent). The costing of each alternative is based on an evolutionary implementation approach and on MAJCOM differences in mission, deployments, and existing automation.

The recommended alternative, called "Hybrid Architecture," provides hardware and support to wings without significant unit automation. This alternative recommends installation of a central computer and workstations in such wings, but would use the existing automation where available. This alternative also provides deployable equipment when required and integrates AFIRMS with other Air Force standard and MAJCOM unique systems. The life-cycle cost of the recommended "Hybrid Architecture" alternative is $240 million in current dollars. This cost includes estimated cost of $130 million for implementing AFIRMS in Air Force Reserve and Air National Guard units.

6.2 Explanation of Cost Factors and Benefits. Cost factors are divided into recurring and non-recurring costs. All recurring costs are classified as Operations and Maintenance (O&M). The O&M costs are subdivided into expenses for personnel, hardware, software, supplies, and utilities. The non-recurring costs consist of development, acquisition, and installation.

Major benefits are divided into utility, manageability, and timely implementation. This division reflects the objectives against which performance in the category is measured. Utility applies to the information output and system utility. Manageability is a combination of low technical and management risk. Timely implementation emphasizes the importance of obtaining program results in the field as soon as possible, even if the results are only an initial improvement. (Refer to the Economic Analysis for a complete description of each factor.)

6.3 Cost Summary of the Recommended Alternative. Analysis, design, and programming costs dominate the costing analysis but are less than 45% of the total undiscounted system cost. Hardware and software maintenance costs are substantial because of the large equipment requirement. Additionally, deployable equipment has a higher rate of maintenance than non-deployable.

The figures below summarize the estimated costs of the recommended alternative. The figures are provided for budgetary evaluation. A full discussion of the costs appears in the AFIRMS Economic Analysis.

LIFE-CYCLE COSTS

Procurement	$43,018,297
O&M/Analysis, Design & Programming	57,133,059
O&M/Installation	13,228,659
O&M/Hardware & Software Maintenance	54,488,414
O&M/Supplies	3,024,446
O&M/Communications Links	4,323,226
Air Force Manpower	
Officer (10)	2,993,839
Enlisted (362)	62,372,628
Total Current Dollar Cost	240,580,109
* Total Present Value Cost	141,297,626

* The Total Present Value is based on the 10% annual discount factors given in AFP 178-8.

SECTION 7. SYSTEM DEVELOPMENT PLAN

The material in this section is repeated in, and expanded on, by the AFIRMS Evolutionary Implementation Plan.

7.1 Contact Point. The point of contact for the evolutionary implementation of AFIRMS is the Air Force Directorate of Operations. The AFIRMS OPR is designated within the Directorate of Operations. The AFIRMS Management Plan contains a statement of the OPR responsibilities as well as those of the Program Management Office.

7.2 Implementation Elements. The AFIRMS EIP is composed of segments, blocks, and phases. Each MAJCOM is a segment of the EIP, as is the HQ USAF. Each segment is composed of a number of blocks. A block is a specified set or subset of functional requirements to be implemented. These requirements are normally represented by a specific set of AFIRMS applications products (screens and processes), communications capabilities, and interface requirements. Each block is composed of five phases. The completion of the five phases implements the functional requirements identified for that block. The phases of a block contain the task detailing necessary for the analysis/requirements definition, the development, the installation, the operation, and the integration/management of the functional block capabilities. Figure 7-1 shows the relationship between the segments, blocks, phases, and time. This figure shows that the EIP is composed of segments (Segment H = HQ USAF and Segment U = USAFE) which have functional capabilities implemented as sequential blocks over time.

Operational AFIRMS is designed to be used on a day-to-day basis. The AFIRMS set of readiness and capability assessment tools available to each functional user are tailored to the work requirements and status information needs of that user. The evolutionary aspect of AFIRMS implementation has two meanings. Both meanings relate to time-phased sequences of activities.

First, the implementation of the initial blocks of AFIRMS functional capability has a sequential timetable over the HQ USAF and the MAJCOMs. The initial block within each segment of the evolutionary implementation provides a core capability for the HQ USAF, MAJCOM headquarters and operating units of each MAJCOM. The core capability may be different for Block 1 of each EIP segment since additional capabilities or enhanced capabilities will become available over time. The

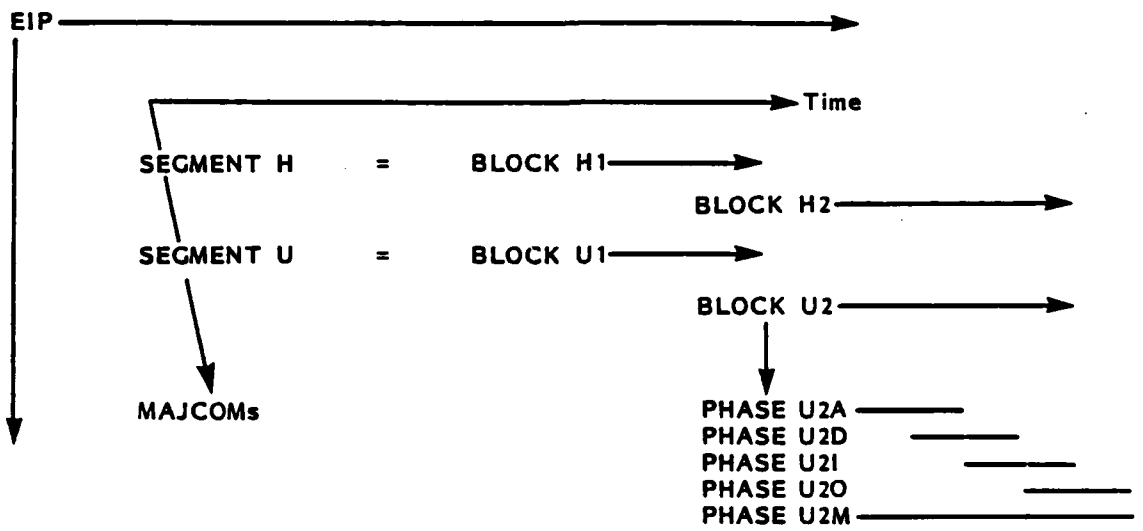

Figure 7-1. AFIRMS EIP Structure

SEGMENT = The HQ USAF or MAJCOM "slice" of AFIRMS. (HQ USAF and USAFE are the first two segments.)

BLOCK = A module of AFIRMS functional capability. (Block 1 functionality = LPP functional capabilities.)

PHASE = A group of tasks required to accomplish a block. (Analysis, Development, Installation, Operation, Integration/Management.)

core capabilities for the first segment implementations are those of the LPP as modified to reflect the lessons learned during LPP trials and tests. Second, the implementation provides for an upgrade of the core capabilities in subsequent blocks. These subsequent blocks provide additional functional capabilities beyond the core functions, accommodate changing missions or environments, and take advantage of improved data processing technology.

7.3 Schedule. In order to reduce the total implementation time required for AFIRMS, block development efforts for several MAJCOM segments must occur in parallel.

The general schedule for implementation is shown in Figure 7-2. This schedule shows the sequencing of segments and of the blocks within each segment.

SEGMENT/BLOCK		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
HQ USAF	1	----	----	----	-						
HQ USAF	2			----	----	----	-				
HQ USAF	3						---	----	----	----	-
USAFE	1	----	----	----							
USAFE	2			--	----	----	--				
AFLC-HQ	1		-	----	----	-					
AFLC-LOCs	2				--	----	----	--			
AFLC-HQ	3							--	----	----	-
AFLC-LOCs	4							--	----	----	-
PACAF	1			-	----	----	-				
PACAF	2					-	----	----			
TAC	1			-	----	----					
TAC	2					--	----	--			
AAC	1					-	----	----			
AAC	2							--	----	--	
SAC	1	--									
SAC	2					-	----	----			
MAC	1	--									
MAC	2							--	----	----	-
AFRES	1		-- -								
AFRES-TAC	2				---	----	-				
AFRES-SAC	3						---	----	--		
AFRES-MAC	4								----	----	-
ANG	1		-- -								
ANG-TAC	2				---	----	-				
ANG-SAC	3						---	----	--		
ANG-MAC	4								----	----	-

Figure 7-2. AFIRMS Master Implementation Schedule

7.4 Segments of the Evolutionary Implementation Plan. A segment of the EIP is a major command "slice" or the HQ USAF portion of AFIRMS. Control of AFIRMS implemented is achieved through the Major Command Segment Plans. The following tasks provide a framework within which implementation priorities can be set and progress monitored.

a. Development and accomplishment of the AFIRMS Program Management Plan.

b. Development and accomplishment of the EIP and its segment plans.

c. Preparation and Update of the Data Project Plan.

d. Development and accomplishment of the Configuration Management Program.

e. Program Objective Memoranda (POM) and budget advocacy.

f. Implemenation scheduling.

g. Supervision of the system developers (whether Air Force or contractor).

h. Staff supervision of worldwide system operation and maintenance.

i. Problem/action reporting.

7.5 **Blocks of the Evolutionary Implementation Plan.** A block is a specific set of AFIRMS functional capabilities. Blocks are defined in terms of statements of functional need, which are based upon the AFIRMS Functional Description. Functional needs may be readiness/sustainability assessment tools, interfaces with other MAJCOM/Air Force/DoD systems, or enhancements to these types of capabilities. Blocks are defined and scheduled in the AFIRMS Management Plan and are controlled by the Configuration Management Program.

Selection of functional requirements for implementation in a particular block in a specific MAJCOM segment is made from the list of unsatisfied requirements for that MAJCOM. This list of unsatisfied requirements is compiled by the AFIRMS HQ USAF Office of Primary Responsibility (OPR) and the Program Management Office (PMO), from problem/action reports received from the MAJCOM, from the set of available or projected AFIRMS products as they are developed and from specific statements of requirement from MAJCOM representatives.

7.6 **Phases of Evolutionary Implementation Plan Blocks.** A phase is one of five sets of actions necessary to achieve the functional capabilities of a block in the AFIRMS EIP.

7.6.1 **Analysis/Requirements Definition Phase.** The Analysis/Requirements Definition Phase consists of those steps necessary to design and specify, in detail, the functional needs programmed for a block in the AFIRMS Management Plan. The completion of this phase results in system/subsystem specifications, database specifications, and supporting documents such as the System Development Plan and the Test/Verification/Validation Plan.

7.6.2 **Development Phase.** The Development Phase consists of those steps necessary to create the products that accomplish the functional needs programmed for a block in the AFIRMS Management Plan. The completion of the Development Phase results in creation, and stand-alone testing, of the program coding necessary to accomplish the functional requirements. The Development Phase also provides the Training Plan, Maintenance Plan, Installation Plan, and the User/Operator Documents.

7.6.3 **Installation Phase.** The Installation Phase consists of those steps necessary to place the functional cpapabilities into operation. The completion of this phase results in the modifying facilities (if necessary), acquiring and placing communications lines and computer hardware into service, installing software, and conducting training.

7.6.4 **Operations Phase.** The Operations Phase consists of those steps necessary to operate and maintain the operational system. System maintenance (hardware and software) is of primary concern during this phase. The completion of the Operations Phase is established by the completion of a new implementation block.

7.6.5 **Systems Integration/Management Phase.** The Systems Integration/ Management phase consists of those steps necessary to monitor and guide the block installation in accordance with the AFIRMS Management Plan Annex B, Evolutionary Implementation Plan. Actions in this phase are concurrent with the Analysis, Development, Installation and Operations Phases. Actions in the Systems Integration/Management Phase result in control of the block implementation, preservation of system integrity, and in monitoring of the worldwide AFIRMS operations.

7.6.2 Development Phase. The Development Phase consists of those steps necessary to create the products that accomplish the functional needs programmed for a block in the AFIRMS Management Plan. The completion of the Development Phase results in creation, and stand-alone testing, of the program coding necessary to accomplish the functional requirements. The Development Phase also provides the Training Plan, Maintenance Plan, Installation Plan, and the User/Operator Documents.

7.6.3 Installation Phase. The Installation Phase consists of those steps necessary to place the functional cpapabilities into operation. The completion of this phase results in the modifying facilities (if necessary), acquiring and placing communications lines and computer hardware into service, installing software, and conducting training.

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APPENDIX A. THE AFIRMS METHODOLOGY MODEL

A.1 Introduction. This appendix presents the formal version of the Structured Analysis and Design Technique (SADT) model upon which the information in Sections 3.2.2, 4.1.6, and 4.2.6 are based. A general explanation of SADT models is provided on this and the following pages.

A.2 How To Read An SADT Model - General Discussion. The SADT graphic technique uses a series of diagrams to describe a system with each level of diagrams representing a greater level of detail.

The top level diagram is a single box representing a major activity. That box is broken down into another diagram containing three boxes that detail the major activity into sub-activities. Likewise, each of those boxes is, in turn, broken down into a diagram containing three to six boxes (see Diagram A-1). The detailing continues until the desired level is reached. The resultant structure is summarized in outline format by the "node list" on page A-3.

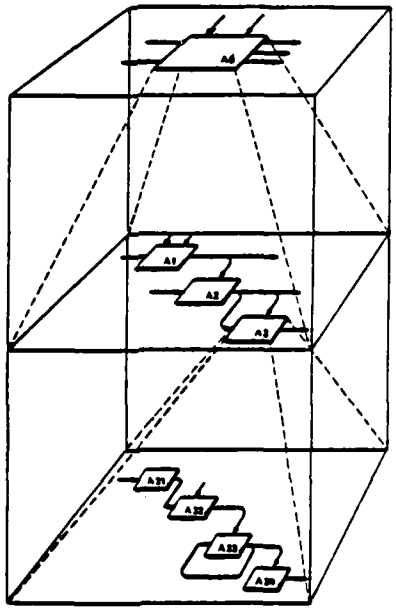


Diagram A-1. SADT Diagram Breakdown

Each box in a diagram represents a specific activity and is named with a verb or verb phrase. Each of the four sides of the box represents a specific type of data: input data enters on the left side; control data enters on the top; output data exits on the right side; and, devices enter from the bottom (Diagram A-2).

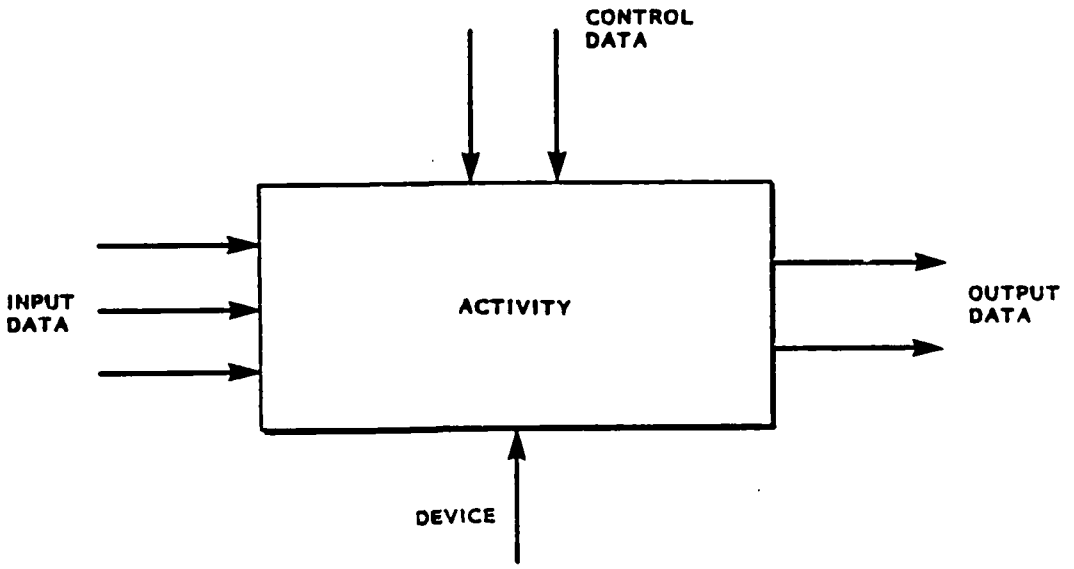


Diagram A-2. SADT Activity Box

Input data is data which is to be transformed by the activity. Output data is data transformed by the activity and is to be used elsewhere. Control data is data that guides the operations of an activity. The devices describe the equipment, organizations, or persons which perform the given activity. Device arrows are often omitted or deferred when the model is intended to show what happens rather than a design of how it happens.

Diagram Number - The node number indicates a diagram's place in a model. A lower level diagram's node number is constructed from the node number of the upper level diagram box number. A0, A1, A2, A12, A121, etc. The node number appears in the box at the lower left of each diagram.

The model is presented as a series of facing pages. In each pair of facing pages, a diagram is presented opposite the text which discusses the diagram. Except in the first page pair, the text is accompanied by a 'parent' diagram in which the box detailed by the diagram has been shaded. The first page pair summarizes the model, therefore there is no 'parent' diagram.

A.3 Node List For AFIRMS Methodology Model.

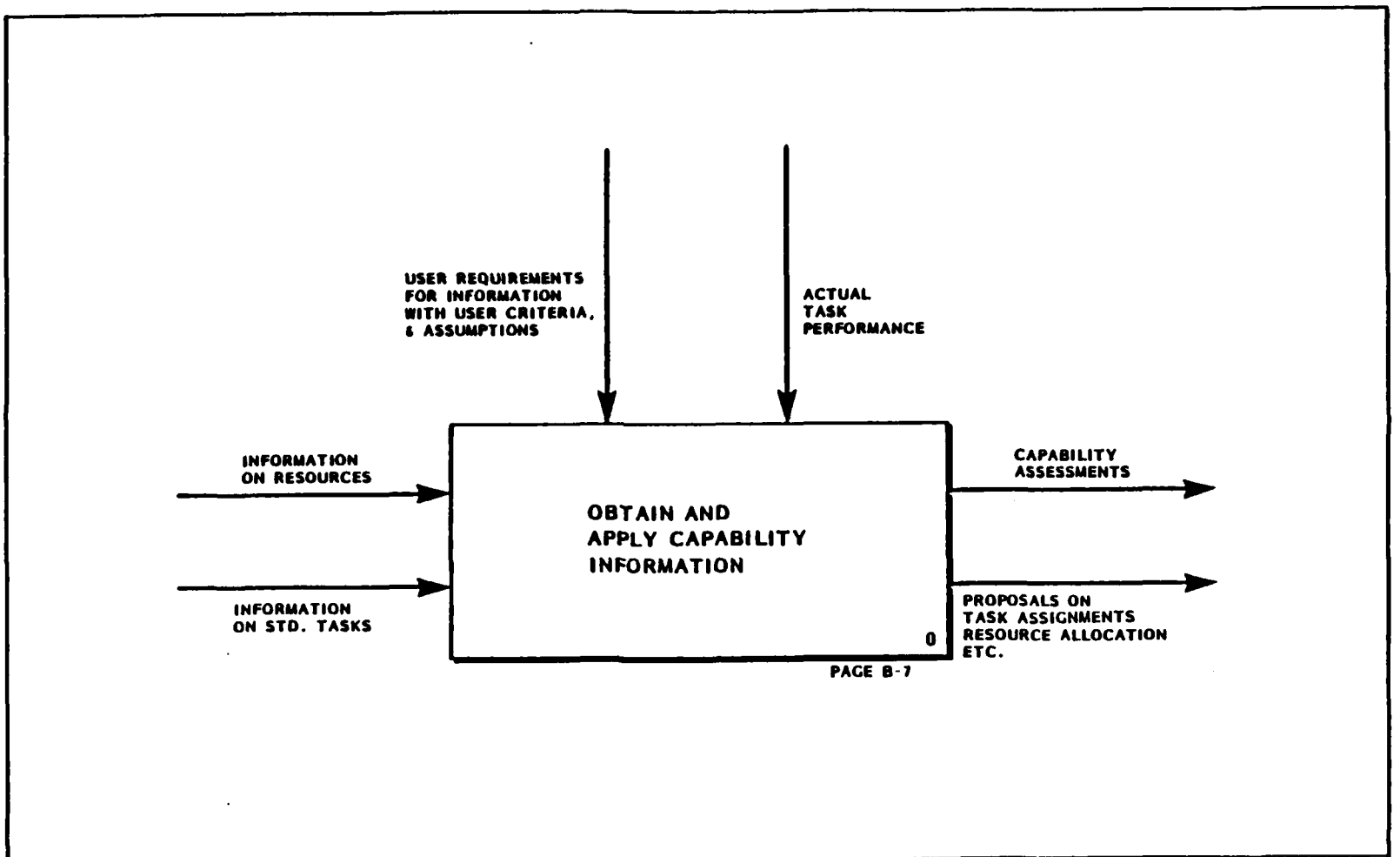
A-0. Obtain and Apply Capability Information (Context)

This one box diagram is intended solely to identify the way in which AFIRMS functions interface with their environment. The diagram is intended to reflect AFIRMS type functions, not the AFIRMS system; data gathering, in particular, may be handled by other systems to which AFIRMS interfaces, rather than by AFIRMS itself.

The basic function of AFIRMS is to convert "information on resources" into "capability assessments." This must always occur under the guidance of "user requirements for information with user criteria and assumptions." This function is represented by three of the arrows surrounding the single box. In addition to "capability assessments," AFIRMS -- or more properly AFIRMS working as the user's scribe and assistant -- may be called on to document "proposals on task assignments, resource allocation, etc." The other two arrows which enter the box represent additional information needed to complete the AFIRMS functions. This is the summary of a model intended to represent groups of functions. Upon those functions can be based a number of configurations, each capable of meeting a specific need of the AFIRMS user community.

The model does NOT address the specifics of equipment, routines, user interfaces, etc, that are needed to implement the functions. Neither does the model try to portray the process by which AFIRMS will be brought into existence. Both implementation designs and implementation plans are the subjects of other documents.

The first level detail of this one box version of the AFIRMS functions is diagramed on page A-7.



NODE: A-0

TITLE: OBTAIN AND APPLY CAPABILITY INFORMATION (CONTEXT)

SOFTECH

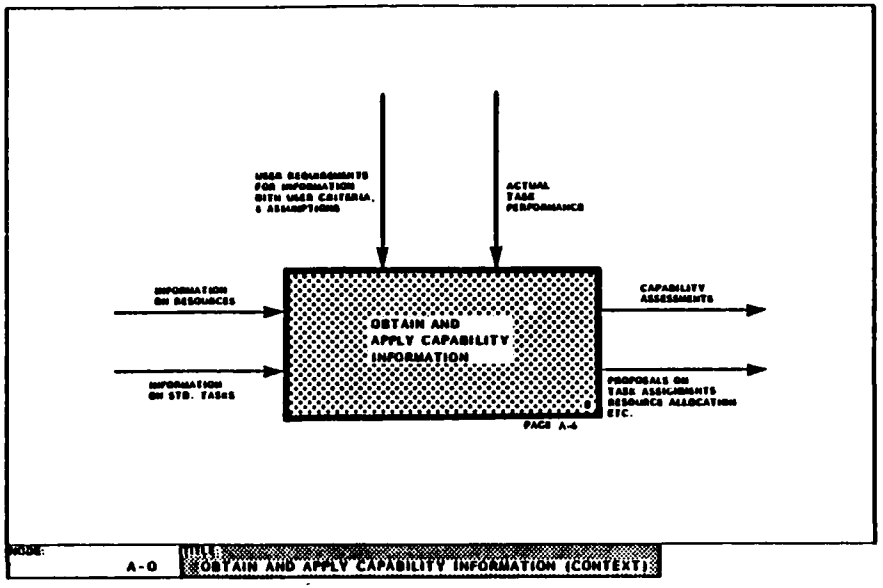
A0. Obtain and Apply Capability Information

The diagram on the facing page details the single box diagram immediately to the right. It shows the interfaces between the primary source of AFIRMS output "determine ability to perform" (box 3) and two module groups or boxes which are necessary to support that box.

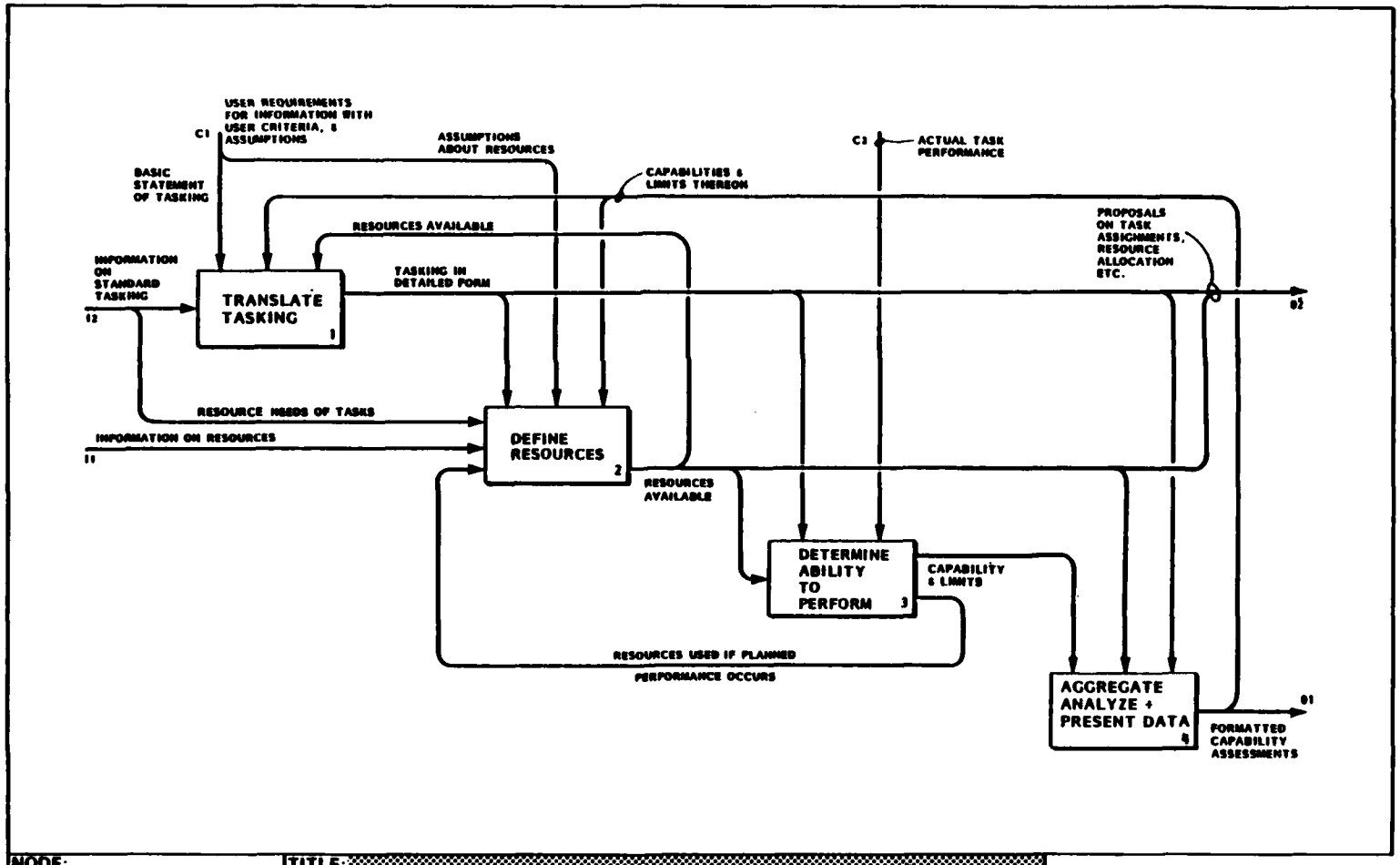
That is, AFIRMS deals basically with the question of how well a unit (e.g. wing or Air Force) can meet a clearly defined tasking given a known -- or forecast -- group of resources.

Since part of the user's specification to AFIRMS of his need may be in the form of a reference to a standard tasking, it is necessary for part of AFIRMS (box 1) to process "information on standard tasking" plus other data to develop a "tasking in detailed form" -- 'detailed' is used here in the sense of expanded. At the same time, another part of AFIRMS (box 2) must provide the actual resource balances available, or an estimate thereof.

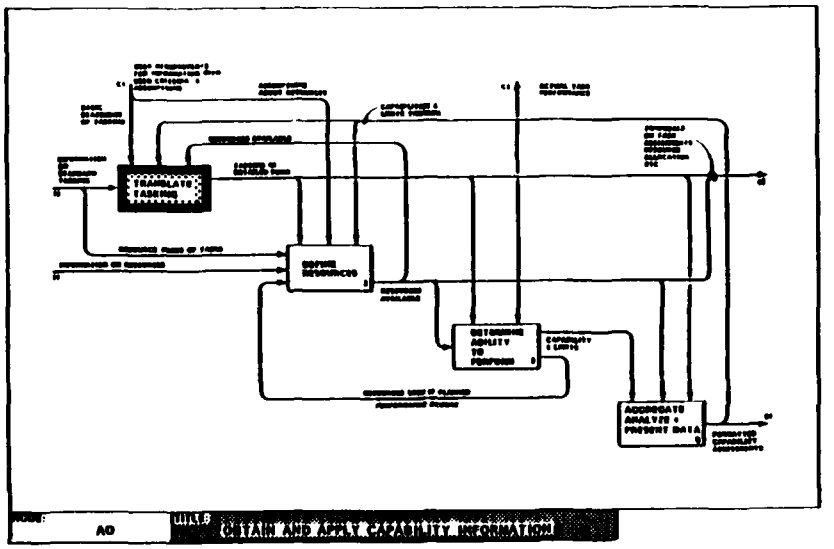
With order and resource information available, the capability can then be evaulated.



Box 4 provides development of MAJCOM and total Air Force level data, develops and applies trend type data, and groups data for presentation.


USER REQUIREMENTS FOR INFORMATION WITH USER CRITERIA, & ASSUMPTIONS
C1
ASSUMPTIONS ABOUT RESOURCES
C3
ACTUAL TASK PERFORMANCE
BASIC STATEMENT OF TASKING
CAPABILITIES & LIMITS THEREON
RESOURCES AVAILABLE
PROPOSALS ON TASK ASSIGNMENTS, RESOURCE ALLOCATION ETC.
INFORMATION ON STANDARD TASKING
I2
TRANSLATE TASKING
1
TASKING IN DETAILED FORM
O2
RESOURCE NEEDS OF TASKS
INFORMATION ON RESOURCES
I1
DEFINE RESOURCES
2
RESOURCES AVAILABLE
DETERMINE ABILITY TO PERFORM
3
CAPABILITY & LIMITS
RESOURCES USED IF PLANNED PERFORMANCE OCCURS
AGGREGATE ANALYZE & PRESENT DATA
4
O1
FORMATTED CAPABILITY ASSESSMENTS
NODE:
A0
TITLE:
OBTAIN AND APPLY CAPABILITY INFORMATION

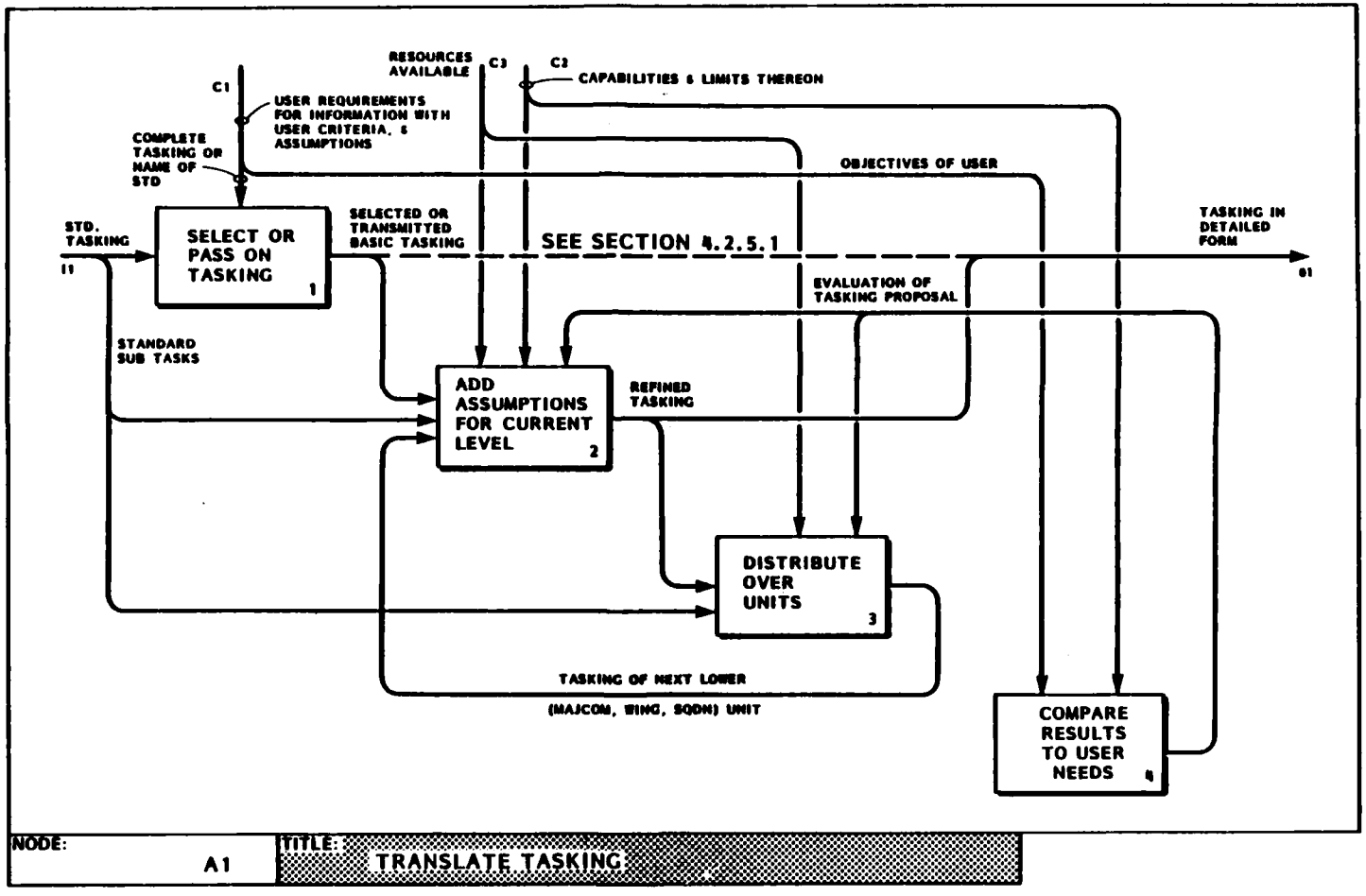
A1. Translate Tasking



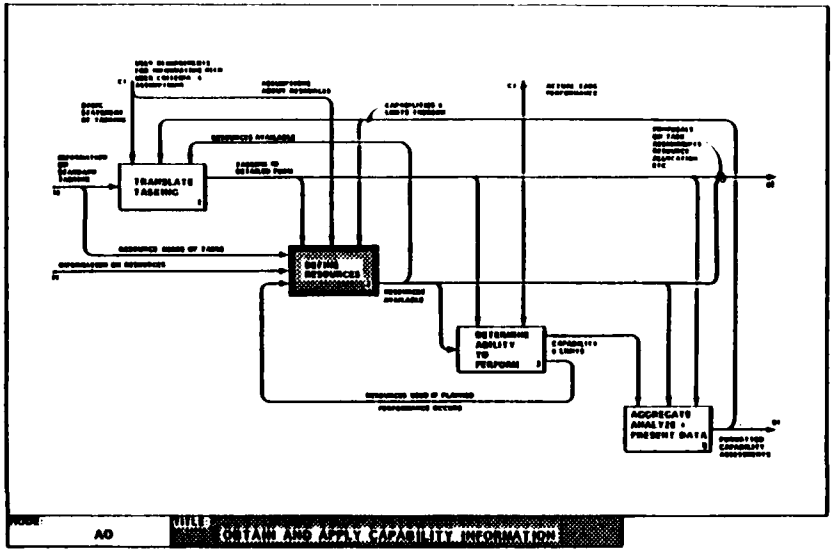
The four boxes of this diagram fall into three levels of complexity. The most basic is box 1, which merely passes on a tasking defined by a user or recovers and passes on a tasking, the name of which the user has supplied.

The next level of complexity occurs in boxes 2 and 3 which uses "resources available" and "capabilities and limits thereon" to generate detailed (again meaning expanded) taskings in a format comparable to that of an ATO. This task may be accomplished by further user inputs in response to promptings. (Neither the prompts or the inputs are shown since that method may not be selected.)

The final, and perhaps speculative, level of complexity is the evaluation (box 4) of the computed "capabilities and limits thereon" in terms of "user objectives." Here the concept is that such evaluation might assist the user -- or even an algorithm -- in iterating to a better set of assumptions or a better distribution of the task.


RESOURCES AVAILABLE
C3
C2
CAPABILITIES & LIMITS THEREON
C1
USER REQUIREMENTS FOR INFORMATION WITH USER CRITERIA, & ASSUMPTIONS
COMPLETE TASKING OR NAME OF STD
OBJECTIVES OF USER
STD. TASKING
I1
SELECT OR PASS ON TASKING
1
SELECTED OR TRANSMITTED BASIC TASKING
SEE SECTION 4.2.5.1
TASKING IN DETAILED FORM
O1
EVALUATION OF TASKING PROPOSAL
STANDARD SUB TASKS
ADD ASSUMPTIONS FOR CURRENT LEVEL
2
REFINED TASKING
DISTRIBUTE OVER UNITS
3
TASKING OF NEXT LOWER
(MAJCOM, WING, SQDN) UNIT
COMPARE RESULTS TO USER NEEDS
4
NODE:
A1
TITLE:
TRANSLATE TASKING

A2. Define Resources



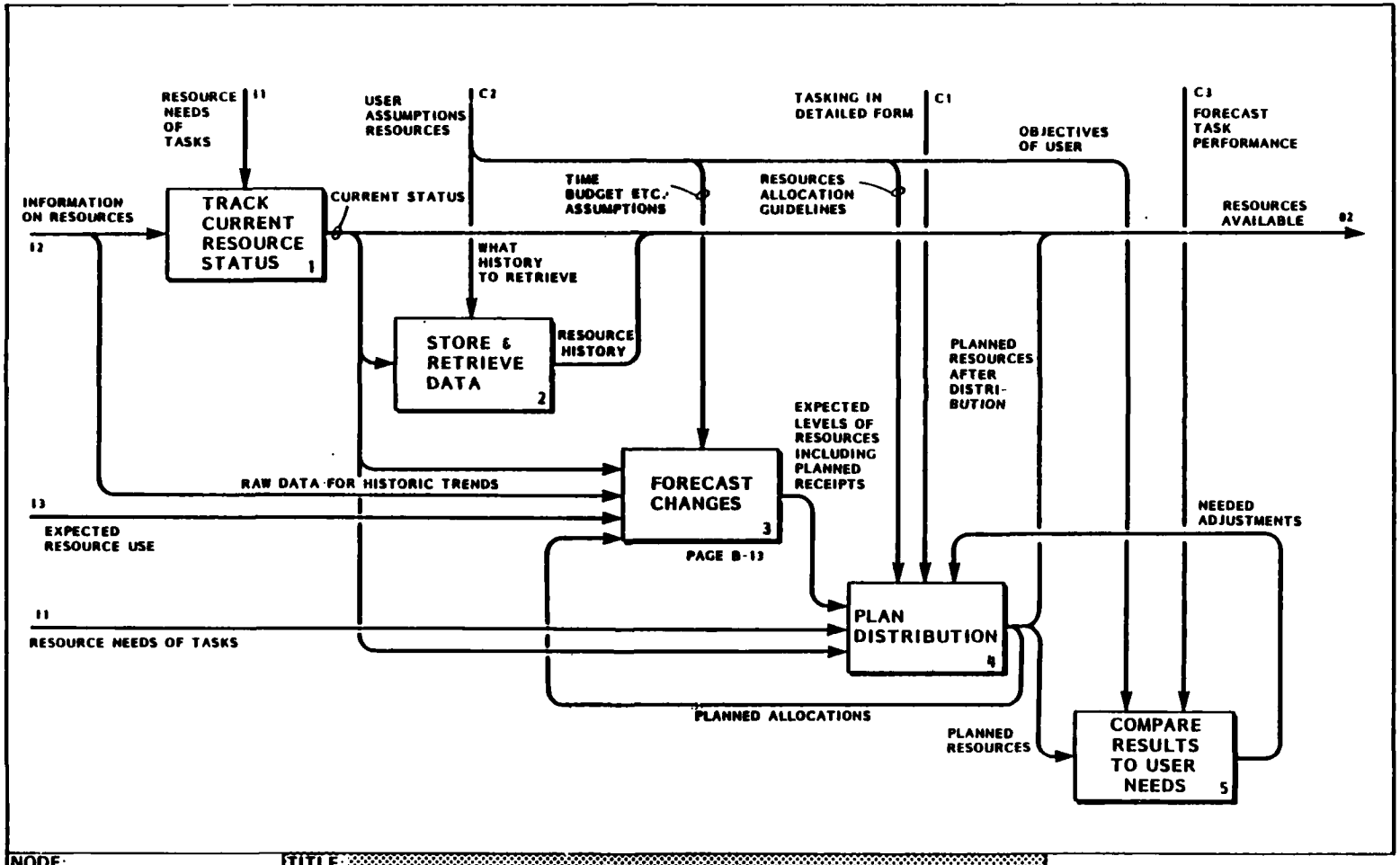
The boxes in this diagram can be thought of in terms of time.

Box 1 collects and maintains records of current resource status. This function may lean heavily on interfaces with systems external to AFIRMS.

Box 2 prepares and reports the "current status" of a user defined time in the past. That is, old outputs of box 1 are stored and recalled.

Boxes 3 and 4 deal with what resources are forecast for times in the future and where they will be allocated.

Box 5 deals with comparing the results of boxes 3 and 4 to user needs.


RESOURCE NEEDS OF TASKS
I1
USER ASSUMPTIONS RESOURCES
C2
TASKING IN DETAILED FORM
C1
C3
FORECAST TASK PERFORMANCE
OBJECTIVES OF USER
INFORMATION ON RESOURCES
I2
TRACK CURRENT RESOURCE STATUS
1
CURRENT STATUS
TIME BUDGET ETC. ASSUMPTIONS
RESOURCES ALLOCATION GUIDELINES
RESOURCES AVAILABLE
O2
WHAT HISTORY TO RETRIEVE
STORE & RETRIEVE DATA
2
RESOURCE HISTORY
PLANNED RESOURCES AFTER DISTRI-BUTION
EXPECTED LEVELS OF RESOURCES INCLUDING PLANNED RECEIPTS
RAW DATA FOR HISTORIC TRENDS
FORECAST CHANGES
3
I3
EXPECTED RESOURCE USE
NEEDED ADJUSTMENTS
PAGE B-13
I1
RESOURCE NEEDS OF TASKS
PLAN DISTRIBUTION
4
PLANNED ALLOCATIONS
PLANNED RESOURCES
COMPARE RESULTS TO USER NEEDS
5
NODE:
A2
TITLE:
DEFINE RESOURCES

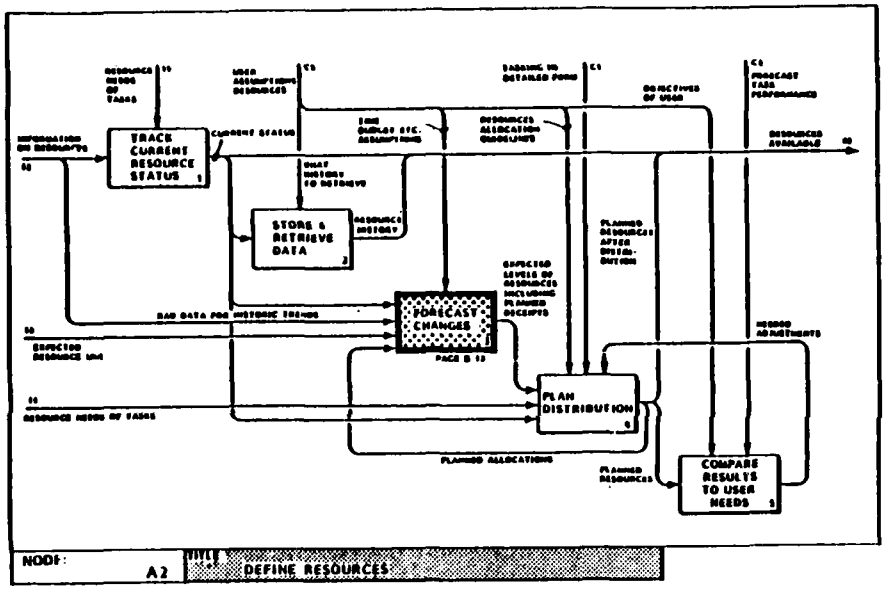
A23. Forecast Changes

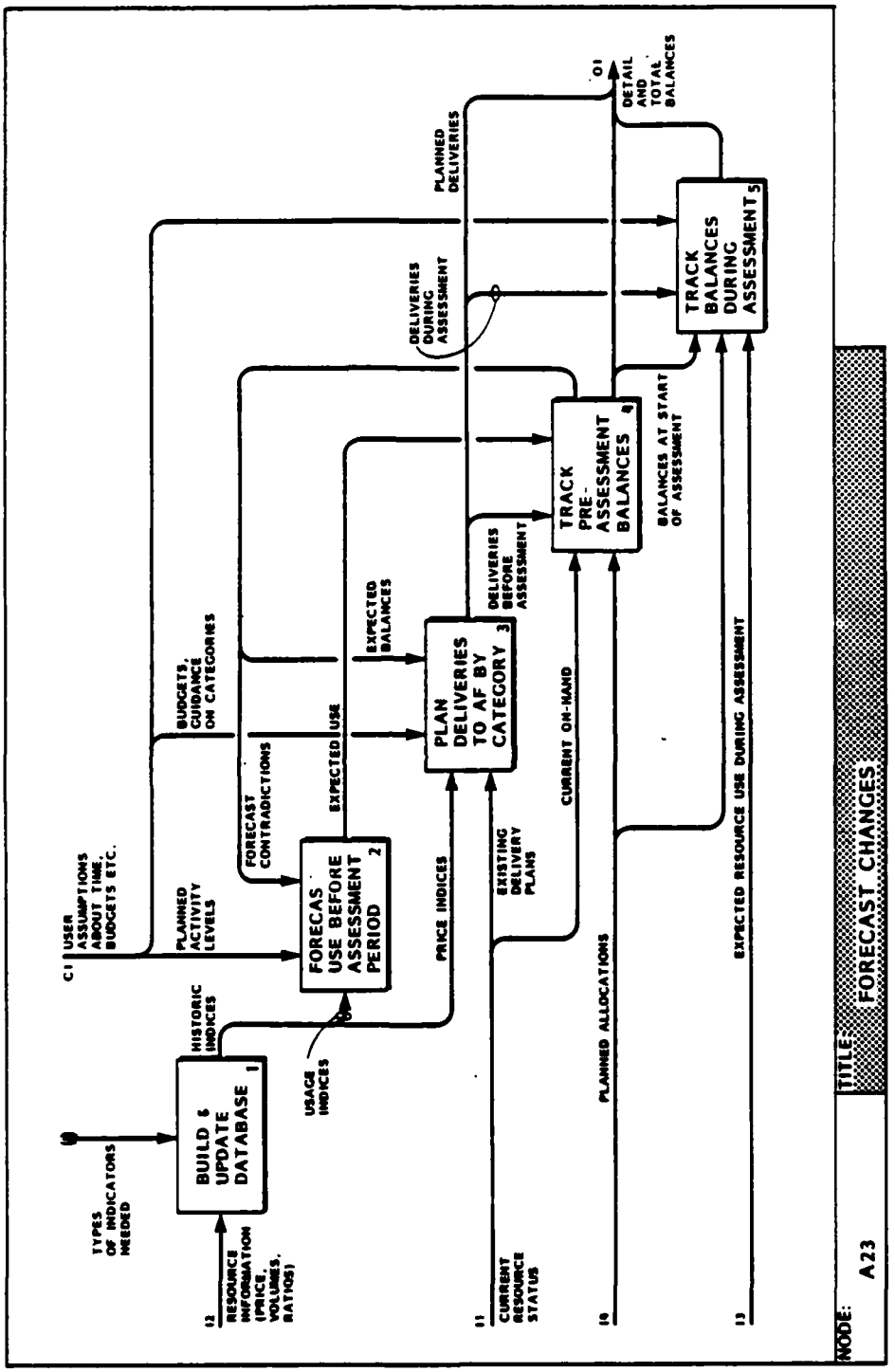
The mechanics of forecasting includes development of a set of historic indices (box 1), and their application (boxes 2 and 3).

Box 2 deals with expected consumption of resources based on activity levels and indicators relating use to activity. Box 3 deals with expected acquisitions based not only on known delivery plans, but (for the out years) budget levels, budget allocations and anticipated prices. These two boxes could be suppressed if box 4 operates on direct forecasts.

Box 4 either tracks balances based on adding receipts and subtracting usage or jumps directly to a balance based on an assumption. Box 4 functions only in the pre-assessment period.

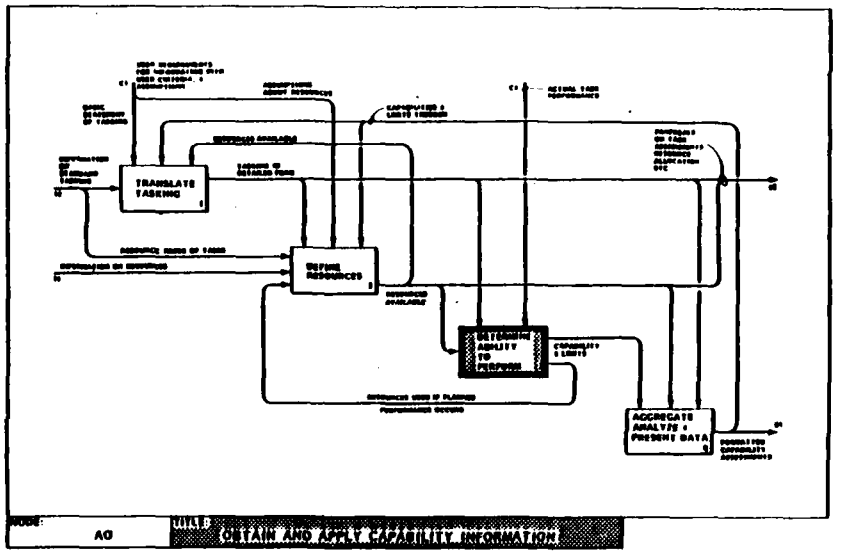
Box 5 resembles box 4, but deals with the assessment period.




TITLE: FORECAST CHANGES
NODE: A23
BUILD & UPDATE DATABASE 1
FORECAST USE BEFORE ASSESSMENT PERIOD 2
PLAN DELIVERIES TO AF BY CATEGORY 3
TRACK PRE-ASSESSMENT BALANCES 4
TRACK BALANCES DURING ASSESSMENT 5
TYPES OF INDICATORS NEEDED
I2 RESOURCE INFORMATION (PRICE, VOLUMES, RATIOS)
HISTORIC INDICES
USAGE INDICES
C1 USER ASSUMPTIONS ABOUT TIME, BUDGETS ETC.
PLANNED ACTIVITY LEVELS
BUDGETS, GUIDANCE ON CATEGORIES
FORECAST CONTRADICTIONS
EXPECTED USE
PRICE INDICES
EXPECTED BALANCES
I1 CURRENT RESOURCE STATUS
EXISTING DELIVERY PLANS
DELIVERIES BEFORE ASSESSMENT
CURRENT ON-HAND
I0 PLANNED ALLOCATIONS
BALANCES AT START OF ASSESSMENT
I3 EXPECTED RESOURCE USE DURING ASSESSMENT
DELIVERIES DURING ASSESSMENT
PLANNED DELIVERIES
O1 DETAIL AND TOTAL BALANCES

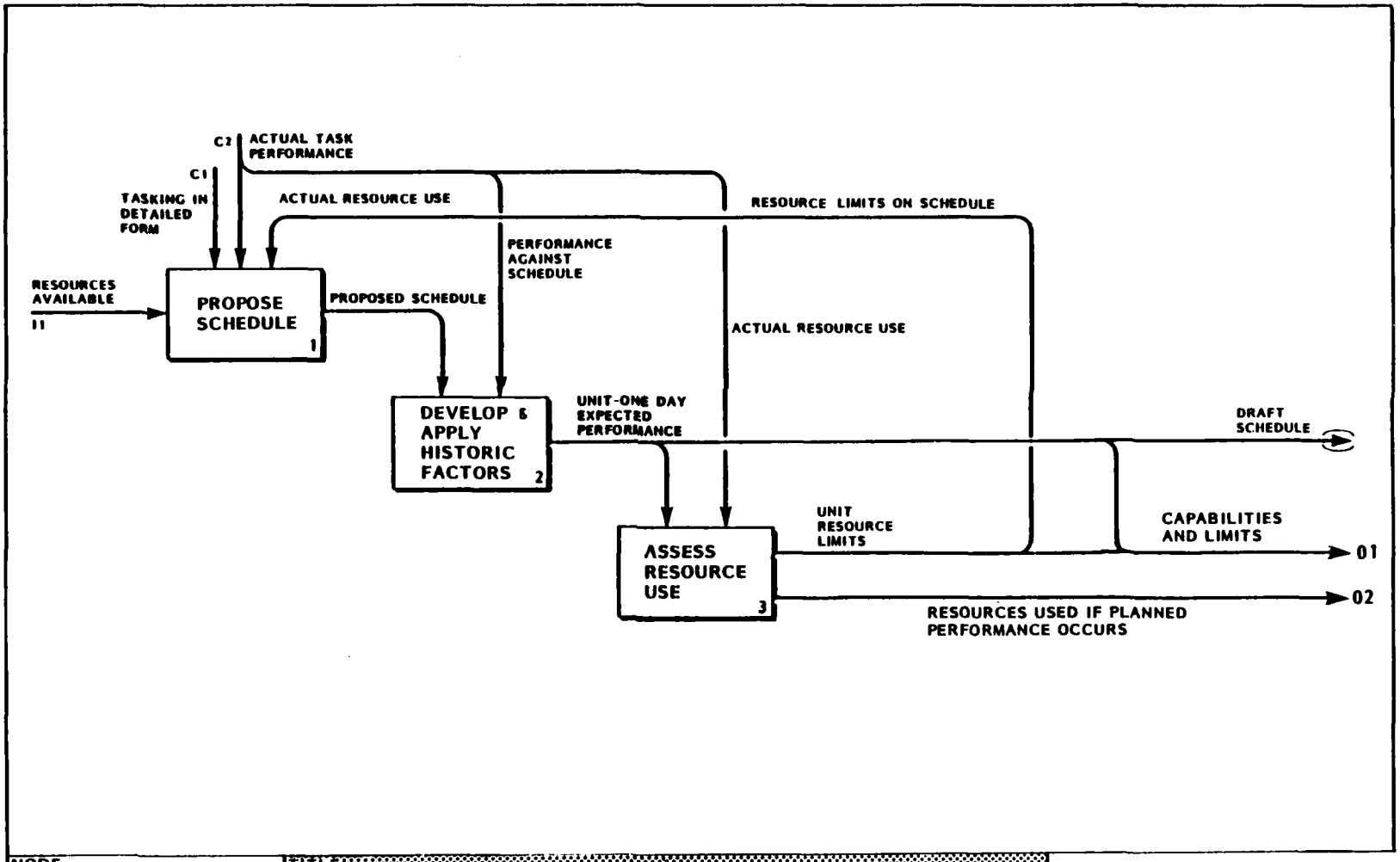
SOFTECH

A3. Determine Ability To Perform



Boxes 1 and 3 work together to produce a schedule. The basic schedule is proposed (box 1), and its requirements for resources are then assessed (box 3). If the needed resources are not available, feedback to box 1 causes correction.

Boxes 1 and 3 see *slightly different schedules.* The reason is that the original schedule is adjusted to account for historic inaccuracies in the scheduling process (box 2). This adjustment is needed to bring estimates of schedules (capabilities) for times in the future as close to realism as possible.

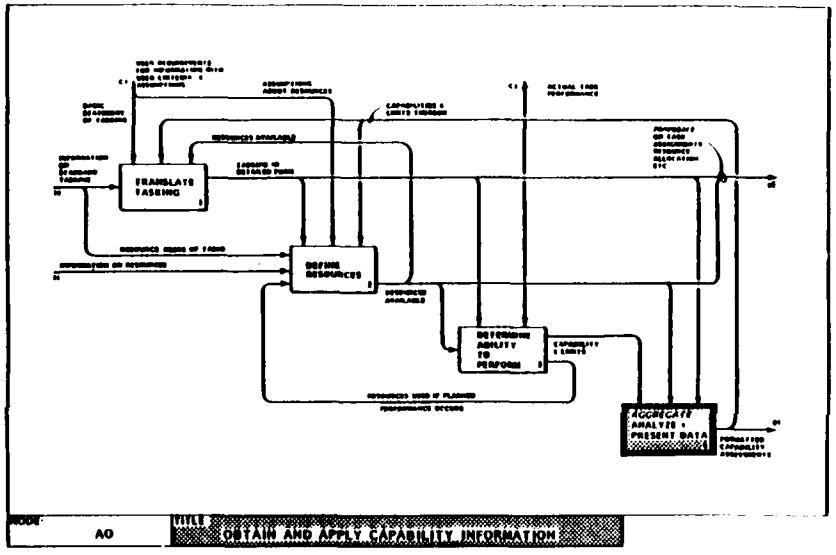

C2
ACTUAL TASK PERFORMANCE
C1
TASKING IN DETAILED FORM
ACTUAL RESOURCE USE
RESOURCE LIMITS ON SCHEDULE
PERFORMANCE AGAINST SCHEDULE
RESOURCES AVAILABLE
I1
PROPOSE SCHEDULE
1
PROPOSED SCHEDULE
ACTUAL RESOURCE USE
DEVELOP & APPLY HISTORIC FACTORS
2
UNIT-ONE DAY EXPECTED PERFORMANCE
DRAFT SCHEDULE
UNIT RESOURCE LIMITS
CAPABILITIES AND LIMITS
ASSESS RESOURCE USE
3
O1
O2
RESOURCES USED IF PLANNED PERFORMANCE OCCURS
NODE:
A3
TITLE:
DETERMINE ABILITY TO PERFORM

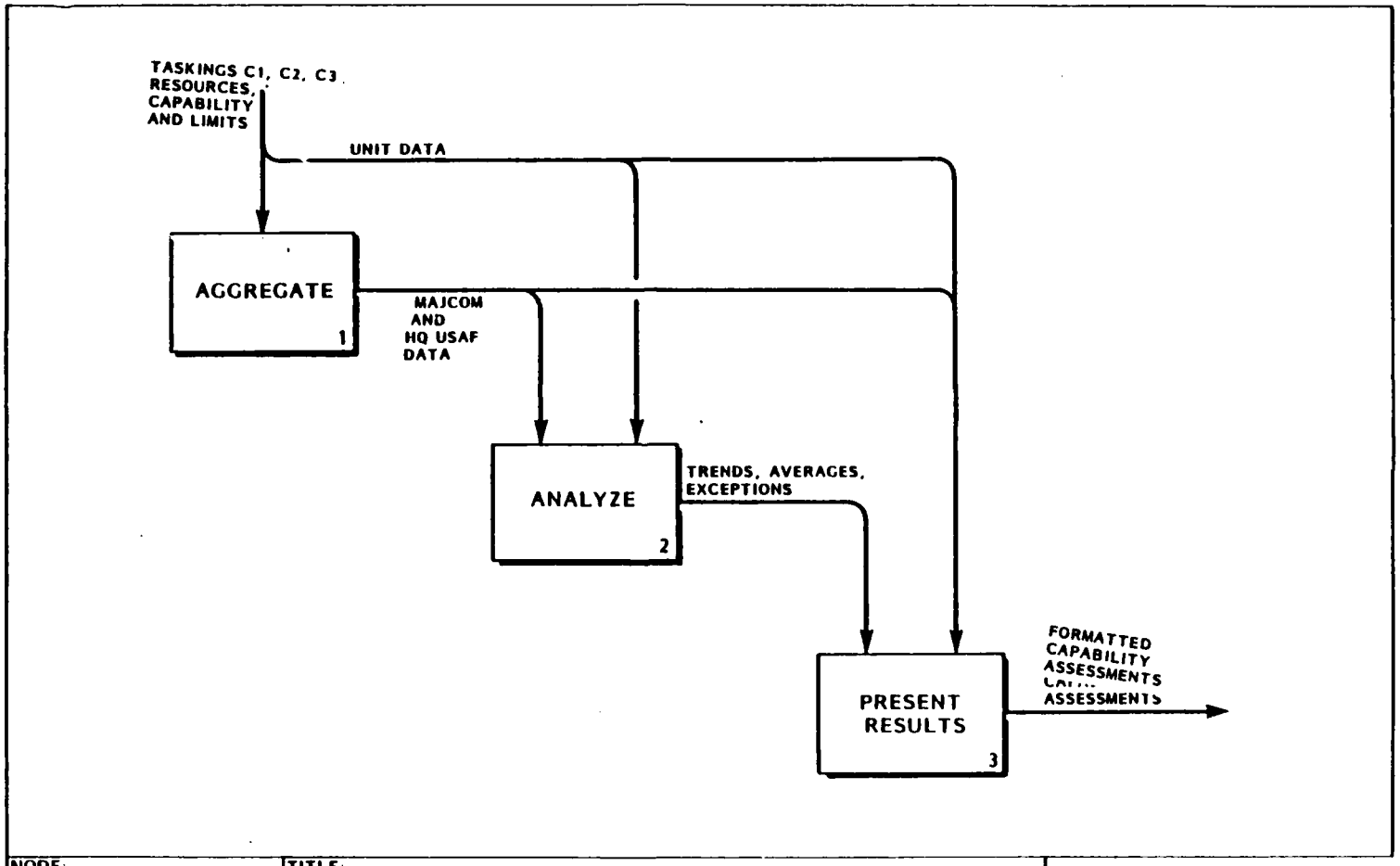
A4. Aggregate, Analyze, and Present Data

This is the administrative part of the model. Box 1, "Aggregate" takes in unit level results and produces MAJCOM and HQ USAF level capabilities.

Box 2 develops a variety of statistical measures (and retains specified day by day results). Each day's results are compared to the statistical measures to detect items which should be highlighted on an exception basis.

Box 3 is concerned with organizing the available data into packages for specific presentations.





NODE:	TITLE:
A4	AGGREGATE, ANALYZE AND PRESENT DATA

Change 1
CDRL 0023
September 1985

AIR FORCE INTEGRATED READINESS MEASURMENT SYSTEM (AFIRMS)

FUNCTIONAL DESCRIPTION

FINAL

Page Insert Changes:

REMOVE	DATE	INSERT
Preface	31 May 1985	Preface CHG1
1-3, 1-4	31 May 1985	1-3, 1-3.1/CHG1, 1-4
1-7, 1-8	31 May 1985	1-7, 1-8/CHG1, 1-8.1/CHG1
1-9, 1-10	31 May 1985	1-9/CHG1, 1-10/CHG1, 1-10.1/CHG1
1-11	31 May 1985	1-11/CHG1, 1-12/CHG1
2-1, 2-2	31 May 1985	2-1/CHG1, 2-1.1/CHG1, 2-2/CHG1, 2-2.1/CHG1
2-3, 2-4	31 May 1985	2-3, 2-4/CHG1, 2-4.1/CHG1
2-13, 2-14	31 May 1985	2-13, 2-14/CHG1
2-23, 2-24	31 May 1985	2-23, 2-24/CHG1
3-9, 3-10	31 May 1985	3-9/CHG1, 3-9.1/CHG1, 3-10
3-13, 3-14	31 May 1985	3-13/CHG1, 3-13.1/CHG1, 3-13.2/CHG1, 3-14/CHG1
4-1, 4-2	31 May 1985	4-1, 4-2/CHG1, 4-2.1/CHG1
4-5, 4-6	31 May 1985	4-5/CHG1, 4-6
4-23, 4-24	31 May 1985	4-23/CHG1, 4-23.1/CHG1, 4-24

SOFTECH

Change 1
CDRL 0023
September 1985

AIR FORCE INTEGRATED READINESS MEASURMENT SYSTEM (AFIRMS)

FUNCTIONAL DESCRIPTION

FINAL

Page Insert Changes (Cont.):

REMOVE	DATE	INSERT
4-29, 4-30	31 May 1985	4-29, 4-30/CHG1, 4-30.1/CHG1
5-3, 5-4, 5-5, 5-6	31 May 1985	5-3, 5-4/CHG1, 5-4.1/CHG1, 5-5/CHG1, 5-6
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7-1, 7-2	31 May 1985	7-1/CHG1, 7-1.1/CHG1, 7-2
7-5	31 May 1985	7-5/CHG1

END

DTIC

9-86