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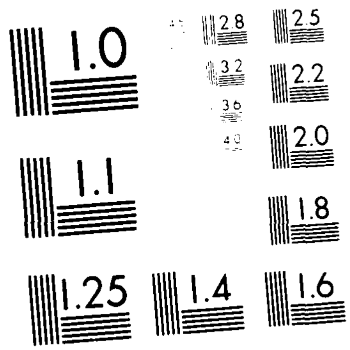

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SOFTECH SofTech, Inc

AIR FORCE INTEGRATED READINESS MEASUREMENT SYSTEM (AFIRMS)

TRANSFORM AND MODEL DESCRIPTIONS

FINAL

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31 May 1985
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Contract No. F49642-83-C-0022

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SECTION 1. GENERAL

1.1 Purpose of the Transform and Model Descriptions. The Transform and Model Descriptions document for the Air Force Integrated Readiness Measurement System (AFIRMS), (Contract No. F49642-83-C-0022) is written to provide an understanding of transforms, models, and data manipulations required in assessment tools of the operational AFIRMS. The goal of this document is to state the AFIRMS readiness assessment tools and processes, and their interrelationships, in terms meaningful to non-Automated Data Processing (ADP) personnel. This is to give the reader an understanding of the processes, data (input and output), and general approach required for the implementation of a viable readiness assessment capability for an operational AFIRMS. Although certain references are made to the AFIRMS Learning Protoype, this document is not a description of what currently exists, but rather of what is required for operational AFIRMS.

This document discusses the manipulations and transformations executed on input data for use by AFIRMS, and algorithms, aggregations, transforms, and models used in processing data to create required economic readiness assessment decision support tools.

1.2 Document Contents. This document has been written to provide the reader with a general description of the processes utilized by AFIRMS. To this end, the main section of this document discusses the nature and use of input and output data for calculations, and the application of this information, in the context of the AFIRMS decision support tool. Throughout this document the sortie is used as the representative metric for assessments. Assessment techniques discussed are capable of incorporating other metrics appropriate to other Air Force major commands.

The appendices to this document detail the specific transformations and modeling process utilized by AFIRMS. Appendices A and B describe the Sortie Generation Model and the Dollars to Readiness Transformation respectively. Information is provided detailing assumptions, limitations, and applications of the tools in the operational AFIRMS. Appendix C presents a tabular summarization of internal calculations in AFIRMS and is used in conjunction with the DRD to fully describe the data information within AFIRMS. Appendix D provides a description of the C-rating system in terms of AFIRMS support of the C-rating computation processes.

1.3 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 development was initiated through a learning prototype and is designed 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 document 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)

p. System Interface Design for the AFIRMS LPP and the Air Force Operations Resource Management System (AFORMS), SofTech, Contract No. F49642-83-C-0022, 2 November 1984. (Unclassified)

q. AFR 700-2, Information Systems Planning, 26 October 1984. (Unclassified)

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, 16 September 1983 (Updated 11 January 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-00200570l, 8 April 1983. (Unclassified)

z. Planning, Programming, Budgeting, and Funding Communications - Electronics Requirements, AFR 100-5, 15 February 1983. (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)

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

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

ii. Computer Programming Languages, AFR 300-10, 15 December 1976. (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

*Material contained in references cc and ee expands on that found in reference ff.

1.4 Terms and Abbreviations.

1.4.1 Abbreviations and Acronyms.

AB - Air Base

ADP - Automated Data Processing

AFIRMS - Air Force Integrated Readiness Measurement System

AFORMS - Air Force Operations Resource Management System

AFS - Air Force Station

ATO - Air Tasking Order

CFMS - Combat Fuels Management System

DoD - Department of Defense

DRD - Data Requirements Document

DSDO	-	Data Systems Design Office
EIP	-	Evolutionary Implementation Plan
FD	-	Functional Description
HQ	-	Headquarters
JCS	-	Joint Chiefs of Staff
LCMS	-	Logistics Capability Measurement System
LPP	-	Learning Prototype Phase
MAJCOM	-	Major Command
MDS	-	Mission, Design, Series
NCA	-	National Command Authorities
OPlan	-	Operation Plan
OPR	-	Office of Primary Responsibility
PMO	-	Program Management Office
POL	-	Petroleum, Oil and Lubricants
SCL	-	Standard Conventional Load
TFW	-	Tactical Fighter Wing
USAF	-	United States Air Force
USAFE	-	United States Air Forces Europe
WMP	-	War Mobilization Plan

1.4.2 Terms and Definitions.

Algorithm	-	A sequence of mathematical expressions that define a computational process. For example, the computation of "turn time" for an aircraft or a "C-rating" calculation. Larger logic structures such as models may contain more than one algorithm.
Manipulation	-	The means by which inputs or a set of inputs are changed to provide useful information to the user.
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.

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

a. 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).

b. Sustainability - The "staying power" of forces, units, weapon systems, and equipments, often measured in number of days. Readiness over time.

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

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

Mission - The task and its purpose, thereby clearly indicating the action to be taken and the reason therefore. The dispatching of one or more aircraft to accomplish one particular task.

Model - A systematic tool used to predict the effect of relevant conditions and factors on an output over a period of time. Models are used to depict various scenarios or constraints on a system to allow testing or validation of results in a more cost effective manner than actually performing a similar test in the real-life environment. The Logistics Capability Measurement System (LCMS) is an example of a model which demonstrates the expected effect on Air Force readiness and sustainability of a particular spares funding level over time.

Process - An algorithm, transform or model; a sequence of logical steps required to accomplish a specific task.

Program - An automated process; a set of computer instructions by which a computer executes a sequence of logical steps required to accomplish a specific task.

Shortfall - The absence of force, equipment, personnel, materiel or capability — identified as a tasked requirement — that would adversely affect the command's ability to accomplish its mission. (Joint Development Agency's Joint Development System Procedures Manual, 1 January 1982.)

Sortie - An operational flight by one aircraft. (JCS Pub 1)

Tasking	-	The process of translating the allocation of requirements 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)
Transform	-	The translation of an input or a set of inputs to an output in a different form.

SECTION 2. INTRODUCTION TO AFIRMS

This section provides a brief introduction to the Air Force Integrated Readiness Measurement System (AFIRMS). A more complete description is provided in the AFIRMS Functional Description.

2.1 AFIRMS Synopsis.

2.1.1 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 to accomplish 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.

2.1.2 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 tasking, hypothetical (standard) tasking 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, 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.

2.2 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 Configurations 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 or squadron). Subsystem specifications detail the specific design and 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 data 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 3. MODELS, TRANSFORMS, AND ALGORITHMS

This summary of models, transforms, and algorithms describes the methodology employed in quantifying the AFIRMS functions. In Figure 3-1, the functions of AFIRMS and the flow of information among these functions is shown. A complete description of these functions and their interactions is presented in the AFIRMS FD.

Figure 3-2 shows the major elements and their associated interactions in the AFIRMS readiness assessment model. The model represented in Figure 3-2 is basically an expansion of three of the Basic AFIRMS Functions, specifically translate tasking, define resources, and determine ability to perform. Throughout this document, the model in Figure 3-2 serves as the basis of discussion. Each of the major elements of the model is expanded in subsequent sections to detail the data inputs and the processing of these inputs in AFIRMS assessments.

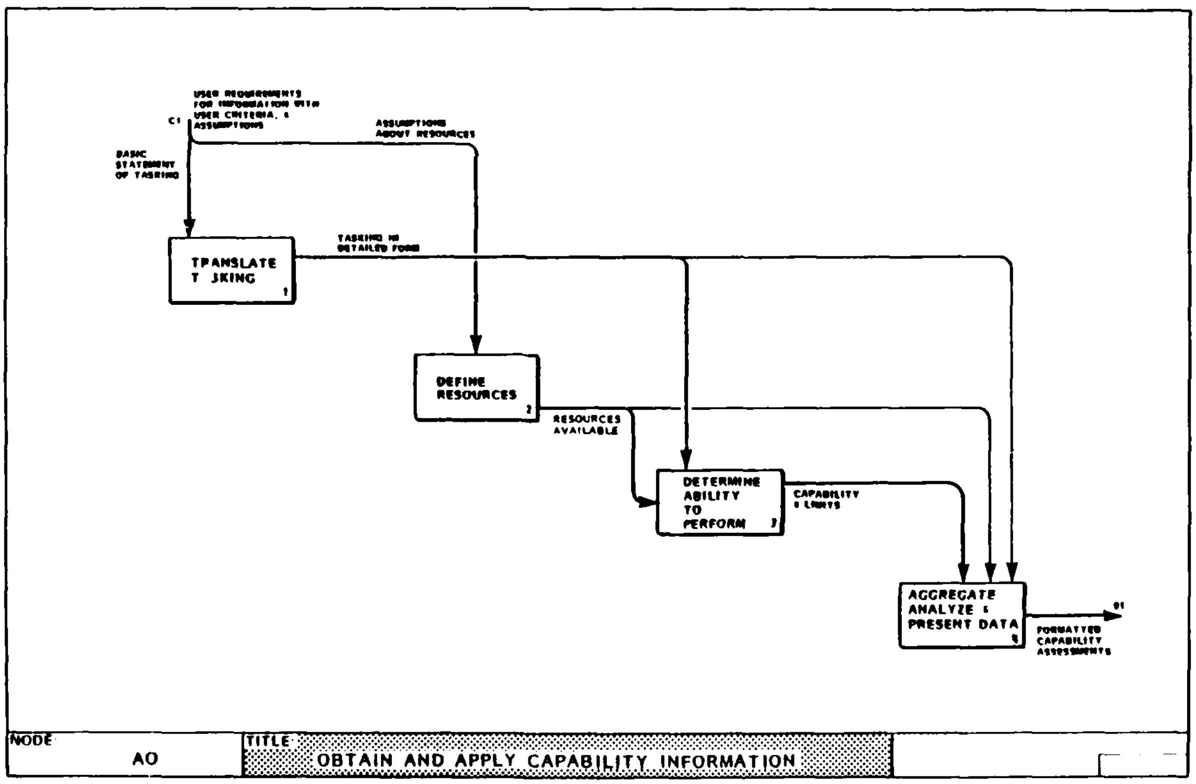


Figure 3-1. Basic AFIRMS Functions Information Flow

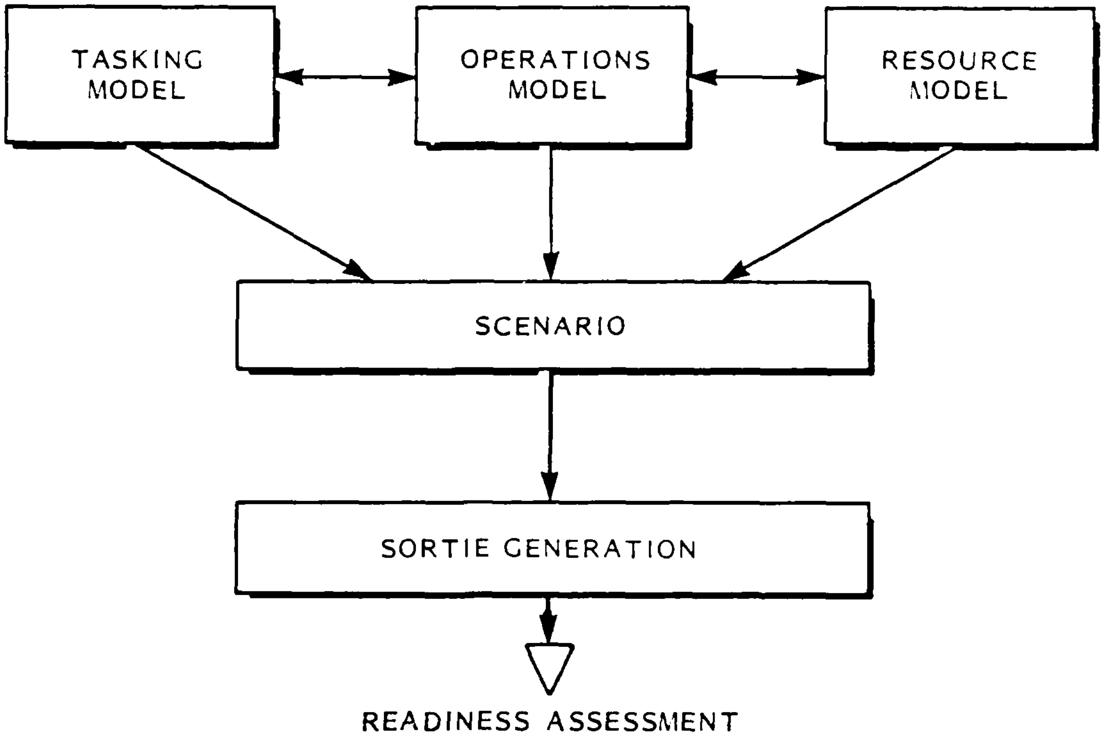


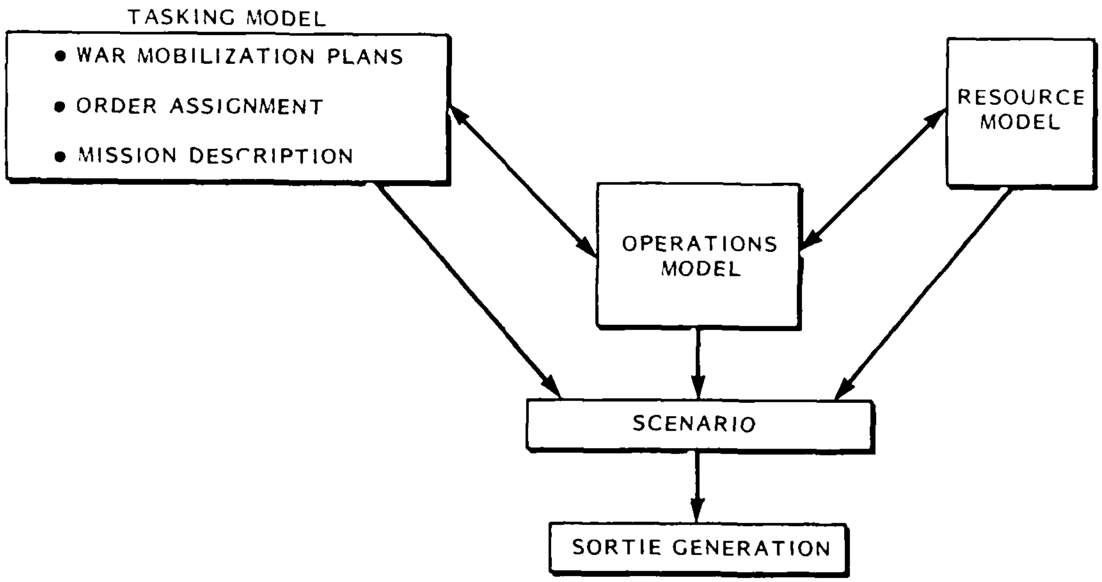
Figure 3-2. Readiness Assessment

It should be noted that some mathematical representations of the computations performed are provided. These equations are provided as conceptual tools for further understanding of modeling techniques and are not intended to represent the specific algorithms required for the operational AFIRMS. Appendices A through C of this document discuss the actual computations performed by the AFIRMS LPP processes. Appendix D describes the approach to AFIRMS support of C-rating calculations.

3.1 Description of Modeling and Transforms.

3.1.1 Data Models. Data models are used in AFIRMS to represent real-world information relationships. These data models are not computational although some models contain simple calculations or transforms. The basic types of AFIRMS data models are Tasking Model, Resource Model and Operations Model. Specific versions of these models can be selected to form a Scenario Model of a particular situation. Task modeling transforms various forms of Air Force operational requirements into unit tasking which defines what a unit must do. Resource modeling defines the resources which are available to perform this tasking. Operations modeling defines key situational factors that represent the context for the assessment of tasking against resources.

3.1.1.1 Task Modeling (Translate Tasking). A basic tenet of AFIRMS is the tasking based nature of the AFIRMS decision support system. Specific requirements (tasks) placed on units or aggregations of units are transformed by AFIRMS processes to provide the basis for the readiness assessment evaluations. Task modeling encompasses the definition and translation of Air Force operational requirements into specific unit level tasking. Figure 3-3 expands the readiness assessment model by showing components of the tasking model that serve to quantify tasking.



- War Mobilization Plans
  - Time Segments
  - Sortie Rates
  - Sortie Durations
- Order Assignments
  - Sortie Allocation by Wing
  - Sortie Allocation by Mission Type
- Mission Description
  - Aircraft MDS(s)
  - Mission Type
  - Mission Priority
  - Fuel Consumption
  - Munitions Load

Figure 3-3. Tasking Model

a. War Mobilization Plans (WMPs): The Air Force, on an annual basis, publishes the WMP outlining the concepts and policies for Air Force operations in wartime and crisis periods. WMP-5 (Volume 5) establishes the basic planning factors and operating data for operations worldwide. AFIRMS provides for the use of WMP-5 data to establish overall sortie requirements and flying data. Specifically, WMP-5 provides tasking segments, sortie rates by mission design series (MDS), and sortie durations. Use of the WMP starting point is optional. Tasking can be established within AFIRMS that is independent of the WMP-5 requirements envelope.

(1) WMP Segment - A grouping of consecutive days within which sortie rates and sortie duration are constant for each MDS. Greater flexibility for defining these quantities (by MDS, by unit, etc.) is required in the operational AFIRMS capability assessment models. Specifically, the sortie duration for an MDS must be variable for WMP periods.

(2) WMP Sortie Rates - The number of sorties per day required per MDS. This rate remains constant for a WMP segment.

(3) WMP Sortie Duration - The length of time, by MDS, required to complete one sortie. This rate remained constant for an MDS over the WMP segment in the LPP. Greater flexibility of definition in the operational AFIRMS is required for sortie duration.

b. Order Assignments: Order assignments (ATOs, Fragmentation Orders, OPlans/OPORDs, etc.) identify wing tasking levels by mission types over time segments. The distribution of wing tasking via order assignment is done by mission type. When order assignments are defined within the WMP-5 environment, the sum of the tasked sorties per day for all mission types at the wing level must equal the total sortie requirements established in WMP-5.

c. Mission Description: Once tasking requirements have been distributed to the wing level, amplified information on mission characteristics is needed. The user further refines the mission operating characteristics. To develop the necessary details of the tasking scenario, mission information on tasking priorities, fuel consumption, and munitions configurations (Standard Conventional Load (SCL)) over tasking segments are defined for each tasked mission type.

(1) Aircraft MDS(s) - The aircraft MDS(s) that will fly the mission type with a particular SCL.

(2) Mission Type - The specific type of mission to be flown, e.g., Close Air Support, Battlefield Air Interdiction, etc., for each aircraft MDS.

(3) Mission Priority - The relative importance of that mission within the particular segment of time. In the LPP assessment models, this was assumed to be the same priority for all wings. For operational AFIRMS, this varies by wing and is a part of the order assignment.

(4) Fuel Consumption - The standard fuel consumption for that mission type and MDS as a function of sortie duration. For the LPP assessment models, the fuel consumed was input by the user. Since consumption varies by MDS and sortie duration, the operational AFIRMS must compute fuel consumption averages.

(5) Munitions Load - The SCL of munitions for that mission type and MDS, along with a priority list of alternative SCLs for the MDS/mission combination.

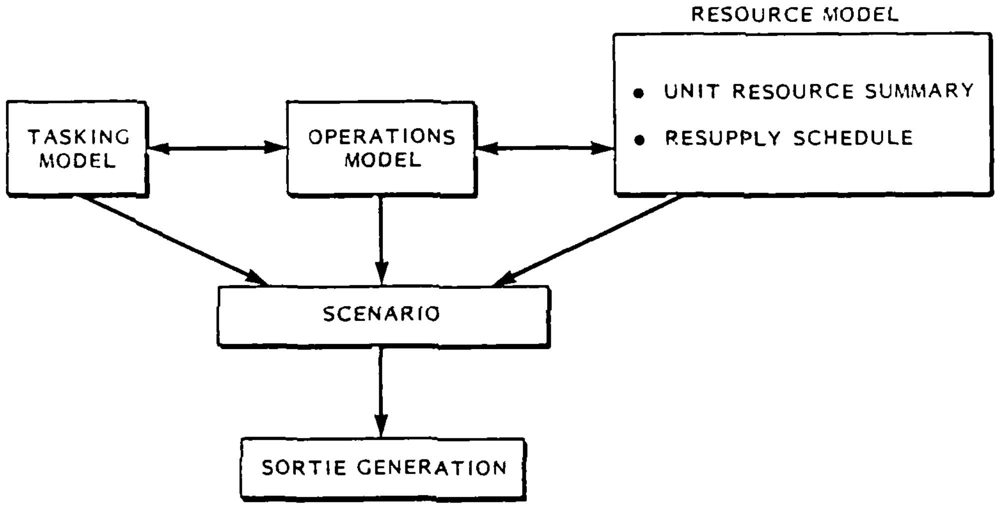
3.1.1.2 Resource Status Modeling (Define Resources). The ability to perform a given task is restricted by the availability of resources required to carry out that mission. To effectively represent readiness, one must not only know what missions are to be performed, but also what resources are available to support those missions. In determining sustainability, information incorporating resource depletion from sortie operations and resource resupply schedules is also required.

Resources are either key or generative in terms of AFIRMS capability assessments. Key resources are those primary resource categories needed to accomplish the tasking. In tactical fighter/reconnaissance units, for example, the key resources are aircrew, aircraft, fuel and munitions. Each of the key resources have secondary resources types which service, support, maintain or deliver the primary resources. Examples of generative resources in tactical fighter/reconnaissance units are spares for aircraft, load crews for munitions, training for aircrews, and fuel trucks and drivers for fuel. AFIRMS capability assessments focus on the status of, and capabilities possible with, the key resources and their interdependencies. AFIRMS addresses generative resource status and capability issues either by interface with other Air Force systems (AFORMS, etc.), parametric representation (repair rates, etc.) or by detailed modeling of the generative resource delivery process (alternate SCLs).

A great deal of this resource status information is available from automated information systems presently operational throughout the Air Force. AFIRMS does not attempt to recreate or duplicate this information. Rather, AFIRMS accesses the available information and adjusts or summarizes information when necessary to provide an accurate model of resources. The determination of whether a resource element is to be maintained internally to AFIRMS, or externally, is not within the scope of this document. (Refer to the Evolutionary Implementation Plan Annex which describes the System Interface Plan.) Instead, the focus is placed on defining the resource elements required and outlining their function in AFIRMS readiness and sustainability assessments.

. In task modeling discussions, AFIRMS progresses from a top level requirements definition, such as the WMP-5, to the wing level detail by defining and distributing tasking. Conversely, in resource modeling, available resources are summarized (aggregated) at the unit level over all unit/base storage facilities and reported up to the MAJCOM level. This reporting of resource data provides a static inventory of resources. By including resupply information, AFIRMS defines the resource "pipeline" in order to accommodate the change from static (readiness) to dynamic (sustainability) modeling.

The relationship of AFIRMS resource status modeling to AFIRMS readiness assessments is shown in Figure 3-4. The unit resource summary establishes the present, historic, or anticipated resource availability. Resource resupply information provides the basis for projections of future resource resupply against resource usage.



- Unit Resource Summary
  - Fuels Available
  - Munitions Available
  - Mission Ready Aircrews Available
  - Mission Capable Aircraft Available
  - Generation Resources Required for the Basic Four Resources
- Resupply Schedule (by day within the tasking plan)
  - Aircraft
  - Aircrew
  - Fuel
  - Munitions
  - Spares and Other Generative Resources

Figure 3-4. Resource Model

a. Unit Resource Summary: Individual resources are categorized and quantified by storage location. Resources are identified by type, where appropriate, and associated with storage locations by type, i.e. JP-4 in tanks. This information is the logistics information necessary to the daily operation of the unit. While detailed information is used in day to day wing level activities, it is not currently required in calculations or determinations made within AFIRMS readiness assessment tools. For example, AFIRMS does not need to know how much JP-4 is in tank 15 at Spangdahlem, but it does need to know the total JP-4 at Spangdahlem.

It should be noted, however, that the basic mechanism in AFIRMS to achieve and maintain data accuracy and timeliness, is to provide the first (unit level) users with the automated tools appropriate to the accomplishment of everyday jobs. This guarantees the accuracy of input data since the input source is also the most rigorous user of the input data. AFIRMS uses this data detail as a quality assurance mechanism on the critical data necessary to the AFIRMS assessment tools.

Additionally, two other factors dictate AFIRMS interest in resource status data to this level of detail. First, for the ad hoc query AFIRMS function, the data requirements are not necessarily capable of being defined ahead of time. Preserving ad hoc query flexibility is, therefore, a valid reason for AFIRMS interest in rather detailed resource status summaries. Secondly, as AFIRMS assessment models and transforms mature, more and more detail in process simulations is likely which, in turn, demands more detailed resource status summaries.

(1) Fuel/Munitions Available - Fuel and munitions inventories are defined by location and storage facility. Fuel and munitions data are categorized by type, as available to support tasking. Only usable fuels and complete "whole-up" munition rounds are included in this inventory status.

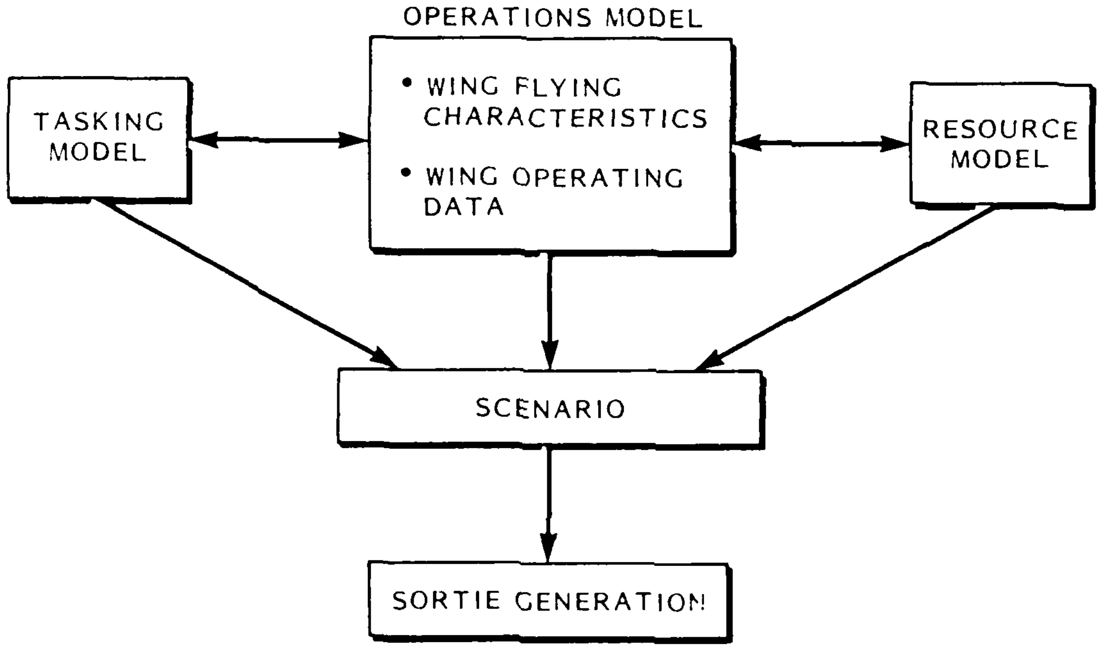
(2) Mission Ready Aircrews Available - The number of available and qualified aircrew members of each type required to form an aircrew by MDS.

(3) Mission Capable Aircraft Available - Aircraft status is identified by unit and MDS. For each unit, the number of authorized aircraft, possessed aircraft, and mission capable aircraft are defined by MDS.

(4) Generative Resources - The resources which are required to support the basic four resources. These resources may service, repair, or provide training to the basic four resources. Examples of generative resources are spares for aircraft, training for aircrew, load crews for munitions, and fuel trucks and drivers for fuel.

b. Resupply Schedule: Resupply data provides the information necessary for AFIRMS to adjust resource inventories for projected logistics resupply. Resource resupply is quantified in terms of the day (the number of days since the tasking scenario was initiated) in which resource resupplies arrive and are placed in a mission ready status, and the amount of the resource resupplied. In determinations of readiness, this information enhances resource status data for snapshot summaries of resource data. In sustainability assessments, resupply data combined with resource depletion by operations, dynamically model resource inventory status over time.

3.1.1.3 Operations Model. Certain operational factors affect the ability of any given wing to perform defined tasking(s). *Situational details, by wing and mission type, provide* amplifying information that determine the constraints within which the wing must perform assigned tasks. Wing flying characteristics and wing operating characteristics qualify tasking and resource data thereby providing information to sortie generation calculations about the real-world operational or what-if environment. Figure 3-5 depicts the operational factors represented in the capability assessment model.



- Wing Flying Characteristics
  - Flying Day
  - Planned Sortie Duration
  - Shift Start Time and Duration
  - Mission Ready Aircrew per Shift
- Wing Operating Characteristics
  - Aircraft Turn Time
  - Aircraft Minimum Time Between Take-Off
  - Aircraft Maintenance Attrition Rate
  - Aircraft Repair Rate
  - Aircraft Combat Attrition Rate
  - Aircraft Battle Damage Rate

Figure 3-5. Operations Model

a. Wing Flying Characteristics: Flying characteristics, established at the wing level, define the hours of operation for that wing and the organization of personnel to support operations. This information defines the maximum operating periods that sortie generation processing can use in computing aircraft and aircrew daily status and capability.

(1) Flying Day - The length of an operating day of a wing which is constant for the wing over all WMP or order assignment time segments.

(2) Planned Sortie Duration - The sortie duration as planned by the tasking authority. For WMP tasking, this is the WMP sortie duration. In what-if scenarios, the user can input any sortie duration desired to see the resulting effect on tasking.

(3) Shift Start Time and Duration - The time that the flying shifts start and the number of hours that formed aircrews are available for shift duty. These remain constant for the wing over WMP segments. In the LPP assessment models, shifts may not overlap; that is, the second shift may not commence before the first shift has ended. The operational AFIRMS Operations Model requires the capability to define overlapping shifts.

(4) Mission Ready Aircrew per Shift - The percentage of total available aircrew assigned to a shift for accomplishing the tasked missions. The crew must be available and qualified to operate the equipment designated for that aircraft MDS and mission type.

b. Wing Operating Characteristics: Wing operating characteristics serve two roles in AFIRMS modeling. First, information relating to the actual operating parameters of airfields, i.e. time between take off can be designated. Secondly, operating characteristics allow for qualitative interpretation of unit support factors and status of generative resource losses.

(1) Aircraft Turn Time - The time from aircraft landing to aircraft take-off. This time is added to sortie duration to determine when the aircraft is available for another sortie.

(2) Aircraft Minimum Time Between Take-Off - The minimum time between take-off of aircraft is a constraint which represents the units ability to launch aircraft. Sorties that cannot be flown due to this constraint are displayed as aircraft shortfalls by the LPP assessment algorithms. Capability to separately identify these shortfalls is required in the operational AFIRMS. If a unit must launch and recover aircraft from the same runway, minimum times will be larger than when launch and recovery on separate runways is accomplished. The minimum time between takeoffs determines the maximum number of launches in a given time.

(3) Aircraft Maintenance Attrition Rate - The break rate for aircraft lost due to maintenance or supply. This rate will reduce the number of capable aircraft available at the beginning of each day of the tasking. These losses are not treated as permanent inventory reductions and are restored to operations each day as set by the aircraft repair rate.

(4) Aircraft Repair Rate - The rate at which aircraft, down due to maintenance attrition, are restored to a mission capable status on a daily basis.

(5) Aircraft Combat Attrition Rate - The rate of aircraft and aircrews lost in battle. These losses are considered as inventory reductions. In the LPP assessment models, aircraft and aircrew attritions are assumed to be the same. For operational AFIRMS, the capability to separate specific attrition rates is required.

(6) Aircraft Battle Damage Rate - The rate at which battle damaged aircraft are restored to mission capable status on a daily basis. This factor was included in the maintenance attrition rate in the LPP model. For the operational AFIRMS, this factor must be separately considered.

<u>3.1.2 Assessment Techniques (Determine Ability to Perform).</u> Basically, readiness assessment is an estimate of a unit's ability to carry out specified tasking with specified available resources. Task modeling translates tasking for such measurement. Resource modeling establishes the resource availability to carry out the tasking. Operating environment modeling qualifies tasking and resource data by situational constraints at the operating level. Together, this information defines the planned scenario for which "ability to perform" determinations are calculated.

The "ability to perform" can be assessed in a number of ways using outputs of the AFIRMS Sortie Generation Model. This flexibility is provided to accommodate a variety of perspectives on capability assessment issues. AFIRMS models can be used to address all four components of military capability as defined in JCS Memorandum of Policy #172 of 1 June 1982, i.e., Readiness, Sustainability, Force Structure, and Modernization. These terms are defined in the Terms and Definitions Section of this document.

The primary focus of AFIRMS is readiness and sustainability evaluations. These evaluations measure, or estimate, Combat Capability. Combat Capability is defined as 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 Susta[illegible]bility" are used interchangeably throughout the AFIRMS documentation. Combat Capability is very closely related to the Unit Report (C-rating) Force Combat Readiness, which is the "...ability to initiate and sustain operation plan (OPlan) execution..." as discussed in AFR 55-15, Section 1-1. Descriptions in this document of the capability assessment models and their uses are presented in terms of "pure readiness" (ability to accomplish one day's tasking) and "pure sustainability" (ability to accomplish a series of one-day taskings). Combat Capability assessments are determined by specifying the task start time and the specific number of days for evaluation (typically 30 or 60 days).

Readiness assessment is a snapshot view of the unit's ability to perform. AFIRMS is concerned with determining the ability of a unit to respond to tasking given the availability of mission ready resources. To this extent, readiness assessment is a static determination of ability to perform. Activities that occur before and after the tasking day under assessment are not an integral part of a readiness assessment. If a determination of readiness is required on day six of a tasking scenario, AFIRMS must use resupply and depletion information for days one through five to establish the resource status on day six. If the status of resources on day six is manually entered, then AFIRMS remains a static decision tool and is not concerned with events in days one through five. If this information is determined by the extension of daily readiness assessments from day one to six, then readiness assessments are the product of a dynamic sustainability assessment methodology.

AFIRMS, through sustainability assessments, is a dynamic tasking based assessment tool. The determination of readiness capability is the result of daily evaluations over time of the operating, tasking, and resource data detailed at the beginning of the tasking scenario. Sustainability determinations show trend and/or aggregate results of daily evaluations while accounting for updated logistics data.

3.1.2.1 Readiness Assessment Transforms. AFIRMS provides two methods for evaluating readiness; individual and integrated capability assessments. Individual capability assessments focus on the capacity of a given resource to meet specific tasking assuming that all other resources are fully available to support tasking. In other words, AFIRMS determines fuel capability by assuming that other resources required to complete tasking, i.e. aircraft, aircrews, and munitions, are fully available.

Integrated capability defines the ability to perform in terms of the limiting resource capability. To accomplish this AFIRMS calculates individual resource capabilities each day, based on resource inventories decremented by the previous day's usages, and uses the minimum resource sortie capability of that day, the resource with the largest readiness shortfall, to establish the integrated readiness sortie capability. No resource has an individual sortie capability greater than the tasking required and all resources are decremented daily based on the sorties which the resource mix are capable of supporting.

AFIRMS tracks four primary resource categories: aircraft, aircrew, munitions, and fuel. The discussion of each resource capability analysis starts with static resource modeling, that is, inventory levels are known and are not a function of previous or subsequent tasking definitions. Resupply, if appropriate for the day being assessed, is included as an increment to the static resource inventory.

Aircraft capability begins with a determination of the number of mission capable aircraft at the start of each day. The number of aircraft possessed by the wing is reduced by the number lost due to maintenance and combat attrition. This modified number of operational aircraft is then incremented by the number of aircraft returned to service by maintenance and battle damage repair. In readiness evaluations, the number of mission capable aircraft at the beginning of each day is the sum of aircraft operations data as shown below. The total number of mission capable aircraft is compared to the tasked sortie requirement, adjusted by an aircraft usage rate, to determine aircraft shortfalls. The aircraft usage rate is a factor that accounts for the nonconsuming nature of aircraft resources usage, i.e., one aircraft may fly more than one sortie.

Aircraft Capability

$$\text{Daily Aircraft Readiness Shortfall} = \sum_{w=1}^{n} \left(\text{Daily Tasked Sorties} - \left(\text{Daily Mission Ready Aircraft} \times \text{Aircraft Usage Rate} \right) \right)$$

$$\begin{aligned}\text{Daily Mission Ready Aircraft} = (&\#\text{ Mission Ready Aircraft Possessed} \\ &- \#\text{Maintenance attrition} \\ &- \#\text{Combat attrition} \\ &+ \#\text{Aircraft Maintenance Repaired} \\ &+ \#\text{Aircraft Battle Damage Repaired} \\ &+ \#\text{Attrition Replacement Aircraft})\end{aligned}$$

w = wing
n = last wing of tasking

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Aircrew capability is based on the number of sorties tasked for that day. Aircrew are assumed to be fully mission ready. AFIRMS determines aircrew capability by first multiplying the wing level summary of mission ready aircrews by the percentage distribution of aircrew by shift. The daily mission ready aircrew is then compared to the tasked sortie requirement to determine aircrew shortfalls.

Aircrew Capability

$$\text{Daily Aircrew Readiness Shortfall} = \sum_{w=1}^{N} \left(\text{(Daily Tasked Sorties} - \left(\text{Daily Shift Mission Ready Aircrews} \times \text{Aircraft Usage Rate (Note 3)} \right) \right)$$

$$\begin{aligned}\text{Daily Mission Ready Aircrew} = \; & (\text{\#Mission Ready Aircrew Possessed (Note 1)} \\ & + \text{\#Mission Ready Aircrew Resupplied} \\ & - \text{\#Combat Attrition} \\ & \times \text{\% Formed Aircrew/Shift (Note 2)}\end{aligned}$$

where: w = wing priority
N = number of wings in tasking

Note 1 - The number of mission capable aircrews is an input from the Resource Model.

Note 2 - The percent formed aircrews per shift is an input from the Operations Model.

Note 3 - Aircrew Usage Rate is the factor accounting for the nonconsumption nature of aircrew resource, i.e., one aircrew may fly more than one sortie per day.

Munitions capability assessments define the ability of specific munitions types, e.g., Mk 82 or Mk 20, to meet specified tasking. Therefore, munitions shortfalls are calculated by each specific munition type. Overall "total" munitions capability is assessed by aggregating each specific munition's sortie capability. Furthermore, in determining munitions capability, AFIRMS evaluates alternative SCLs when available, to determine whether alternative munitions are available to support the mission tasking. The LPP assumed all SCL alternatives were equally satisfactory for accomplishing the tasking. The operational AFIRMS requires the capability to distinguish between SCLs with respect to effectiveness. Since munitions shortages are only counted after alternate SCL munitions have been exhausted, the munitions shortages for desired primary munition types may be considerably larger than shown since alternate munitions may have provided capability to accomplish the tasking.

As stated, munitions capability is evaluated by specific munitions type. In order to accomplish this, AFIRMS counts the number of sorties that can be performed until inventories are depleted. In other words, the number of sorties that can be flown on any given day is determined by the availability of resources to support those sorties. The number of munitions supportable sorties is first determined by mission type, evaluated from highest to lowest mission priority, and then summed over MDS. When inventory is depleted, sortie summation is terminated and the number of munitions capable sorties is established. This number is then compared to the tasked sortie level to determine munitions shortfalls.

Munitions Capability

$$\text{Daily Munitions Capability Shortfall} = \sum_{w=1}^{N} \left(\text{Tasked Sorties} - \text{Daily Munitions Capable Sorties} \right)$$

Daily Munitions Capable Sorties =

$$\sum_{M=1}^{M=n} \text{Inventory} - \left(\sum_{p=1}^{n} \text{SCL} \right)$$

Where:

SCL	=	Standard Conventional Load of munition types by mission type
Inventory	=	Munitions inventory by type, including resupply by type
M	=	Mission Type priority
P	=	SCL substitution priority (Munitions capable sortie summation stops for a mission type when the inventory can no longer support one of the mission type SCL substitution alteratives.)
w	=	Wing priority
n	=	Number missions in the tasking
N	=	Number of wings in the tasking

Fuel assessments define capability by specific fuel types, e.g., JP-4, JP-5, etc., for the accomplishment of specified tasking. Total fuel capability is an aggregation of sortie capability over fuel types. The AFIRMS LPP model assumes that fuel types are not interchangeable and therefore, no inventory alternatives exist to support tasking. The operational AFIRMS requires the capability to dynamically substitute alternative fuels, if available for the given MDS, as is accomplished for the munitions assessment algorithms.

The same methodology employed by AFIRMS in munitions assessments is also utilized in fuel assessments. Basically, AFIRMS counts the number of sorties that can be flown before fuel inventories are exhausted. Fuel capability is first summed by mission type, evaluated from highest to lowest mission priority, and then summed over tasked MDS. When the resource inventory is depleted, sortie summation is terminated and the number ofsupportable sorties is established. This number is then compared to the tasked sortie level to determine fuel shortfalls. In future applications, fuels assessments may be expanded to evaluate other forms of POL important to readiness and /sustainability assessments.

Fuel Capability

$$\text{Daily Fuel Capability Shortfall} = \sum_{w=1}^{N} \left(\text{Tasked Sorties} - \text{Daily Fuel Capabie Sorties} \right)$$

Daily Fuel Capable Sorties =

$$\sum_{M=1}^{M=n} (\text{Inventory - Fuel Consumptions})$$

Fuel Consumption	=	Gallons per mission type sortie
M	=	Mission Priority
w	=	Wing
Inventory	=	Fuel Inventory, including resupply by day
n	=	Number of wings of missions in the tasking
N	=	Number of wings in the tasking

3.1.2.2 Sustainability Assessment Transforms. AFIRMS is a capability measurement system, including readiness and sustainability. As discussed previously, readiness is a snapshot view of capability to meet tasking. Another useful capability assessment tool is the evaluation of sustainability; that is, readiness over time.

Sustainability is a measurement of the "staying power" of forces and resources measured over a period of time. Thus, we are concerned with the ability of units to execute tasked missions over time. The transformations and processes defined in the evaluation of readiness by AFIRMS are applied iteratively over time to achieve sustainability assessments. Whereas readiness assessments deal with the static determination of capability, sustainability deals with the dynamic assessment of capabilities. To provide this shift from static modeling to dynamic modeling, AFIRMS incorporates logistics information, i.e., resupply schedules, including generative resources such as spare parts data. Individual and integrated capability assessments apply the static assessment processes over segments of time. The preceding processes requires the insertion of a summation over tasking days $\left(\sum_{d=1}^{D}\right)$ after the summation over wings $\left(\sum_{w=1}^{N}\right)$ in the mathematical expression of the preceding expressions. This insertion provides a time series view of capability by wing.

The AFIRMS sustainability transforms allow assessments with or without resupply data. If sustainability transforms are run under conditions of resupply, then AFIRMS provides assessments that represent the staying power of forces, given scenario defined tasking and logistics resupply as well as inventory information. If sustainability assessments are processed without resupply data (assuming that the resupply schedule is zero), AFIRMS will show the staying power of forces, given the assigned tasking and the initial resource inventory.

Figure 3-6 is a graphical representation of the AFIRMS sustainability model. The only difference between this model and the model in Figure 3-2 is the interaction of logistics information between the resource summary model and the tasking requirements definition to decrement and/or increment resource inventories each day for comparison against tasking for that day.

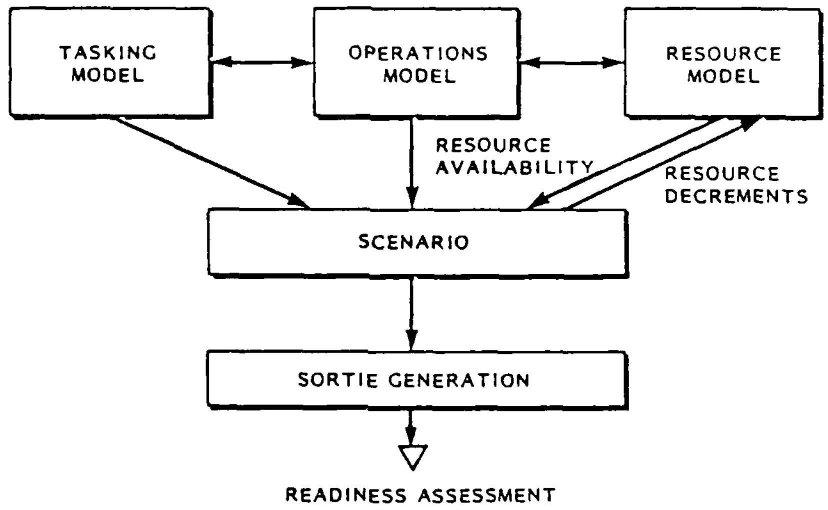

Figure 3-6. Sustainability Assessment

Note: In order to express the complete form of sustainability assessments, the above model should be considered as a mathematical function (f (x)) for the assessment tool. This function (f (x)) must then be applied over time to obtain a true measure of sustainability. The following expression represents this application:

$$\sum_{d=o}^{D} f(x)$$

where	d	=	Day of tasking being evaluated
	D	=	total number of days in tasking
	f(x)	=	above model

3.1.2.3 Dollars to Readiness Transforms. As capability assessments are important to AFIRMS so is the function of relating support dollars to readiness. This function fulfills the congressional mandate stipulating that Congress be able to see and understand the impact of proposed appropriations on readiness. The goals of the dollars to readiness tool in AFIRMS are basically:

a. Determine the level of funding necessary to achieve and maintain the desired levels of readiness and sustainability.

b. Determine levels of readiness and sustainability that can be achieved with a given funding situation. This goal is implemented in AFIRMS only through the iterative successive approximation use of the assessment models. The Operational AFIRMS requires the capability to "optimally" distribute dollars over resources, based on predefined priority scenarios.

c. Demonstrate whether readiness and sustainability actually change given the increase/decrease of funding. This goal is implemented in AFIRMS only for relatively short periods of time in which the "baseline" tasking does not change significantly.

The above goals can be couched in more fundamental terms, such as if "X" dollars are allocated or deallocated, how much will Air Force readiness increase or decrease; or, if Air Force readiness is to increase by "Y," how much additional funding is required; or, how much has capability changed over the last "n" years with respect to the "Z" dollars spent? In all cases, there are certain constraints and limitations against which the answers to these questions must be judged.

The first is that whatever dollar amounts are finally tallied, or level of readiness obtained, one does not ultimately know how successful the allocation is until it is used, either in peace or war. Secondly, it is not feasible to predict with absolute precision exactly what represents the best allocation of budgets. This is true especially in terms of projecting future budgets unless the associated tasking priorities can be established. In all cases, good solutions are possible, but statistically optimal solutions cannot be expected.

AFIRMS' approach to dollars to readiness assessments is essentially a simple quantity times unit price calculation. The quantities are of key resources tasked and short as given by a specific execution of the capability assessment (sortie generation) model. The unit price is dollars per unit amount for the specified resource types. Each type of key resource tasked and short for each wing, for each day, and for each mission type, can be obtained from the data available in the appropriate sortie generation model output. Note that the generative resource types are not yet included in the AFIRMS capability assessment algorithms. Therefore, dollars to readiness assessments are not yet made for these resources. Figure 3-7 is a graphical representation of the AFIRMS Dollars to Readiness transform.

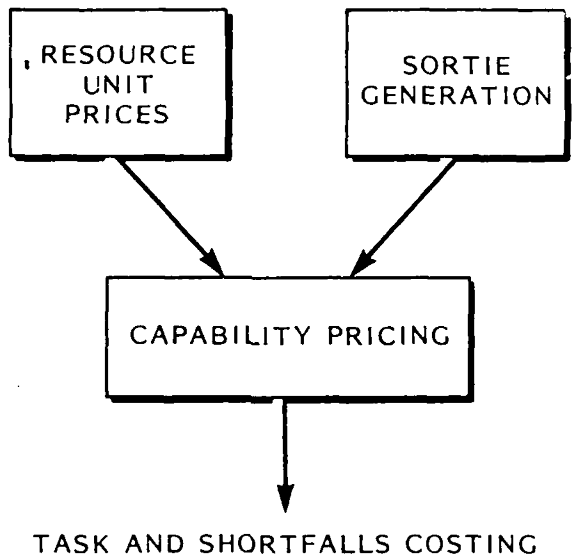

Figure 3-7. Dollars to Readiness

Both the tasked and short resource quantities are summed for the specified tasking by resource type over mission type, over days, and over wings. This sum provides the total quantities of each resource type tasked and short, respectively, during the entire tasking period, for all tasked units and all tasked missions. The unit price for each of these resource types is multiplied by the quantity of the corresponding resource tasked and short to provide the dollars to readiness assessments. The logical algorithm is given below. The actual algorithms used in the model are given in Appendix B. The algorithms differ from the logical expression to accommodate programming/processing efficiencies.

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$$\text{Dollars Tasked (Short)} = \sum_{W=1}^{N} \sum_{d=1}^{D} \sum_{M=1}^{m} \sum_{R=1}^{4} (\text{Quantity}) \times (\text{Unit Price})$$

Where:

Quantity	=	Amount of resource tasked (short)
Unit Price	=	Unit price for resource type
R	=	Resource type
d	=	Day of tasking
W	=	Wing
n	=	Number of wings in tasking
D	=	Total number of days in tasking
M	=	Mission Priority
m	=	Lowest Mission Priority
N	=	Number of wings in tasking

<u>3.1.3 What-If Assessments</u>. Since AFIRMS is an automated system with flexible input models, and because of the sortie unit of measure used to measure readiness for fighter/reconnaissance units, it is possible to test hypothetical situations. Other types of units may have units of measure other than the sortie. These metrics will, however, be "resource integrators" and operate similarly to the sortie for "what if" assessment purposes. Examples of possible hypothetical situations are:

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

b. What if the required taskings are changed?

c. What if funds are changed in out-year FYxx?

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

The capability for what-if exercises is provided through data replication (virtual copy) of the AFIRMS database. 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 while preserving the real database intact.

AFIRMS applies this what-if technique to the two prime areas of AFIRMS evaluation: sortie generation (readiness and sustainability assessments) and dollars to readiness transforms. In the sortie generation what-if exercises, hypothetical changes to tasking, resource scenario characteristics can be evaluated. Dollars to readiness exercises reflect the dollar impact of these various capability assessment exercises. Through an iterative evaluation of the dollars to readiness outcomes, funding level impacts can be examined.

3.1.3.1 Sortie Generation. The impact of any anticipated or desired change in standard tasking and/or operations plans of the Air Force can be evaluated through sortie generation what-if exercises. In the what-if exercise, the user is allowed to establish any hypothetical set of data (non- standard) that the user desires to evaluate. This hypothetical data may range from a simple change in one or more of the data elements in the Tasking Model, Scenario Model, or the Resource Model up to the complete specification of ad-hoc data inputs for all the status models. The sortie generation model what-if tool provides a considerable improvement in evaluating the impact of changes over the manual, time consuming, trial and error process.

3.1.3.2 Dollars to Readiness. What-if dollars to readiness evaluations provide a useful means for evaluating the impact of various readiness and sustainability scenarios on funding distributions and funding levels. At this writing, AFIRMS determines the distribution of funds for maximizing readiness status only by iterative applications of models with "off line" human evaluations and adjustments. AFIRMS evaluates and presents information on where resource shortfalls exist and determines the dollar amount of that resource shortfall as a tool for use in this method of successive approximations.

A number of possible applications exist for the what-if methodology in the dollars to readiness area. For example, AFIRMS can be used to evaluate the impact of unit price changes on the total dollar requirements to attain a specific readiness capability. Also, AFIRMS can be used to determine the additional funding required to attain and maintain a certain level of readiness or determine the capability which can be achieved under a funding reduction.

There are several limitations to the application and use of this tool. First, AFIRMS does not currently provide a means to automatically determine where to allocate additional funding. That is to say, AFIRMS does not provide the tool to determine if X dollars are available, then by spending so much on resource A and so much on resource B, the maximum increase in readiness could be obtained. This capability is scheduled for development in a later block of the program and will provide for dollar optimization of resource allocations against tasking requirements under given priority assumptions.

Certain limitations affect the accuracy of dollars to readiness what if exercises. In the LPP, AFIRMS did not explicitly consider the complexity of the logistics and procurement cycle. The period between the allocation of dollars for resources and the day that the resource is available varies by resource, mission, and location. Where fuels, munitions, and other consumable resources may be procured and available in a matter of days, weeks, or months, the acquisition of aircraft or the training and qualification of aircrews may take many months or years. This disparity in procurement and logistics times is not currently incorporated into the AFIRMS methodology. The user must "front load" resources (dollars) to accommodate these procurement lags. Associating readiness dollar requirements to budgetary appropriations line items is to be detailed during Block 1 of the Analysis Phase for the operational AFIRMS at HQ USAF.

3.2 Description of Algorithms. The AFIRMS models utilize basic mathematical methods in the performance of calculations. The Sortie Generation Model (SGM) and Dollars to Readiness Model (DTRM) utilize addition, subtraction, multiplication, and division to meet the functional requirements. Use of complex mathematical modeling or evaluation techniques are not required to meet the functional objectives of the system. The summation algorithms become complex only when aggregations are performed, particularly in the dollars to readiness model.

The specific algorithms or calculations which are not directly associated with calculations of the Sortie Generation or Dollars to Readiness Models are presented in Appendix C of this document. These algorithms are used by AFIRMS products which perform calculations that are independent of Sortie Generation of Dollars to Readiness Model calculations.

APPENDIX A: SORTIE GENERATION MODEL DESCRIPTION

A.1 Introduction. The Sortie Generation Model (SGM) is an integral part of the Air Force Integrated Readiness Measurement System (AFIRMS), and performs a host of functions necessary for the achievement of stated AFIRMS goals. The Sortie Generation Model supports numerous AFIRMS products (screens) for the database display and manipulation of SGM input (setup) data, and output data. In conjunction with these facilities, the SGM provides a tool which allows a user to assess a wing's (or wings') capability to perform a given set of tasks. A wing's task(s) is depicted as consisting of numerous parameters, including task duration, mission types and number of sorties for each day of the task duration, and the associated resource requirements. By applying the given set of tasks to the wing's given resource levels (including the application of a described resupply plan), the SGM computes the degree to which the wing may be able to meet the task's requirements.

Additionally, if the wing's given resource levels are not sufficient to support the defined task set (shortfall), the SGM provides information depicting that shortfall for each individual resource. This allows the user to make various useful determinations such as the identification of resource deficiencies and resource requirements.

This document provides a functional overview of the AFIRMS LPP SGM and an explanation of those factors which significantly affect its performance and results. It is intended such that a user or an analyst may, by reading this document, determine the current functionality of this tool toward a specified purpose, as well as the strengths and limitations of the model.

Section A.2 discusses the major assumptions upon which this model was constructed, and the subsequent limitations imposed. A description of the major algorithms and processes applied within the SGM are included in Section A.3, and Section A.4 details the functional descriptions of the model on a module by module basis. Section A.5 describes the model's input data requirements, and Section A.6 describes the output data.

A.2 Assumptions and Limitations. This model was developed in the AFIRMS Learning Prototype, and as such, was characterized by a rapid development in order to adequately depict the viability and utility of such a model at various command levels. Thus, this Sortie Generation Model (SGM) was not the product of an on-going research and development effort aimed at the full capabilities required of an operational model. Rather, its purpose was to exhibit the fact that an operational model would be a desirable and highly useful item, and to demonstrate the form and function of such a model. In order to accomplish this in the required time period, various assumptions were made, and various limitations accepted. During the implementation of an operational AFIRMS, several of these limitations must be eliminated in order to provide a more useful capability assessment tool.

A.2.1 Assumptions. This sub-section summarizes the more significant assumptions employed in the SGM. An asterisk annotates an approach, assumption, or function which exits as described in the LPP SGM, but which will require reevaluation, and perhaps subsequent modification, during Phase 1 of the development of the operational AFIRMS.

a. The number of sorties produced will equal the sorties allowed by the limiting resource, but never greater than the number of sorties tasked. In this sense, the number of sorties "produced" is defined as the number of sorties that could be flown, given the current resource and tasking scenario. Further, the model does not identify capability in excess of the tasking requirements.

b. The amount of each resource expended (and thus, the amount decremented from each wing's resources) is based upon the number of sorties produced.

*c. Total sorties are not differentiated from total effective sorties. For example, a mission might require 50 sorties to be successful, but resource limitations will allow only 3 sorties for that mission. The SGM assumes that these 3 sorties will be flown, despite the possibility that these missions might conceivably be scrubbed completely due to the probability that only 3 sorties would be ineffective.

*d. The SGM accounts for only the four basic resource types: aircraft, aircrews, fuel, and munitions, with munitions broken down into specific munitions types. Munitions requirements will be applied first (with respect to tasking, mission priority, alternate standard conventional loads (SCLs), and munitions availability), and a modified tasking will be computed in accordance with those limitations, if any. This modified tasking is then applied to the remaining resources.

*e. Turn times will be assumed to be the same for all mission types for a given wing and day.

*f. Tasking and capability quantities will be defined in terms of waves for any given wing and day. The number of waves in a day will be equal to the duration of the wing's task (flying) day divided by the wing's cycle time, rounded down to the integer. The wing's cycle time will be equal to the wing's flight time plus the turn time for the given wing and day.

*g. Flight time will be consistent for a wing during the entire period of tasking.

*h. All physical aircraft breakdowns (pre-flight, takeoff, and during flight) will be simulated with a single summary attrition rate known as the maintenance attrition rate.

*i. All occasions of combat loss of aircraft will result in a simultaneous loss of an aircrew. A single attrition rate known as the combat attrition rate represents both losses.

*j. All types of aircraft repair will be simulated with a single summary rate known as the maintenance repair rate.

*k. All the above rates will be applied after each simulated wave.

*l. Aircraft attrition after a wave will be equal to those aircraft lost due to maintenance attrition which could not be repaired before the next wave, plus those aircraft lost due to combat attrition. Aircrew attrition will be a function of those aircrew lost due to combat attrition only.

*m. It will be assumed that schedulers can work to the needs of the crew for each turn.

n. Fuel will be used until totally depleted.

*o. All assets are the wing's assets.

p. A minimum time between takeoffs will be assumed, and will be consistent for a given wing and day.

*q. A constant average fuel consumption will be assumed for each mission type for a given day.

*r. Each mission type for any given day will be associated with a primary SCL. However, the application of alternate SCLs (due to shortage of munitions required by higher priority SCLs) will not diminish the priority of the mission type.

*s. Each wing will be associated with one and only one mission design series (MDS) of aircraft.

*t. All aircraft are capable of performing any mission tasked. There are no distinctions made between design series.

*u. An individual mission will be considered a single sortie, and will be accepted or rejected on that basis.

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*v. Mission types are spread out evenly across all waves.

w. The association of sorties produced to mission types tasked will be accomplished in accordance with the priorities of the mission types.

x. The total number of sorties produced by a specific resource is determined on a daily basis, independent from all other resources.

*y. Task (flying) day duration will remain constant for a given wing during the entire period tasked.

A.2.2 Limitations. A number of the above assumptions produce several functional limitations in the SGM. Some are self-explanatory, while others are meaningful only under certain highly specific situations. In each case, the SGM user must be aware of these limitations in order to properly interpret the results of the model. In some cases, an assumption leads directly to one or more fairly obvious limitations. For example, assumption "y" states that the flight time will remain constant for a wing during the entire period of tasking. Thus, the model limits the flexibility one has to define different flight times for sorties (or missions) tasked for the same wing. In this case, the assumption is in itself, a single limitation. In fact, all assumptions are in themselves, limiting factors, and this sub-section will not attempt to re-iterate the obvious limitations imposed by the assumptions stated previously. Rather, it enumerates and explains additional significant limitations placed on the system.

A.2.1 Limitations Involving Individual Resource Capability Assessment. The SGM is designed to provide "integrated capability" assessments; that is, to evaluate tasking capabilities given usage requirements for all four basic resources simultaneously. The SGM approaches the capability determination of each resource individually for any given day, applying the resource's tasking for that day to the availability of that resource at the start of the day. The degree to which each individual resource is decremented before the start of the next day is a function of the number of sorties produced during that day. Since the number of sorties produced is a function of the limiting resource (or resources), the SGM will not actually produce an independent view of the individual resources' capability during an entire tasking period since resources are decremented based on the sortie requirements which are flyable under the most limiting resource. A user can induce this true individual picture of a given resource's capability during the tasked period by setting up a model run which provides adequate inventory of the other three resources.

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As an example of this limitation, assume a situation where all of a wing's fuel has been consumed, and resupply is not scheduled for the remainder of the tasking period. If the wing has only enough aircraft to handle one more day of tasking, aircraft will never be identified as a shortfall resource since no sorties will be produced due to the lack of fuel, and thus no aircraft will be decremented. In this case, the fact that the wing does not have enough aircraft to support its tasking will not surface in the model output. The model does provide the tool necessary to isolate the above shortage of aircraft, but the user must understand how to employ it in order to do so. In this case, setting up an SGM under the same conditions as before, but with an adequate supply of fuel, will cause the aircraft shortage to surface.

A.2.2 Munitions Capability Determination Limitations. The model attempts to meet the munitions needs of the tasking by applying a tasked mission type's primary SCL to the munitions available. If it determines that the tasking has not yet been met, but the primary SCL can no longer be filled due to a shortage of some munitions type, it attempts to meet that mission type's tasking using alternate SCLs (if provided), in order of SCL priority. If the tasking has not been met by the time the lowest priority SCL has been interrogated and exhausted, the model determines that a munitions shortfall has occurred. It then determines how many sorties are short due to munitions, which munitions types constitute the shortage, and how many rounds of each short munition are short. It does this by applying the number of sorties short due to munitions to the primary SCL. Thus, for any given mission type, the only munitions shortages that will be evidenced are with respect to those munitions types required by that mission type's primary SCL. This has several additional ramifications:

- Munition types not present in any mission type's primary SCL will never evidence a shortfall. The list of munitions types short gives the user one way, by obtaining a greater supply of the munition types listed, to increase the wing's capabilities and meet the tasking, or to at least, meet that part of the tasking not limited by other resources. The key here is 'one' way. In fact, there may be numerous ways to accomplish this, depending upon the number and makeup of the alternate SCLs. These alternate means of meeting the tasked munitions requirements do not surface in the SGM output.

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- Currently, the munitions shortage is computed by applying the number of sorties short due to munitions, to the primary SCL; the ENTIRE primary SCL. Thus, if there are 3 sorties short due to munitions, and the primary SCL consists of 2 A-BOMBS and 3 B-BOMBS, a shortage of 6 A-BOMBS and 9 B-BOMBS will be registered, even if there are sufficient A-BOMBS and the shortage is just for B-BOMBS. The shortage of B-BOMBS is enough to fail the requirements of the primary SCL, and thus evidences an artificial shortage of A-BOMBS. Again, munitions tasked are represented in the model output only in terms of the primary SCL. Thus, the only evidence provided that alternate SCLs were utilized is in the list of munition types (and no. of rounds of each) used. However, there is no easy way to determine which and how many alternate SCLs were utilized in attempting to meet the tasking.

<u>A.2.3 Limitations Imposed By The Application of a 'Modified' Tasking</u>. As described previously (Section A.1, item 4), the SGM applies the tasking to the munitions resources first, after which it computes a 'modified' tasking to which the other 3 resource's requirements are applied. This modified tasking is, in effect, the capability with respect to munitions. Since all capability computations are directly influenced by the associated tasking, this has several significant ramifications. Before the more significant of these are discussed, it should be noted that, as before, this limitation may be eliminated. A model run in which the associations have been set up such that all required munitions are readily available eliminates munitions as a limiting factor. Effectively, the 'modified' tasking will, in this case, be the actual original tasking, and it will be applied to all the other resources as such.

The tasking column in the SGM by-wave output table is the modified tasking. It is equal to the sorties produced by munitions column in the same table. The original tasking for that wave can be obtained from the information in this table merely by adding the number of sorties short due to munitions to the modified tasking. However, understand the following example: if for a given wave, we have the following output (assume that the other resources are not a factor):

<u>WAVE n</u>

SORTIES TASKED:	14	------- / EQUAL BY
SORTIES PRODUCED BY MUNITIONS:	14	------- DEFINITION /
SORTIES PRODUCED BY FUEL:	14	
SORTIES SHORT DUE TO MUNITIONS:	6	
SORTIES SHORT DUE TO FUEL:	0	
SORTIES CAPABLE BY FUEL:	17	

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Thus, the original tasking for this wave was 20. This tells us that:

- We were short 6 sorties due to munitions, and that the tasking was modified from 20 to 14 for application to the other resources.
- We had enough fuel to fully accommodate the modified tasking.

However, it does not show that only enough fuel to accommodate 17 sorties was available, and that had enough munitions been available to support the original 20 sorties tasked, a fuel shortage amounting to 3 sorties would have surfaced. This shortage (for this given wing-day-wave) would surface if the model were run again with adequate munitions supplies.

Basically, the limitations fostered by this concept of modified tasking relate to the integrated resource capability measurement process. Munitions capabilities are measured with respect to the assigned tasking. Tasking is re-defined by the munitions capability with respect to the original tasking, and the fuel, aircraft, and aircrew capabilities are measured with respect to the modified tasking.

<u>A.3 Functional Process Descriptions.</u> The Sortie Generation Model functional processes are straight-forward. The model is given a set of tasking and resource input data, performs a series of processes on that data, and produces a set of capability output data. The actual content and format of the input and output data sets are described in Section A.5 and A.6 of this document. Section A.4 contains a description of the actual functions of each SGM Software Module. This section provides a description of the processes applied to the input data which produce the output data, but avoids explicit reference to implementation details (i.e., system and software architecture and design), except where such reference is considered necessary towards increasing the reader's understanding. The purpose of this section is to provide an analytical understanding of the SGM functional processing.

<u>A.3.1 Functional Overview.</u> Functionally, the SGM can be viewed in three parts; the input data retrieval and preparation segment, the model processing functions, and the output or post-processing segment. The model itself cannot be implemented as a completely separate computer process or program. Rather, it is integrated with a

process known as the Data Base Server (DBS), which is continually running throughout the execution of the AFIRMS SGM to provide access and security controls for the system. The discussion present in this document does not include an explanation of the database server functions. Figure A-1 shows the functional organization of the SGM.

A.3.1.1 **Input Data Retrieval and Preparation.** In considering the methodology applied to the implementation of this activity, it was important to note that the quantity of input data required for an SGM run varies greatly depending upon the length of the time period requested, number of wings, number of mission types tasked, number of waves tasked, etc. When these dimensions get large, the SGM runtime and memory requirements increase rapidly.

The model itself supports a dynamic memory allocation and deallocation mechanism. Input data retrieval activity is divided into two separate segments: one segment retrieves the required data from the database, expands it into daily increments in a specified format, and places it into a disk file; the other segment reads this file and stores the data read into dynamically allocated memory storage areas. These two segments together constitute the SGM 'Front End' and are discussed independently in the next sections.

A.3.1.1.1 DBMS Data Retrieval Segment. This segment interfaces with the database SGM input tables within the AFIRMS database. There are eleven database tables which interact through seven AFIRMS product screens. The data is fetched from the database tables and is organized into a form acceptable to the data file reading and memory allocation segment of the Sortie Generation Model.

The seven AFIRMS Product Screens that interact with the SGM input tables are SGM Associations, Mission Profile Definition, Order Assignments, Wing Flying Day, Wing Resupply Day, Wing Operations Rates Screen, and Wing Resource Summary. Based upon labels which identify the sets of information input through these previously described screens, the data retrieval segment extracts the information from the database and initiates the data file reading and memory allocation segment. Figure A-2 shows the input functions within the SGM.

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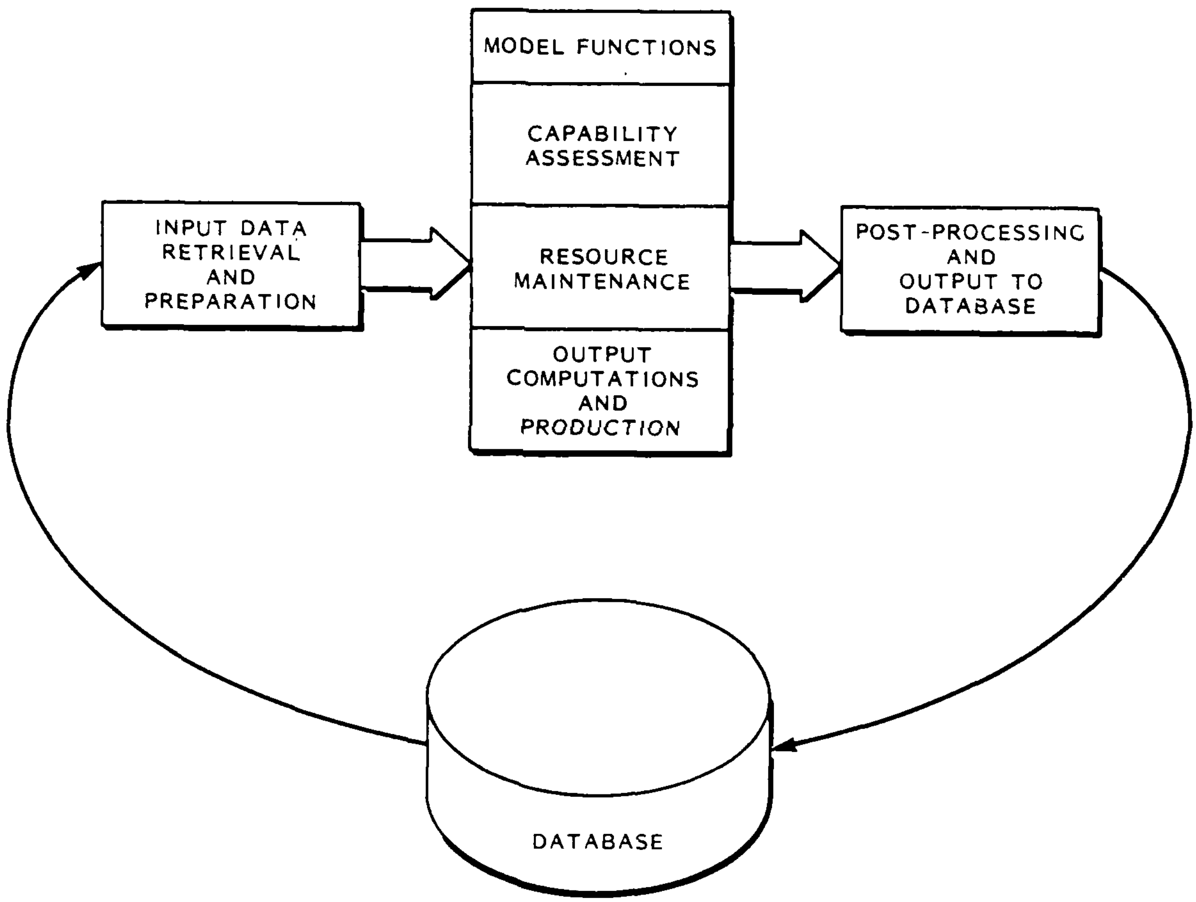

Figure A-1. Sortie Generation Model Overview

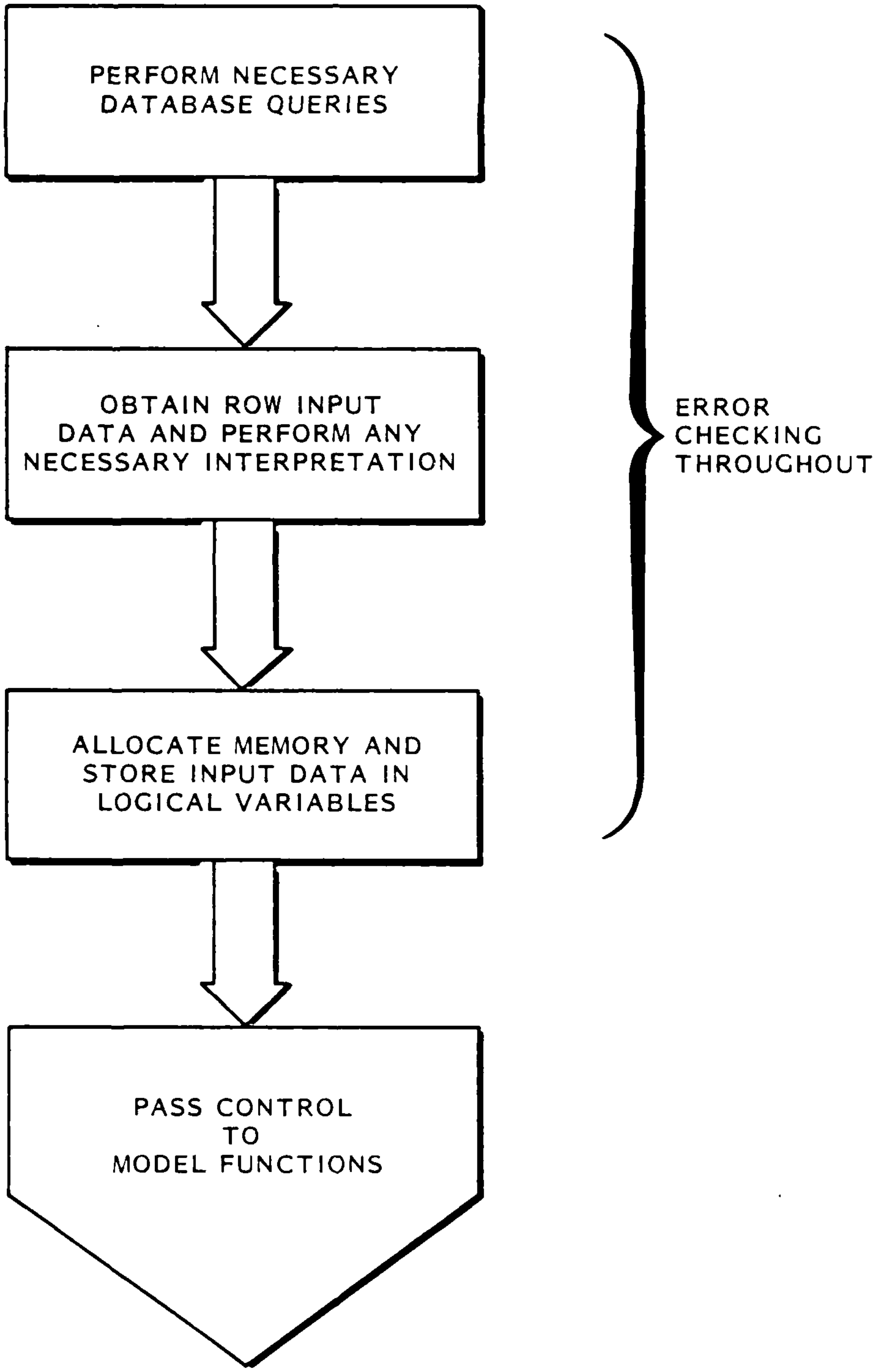

Figure A-2. Sortie Generation Model Input Data Preparation

A.3.1.1.2 Data File Reading and Memory Allocation Segment (C). This segment opens and reads from the disk file previously created, allocating main memory for each item it reads, and storing each item appropriately. Certain items undergo some pre-processing between the time they are read from the disk file and the time they are stored in main memory (i.e., some integers representing percentages are interpreted as real numbers, etc.). The start address of each allocated portion of memory is stored and later used (in the post-processing segment) to deallocate these areas.

A.3.1.2 The Sortie Generation Model. The SGM itself consists of numerous modules which apply the transform algorithms to the set of input data quantities. Capability assessment of each of the four resource categories is accomplished by wing, by day, and by mission type. Resources are appropriately decremented in preparation for the next day. A set of output quantities evidencing the model's computational results are produced and stored in dynamically allocated main memory areas. Functionally, these SGM processes can be broken down into three areas; capability assessment, resource decrementation, and final processing and output production. The functional information flow of the SGM process is shown in Figure A-3.

A.3.1.2.1 Capability Assessment. Capability assessment is performed as a series of steps in which each resource's capability with respect to tasking is assessed. With the exception of the affect on tasking of munition capability, these assessments are computed independently on a daily basis. For each day, for each wing, and for each mission type, the following procedure is applied.

First, certain parameters which are necessary to, and remain constant throughout, the capability assessment of the given wing for the given day, are computed. These include the number of waves, crew replacement schedules, computation of various attrition rates, and aircraft limitations by wave (i.e., maximum number of aircraft that can takeoff in the defined wave period given the minimum required time between takeoffs).

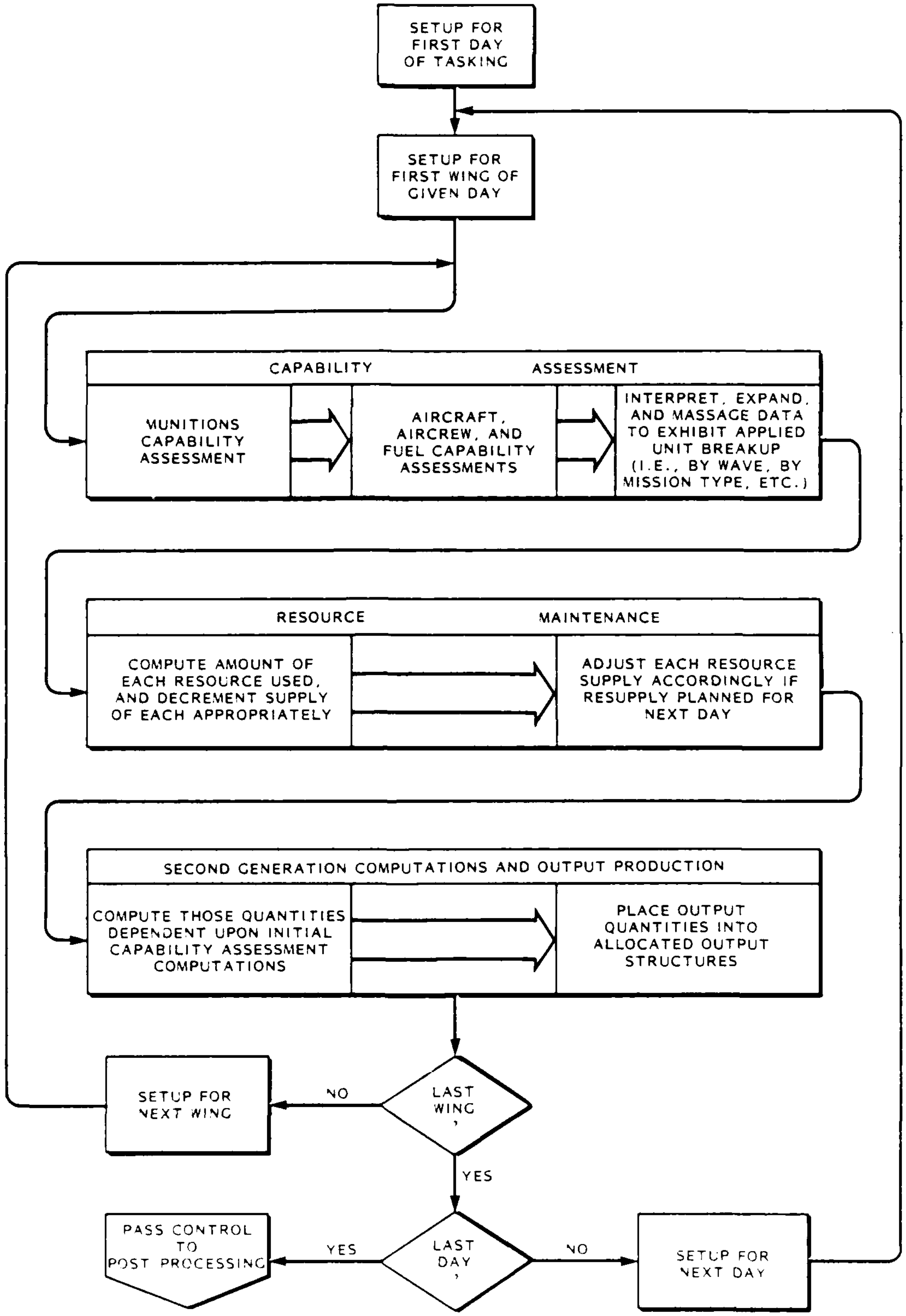

Figure A-3. Sortie Generation Model Functions

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Next, the munitions capability is computed against the original tasking for that day and wing by order of mission type priority. For each mission type, the Standard Conventional Loads (SCLs) have been defined with an order of SCL substitution. These are applied to the tasking for that mission type, and the wing's current munitions resources. Once the munitions capability has been assessed with respect to the original tasking, it is broken down by waves for that day and wing, in addition to the mission type breakdown for that day and wing. At this point, the tasking against which the other three resources are measured is modified to be the munitions capability as a simplifying step to subsequent calculations.

It is important to understand the relationship between tasking and capability assessment. If the tasking applied to a resource is 20, then that resource will not be assessed as having a capability above 20 under any circumstances, regardless of how plentiful that resource is. Thus, if the original tasking was 20 and the munitions capability was assessed at 14, the tasking applied to the other three resources would be 14. Note the following:

- If the munitions capability had been able to meet the original tasking, then the modified tasking would have been equivalent to the original tasking, and would have been applied to the other three resources as such.
- This concept of modified tasking does not impact the computation of the most limiting resource, which will surface exactly as it would have if the original tasking had been applied throughout.

After determining the munitions capability, the modified tasking is then applied to each of the other three resources in turn; aircraft, aircrews, and fuel. In each case, the capability is broken down by wave in addition to the breakdown by mission type. Aircraft are assigned to waves, and both maintenance and combat attrition are applied by waves. The same is true for aircrews, except that only the combat attrition is applied. Fuel capability for the day is computed by applying the fuel requirements for the different mission types and then assigning the assessed fuel capability to the waves. Consistency algorithms are applied to the four capabilities in order to maximize the sortie generation capability as a whole. In the final step, the limiting resource is identified for each wave, and the actual number of sorties flown for each wave (for this day and wing) is computed. Note that the limiting resource may differ between waves.

A.3.1.2.2 Decrementing of Resources. Each wing's resources are decremented in preparation for the following day and incremented by resupply scheduled (if any). It is important to note that each resource is decremented with respect to the amounts consumed by the sorties flown which are established by the limiting resource for each wave. While each resource capability (with the exception of modified tasking discussed previously) is computed individually with respect to the applied tasking on any given day, they are not 'independent' of each other over the tasking period since the quantity of each resource available is decremented by what was flown the previous day. Sorties flown can be a function of any one of the four resources, whichever was the limiting factor. An individual 'independent' look at each resource would consist of the original tasking being applied separately to each resource's capability assessment, and each resource being decremented before the following day by what it COULD HAVE FLOWN given the original tasking, regardless of the possible limitation of any other resource. Note that by running the model with unlimited quantities of any three of the four resources, one will obtain an 'individual independent' look at the fourth resource. This is currently available in the LPP SGM.

After properly decrementing each resource, the SGM interrogates the resupply plan to see if any resupply is scheduled for the following day for each resource. If so, each resource is incremented accordingly. The model allows the resupply of resource types which are in the established wing resource inventory.

A.3.1.2.3 Final Processing and Output Production. At this point, all resource capability data, shortfall data, and pertinent miscellaneous data, are computed in terms of mission types per day per wing, in addition to the by wave computation currently available, with the exception of munitions capability which has already been computed in terms of both waves and mission types. Then, quantities such as amount of each resource actually used are computed for each wave, and for each mission type, and all these results are placed in a dynamically allocated area of main memory by wing, by day, by wave, and by wing, by day, by mission type.

A.3.1.3 Post-Processing and Output to ORACLE. After the SGM has completed the processing of capability assessment and resource maintenance algorithms for the entire period of tasking, if no errors have been encountered, the third SGM segment processing is initiated. Some of the SGM output tables in the database require data for AFIRMS products in slightly different arrangements than is used in SGM processing. Thus, some post-processing is required (i.e., summing of certain quantities across mission types for each wing and day). This segment can be functionally broken up into two interleaving activities; post-processing and output to the database.

A.3.1.3.1 Post-Processing. When the post-processing segment is invoked, the output generated by the model is almost ready for insertion into the database. Two output requirements, however, have not been completed: 1) fuel requirements for each mission on a daily basis across all wings; and 2) rounds of munitions tasked, short, and used by wing, by day, by mission.

The fuel requirements of each mission for each day for all wings is calculated using standard sortie fuel loads provided by the SGM input data. These fuel requirements are identified both for tasked sorties and for sortie actually flown. The munitions data summations are also gathered for three different totals (tasked, short, used) and saved in a looping process.

A.3.1.3.2 Output to ORACLE. Prior to inserting the SGM output into the database, all existing records with the same database label are removed from each of the SGM output tables associated with this label. This protects against proliferation of information and ensures that only the most current output is stored in the database. To avoid unnecessary processing, a check is made after attempting to delete records from the first table to see if any records were actually deleted. If not, execution can move on to the insertion phase.

Upon successful completion of the deletion process, the task of transferring the SGM output into the database begins. Since the output structure is grouped primarily by wing and since the major portion of the data inserted into the database must be broken down by wing, most of the database tables are handled simultaneously during the program's execution. The mission fuel requirements, however, must be inserted separately since the data is collected across all wings as explained above.

If at any time during the deletion or insertion process an error is detected, the changes made previously are canceled and the database is restored to its initial state. An appropriate message is returned to the calling program to signal success or failure of the output to the database.

A.3.2 Increasing Functionality. Experience with setting up for a model run, actually running it, and observing the model output, identified a number of ideas for increasing both the functionality and the utility of the SGM. These include enhanced functionalities which may be made available to the user via modifications to either the model, the input data, or both.

- Eliminate the limitations imposed by the modified tasking by eliminating this approach in the model. This would require a substantial software modification effort and a significant increase in processing requirements.
- Simplify the data input set up for the SGM. The set of input data necessary to run the SGM is quite complex. As it currently stands, an inexperienced user has difficulty setting all of this data up correctly with appropriate internal consistency within the Tasking Model. This results from the flexibility built into the model scenario set-up methodology. A remedy to this situation would be an SGM internal consistency checker; a program which would tell the inexperienced user where the input data is in error and point to the item(s) requiring correction. A more useful remedy is to construct a user interface to the various input products which will force user input consistency. This latter solution is the substantially more complicated solution from a programming point of view.

A.4 Functional Module Descriptions. The SGM is a process which consists of 56 internal subroutines and various other external routines (either system functions or utility routines common to AFIRMS). This section provides a functional description of each of the 56 subroutines. No attempt is made to describe these routines in the level of detail that a programmer requires to write the routine. The LPP source code, with detailed program's comments, is available for those readers interested in such detailed definition of SGM logic. These sections describe the purpose, placement, and function of each routine. As in previous sections, the model will be described as consisting of 3 functionally separate segments; the front end, the model itself, and the post-processing and output to the database.

A.4.1 The SGM Front End. As previously described, this segment retrieves the set of input data from the database, performs initialization processing, allocates dynamic memory areas, and stores the input data set on-line in those areas. LPP applications programming languages are identified as FORTRAN(F) or "C" (C) in the descriptions that follow.

a. RUNSGM (F) - QUERY ORACLE AND BUILD INPUT DATA FILE. This routine extracts data from the AFIRMS SGM input tables based on a user supplied label. This label is used to query a "set-up" or associations table which defines the set of information that the user defined for the particular run of the Sortie Generation Model. The "set-up" table (input via the SGM Associations Screen) identifies six information set labels. These labels identify a set of resource information, a generic set of mission information, a set of information identifying the wing tasking to be used, a set of information pertaining to general wing operations, a set of information pertaining to the flying schedules at the wings that are to be tasked, and a set of resupply schedules for the wings.

   Based upon the information contained in this set-up table, the module RUNSGM extracts the proper information from the LPP database tables. Some information placed in the SGM input tables is placed into the database according to time period of the tasking (i.e., day 0 through day 6 of the plan). When this information is extracted from the database, a translation is made to supply the SGM input data by individual tasking day to the module VDRVSGM.

   RUNSGM passes the retrieved database information to the module BUFFER WRITER to perform the actual write to the interface buffer to be read by the module VDRVSGM. At the conclusion of processing by RUNSGM, the module VDRVSGM is initiated.

b. BUFFERWRITER (F) - DATA BUFFER FILLER. This module was designed to write the data retrieved by RUNSGM to the VDRVSGM interface buffer. The large amount of data retrieved by RUNSGM made the design of this module necessary. This routine takes a character string input and writes the information to a temporary buffer. The buffer is flushed to a disk file when full. At the completion of RUNSGM and before VDRVSGM is initiated, the buffer is flushed again and the disk file is closed.

c. VDRVSGM (C) - SGM DRIVER. This routine constitutes the main SGM 'driver'. All SGM activities other than those performed by RUNSGM and BUFFER WRITER (4.1.1 and 4.1.2 above) can be traced directly back to VDRVSGM, and have been, either directly or indirectly, initiated by this routine. VDRVSGM declares all external type variables, handles upper level error branching, and directly initiates the following activities:

   (1) Opening of, and setup for, the reading of the input data file created by RUNSGM.

   (2) The actual reading of the aforementioned data, and the allocation of space for, and storing of, this data in main memory.

(3) Allocation of dynamic memory areas for the major output structures.

(4) Capability assessment and all model functions.

(5) Post-Processing and Output to ORACLE.

(6) The freeing up of most dynamic memory areas.

(7) Final error status computations and processing.

d. VRDTRNSGM (C) - DRIVER FOR INPUT FROM DATA FILE. This routine is the driver for the set of routines that acquire the input data from the data file, allocates dynamic memory to store that data, and stores it. VRDTRNSGM reads the label and control information (i.e., number of wings, number of Mission Types, etc.), stores these appropriately, and invokes the various other read routines accordingly, passing to them the control and parametric information they require. The SCL Table is read and stored directly in this routine, rather than in a subroutine invoked by VRDTRNSGM.

e. VRDMSNSGM (C) - READ MISSION DATA (BY DAY). VRDMSNSGM reads and stores all the information relating to all the Mission Types that may be tasked for a given day.

f. VWNGTSGM (C) - READ WING TASKING DATA (BY DAY). VWNGTSGM reads and stores all the information relating to each wing's tasking (Mission Types, sorties tasked, associated rates, etc.) for a given day.

g. VRDWNGSGM (C) - READ WING RESOURCE DATA. VRDWNGSGM reads and stores all of the initial resource information and accompanying resupply data for each wing that might be tasked during the tasking period.

h. VRDMUNSGM (C) - READ MUNITIONS DATA STRUCTURE. VRDMUNSGM reads and stores a particular type of structure relating to munitions. This structure consists of a number (the number of munition types to follow, say n), and for each n, a munition type and an associated number of rounds.

i. VGETSGM (C) - CONTROL READING OF DATA FILE AND BUFFER POINTERS. VGETSGM is the routine that actually opens, reads, and closes the input data file, and maintains the in-line character buffer containing the information read. It also ensures that the pointer to this character buffer is kept current and correct.

j. VCONF (C) - CONVERT STRING TO FLOATING POINT. VCONF is passed a character string and a length, and converts that many characters of the string to a floating point number, placing the result in a specified address. If no decimal point is present in the string, then the result is just the integer value of those characters converted to a floating point type.

k. VCONI (C) - CONVERT STRING TO INTEGER. VCONI is passed a character string and a length, and converts that many characters of the string to an integer number, placing the result in a specified address.

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A.4.2 The Sortie Generation Model. The SGM's modules can be broken into three functional areas. A fourth module completes the "housekeeping" functions. These modules are: Capability Assessment, Resource Decrementation, Final Processing and Output Production, and Miscellaneous General Utility.

A.4.2.1 Capability Assessment. The following routines are all directly involved with the capability assessment functions of the model. It should be noted that while this segment of the model computes the capability assessment information, this data is massaged and expanded in the Post-Processing and Output Production segment.

a. VCAPABSGM (C) - DRIVER FOR CAPABILITY ASSESSMENT. VCAPABSGM is the driver for the Capability Assessment segment of the SGM. Additionally, it drives the resource decrementation segment, and a portion of the post-processing and output production. For each day and for each wing, VCAPABSGM will invoke the capability assessment processing, invoke the resource decrementation processing, and control that portion of the post-processing and output production associated with the final computations for each given wing and day.

b. VSETDEPE (C) - INITIALIZE DEPENDENT QUANTITIES. VSETDEPE computes various initialization parameters required throughout the capability assessment processing, for a given day and wing. These include various attrition rates, wave calculations, minimum and maximum values, and other required parameters, each of which is dependent upon the information supplied for a given day and wing.

c. VCOMPWAV (C) - COMPUTE NUMBER OF WAVES. VCOMPWAV is a function which computes the number of waves to fly for a given day, wing, and mission type.

d. VCKMUNSGM (C) - COMPUTE MUNITIONS CAPABILITY. VCKMUNSGM performs the munitions capability assessment and computes the modified tasking. It creates a copy of the given wing's munitions resources at the time, and applies the original tasking to this copy, in addition to applying the prioritized mission type and SCL information and requirements. Additionally, it computes a breakdown of the munitions capability by wave, by mission type, and by mission type and SCL type (i.e., for each mission type tasked for that day and wing, how many sorties were produced using SCL 1, SCL 2, etc.). This information is important to the remainder of the capability assessment routines and to the resource decrementation processing.

e. VCPMUNAV (C), VDECMUNS (C), and VFRMUNAV (C) - MUNITIONS ROUTINES. These three routines are used in conjunction with each other by VCKMUNSGM in order to create a copy of the given wing's available munitions resources (VCPMUNAV), decrement this copy with respect to munitions used while assessing the munitions capability (VDECMUNS), and free up the memory used to store this copy upon completion of the munitions capability assessment (VFRMUNAV). Note that the wing's actual munitions resources will be decremented in the resource decrementation segment.

f. VHECKMC (C) - COMPUTE AIRCRAFT CAPABILITY. VCHECKMC computes the aircraft capability assessment with respect to the modified tasking, by wave, and with the application of combat, maintenance, and repair rates.

g. VCHECKCR (C) - COMPUTE AIRCREW CAPABILITY. VCHECKCR computes the aircrew capability assessment with respect to the modified tasking, by wave, and with the application of combat attrition, known crew shift times, and percentages of crews available on each shift.

h. VCHECKFU (C) - COMPUTE FUEL CAPABILITY. VCHECKFU computes the fuel capability assessment with respect to the modified tasking, by wave, and with respect to the munitions capability breakdown by wing-day-mission type. Each mission type has an associated fuel requirement.

i. RESOURCE DECREMENTATION MODULES. The following modules perform the decrementation of each wing's available resources with respect to what was actually flown that day.

j. VSETMUNI (C) - UPDATE MUNITIONS RESOURCES. Decrements munitions resources accordingly, and handles resupply for upcoming day.

k. VSETMC (C) - UPDATE AIRCRAFT RESOURCES. Decrements aircraft resources accordingly (aircraft are lost due to both maintenance and combat attrition, but those lost due to maintenance attrition may be repaired if the repair rate is greater than zero), and handles resupply for the upcoming day.

l. VSETCREW (C) - UPDATE AIRCREW RESOURCES. Decrements aircrew resources accordingly (aircrews are lost due to combat attrition), and handles resupply for the upcoming day.

m. VSETFUEL (C) - UPDATE FUEL RESOURCES. Decrements fuel resources accordingly, taking mission types flown into account.

n. VRESUP (C) - COMPUTE RESUPPLY FOR GIVEN DAY AND RESOURCE. Interrogates a wing's resupply schedule for a given day and resource type, and if that resource is to be resupplied on that day, returns the quantity of that resource being resupplied.

A.4.2.3 Final Processing and Output Production Modules. The following routines perform processing which manipulates and/or expands capability assessment quantities previously computed, sets up and/or places data into output areas, or cleans up during and/or at the end of a model run. In a sense, they are all "housekeeping" routines.

a. VSETWAVE (C) - COMPUTE WAVE DEPENDENT ASSESSMENT QUANTITIES. This routine computes various wave quantities based upon previously computed capability assessments, such as total quantities used, tasking per wave, etc.

b. VSETMSN (C) - COMPUTE MISSION DEPENDENT ASSESSMENT QUANTITIES. This routine organizes all previously computed wave information into the wing, day, mission type format, and places all of this information into the output structures.

c. VFREESGM (C) - DEALLOCATE DYNAMIC MEMORY. VFREESGM frees up all areas of memory previously allocated by the VZALLOC (see Section 4.2.4 below) routine.

d. VSETERR (C) - FORMAT RETURN STATUS MESSAGE. This routine interrogates the running error code and counter, and creates the appropriate error message (if any) to return to the database server.

e. MISCELLANEOUS, GENERAL, AND UTILITY ROUTINES. Most any large computer program will include amongst its many modules, various subroutines/functions whose utility is such that they are invoked from more than one logically separate segment of the program, or are generalized enough so as to be categorized as 'General' routines.

f. VALLOC1 (C) - ALLOCATE MAJOR OUTPUT STRUCTURES. VALLOC1 is a routine which, by accessing the data structures containing the raw input from the input data file, allocates the dynamic memory required to hold the lower levels of the output data structures.

g. VALLOC2 (C) - ALLOCATE MUNITIONS STRUCTURE. VALLOC2 is invoked in order to allocate the dynamic memory areas necessary in order to contain a munitions structure as defined in 4.1.8 above.

h. VALLOC3 (C) - ALLOCATE WAVE PORTIONS OF OUTPUT STRUCTURES. This routine is called in order to allocate the output structures destined to contain the output wave information for a given wing and day.

i. VFMUNTYP (C) - FIND AVAILABLE ROUNDS OF GIVEN MUNITION TYPE. VFMUNTYP returns the number of rounds available to a specified wing of a given munition type.

j. VFNDSCL (C) - FIND GIVEN SCL IN SCL TABLE. VFNDSCL returns the index to the SCL Table for a given SCL type.

k. VFNDSCLP (C) - FIND GIVEN PRIORITY SCL FOR GIVEN MISSION TYPE. VFNDSCLP is given a mission type and an SCL priority number, and returns the name of the SCL type that corresponds to the given priority, for the given mission type.

l. VFWNGSGM (C) - FIND GIVEN WING'S RESOURCE STRUCTURE. VFWNGSGM returns a pointer to the beginning of the storage area containing a given wing's resources. If the given wing's resources are not currently being held, VFWNGSGM will allocate dynamic memory for storing a new wing's resources and return a pointer to the beginning of the newly allocated area.

m. VGETMSNP (C) - FIND MISSION TYPE WITH GIVEN PRIORITY. VGETMSNP will, for a given wing, day, and priority, return two pointers; one that points to the tasking for that priority mission type for the given wing and day, and another that points to the same mission type as defined in the mission type table for the given day.

A.4.3 Post-Processing and Output to ORACLE. The routines listed in this section perform the post-processing and output to the ORACLE portion of the SGM.

a. VORASGM (C) - Main SGM Output Routine. VORASGM is the main procedure of the post-processing and output phase of the SGM. Its execution can be broken into two phases, insertion and deletion.

Before inserting the output of the model into the database, each of the output tables must be cleared of records having the SGM labels identical to the label for the run. This is the deletion phase of VORASGM. Since every run of the model produces output for each of the output tables, VORASGM need only check one table to determine whether or not the label does exist. If found, all records with that label must be erased from each output table. Otherwise, execution may continue with the insertion phase.

The insertion phase begins after successful completion of the deletion phase. For the most part it is a straight forward placement of capability and shortfall data into the appropriate database tables as obtained from the model itself. This data has been placed in structures which are accessed as the program loops through each wing, day, wave, mission type, and munition type.

Two database requirements, however, must be extracted from the model's output as the looping process is in progress. Munitions tasked, used, and short are gathered into temporary storage areas prior to insertion after which the storage is freed. Finally, mission fuel requirements are accumulated throughout the insertion phase and placed into ORACLE as the last step in the insertion phase.

If at any time during the execution of VORASGM an error is encountered, a call is made to ORACLE to perform a database 'rollback.' Any changes made before the error are reversed to restore the database to its original state. VORASGM returns a code to the calling routine signalling success or failure and prepares an appropriate message for output to the user.

b. Interface to the database. All database transactions in AFIRMS occur through program calls to a database host language interface (HLI). Requirements for interfaces involving multiple programming languages are described here in terms of the LPP implementation. Operational AFIRMS interface requirements will depend upon the DBMS and programming languages selected. Separate libraries were supplied for C and FORTRAN interfaces used in the LPP.

To prevent the main SGM output routine, VORASGM, from becoming overly complex, C and FORTRAN procedures handle the required data manipulation before the actual calls to each of the HLI library routines.

The following LPP implementation details are provided as an example of the calling sequence from the main SGM output routine to the HLI library:

VORASGM --| COEXEC --| FOEXEC --| OEXEC

The LPP routines explained below detail the C to FORTRAN interface and are grouped according to the HLI routine involved for ORACLE (the LPP DBMS).

(1) COCOF (C) and FOCOF (F) - Disable ORACLE's Autocommit Feature. COCOF acts as an interface between C and FORTRAN calls to the ORACLE HLI library routine, OCOF, which disables the autocommit feature. FOCOF performs the actual call to OCOF.

(2) COOPEN (C) and FOOPEN (F) - Open ORACLE 'Cursor Areas'. COOPEN acts as an interface between C and FORTRAN calls to the ORACLE HLI library routine, OOPEN, which establishes a cursor area for passing SQL statements to ORACLE. FOOPEN performs the actual call to OOPEN.

(3) COBNDRV (C) and FOBNDRV (F) - Establish ORACLE 'Bind' Variables. COBNDRV acts as an interface between C and FORTRAN calls to the ORACLE HLI library routine, OBNDRV. OBNDRV allows dynamic modification of SQL statements by associating program variables with the various fields in the database tables. Before FOBNDRV performs the actual call to OBNDRV, the string holding the name of the program variable to be bound must be first copied to a structure recognizable by FORTRAN (see Section 4.3.2.8).

(4) COSQL3 (C) and FOSQL3 (F) - Define ORACLE SQL Statement. COSQL3 acts as an interface between C and FORTRAN calls to the ORACLE HLI library routine, OSQL3, which associates a specific SQL statement with a cursor area established via a call to OOPEN. The string holding the entire SQL statement must be first copied to a structure recognizable by FORTRAN before FOSQL3 can perform the actual call to OSQL3 (see Section 4.3.2.8).

(5) COEXEC (C) and FOEXEC (F) - Execute ORACLE SQL Statement. COEXEC acts as an interface between C and FORTRAN calls to the ORACLE HLI library routine, OEXEC, which causes the SQL statement established through OBNDRV and OSQL3 to be processed. FOEXEC performs the actual call to OEXEC.

(6) COCLOSE (C) and FOCLOSE (F) - Close ORACLE 'Cursor Areas'. COCLOSE acts as an interface between C and FORTRAN calls to the ORACLE HLI library routine, OCLOSE. It disconnects a cursor area from ORACLE and frees the resources associated with it. FOCLOSE performs the actual call to OCLOSE.

(7) COROL (C) and FOROL (F) - Perform ORACLE 'Rollback'. COROL acts as an interface between C and FORTRAN calls to the ORACLE HLI library routine, OROL. It is called to restore the database to its original state by cancelling all changes if an error is detected in any of the other HLI routines. FOROL performs the actual call to OROL.

(8) VSETFORB (C) - Prepare FORTRAN Character Descriptor Information. VSETFORB accepts a pointer to a C character string and establishes the descriptor information required before that string can be passed to a FORTRAN character variable. The descriptor information is placed in a structure which can be passed directly to FORTRAN routines. VSETFORB is used prior to calls to the ORACLE HLI routines, OBNDRV and OSQL3, which expect character data as part of their argument lists.

A.5 Sortie Generation Model Input Transaction.

NOTE:

L = Indicates that a two byte integer field is present in the input data file immediately before this quantity which indicates the length (in bytes) of the quantity itself.

N = Indicates an integer quantity.

F = Indicates a floating point quantity.

A = Indicates an alphanumeric (or string) quantity.

D = Indicates a data elements appearance number in the AFIRMS Data Requirements Document (DRD). Those elements without an appearance number do not have corresponding entries in the DRD.

[subroutine name] = Indicates the routine that reads and stores this quantity from the input data file.

Note also that the following quantities are passed directly to the SGM from the ORACLE input routine, RUNSGM:

1) Name of input data file (L,A)

2) Unconstrained Munitions Flag (1 byte,N)

3) Unconstrained Fuels Flag (1 byte,N)

4) Unconstrained Aircraft Flag (1 byte,N)

5) Unconstrained Aircrew Flag (1 byte,N)

6) Number of days of tasking (3 bytes,N)

7) Number of wings included in wing resource data (2 bytes,N)

And for each wing,

8) Number of days of resupply planned (2 bytes,N)

INPUT DATA FILE FORMAT

1. NAME OF MODEL RUN
   L,A,VRDTRNSGM

FOR NUMBER OF DAYS OF TASKING

2. NUMBER OF MISSION TYPES
   2,N,VRDTRNSGM

FOR NUMBER OF MISSION TYPES

3. MISSION TYPE (D = 9A)
   L,A,VRDMSNSGM

4. MISSION TYPE PRIORITY (D = 9B)
   2,N,VRDMSNSGM

5. GALLONS OF FUEL USED FOR MISSION TYPE (D = 8E)
   5,N,VRDMSNSGM

6. NUMBER OF SCL ALTERNATES
   2,N,VRDMSNSGM

FOR NUMBER OF SCL ALTERNATES

7. SCL TYPE (D = 8A)
   6,A,VRDMSNSGM

8. SCL PRIORITY USAGE (D = 8D)
   2,N,VRDMSNSGM

9. NUMBER OF WINGS BEING TASKED

SOFTECH

FOR NUMBER OF WINGS BEING TASKED

10. WING DESIGINATOR (D = 1F)
L,A,VWNGTSGM

11. NUMBER OF MISSION TYPES
2,N,VWNGTSGM

FOR NUMBER OF MISSION TYPES

13. MISSION TYPE (D = 59G)
L,A,VWNGTSGM

14. NUMBER OF SORTIES TASKED (D = 59K)
3,N,VWNGTSGM

15. TURN TIME (D = 1J)
4,F,VWNGTSGM

16. MAINTENANCE ATTRITION RATE (D = 1K)
3,N,VWNGTSGM

17. COMBAT ATTRITION RATE (D = 8H)
3,N,VWNGTSGM

18. AIRCRAFT REPAIR RATE (D = 1L)
3,N,VWNGTSGM

19. MINIMUM TIME BETWEEN TAKEOFF (D = 1M)
4,F,VWNGTSGM

FOR NUMBER OF WINGS BEING TASKED

20. WING DESIGINATOR (D = 1E)
L,A,VFWNGSGM

21. MISSION DESIGN (MD) (D = 1N)
L,A,VRDWNGSGM

22. START TIME (D = 1O)
4,N,VRDWNGSGM

23. DURATION OF TASKING DAY (D = 1P)
2,N,VRDWNGSGM

24. FLIGHT TIME (D = 1Q)
4,F,VRDWNGSGM

25. NUMBER OF FMC AIRCRAFT (D = 13B [Resource Type])
(D = 13H [Resource Amount])
3,N,VRDWNGSGM

SOFTECH

26. NUMBER OF GALLONS OF FUEL AVAILABLE (D = 13B [Resource Type]) (D = 13H [Resource Amount])

8,N,VRDWNGSGM

27. NUMBER OF FORMED AIRCREWS (D = 13B [Resource Type]) (D = 13H [Resource Amount])

3,N,VRDWNGSGM

28. NUMBER OF AIRCREW SHIFTS
1,N,VRDWNGSGM

29. DURATION OF SHIFT (D = 1R)
2,N,VRDWNGSGM

FOR NUMBER OF AIRCREW SHIFTS

30. SHIFT START TIME (D = 1S)
4,N,VRDWNGSGM

31. PERCENTAGE OF FORMED CREWS IN SHIFT (D = 1T)
4,F,VRDWNGSGM

32. NUMBER OF MUNITION TYPES
3,N,VRDMUNSGM FROM VRDWNGSGM

FOR NUMBER OF MUNITION TYPES

33. MUNITION TYPE (D = 13B)
L,A,VRDMUNSGM FROM VRDWNGSGM

34. AMOUNT (D = 13H)
8,N,VRDMUNSGM FROM VRDWNGSGM

FOR NUMBER OF RESUPPLY DAYS

35. DAY OF RESUPPLY (D = 20F)
3,N,VRDWNGSGM

36. NUMBER OF AIRCRAFT (D = 20F)
2,N,VRDWNGSGM

37. NUMBER OF AIRCREW (D = 20F)
3,N,VRDWNGSGM

38. NUMBER OF GALLONS OF FUEL (D = 20F)
7,N,VRDWNGSGM

39. NUMBER OF MUNITION TYPES
3,N,VRDMUNSGM FROM VRDWNGSGM

FOR NUMBER OF MUNITION TYPES

40. MUNITION TYPE (D = 20F)
L,A,VRDMUNSGM FROM VRDWNGSGM

41. AMOUNT (D = 20F)
8,N,VRDMUNSGM FROM VRDWNGSGM

42. NUMBER OF SCL TYPES
3,N,VRDTRNSGM

FOR NUMBER OF SCL TYPES

43. SCL TYPE (D = 39A)
6,A,VRDTRNSGM

44. NUMBER OF MUNITION TYPES
2,N,VRDTRNSGM

FOR NUMBER OF MUNITION TYPES

45. MUNITION TYPE (D = 39B)
L,A,VRDMUNSGM FROM VRDTRNSGM

46. AMOUNT (D = 39C)
8,N,VRDMUNSGM FROM VRDTRNSGM

A.6 Sortie Generation Model Output Description

(MODEL RUN NAME WILL BE OUTPUT WITH EACH RECORD FOR ALL TABLES)

D = Indicates a data elements appearance number in the AFIRMS Data Requirements Document (DRD). Those elements without an appearance number do not have corresponding entries in the DRD.

1. NUMBER OF DAYS OF TASKING

2. NUMBER OF WINGS

FOR NUMBER OF WINGS

3. MISSION DESIGN [MD] (D = 11C)

4. WING DESIGINATOR (D = 11A)

FOR NUMBER OF DAYS TASKED

5. AIRCRAFT USAGE RATE (D = 13F)

6. AIRCREW USAGE RATE (D = 13F)

FOR EACH WAVE

7. TOTAL SORTIES TASKED FOR WAVE (D = 74H)

8. TOTAL SORTIES SHORT DUE TO AIRCRAFT (D = 74I)

9. TOTAL SORTIES SHORT DUE TO AIRCREW (D = 74I)

10. TOTAL SORTIES SHORT DUE TO FUEL (D = 74I)

11. TOTAL SORTIES SHORT DUE TO MUNITIONS (D = 74I)

12. TOTAL SORTIES PRODUCED AIRCRAFT (D = 74J)

13. TOTAL SORTIES PRODUCED AIRCREW (D = 74J)

14. TOTAL SORTIES PRODUCED FUEL (D = 74J)

15. TOTAL SORTIES PRODUCED MUNITIONS (D = 74J)

16. NUMBER OF MISSION TYPES

FOR NUMBER OF MISSION TYPES

17. TOTAL SORTIES TASKED FOR MISSION TYPE (D = 59K)

18. PRIORITY OF MISSION TYPE (D = 59L)

19. PRIMARY SCL TYPE (D = 59N)

20. MISSION TYPE (D = 59G)

21. TOTAL SORTIES PRODUCED (D = 59O)

22. TOTAL SORTIES SHORT (D = 59P)

23. NUMBER OF GALLONS OF FUEL USED (D = 73I)

24. NUMBER OF GALLONS OF FUEL SHORT (D = 73J)

25. TOTAL SORTIES SHORT FOR FUEL (D = 73K)

26. NUMBER OF AIRCRAFT USED (D = 73I)

27. NUMBER OF AIRCRAFT SHORT (D = 73J)

28. TOTAL OF SORTIES SHORT FOR AIRCRAFT (D = 73K)

29. NUMBER OF AIRCREW USED (D = 73I)

30. NUMBER OF AIRCREW SHORT (D = 73J)

31. TOTAL SORTIES SHORT FOR AIRCREW (D = 73K)

32. TOTAL SORTIES SHORT FOR MUNITIONS

33. NUMBER OF MUNITION TYPES USED

FOR NUMBER OF MUNITION TYPES USED

34. MUNITION TYPE (D = 73C)

35. NUMBER OF MUNITIONS USED (D = 73I)

36. NUMBER OF MUNITION TYPES SHORT

FOR NUMBER OF MUNITION TYPES SHORT

37. MUNITION TYPE (D = 73C)

38. NUMBER OF MUNITIONS SHORT (D = 73J)

39. NUMBER OF MUNITION TYPES TASKED

FOR NUMBER OF MUNITION TYPES TASKED

40. MUNITION TYPE (D = 73C)

41. NUMBER OF MUNITIONS TASKED (D = 73J)

APPENDIX B. DOLLARS TO READINESS TRANSFORMS DESCRIPTION

B.1 Introduction. The Dollars to Readiness Model (DTRM) is an important part of the Air Force Integrated Readiness Measurement System (AFIRMS). It performs the functions necessary for the achievement of the AFIRMS goals related to integrating the concepts of capability assessment and the budgeting process (the POM cycle). AFIRMS supports numerous screens/products for the display and manipulation of DTRM input (setup) data, and output data. Once a wing's (or wings') capability to perform a given set of tasks has been determined via the Sortie Generation Model (SGM), these products provide the tools which allow users to assess the costs (dollars) associated with bringing the wing (or wings) capability to support 100% of tasking.

A full description of the SGM is provided in Appendix A of this document. It suffices to say here that the primary outputs of the SGM are: 1) the required task level; and 2) the resource capability level of each wing(s) in question. The DTRM uses this information (for each of the four basic resources considered by the SGM) and a user specified pricing set to determine the operating costs for the tasked and shortfall resource requirements.

The DTRM performs two primary functions in the AFIRMS environment. The first function involves the calculation and determination of required and shortfall levels of resources in dollars for a specific tasking level. The second function allows the user to determine an "optimal" distribution of funds so as to maximize unit capability. The first function is currently operational within the AFIRMS system. The optimization function is scheduled for development in Block 1 of HQ USAF AFIRMS implementation.

This document provides a functional overview of the current AFIRMS Dollars to Readiness Model, and an explanation of those factors which most significantly affect its performance and results. Its purpose is such that a user or analyst may, by reading this document, determine the current functionality of this tool. Furthermore, this document portrays the strengths and limitations of the DTRM, and its overall usefulness.

In Section B.2, the major assumptions upon which this model was constructed, and the projected limitations imposed are discussed. A description of the major algorithms and processes applied within the DTRM are included in Section B.3.

B.2 Assumptions and Limitations. AFIRMS' initial development was as a learning prototype which emphasized the rapid development of tools to demonstrate the viability and utility of AFIRMS to various levels of Air Force command. As such, the present operational DTRM meets only one of the two requirements for the operational model, i.e., the resource total and resource shortfall dollar calculations. In providing this minimum functionality, various assumptions were made and subsequently limitations accepted. This section enumerates the significant assumptions and limitations of the LPP DTRM.

B.2.1 Assumptions.

a. The successive refinement (iterative) approach to determining the optimal cost-constrained solution was the best, time-constrained solution for LPP DTRM development. This approach involves 1) running the SGM to determine capabilities, 2) evaluating, and estimating the size of, the largest shortfall, 3) adjusting the appropriate resources to reflect apportionment/reapportionment of dollars, and 4) repeating this process. Reevaluation of this methodology is scheduled during the analysis phase of Block 1 implementation of AFIRMS at HQ USAF.

b. The prices contained in any Resource Price-Set chosen for a DTRM run represent user qualified information. As such, any assumptions made when selecting prices for the resources will propagate through the model to the final cost (dollars) calculated.

B.2.2 Limitations.

a. Information provided from the successive refinement approach to dollar optimization provides only an approximate optimal dollar distribution based upon user redefinition of resource allocations. This, therefore, is only a part of the solution to the Dollars to Readiness/Capability Assessment functionality required in the operational AFIRMS.

B.3 Functional Process Descriptions.

B.3.1 Introduction. This section describes the processes applied to the input data to produce output data, and is targeted toward a functional approach to understanding the DTRM.

The Dollars to Readiness Model is essentially is a simple quantity times unit price calculation. The quantities used in the calculations are obtained by user selection of a Sortie Generation Model output data set (an SGM label name). The unit price data is obtained by user selection of a unit price data set (Resource Price Set label), where the unit price data set contains cost data for all resource categories to be evaluated. These two data labels are associated in a dollars to readiness model run label.

B.3.2 Functional Overview. At a macro level, the model consists of three parts; 1) database preparation, 2) the model itself, and 3) the output and post-processing segment. Prior to entering a discussion of these segments, it is important to briefly note some relevant architectural details of the DTRM implementation. The model itself is not implemented as a completely separate computer process, or program. Rather, it is integrated with an AFIRMS system process known as the Database Server (DBS), which is continually running throughout the execution of the AFIRMS Support Software Environment. This DBS process handles all access and security control functions for the AFIRMS system.

After selecting the DTRM function, the user is requested to enter the name of the DTRM instance to be run. This name (label) will be used in Sections 3.2.1 and 3.2.3.2 to prepare the database for updates and label the output data respectively.

As stated, the DTRM is essentially a simple quantity times unit price calculation. The quantities are the total resources tasked and short by resource type as given by an output of a specified SGM run. The unit prices are dollars per unit amount for the four basic resource types. The resources considered by the SGM and therefore required to be priced are fuel, munition types, aircrew, and aircraft types. It is important that each type of resource tasked and short for each wing, for each day, for each mission type be determined from data available in the designated SGM output data set. Therefore, the data elements identified in DTRM algorithms are defined by resource type, by wing, by day, and by mission type.

Once resource quantities are determined, the tasked and shortfall amounts are summed by resource type over mission types, over days and over wings (included in the run of the SGM). This obtains the total quantities of each resource type tasked and short over the entire tasking period, for all tasked wings, and all tasked missions. The unit price for each of these resource types is multiplied by the quantity for the corresponding resource tasked and short to provide the total dollars tasked and short, respectively, by resource.

The user has the capability to perform what-if pricing simulations on one or more SGM output data sets against various Resource Price Sets to evaluate various budgeting scenarios.

B.3.2.1 Database Preparation. This segment of the DTRM deals with the preparation of the database to receive the output data to be generated from the DTRM itself (Section 3.2.3) and to be loaded into the database by the output segment (Section 3.2.3.2). This portion of the algorithm makes the assumption that since the user has asked for the DTRM to be run with a specified output label, any previous DTRM output with the same label is to be deleted and replaced by the new DTRM results. Therefore, a database command is executed to clear all DTRM database output tables of all data associated with the specified label.

B.3.2.1.1 Inputs. The only input to this segment is the name of the DTRM to be run:

i1) DTRM Label: DRD appearance number of this element is 4B.

B.3.2.1.2 Transforms. The database delete command as discussed above.

B.3.2.1.3 Outputs. None.

B.3.2.2 The Dollars to Readiness Model. The model is essentially composed of four pairs of transformations: a task transformation and a shortage transformation for each of the four resource areas (aircraft, aircrew, fuel, munitions). Section 3.2.2.1 discusses the munitions transformations; fuel is presented in Section 3.2.2.2; aircrew in Section 3.2.2.3; and, aircraft in Section 3.2.2.4.

SOFTECH

B.3.2.2.1 Munitions Transformations.

B.3.2.2.1.1 Inputs. The five data elements which are input into these transformations are listed below.

i1) Munition type: DRD appearance number of this element is 73C.

i2) Number munitions tasked: DRD appearance number of this element is 73L.

i3) Number munitions short: DRD appearance number of this element is 73J.

i4) Munition type unit price: DRD appearance number of this element is 13BB.

i5) Resource unit price: DRD appearance number of this element is 13BB.

B.3.2.2.1.2 Transforms. The transforms in this section are presented using the sequence numbers from the input section listed above (i.e., whenever munition type is referenced, i1 will be used).

a. Extract the munition type unit price using the following:

i4 = i5 (For each Munition Type, i1)

B.3.2.2.1.2.1 Dollars Tasked. Sum the number of munitions tasked of each type over all wings, all missions, and all days. Then take that amount and multiply by the unit price for that munition type and sum this amount over all munition types.

$$o1 = \sum^{i1} \left((\sum^{W} (\sum^{D} (\sum^{M} (i2)))) * i4 \right)$$

M = number of missions in tasking

D = number of days in tasking

W = number of wings in tasking

SOFTECH

B.3.2.2.1.2.2 Dollars Short. Sum the number of munitions short of each type over all wings, all days, and all missions. Then take that amount and multiply by the unit price for that munition type and sum this amount over all munition types.

$$o2 = \sum^{i1} \left(\left(\sum^{W} \left(\sum^{D} \left(\sum^{M} (i3) \right) \right) \right) * i4 \right)$$

M = number of missions in tasking
D = number of days in tasking
W = number of wings in tasking

B.3.2.2.1.3 Outputs. The two data elements which are output from these transformations are listed below.

o1) Total $ munitions tasked: DRD appearance number of this element is 13CC.

o2) Total $ munitions short: DRD appearance number of this element is 13DD.

B.3.2.2.2 Fuel Transformations.

B.3.2.2.2.1 Inputs. The five data elements which are input into these transformations are listed below.

i1) Number sorties tasked: DRD appearance number of this element is 56G.

i2) Gallons of fuel required: DRD appearance number of this element is 73L.

i3) Gallons of fuel short: DRD appearance number of this element is 73J.

i4) Fuel unit price: DRD appearance number of this element is 13BB.

i5) Resource unit price: DRD appearance number of this element is 13BB.

B.3.2.2.2.2 Transforms. The transforms in this section are presented using the sequence numbers from the input section listed above (i.e., whenever number sorties tasked is referenced, i1 will be used).

a. Extract the fuel unit price using the following:

i4 = i5 (For each Fuel type - JP-4)

NOTE: The current AFIRMS tracks only one resource fuel type. Reevaluation and implementation of multiple fuel tracking within AFIRMS will be accomplished in the Block I AFIRMS implementation at HQ USAF.

SOFTECH

B.3.2.2.2.2.1 Dollars Tasked. For each day of tasking and for each mission type, sum the sorties task for all wings. Then take that amount and multiply by the number of gallons required for that mission type and day, and sum this amount over all mission types and all days. This will yield a total number of gallons of fuel tasked. The value of o1 is obtained by multiplying by the fuel unit price.

$$o1 = \left(\sum^{D} \left(\sum^{M} \left(\sum^{W} (i1) \right) * i2 \right) \right) * i4$$

M = number of missions in tasking
D = number of days in tasking
W = number of wings in tasking

B.3.2.2.2.2.2 Dollars Short. Sum the number of gallons of fuel short over all wings, all days, and all missions. Then take that amount and multiply by the fuel unit price.

$$o2 = \left(\sum^{W} \left(\sum^{D} \left(\sum^{M} (i3) \right) \right) \right) * i4$$

M = number of missions in tasking
D = number of days in tasking
W = number of wings in tasking

B.3.2.2.2.3 Outputs.

o1) Total $ fuel tasked: DRD appearance number of this element is 13CC.

o2) Total $ fuel short: DRD appearance number of this element is 13DD.

B.3.2.2.3 Aircrew Transformations.

B.3.2.2.3.1 Inputs. The six data elements which are input into these transformations are listed below.

i1) Number sorties tasked: DRD appearance number of this element is 56G.

i2) Aircrew usage rate: DRD appearance number of this element is 11N.

i3) Number of aircrew short: DRD appearance number of this element is 73J.

i4) Aircrew unit price: DRD appearance number of this element is 13BB.

i5) Resource unit price: DRD appearance number of this element is 13BB.

i6) Wing MD: DRD appearance number of this element is 56A.

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B.3.2.2.3.2 Transforms. The transforms in this section are presented using the sequence numbers from the input section listed above (i.e., whenever aircrew usage rate is referenced, i2 will be used).

a. Extract the aircrew unit price using the following:

i4 = i5 (For Aircrew which fly MD i6 at each wing)

B.3.2.2.3.2.1 Dollars Tasked. Sum the number of sorties tasked of each wing, for each day, over all missions. Then take that amount and divide by the aircrew usage rate specified for that wing-and-day and sum this amount over all wings and all days. This will yield a total number of aircrew tasked and by multiplying by the aircrew unit price, o1 is obtained.

$$o1 = \left(\sum^{W} \left(\sum^{D} \left(\left(\sum^{M} (i1) \right) / \ i2 \right) \right) \right) * i4$$

M = number of missions in tasking
D = number of days in tasking
W = number of wings in tasking

B.3.2.2.3.2.2 Dollars Short. For each wing, sum the aircrew short for all days and mission types. Multiply this value by the aircrew unit price and then sum over all wings. (The calculation of dollars short differs from dollar tasked because of the internal data representation within AFIRMS.)

$$o2 = \left(\sum^{W} \left(\sum^{D} \left(\sum^{M} (i3) \right) \right) \right) * i4$$

M = number of missions in tasking
D = number of days in tasking
W = number of wings in tasking

B.3.2.2.3.3 Outputs.

o1) Total $ aircrew tasked: DRD appearance number of this element is 13CC.
o2) Total $ aircrew short: DRD appearance number of this element is 13DD.

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B.3.2.2.4 Aircraft Transformations.

B.3.2.2.4.1 Inputs. The six data elements which are input into these transformations are listed below.

- i1) Number sorties tasked: DRD appearance number of this element is 56G.
- i2) Aircraft usage rate: DRD appearance number of this element is 11N.
- i3) Number of aircraft short: DRD appearance number of this element is 73J.
- i4) Aircraft unit price: DRD appearance number of this element is 13BB.
- i5) Resource unit price: DRD appearance number of this element is 13BB.
- i6) Wing MD: DRD appearance number of this element is 56A.

B.3.2.2.4.2 Transforms. The transforms in this section are presented using the sequence numbers from the input section listed above (i.e., whenever aircraft usage rate is referenced, i2 will be used).

a. Extract the Aircraft Unit Price using the following:

i4 = i5 (For each Aircraft MD, i6 at each wing))

NOTE: The current AFIRMS does not associate multiple MDSs to wings. The operation AFIRMS will allow for multiple MDS association. Implementation of multiple MDS associations is scheduled for Block 1 HQ USAF implementation.

B.3.2.2.4.2.1 Dollars Tasked. Sum the number of sorties tasked of each wing, for each day, over all missions. Then take that amount and divide by the aircraft usage rate specified for that wing-and-day and sum this amount over all wings and all days. This will yield a total number of aircraft tasked and by multiplying by the aircraft unit price, o1 is obtained.

$$o1 = \left(\sum^{W} \left(\sum^{D} \left(\left(\sum^{M} (i1) \right) / i2 \right) \right) \right) * i4$$

M = number of missions in tasking
D = number of days in tasking
W = number of wings in tasking

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B.3.2.2.4.2.2 Dollars Short. Sum the number of aircraft short over all wings, all missions and all days. Then take that amount and multiply by the aircraft unit price. (The calculation of dollars short differs from dollars tasked because of the internal data representation with AFIRMS.)

$$o2 = \left(\sum^{W} \left(\sum^{D} \left(\sum^{M} (i3)\right)\right)\right) * i4$$

M = number of missions in tasking
D = number of days in tasking
W = number of wings in tasking

B.3.2.2.4.3 Outputs.

o1) Total $ aircraft tasked: DRD appearance number of this element is 13CC.

o2) Total $ aircraft short: DRD appearance number of this element is 13DD.

B.3.2.3 Post-Processing and Output to the database. After the processing has completed, the post-processing function is initiated. This is done only if no errors have been encountered. The primary purpose of the post-processing section is to gather the output data from each of the four resource calculations performed and convert this information from dollars to millions of dollars (rounding is performed).

Following the units conversion, the eight computed values along with the selected DTRM label are inserted into the database.

B.3.2.3.1 Inputs. There are nine inputs to this segment:

i1) DTRM Label: DRD appearance number of this element is 4B.

i2) Total $ munition tasked: DRD appearance number of this element is 13CC.

i3) Total $ munition short: DRD appearance number of this element is 13BB.

i4) Total $ fuel tasked: DRD appearance number of this element is 13CC.

i5) Total $ fuel short: DRD appearance number of this element is 13BB.

i6) Total $ aircrew tasked: DRD appearance number of this element is 13CC.

i7) Total $ aircrew short: DRD appearance number of this element is 13BB.

i8) Total $ aircraft tasked: DRD appearance number of this element is 13CC.

i9) Total $ aircraft short: DRD appearance number of this element is 13BB.

B.3.2.3.2 Transforms. The database insert command as discussed above, and the unit's conversion from thousands to millions of dollars.

B.3.2.3.3 Outputs. Mass storage file of above data inputs is created.

APPENDIX C. ATTRIBUTE CLASS ALGORITHMS

This appendix addresses algorithms utilized by AFIRMS to perform its various functions. These algorithms describe calculations that have not been covered in Appendix A or Appendix B of this document. References to data types in this appendix use the IDEF-1 methodology which is described in detail in the AFIRMS Data Requirements Document (DRD). While a full understanding of IDEF-1 methodology is helpful it is not needed in reading the material that follows.

In addition to the basic mathematical operations of addition, subtraction, multiplication, and division, the following computational techniques are utilized by AFIRMS.

Count	-	The process of accumulating the number of occurrences of a specific data type given that a set of decision conditions have been met. As an example, if one was counting airman assigned to a unit, a counter would be incremented each time an airman's name was found in the database that had the specific unit identification associated with the name.
Minimum Count	-	This is an extension of the counting process. In this case a number of related items are individually counted based on the stated conditions and the minimum count (i.e., smallest number) is used to define the data element.
Aggregation	-	The process of accumulating the values associated with the occurrence of an element given that stated conditions have been met. In aggregating the number of aircraft in a MAJCOM, the number (value) of aircraft in each unit in the MAJCOM are summed together by MDS.

C.1 Table Layout

Table C-1 shows the derivation of all data not input to the system or derived. Each item that is calculated in AFIRMS is identified by number and name in the first two columns of the table. In some cases more than one source is used for an item. These differences may be between echelons or between types of resources. Column 3 identifies the instance being documented or indicates that the method given applies to all

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instances. Columns 4 and 5 in the table describe the specific form of the algorithm. Column 4 defines the algorithm and column 5 defines the constraints that the operation is performed under.

Throughout this table hierarchical aggregation is assumed; that is, the output of the higher level of definition is the sum of the outputs at the next lower level.

Table C-1

ALGORITHM SPECIFICATIONS

APPEARANCE NO.	APPEARANCE CLASS NAME	INSTANCE	CALCULATION	REMARKS
13H	Current Amount	Aircraft	Count 11 Ps 11P = Aircraft Tail Number	Count all aircraft assigned to that unit (11A = unit ID), and that are on base (11G = on base). This assumes no assembly of aircraft.
		Aircrews	Minimum Count 12As 12A = Airman's Last Name	Count all aircrew members by position (12I = aircrew position) for aircrew assigned to that unit (12B = unit ID) and that are available (12C = available). This requires that aircrew position requirements be established by MDS.
		Fuels/ Munitions	88C 88C = Quantity of Type in Status	Sum all fuels/munitions that are assigned to that unit (88B = unit ID) and that is on base (88A = on base). In these instances, 88C represents the "whole-up" resource quantity. (These quantities are processed outside AFIRMS and supplied to AFIRMS for use.)
13I	Current Off base Amount	Aircraft	Count 11 Ps 11P = Aircraft Tail Number	Count all aircraft assigned to that unit (11A = unit ID), and are off base (11G = off base). This assumes no assembly of aircraft.
		Aircrews	Minimum Count 12As 12A = Airman's Last Name	Count all aircrew members by position (12I = aircrew position) for aircrew assigned to that unit (12B = unit ID) and that are not available (12C = not available). Aircrew that are not available are considered off base.
		Fuels/ Munitions	88C 88C = Quantity of Type in Status	Sum all fuels/munitions that are assigned to that unit (88B = unit ID) and that are off base (88A = off base). In these instances, 88C represents the "whole-up" resource quantity.

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Table C-1

ALGORITHM SPECIFICATIONS (Continued)

APPEARANCE NO.	APPEARANCE CLASS NAME	INSTANCE	CALCULATION	REMARKS
13L	Unit Prorata Share of Resource	Unit for all resources	13G unit/ 13 MAJCOM 13G = Resource Assigned Amount	The sum of a resource type assigned to that unit is divided by the sum of that resource assigned to the MAJCOM. This is done for all resource types
13M	Resource Possessed Total	All	13H + 13I 13M = Current Amount 13I = Current Off Base Amount	The sum of on base and off base resources currently assigned to that unit (11A = unit ID).
13P	Aircrew MR	All	Minimum Count 12As 12A = Airman's Last Name	Count all aircrew members by position (12I = aircrew position); for aircrew assigned to that unit (12B unit ID), that are available (12C = available), and that are mission qualified (12M = null).
13Q	Aircraft MC	All MDS by location	*Count 11P* 11P = Aircraft Tail Number	*Count aircraft* that are mission capable (11E = FMC or PMC) that are assigned to that unit (11A = unit ID) and that location (11G = location).
13W	Resource Total Currently Available	All	13H + 13T 13H=Current Amount 13T - H_Off Base Amount	This varies from 13M in that off base resources are qualified by resources available for use.
13X	Resource Supply Days Remaining	All	13W 13Y 13W = Resource Total Currently Available 13Y = Resource Daily Expenditure Rate	

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Table C-1

ALGORITHM SPECIFICATIONS (Continued)

APPEARANCE NO.	APPEARANCE CLASS NAME	INSTANCE	CALCULATION	REMARKS
13Y	Resource Daily Expenditure Rate	All	$\sum^{N} \frac{13R}{N}$ N = Number of days 13R = H Expended Supply	The actual resource expenditures for an N-day period are summed and then divided by N. This value is a moving average and is calculated for every day in the tasking. The user can either specify N at execution time and have AFIRMS calculate this rate, or the user can input this rate directly.
13Z	Resource Supply Days Until Critical	All	$\frac{(13W - 13V)}{13Y}$ 13W = Resource Total Currently Available 13V = Supply Critical Level 13Y = Resource Daily Expenditure Rate	The resource available quantity less the resource supply critical level is divided by the resource expenditure rate. Resource resupply information is not included.
15K	Flight Duration	All	15J - 15I 15J = Mission Land Time 15I = Mission Take-Off Time	
50F	Sortie Expected Flight Duration	All	50E - 50D 50E = Sortie Expected Land Time 50D = Sorties Assigned Take-off Time	

Table C-1

ALGORITHM SPECIFICATIONS (Continued)

APPEARANCE NO.	APPEARANCE CLASS NAME	INSTANCE	CALCULATION	REMARKS
501	Actual Flight Duration	All	50H - 50G 50H = Actual Land Time 50G = Actual Take-off Time	
92E	Number of MICAP Days	All	Current Date - 92D 92D = MICAP Start Date	The current date as supplied by the operating system less the MICAP start date.

APPENDIX D. AFIRMS C-RATING COMPUTATIONS

D.1 Introduction. The Air Force Integrated Readiness Measurement System (AFIRMS) Program was initiated by the United States Air Force in response to an increased need for an accurate assessment of force readiness. One of the mechanisms the Air Force currently uses to assess combat readiness is the combat-rating (C-rating). The purpose of this document is to define the means by which AFIRMS can support C-ratings calculations.

D.2 Air Force Combat Reasiness Reporting. To meet reporting objectives, C-ratings measure four status areas in terms of unit Design Operational Capability requirements.

D.2.1 Measured Areas. Air Force units report resource fill percentages or raw data in each of the four measured areas (listed below) from which C-ratings are derived. These resource fill percentages provide the detailed readiness information required for crisis decision-making and resource management.

C-ratings assess the status of these four measured (resource) areas:

1) Personnel
2) Equipment and Supplies on Hand
3) Equipment Readiness
4) Training

C-ratings are assigned to show a unit's overall combat readiness and the availability and readiness of selected unit combat essential materiel and personnel resources. Measured area C-ratings provide visibility of resource status to advise the National Command Authorities (NCA) on current forces' readiness. Only organic resources under the operational control (OPCON) of the reporting unit or its parent unit are measured for unit readiness reporting. Theater resources (i.e. POL, munitions, communications) are reflected in force level Air Force combat readiness reporting as addressed by the Theater Commander-in-Chief (CINC) Situation Report (SITREP).

D.2.2 DOC Response Time. An Air Force unit must be ready for deployment and employment within a specified time. These specified times range from minutes for alert forces to days for units not manned or equipped to meet immediate wartime tasking. A unit's response time is established in approved plans or 28-series publications on mobility and in the unit's DOC (Designed Operational Capability) statement. This time (or 72 hours, whichever is shorter) is called the unit's "DOC response time" and is reported in the Unit Status and Identity Report (UNITREP). The Air Force concept of measuring combat readiness requires an assessment of a unit's ability to prepare its resources to perform its C-rated wartime mission, within the unit's DOC response time. The unit's measured resource area and overall C-ratings are based on this requirement.

D.2.3 Reporting Objectives. Air Force combat readiness reporting objectives as stated in Air Force Regulation 55-15, Sections 1-4 and 1-6, are:

1) to provide a timely and accurate assessment of a unit's capability to accomplish its wartime mission, and

2) to establish a data base of essential readiness and resource management information for such purposes as assessing the impact of budgetary allocations and management actions on unit readiness.

D.3 Transforming Measured Area C-Ratings Into Overall Unit C-Ratings. The unit commander's assessment is the key element in determining and reporting a unit's C-rating. He/she uses these computed resource status data, along with nonmeasured information, to determine the unit's overall C-rating.

After objective "counts" are complete, the unit commander must consider this information, along with subjective factors, to determine if the lowest C-rating in the four measured areas adequately portrays the unit's capability.

Some factors that may not be quantified in the four resource areas, but which the unit commander must consider when assigning an overall unit C-rating are:

a. Absence of critical resources masked by high fill percentages in measured resource areas.

b. Changes in tasking without corresponding changes in resource authorization.

c. Morale, personnel experience, or turnover rates.

d. Results of unit readiness exercises.

e. Limiting factors (LIMFACs) on the unit's wartime mission that are based on organic resources under the OPCON of the unit or its parent unit

These definitions of readiness categories are provided in Air Force Regulation 55-15, Section 2-2, as guidelines to be used by the commander when rating a unit's capability:

C-1, Fully Combat Ready. A unit which possesses its prescribed levels of wartime resources and is trained so that it is capable of performing the wartime mission for which it is organized, designed, or tasked.

C-2, Substantially Combat Ready. A unit which has only minor deficiencies in its prescribed levels of wartime resources or training that limit its capability to perform the wartime mission for which it is organized, designed, or tasked.

C-3, Marginally Combat Ready. A unit which has major deficiencies in prescribed wartime resources or training that limit its capability to perform the wartime mission for which it is organized, designed, or tasked.

C-4, Not Combat Ready. A unit which has major deficiencies in prescribed wartime resources or training and cannot effectively perform the wartime mission for which it is organized, designed, or tasked.

When the unit commander assigns an overall unit C-rating different from that derived by the lowest of objective factors, supporting remarks must be submitted.

D.4 Computing C-Ratings for Aircraft Units. The four measurement areas for C-rating are Personnel, Equipment/Supplies On-hand, Equipment Readiness, and training.

D.4.1 Personnel Measured Area. The measurement area of personnel included evaluation of total personnel and critical personnel.

D.4.1.1 C-Rating Computation. Units must compute a personnel C-rating for both total personnel and critical personnel. In determining C-ratings for aircraft units, the availability of both assigned aircrew members and direct support maintenance personnel must be considered.

a. Total Personnel - this C-rating is determined by dividing the total personnel available by the total personnel authorized (Unit Manpower Document (UMD)) or required (Unit Type Code (UTC)) and relating the corresponding percentage to the proper C-rating in Table D-1 of Annex 1. This computation is performed regardless of the Air Force Specialty Code (AFSC) and skill levels of assigned and available personnel.

b. Critical Personnel - this C-rating is determined by dividing the critical personnel available by the critical personnel authorized (UMD) or required (UTC) and relating the corresponding percentage to the proper C-rating in Table D-1. This computation is performed for the specific AFSC and skill level.

   Critical personnel who are surplus to the unit's critical personnel authorization (UMD) or requirement (UTC) are not counted as part of the critical personnel available. But, they may be counted if they can fill a requirement shortage in the same AFSC at a lower "skill level" (that is, surplus "5" skill levels may be used to fill "3" skill level shortages, but not "7" skill level shortages).

D.4.1.2 Information Required. The following data is required for the personnel management area.

a. Total Personnel

   1) Number of total personnel assigned/authorized

   2) Number of total personnel available

b. Critical Personnel

   1) Number of critical personnel assigned/authorized as well as corresponding AFSCs and skill levels

   2) Number of critical personnel available as well as corresponding AFSCs and skill levels

   3) Definition algorithm of critical personnel (see Table 2).

D.4.2 Equipment and Supplies On Hand Measured Area. The Equipment and Supplies On Hand measurement area includes combat essential equipment and support equipment/supplies.

D.4.2.1 C-Rating Computation. Equipment and supplies on hand is a readiness measurement of a unit's ability to generate or deploy with resources identified in the unit's DOC statement.

a. Combat Essential Equipment - Combat essential equipment for aircraft units is possessed aircraft only. The possessed aircraft rating is computed by dividing the total number of aircraft possessed, regardless of operational status, by the number authorized or required, and relating the corresponding percentage to the proper C-rating shown in Table D-3 of Annex 1.

b. Support Equipment & Supplies - Support equipment and supplies on hand ratings are determined by computing the percentage of selected equipment and supply items on hand versus those authorized or required for the organization being rated (see Annex 1, Table D-3). Only organic equipment and supplies are measured. Theater assets (for example, munitions and POL) are not included in the aircraft unit C-ratings.

D.4.2.2 Information Required. The following data is required for the equipment and supplies on hand measured area.

a. Combat Essential Equipment

 1) Number of total aircraft possessed

 2) Number of aircraft authorized/required

b. Support Equipment & Supplies

 1) Number of war readiness spares kits (WRSK), # base level self-sufficiency spares (BLSS), amount peacetime operating stock (POS) See Annex 1, Table D-3, Note 2 for further clarification

 2) Number of spare aircraft engines

 3) Number of mobility bags

 4) Number of electronic countermeasures (ECM) and electronic counter-countermeasures (ESM)

 5) Number of other support equipment & supplies (to be itemized in MAJCOM supplements or supporting regulations (i.e.: chaff, test equipment/stations) See Annex 1, Table 3, Note 5 for further clarification

D.4.3 Equipment Readiness Measured Area. The measurement area of Equipment Readiness includes only Combat Essential equipment.

D.4.3.1 C-Rating Computation. Aircraft units measure only combat essential equipment (possessed aircraft) in this area.

The deputy commander for maintenance must determine those aircraft that can be made "mission ready available (MRA)". The equipment readiness percentage is determined by dividing the number of aircraft that can be made MRA within the DOC response time by the number of aircraft authorized to, or required by, the unit. [For an aircraft to be considered MRA, all basic systems list (BSL) items on the MAJCOM minimum essential subsystem list (MESL) (prescribed by AFR 65-110) that apply to the particular DOC under consideration, must be operational.]

NOTE: The DOC response time is the period in which the unit configures its aircraft for the wartime mission. Aircraft MRA configuration includes such activities as servicing, weapons uploading, crew pre-flights, etc., for the wartime mission.

D.4.3.2 Information Required. The following data is required for the equipment readiness measurement area.

a. Number of aircraft authorized/required
b. Number of aircraft that can be made MRA within DOC response time

D.4.4 Training Measured Area. The measurement area of training includes only mission ready and available crews as a percentage of authorized crews.

D.4.4.1 C-Rating Computation. Training readiness measurement is designed to relate the current level of unit training with that of a fully trained unit for war. MAJCOMs must ensure that mission ready criteria for aircrews agree with that needed for the C-rated wartime mission. MAJCOMs must publish their own training requirements since training elements vary widely between weapon systems.

The training area C-rating assesses the percentage of mission ready available crews (JCS method "B" as described in section 3-17 of AFR 55-15).

The C-rating reported must be derived from dividing mission ready crews available at the unit by primary duty crews authorized or required. These crew members must be available to meet unit tasking within the unit's DOC response time to be counted as available.

NOTE: Mission capable or mission support crew members are not be counted in the training measured area.

Excluded from the training area computations are overhead crews (for example wing training officers, safety officers, maintenance officers, etc.) who maintain mission ready status. But, the C-rated unit's squadron commander and operations officer may be counted in the training measured area. Overhead crew members who maintain mission ready status and are available may only be used in assessing the unit's overall C-rating.

<u>D.4.4.2 Information Required</u>. The following data is required for the training measurement area.

a. Number of crew members available to meet unit tasking within unit's DOC response time (# mission ready crews)

b. Number of primary duty crews authorized/required

<u>D.5 AFIRMS Application and Implementation</u>. One of the primary goals of both AFIRMS and C-Ratings is to provide "management" with a current, accurate measurement of force readiness.

AFIRMS and the C-Ratings System make use of similar data for an assessment of combat readiness. It is therefore reasonable to utilize AFIRMS tools to assist in the C-ratings calculations by automating the C-rating process. The basic difference between AFIRMS and C-ratings is that AFIRMS examines and compares the inventory data against specified tasking requirements whereas the C-Rating system is strictly an "inventory readiness" examination process.

Initial AFIRMS implementation of the C-ratings process provides an on line, interactive posting of C-rating resource data which is generated offline (manually) in accordance with current Air Force procedures. This data is then processed against the appropriate C-rating tables to automatically generate the requisite C-rating for each measured area. Presently, The AFIRMS database contains or tracks most , but not all of the data elements required to automate the C-rating calculations as part of the readiness assessment data requirements. As AFIRMS evolves, the unique C-ratings summary data can be incorporated into the wing resource data maintained by AFIRMS. Automated generation of trial C-rating calculations can accomplished based on the unit database. These trial C-rating results would then be reviewed for accuracy and for assessment of the overall C-rating in accordance with the commander's estimate of actual overall readiness. During the analysis phase of each AFIRMS implementation, unique requirements for the C-rating product can be developed, as required, based on MAJCOM and overall Air Force wide need.

Table D-1*

PERSONNEL C-RATING CRITERIA

PERSONNEL C-RATING CRITERIA		
If the lower percentage of the following is		
Total Personnel	Critical Personnel	
Percentage of "total" authorized or required personnel who are available (see note)	Percentage of authorized or required personnel with critical AFSCs who are available (see note)	then the unit's reported personnel C-rating is
A	B	
90-100	85-100	C-1
80-89	75-84	C-2
70-79	65-74	C-3
0-69	0-64	C-4

NOTE: Personnel available definitions are in Appendix D and personnel availability codes are in Appendix E.

$$\text{Fill percentage for Total Personnel} = \frac{\text{total personnel available}}{\text{total personnel authorized/required}}$$

$$\text{Fill percentage for Critical Personnel} = \frac{\text{critical personnel available}}{\text{critical personnel authorized/required}}$$

See Table D-2 for AFSCs and skill levels.

*Reproduced from AFR-55-15 "Unit Combat Readiness Reporting" page 16.

Table D-2*

CRITICAL AIR FORCE SPECIALTY CODES (AFSCs)

C-Rated Unit	Chapter	Critical AFSC for Generation Units (see notes 1 and 2)	
Aircraft (Crews) OPR: HQ USAF/XOOIM	4	Officer: Airman:	10XX, 11XX, 12XX, 132X, 14XX, 15XX 17XX, 22XX, 2534 11XXX, All AFSCs with A and P Prefixes
Aircraft (Maintenance) OPR: HQ USAF/LEYM	4, 12	Officer: Airman:	401X, 402X, 409X 32XXX, 42XXX, 43XXX, 602XX, 645XX
Aircraft (Munitions) OPR: HQ USAF/LEYW	4	Officer: Airman:	401X, 405X 316X0, 316X1, 461XX, 462XX, 463XX, 464XX, 645X0
Aircraft (Other) OPR: HQ USAF/XOOIM	4	Officer: Airman:	80XX 122XX, 201XX, 206XX, 233XX, 274X0, 404X1
Aerial Port OPR: HQ USAF/LETX	5	Officer: Airman:	60XX 114XX, 472X1C, 511X0, 602XX, 605XX
Communications OPR: HQ USAF/XOKT	6	Officer: Airman:	161X, 163X, 17XX, 301X, 302X, 303X, 304X, 305X 271X2, 272XX, 29XXX, 30XXX, 361XX, 362XX, 472X2, 542XX, 545XX
Civil Engineering OPR: HQ AFESC/DEO	7	Officer: Airman:	5516, 5525X RED HORSE only: 9346 54250, 54251, 54252, 54270, 54271, 54272, 54299, 54533, 54550, 54551, 54552, 54570, 54571, 54572, 54599, 551X1, 55100, 55150, 55170, 55199, 55250, 55252, 55255, 55273, 55275, 55299, 55350, 55370, 55390, 55500, 55570, 55590, 56651, 56670, 56671, 56691, 571X0, 64570 RED HORSE only: 42770, 47200, 47250, 47271, 55200, 55251, 55300, 56650, 62250, 62270, 64500, 64550, 64551, 64591, 90270
ICBM OPR: HQ USAF/XOOTS	8	Officer: Airman:	182X 316X0F, 445X0E
Medical OPR: HQ USAF/SGHR	9	Officer: Airman:	93XX, 94XX, 95XX, 973X, 974X, 976X, 983X 902XX, 906XX
Security Police OPR: HQ AFOSP/SPO	10	Officer: Airman:	81XX 81XXX
Tactical Air Control System OPR: HQ USAF/XOORC	11	Officer: Airman:	114X, 14XX, 17XX, 22XX, 30XX, 513X, 80XX 201XX, 205XX, 206XX, 222XX, 233XX, 274XX, 275XX, 276XX, 291XX, 293XX, 301XX, 302XX, 303XX, 304XX, 305XX, 306XX, 307XX, 308XX, 309XX, 362X2, 423X5, 427X1, 472X2, 511XX, 542XX, 545XX, 645X0, 902XX
Tactical Warning and Attack Assessment, OPR: HQ USAF/XOSO	13	Officer: Airman:	201X, 202X, 203X, 28XX, 51XX 205XX, 276XX, 277XX, 51XXX
Base Transportation OPR: HQ USAF/LETX	14	Officer: Airman:	60XX 472X0, 472X1A, 472X1B, 472X1C, 472X1D, 4727X, 47299, 602X1, 602X2, 60273, 60299, 603XX, 605XX, 645X0
Supply OPR: HQ USAF/LEYS	15	Officer: Airman:	64XX 645XX, 631X0, 545XX
Services OPR: HQ AFESC/DEO	16	Officer: Airman:	62XX 61170, 61190, 622XX
Aircraft Control and Warning (ANG only) OPR: HQ ANGSC/XOS	N/A	Officer: Airman:	17XX, 30XX 276XX, 291XX, 303X2, 304X0, 304X4, 361X0, 362X1, 472X2, 645X0, 811XX
Weather (ANG only) OPR: HQ ANGSC/XOS	N/A	Officer: Airman:	251X, 252X 251XX
Reconnaissance Technical (ANG only) OPR: HQ ANGSC/XOS	N/A	Officer: Airman:	None 206XX, 233XX

NOTES:

1. Units with a mobility mission must use the UTC listing for critical AFSCs.

2. When computing the critical personnel C-rating, compute against each specific AFSC and skill level (upward skill level substitution only allowed in the unit's overall C-rating).

*Reproduced from AFR-55-15 "Unit Combat Readiness Reporting" page 17.

Table D-3*

AIRCRAFT EQUIPMENT AND SUPPLIES ON HAND ASSETS MEASURED

AIRCRAFT EQUIPMENT AND SUPPLIES ON HAND ASSETS MEASURED

RULE	A	B	C	D	E	F	G
	If the aircraft unit type is	then these items must be measured					
		combat essential equipment	support equipment and supplies (1)				
		possessed aircraft	WRSK, BLSS, and POS (2)	spare engines	mobility bags (3)	EW (ECM and ESM) (4)	other support equipment and supplies (5)
1	Fighter/Attack	X	X	X	X	X	CC
2	Airlift	X	X	X	X		CC
3	Bomber, SIOP	X		X		X	CC
4	Bomber, Other	X	X	X	X	X	CC
5	Tanker, SIOP	X		X			CC
6	Tanker, Other	X	X	X	X		CC
7	Reconnaissance	X	X	X	X	X	CC
8	Warning & Control	X	X	X	X		CC
9	Rescue	X	X	X	X		CC
10	Special Operations	X	X	X	X	X	CC
11	Electronic Countermeasures	X	X	X	X	X	CC
12	TACS (FAC)	X	X	X	X		CC

NOTES:

1. Codes: X - Resource is measured if organic to the unit; i.e., the unit has direct control over the resource

   CC - Resources are normally considered in the commander's judgment, and must be organic to the unit, but see note 5 below.

2. For units with mobility missions, peacetime operating stock (POS) is used to fill WRSK; for units with a generation mission, POS will only be considered in the unit's overall C-rating (POS is not used to fill BLSS, except for units with a generation DOC as noted in paragraph 4-7d(1)(g)) of AFR 55-15.

3. Mobility bags (A, B, and C) will be measured for all units that require them (see Table D-7).

4. Specific reporting instructions to be published by MAJCOMs.

5. The MAJCOM may determine resources to be objectively measured in this area. Procedures must be included in MAJCOM supplements or supporting regulations. Examples of items are: test equipment/stations, AGE, TRAP, PAVE SPIKE (PENNY) pods, chaff, etc. If these items are not measured in this resource area, then the commander must assess their impact on the unit's wartime mission in the unit's overall C-rating.

*Reproduced from AFR-55-15 "Unit Combat Readiness Reporting" page 29.

Table D-4*

AIRCRAFT UNITS EQUIPMENT AND SUPPLIES ON HAND C-RATING CRITERIA

AIRCRAFT UNITS EQUIPMENT AND SUPPLIES ON HAND C-RATING CRITERIA

[illegible] Essential	Support Equipment and Supplies (1)					Equipment and Supplies on Hand C-Rating
(Possessed Aircraft) Reported Percentage	Overall Support Equipment and Supplies Reported Percentage	as derived from these categories				
		WRSK/BLSS (percent)	Spare Engines (percent) (2)	Mobility Bags (A, B, and C) (percent) (3)	EW and Other Equipment & Supplies (4)	
90-100	90-100	90-100	90-100	90-100	90-100	C-1
80-89	80-89	80-89	70-89	80-89	80-89	C-2
60-79	65-79	65-79	60-69	65-79	65-79	C-3
0-59	0-64	0-64	0-59	0-64	0-64	C-4

NOTES:

1. Use Table D-3 for proper categories and procedures. The lowest percentage will be reported for the support equipment and supplies percentage.

2. Reference Table D-5 for spare engine percentage and C-rating conversion table.

3. See Table D-7 to compute (mobility bags) C-rating.

4. MAJCOMs determine items and develop procedures using Table D-3 and C-rating definitions and percentages as a guide. Percentage conversion tables may be developed by MAJCOMs.

$$\text{Fill percentage for Combat Essential Equipment} = \frac{\text{total \# aircraft possessed}}{\text{\# aircraft authorized/required}}$$

$$\text{Fill percentage for Support Equipment and Supplies} = \frac{\text{selected equipment and supply items on hand}}{\text{selected equipment and supply items authorized/required}}$$

See Table D-3 for support equipment and supplies to be measured.

*Reproduced from AFR-55-15 "Unit Combat Readiness Reporting" page [illegible].

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Table D-5*

AIRCRAFT SPARE ENGINES C-RATING COMPUTATION

Number of Spare Engines Required (see notes 2 and 3)									Reported Percentage	C-Rating
1	2	3	4	5	6	7	8	more than 8 (percent)		
Number of Available Spare Engines (see note 4)										
1	2	3	4	5	6	7	8	100	100	C-1
		2	3	4	5	6	7	90	90	
					4	5	6	89	89	
0	1	1	2	3		4		80	85	C-2
					3	3	5	70	80	
				2	2	2	3	69	79	
		0	1	1	1		2	65	72	C-3
			0	0	0	1	1	60	65	
								59	64	
						0	0	0	0	C-4

NOTES:

1. This table is used with tables 3 and 4.

2. The number of spare engines required is the computed unit spare engine stockage objective for units with a generation mission, or the number required in the deployment UTC for units with a mobility mission. The requirement is for a 30-day period unless specified differently in the unit DOC statement.

3. Units that report at the squadron level must use the number required for that squadron. Units that report at the wing level must use the number required for the wing.

4. Available spare engines must be serviceable. Available and serviceable spare engines include those engines estimated to be provided by the pipeline, Jet Engine Intermediate Maintenance (JEIM), and the Centralized Intermediate Repair Facility (CIRF) (for PACAF units). This includes all engines that can be made serviceable and available within the 30-day period. Consider that limited or no production may be available to units with a mobility mission following deployment.

*Reproduced from AFR-55-15 "Unit Combat Readiness Reporting" page 30.

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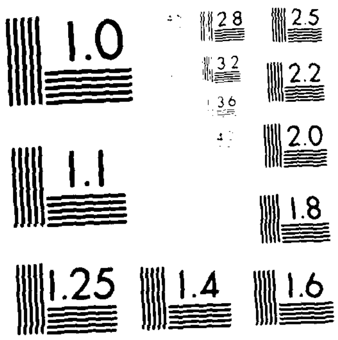

MICROCOPY RESOLUTION TEST CHART

Table D-6*

AIRCRAFT EQUIPMENT READINESS C-RATING CRITERIA

AIRCRAFT EQUIPMENT READINESS C-RATING CRITERIA	
If the number of aircraft possessed and mission ready available divided by number of aircraft authorized (PAA) or required is (percent)	then the C-rating is
75-100	C-1
60-74	C-2
50-59	C-3
0-49	C-4

Equipment Readiness Percentage = # aircraft MRA within DOC response time / # aircraft authorized to or required by the unit

*Reproduced from AFR-55-15 "Unit Combat Readiness Reporting" page 30.

Table D-7*

MOBILITY BAGS (INDIVIDUAL EQUIPMENT) C-RATING CRITERIA

MOBILITY BAGS (INDIVIDUAL EQUIPMENT) C-RATING CRITERIA (see notes 1, 2, and 3)	
If the percentage of total required mobility bags is (see notes 3 and 4)	then the mobility bags' C-rating will be
90-100	C-1
80-89	C-2
65-79	C-3
0-64	C-4

NOTES:

1. The following criteria will be used to determine the mobility bags portion of the "support equipment and supplies" category C-rating (see Table D-3).

2. Some units (especially generation units) refer to mobility bags as individual equipment. The following terminology will be considered the same when computing this measured area:

   "A" bags = individual set or protective equipment set.
   "B" bags = cold weather set.
   "C" bags = Chemical Warfare Defense Equipment (CWDE) set.

3. Mobility bags need only be computed once a month, unless a major supply action occurs (includes redistribution).

4. For mobility bag computation, each bag should be counted separately. They should then be totaled and compared to the overall bag requirement. One type of mobility bag must not be substituted for another. For example, if 50 personnel each require an "A", "B", and "C" bag, then the requirement is 150 bags. If there are 60 "A" bags, 45 "B" bags, and 25 "C" bags available, then the total available is 120 bags (note that the available "A" bags cannot exceed the 50 "A" bags requirement for measurement purposes). The resultant mobility bag percentage is 80 (120 divided by 150) and C-2.

*Reproduced from AFR-55-15 "Unit Combat Readiness Reporting" page 30.

Table D-7*

MOBILITY BAGS (INDIVIDUAL EQUIPMENT) C-RATING CRITERIA (Continued)

5. The following list is used to determine what constitutes a mobility bag for C-rating counting purposes:

Aircrew Items	Unit of Issue	OPS Ensemble #1	OPS Ensemble #2
Filter Pack	each	1	N/A
Hood	each	1	N/A
Mask	each	1	N/A
Suspension Assy	each	1	N/A
Footwear, Cover Plastic	pair	1	N/A
M-13A2 Filter Sets	set	1	1
Inserts	pair	1	1
Helmet	each	1	N/A
Undercoverall	each	1	1
Gloves, Neoprene	pair	1	1
Socks, Tube	pair	1	1
Cape, Plastic	each	1	1
Undershirt	each	1	1
Drawers, cotton	each	1	1
Non-Aircrew Items			
M-17 Mask	each	1	N/A
M-13A2 Filter Sets	set	1	1
M-6A2 Hood	each	1	1
Overgarment	each	1	1
Gloves w/inserts	pair	1	1
Inserts, Cotton	pair	1	1
Socks, Tube	pair	1	1
Overboots	pair	1	1

*Reproduced from AFR-55-15 "Unit Combat Readiness Reporting" page 19.

Table D-8*

TRAINING C-RATING CRITERIA

TRAINING C-RATING CRITERIA	
If the percentage of authorized or required crews that are formed, mission (combat) ready, and available is	then the unit's reported C-rating is
85-100	C-1
70-84	C-2
50-59	C-3
0-49	C-4

$$\text{Training Percentage} = \frac{\text{\# mission ready crews available}}{\text{\# primary duty crews authorized or required}}$$

*Reproduced from AFR-55-15 "Unit Combat Readiness Reporting" page 18.

ANNEX B. AFIRMS DATA RELATING TO C-RATINGS

B.1 AFIRMS Data Relating To C-Ratings.

The data items listed herein represent sample data elements established in the AFIRMS LPP which have immediate application to an automated C-rating application within the operational AFIRMS. Further study is required to determine precisely which data elements can be aggregated to provide the required information for each measured area resource. This process will then provide C-rating summary data for processing against the appropriate C-rating tables of AFR 55-15, as shown in Annex A. User data input will then be accomplished via AFIRMS functional products or other systems which AFIRMS interfaces, and therefore not duplicated for C-rating purposes.

a. Data Elements in the Aircraft Table:

1) AC_CURRENT_STATUS
2) AC_TAIL_NO
3) AC_OWNING_UNIT_NAME
4) AC_MDS
5) TANK_CONFIG
6) AC_LOC_ON_BASE
7) STATION_STATUS
8) PRE_SELECT
9) ETIC_HR
10) ETIC_DY
11) GENERATION_FACTOR

b. Data Elements in the Airman Table:

1) AIRMAN_UNIT_TYPE
2) AIRMAN_UNIT
3) AIRMAN_NAME
4) AIRMAN-RANK
5) AIRMAN_POSITION
6) AC_WX_CAT
7) AIRMAN_CREW_DAY_START

8) AIRMAN_DNIF

9) AIRMAN_LEAVE

10) AIRMAN_TDY

11) AIRMAN_AVAL

12) AIRMAN_ETR

13) AIRMAN_GCC_LEVEL

14) AIRMAN_EXPECTED_MR_DATE

15) AIRMAN_GBU_SKILL

16) AIRMAN_STK_SKILL

17) AIRMAN_MDS_SKILL

18) AIRMAN_FLT_QL_SKILL

c. Data Elements in the Resources Table:

1) RESOURCES_OWNING_UNIT

2) RESOURCES_TYPE

3) RESOURCES_DESIGNATOR

4) RESOURCES_CATEGORY

5) RESOURCES_AMOUNT_AUTH

6) RESOURCES_CRITICAL_LEVEL

7) RESOURCES_CURR_BUILT_UP

8) RESOURCES_REMARKS

d. Data Elements in the Resource Status Table:

1) RES_STAT_OWNING_UNIT

2) RES_STAT_DESIGNATOR

3) RES_STAT_CHECK_DATE

4) RES_STAT_AMOUNT_ON_BASE

5) RES_STAT_AMOUNT_OFF_BASE

6) RES_STAT_AMOUNT_EXPENDED

END
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