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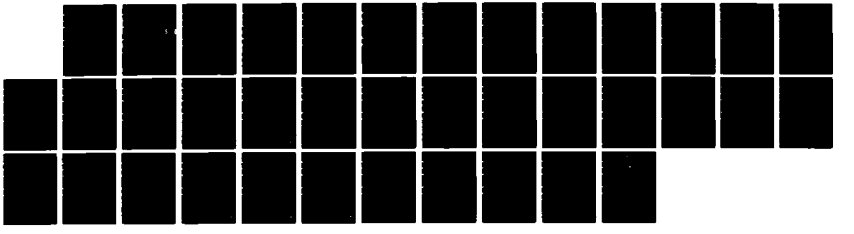

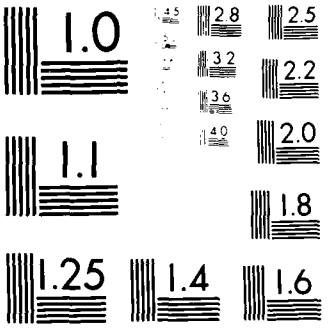

SOFTECH SofTech Inc

AIR FORCE INTEGRATED READINESS MEASUREMENT SYSTEM (AFIRMS)

ANALYSIS OF MILITARY AIRLIFT COMMAND (MAC) CAPABILITY ASSESSMENT METRICS

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SECTION 1. GENERAL

1.1 Purpose of the MAC Capability Assessment Metric Report. This report is based on a study performed by SofTech in July and August of 1985. The study is the initial phase of a requirements analysis effort to tailor AFIRMS to the needs of the Military Airlift Command (MAC). The MAC requirements analysis is a small part in the development of the Air Force Integrated Readiness Measurement System (AFIRMS), a summary of which appears below. The purpose of this report is to discuss the choice of a capability assessment metric, or unit-of-measure, for MAC. Prior to July 1985, a Learning Prototype Phase (LPP) tested the basic concepts of AFIRMS on an experimental testbed system which linked a base, a major command (MAJCOM), and Headquarters, United States Air Force (HQ USAF). That phase focused on the tactical fighter environment at Headquarters, United States Air Forces in Europe (HQ USAFE) and Spangdahlem Air Base.

This study, and a concurrent study of Strategic Air Command (SAC) broaden the base upon which AFIRMS rests. This base will support the definition and design phase of AFIRMS development.

1.2 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 interdependences, 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 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 system and AFIRMS.

(2) Data Quality Assurance. Capability assessment is not better than the data upon which it is based. Therefore, AFIRMS emphasizes a user orientation toward quality assurance of data source. 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.

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

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

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

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

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

1.4 References.

a. AFIRMS Data Analysis, SofTech, 15 February 1979.

b. AFIRMS Product Descriptions, SofTech, 31 May 1985.

c. MAC Information Flow Study, Col. Kurt G. Blunck, USAF, MAC/SI, June 1980.

d. Military Airlift Command (MAC) Capability Assessment System Study Report, Lt. Col. Joseph H.L. Guenet, USAF, et al, HQ MAC/OL-G, July 1982.

e. Draft System Operational Concept (SOC) for the MAC Information Processing System (IPS), HQ MAC/SIP, 15 May 85.

f. MAC Mission Element Need Statement (MENS) for AFIRMS, MAC/DOC letter, 2 July 1985.

g. Air Force Wide Mission Area Analysis (AFWMAA) Mission Area Analysis Decision Support System (MAA/DSS), Force Projection/Airlift/Load Movement Functional Description Working Draft, ANSER (for AF/XOXR), May 1985.

h. USAF War Mobilization Plan, Volume 5 (WMP 5), AF/XOXIC.

i. MAC Unit Designed Operational Capability (DOC) Statements, AF/XOOIM.

j. Analysis of Strategic Air Command (SAC) Capability Assessment Metrics, SofTech, 30 September 1985.

k. Military Airlift Command (MAC) AFIRMS Requirements Analysis, SofTech, 30 September 1985.

l. Joint Chiefs of Staff Memorandum of Policy No. 172 (JCS MOP 172), 2nd Revision, Military Capability Reporting, 1 June 1982.

1.5 Acronyms.

AAW	-	Aeromedical Airlift Wing
ACL	-	Allowable Cabin Load; also known as Allowable Cargo Load
AF	-	Air Force
AECC	-	Aeromedical Evacuation Control Center
AFB	-	Air Force Base
AFIRMS	-	Air Force Integrated Readiness Measurement System
AIMS	-	Airlift Implementation and Monitoring System
ALCC	-	Airlift Control Center
ALCE	-	Airlift Control Element
ALD	-	Airlift Division
ARR	-	Aerospace Rescue and Recovery
ARRS	-	Aerospace Rescue and Recovery Service
ASMRO	-	Armed Services Medical Regulating Office
ATO	-	Air Tasking Order
AWS	-	Air Weather Service
CAMS	-	Core Automated Maintenance System
CFMS	-	Combat Fuels Management System
CINC	-	Commander in Chief
COMALF	-	Commander Airlift Forces
CONUS	-	Continental United States
CRAF	-	Civil Reserve Air Fleet
CSMS	-	Combat Supplies Management System
CSS	-	Combat Supplies System
DG	-	Defense Guidance
DOC	-	Designed Operational Capability
DoD	-	Department of Defense
HQ MAC	-	Headquarters, Military Airlift Command
HQ USAF	-	Headquarters, United States Air Force
IPS	-	Information Processing System
JCS	-	Joint Chiefs of Staff
JDA	-	Joint Deployment Agency
JMRO	-	Joint Medical Regulating Office

JTB	-	Joint Transportation Board
JUWTF	-	Joint Unconventional Warfare Task Force
LPP	-	Learning Prototype Phase
MAC	-	Military Airlift Command
MACAF	-	Military Airlift Command Numbered Air Force
MAJCOM	-	Major Command
MAW	-	Military Airlift Wing
OPlan	-	Operations Plan
ORI	-	Operational Readiness Inspection
OSA	-	Operational Support Airlift
OSC	-	Operations Support Center
SAC	-	Strategic Air Command
SAAM	-	Special Assignment Airlift Mission
SOF	-	Special Operations Forces
UNITREP	-	Unit Status and Identity Report
US	-	United States
USAFE	-	United States Air Forces in Europe
Ute	-	Utilization (rate)
WMP	-	War Mobilization Plan
WSMIS	-	Weapon System Management Information System

SECTION 2. CAPABILITY ASSESSMENTS

Two types of capability are recognized, one of which is a component of the other. Combat capability consists of readiness and sustainability. It is a component of military capability which also includes force structure and modernization. AFIRMS assesses the unit's combat capability to perform a specific task. A discussion of some issues in determining units of measure are included in Appendix A.

2.1 Capability Relationships. Table 2-1 summarizes the relationships among the elements of Military Capability as defined in Joint Chiefs of Staff (JCS) Memorandum of Policy No. 172 (MOP 172). Definitions of the terms appear in Section 2.2. AFIRMS is concerned with combat capability, but we identify all elements of military capability to establish a basis for defining a proper metric for AFIRMS.

Table 2-1

ELEMENTS OF CAPABILITY

MILITARY CAPABILITY	WHICH INCLUDES:	
	FORCE STRUCTURE, MODERNIZATION, AND COMBAT CAPABILITY	WHICH INCLUDES:
		READINESS AND SUSTAINABILITY.

2.2 Definitions of Capability Terms. (See reference 1 in Section 1.4.)

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). Its components are: Combat Capability (that is Readiness and Sustainability), Force Structure, and Modernization.
Force Structure	-	Numbers, size, and composition of the units that comprise our defense forces, e.g., divisions, ships, air wings.
Modernization	-	Technical sophistication of forces, units, weapons systems, and equipment.
Readiness	-	The ability of our forces, units, weapon systems, or equipment to deliver the outputs for which they were designed (includes the ability to deploy and employ without unacceptable delays).
Sustainability	-	The "staying power" of our forces, units, weapon systems, and equipment, often measured in numbers of days.

2.3 The Type of Capability Measured.

AFIRMS is not chartered to assess Military Capability. If it were, it would have to measure "ability to achieve a specified wartime objective," most probably as seen in the ability to "destroy a target set." In other words, force modernization and force structure are not included in the AFIRMS capability assessment.

Instead, AFIRMS evaluates Readiness and Sustainability, two of the four components of Military Capability. This subdivision permits analysis and measurement of the components of Combat Capability with an accuracy and precision not possible for all of the Military Capability components. However, even the statement that AFIRMS deals with Readiness and Sustainability (or Combat Capability) does not fully clarify the issue.

For example, Readiness is defined as "The ability ... to deliver the outputs." Three possible interpretations of those words have been considered in AFIRMS. Two of the interpretations are rejected as outside the AFIRMS scope of readiness or sustainability:

- Mission completion, i.e., cargo delivered/dropped:
  - On time
  - Undamaged
  - On target (e.g., within the drop zone).
- Mission results, i.e., target destroyed.

Instead, AFIRMS assesses the unit's ABILITY TO LAUNCH the mission tasking and TO SUSTAIN THE LAUNCHING of the mission tasking for a specified number of days. Thus, AFIRMS concerns itself with factors such as missions, sorties, flying hours, or ton-miles. This decision leaves to other systems the evaluation of the quality of mission accomplishment. This study is directed to establishing which data items should be counted at the "launch" level to effectively state the Readiness and Sustainability of MAC.

2.4 **The AFIRMS Approach to Capability Measurement.** AFIRMS capability assessment is, by definition, tasking based. The intent is to measure the extent to which a specified unit or force can launch and sustain its mission tasking. This approach has two major advantages:

- It addresses the central concern of commanders, i.e., "what is my unit's ability to perform the assigned task?"
- It provides a basis for integrating all the needed resources (e.g., aircraft, aircrew, etc.) rather than viewing them individually, or in small groups, as is done by traditional inventory systems.

The AFIRMS approach leads directly to a focus on the tasking for the first day when discussing readiness and to a focus on the tasking over a period of days when discussing sustainability. This approach also suggests that the proper metric(s) for AFIRMS is:

- The unit-of-measure in which tasking is stated, e.g., missions; and/or
- A translation of the unit-of-measure in which tasking is stated, e.g., sorties, flying hours, ton-miles.

Another aspect of AFIRMS is significant in the consideration of metrics. AFIRMS does not want to collect data that has already been captured or computed. Wherever the needed data is available, in detail and in a form usable by AFIRMS, the AFIRMS program is committed to use that data as developed by existing or future systems, e.g., Airlift Implementation and Monitoring System (AIMS), Information Processing System (IPS), etc. The use of appropriate metrics which are already computed by other systems is in complete agreement with the AFIRMS concept (reference Section 1.2.b(1)).

Additionally, AFIRMS assesses capability at the unit level where aggregation of resources does not conceal distributional problems. (AFIRMS attempts to avoid the error of assuming that a wing short of aircrews and another wing with more than enough aircrews equal two wings with enough aircrews.) At the same time, AFIRMS must ultimately report on the total capabilities of the Air Force. Thus, the metric chosen need not be the same at all command levels, but must be one which allows for aggregation from unit level to a higher command level.

SECTION 3. MAC MISSIONS AND METRICS

The primary mission of the Military Airlift Command (MAC) is to provide airlift to all Department of Defense (DoD) agencies: as a specified command under the Joint Chiefs of Staff (JCS) during times of crisis; and as the Single Manager/Operating Agency for Airlift under the Secretary of the Air Force for peacetime logistics operations. In peacetime, MAC commands and trains units for all of the missions listed below. During a contingency or crisis, MAC provides tactical airlift, search and rescue, and special operations units to the overseas theatre commanders.

The missions of the MAC flying units are:

- Strategic Airlift (air movement between theatres)
- Tactical Airlift (air movement within theatres)
- Aeromedical Airlift (a task of strategic and tactical airlift)
- Search, Rescue, and Recovery (includes Combat Rescue)
- Special Operations
- Weather Reconnaissance (including Air Sampling)
- Operational Support Airlift

The term "mission" has two meanings in the Air Force and in this report. The mission as a metric uses the second definition.

(1) An operational or specialized task categorized by objective (e.g., Airlift, Close Air Support, Special Operations, etc.) and/or perspective (i.e., strategic, tactical).

(2) The mission is also the dispatching of one or more aircraft to accomplish one particular task. An aircraft dispatched on a mission may fly one or more sorties; each sortie may be one or more hours in duration.

3.1 Strategic Airlift. Strategic airlift is the air movement of unit and logistical cargo and passengers between the US and the overseas theatres or between theatres. The mission also encompasses the strategic aeromedical airlift and special air support missions. Strategic airlift forces possess a

capability to airland and airdrop troops, supplies, equipment. This capability enables strategic airlift units to augment the tactical airlift forces when necessary.

The strategic airlift forces are made up of active military, Air Reserve Forces (Air National Guard and Air Force Reserve), and the Civil Reserve Fleet (CRAF). The military units fly C-5 and C-141 aircraft while the airline CRAF are a mixture of aircraft such as Boeing 707 and 747, DC-8 and 10, Lockheed L-1011, etc.

3.1.1 Strategic Airlift - Organization. The global strategic airlift responsibility is directed by HQ MAC from Scott AFB, IL and controlled by two numbered Air Forces (21st AF at McGuire AFB, NJ; 22nd AF at Travis AFB, CA); each has geographical area boundaries. The 21st AF controls all airlift operations east of the Mississippi river to Pakistan including South America and Africa. The 22nd AF controls all airlift operations west of the Mississippi river to Southwest Asia including Australia and New Zealand. (The 23rd Air Force of MAC has special, non-airlift responsibilities. See Sections 3.4.1, 3.5.1, and 3.6.1.)

The military airlift units pass control of the aircraft and aircrews to the MACAFs when they depart the home base and do not regain it until the aircraft and/or aircrews arrive back at home base. Additionally, aircrews are positioned around the world at several staging bases. The aircraft and aircrews may be in the system for days or weeks at a time before arriving back at their home base. During a crisis or contingency, the aircraft and crews would probably cycle through the home base more frequently for crew changes and repairs. However, the CRAF is directly controlled by the HQ MAC rather than by the MACAFs. How the CRAF's capability will be assessed is yet to be determined and is outside the scope of this analysis. While it would seem to be a straight forward computation, collection of the CRAF resource status data will complicate the process. The CRAF portion of the strategic airlift capability needs further analysis.

3.1.2 Strategic Airlift - Tasking. Tasking is passed to HQ MAC by the Joint Deployment Agency (JDA) during a major crisis. In peacetime and minor crises, MAC receives the tasking (in the form of airlift requests) from the Air Force major commands (MAJCOMs) and other services and DoD agencies. The tasking is expressed in tons of cargo (bulk, oversize, outsize) and passengers to be moved from an origin to a destination by a specified date. In peacetime operations, missions are classified as channel missions or special assignment airlift missions (SAAMs). In a crisis, that classification virtually goes away, at least in the early stages of a crisis; in a long term conflict (e.g., Vietnam) the mission classifications would apply.

The USAF WMP and unit DOC statement tasking is not in terms of cargo or missions but is in terms of flying hours per day per aircraft (often called a utilization or "ute" rate).

3.1.3 Strategic Airlift - Capability Assessment. HQ MAC receives crisis tasking in the form of a request/order to move X tons and/or passengers from base Y to base Z. MAC does not simply pass this pro rata tasking to its units. Instead, HQ MAC prepares a schedule (called a Mission Flow) of missions for its strategic airlift units and CRAF aircraft to move the tasked cargo and passengers from base Y to base Z. (A mission includes the sortie(s) to send an aircraft from home base (if applicable) to onload at base Y, the sortie(s) to arrive and offload at base Z, and (if applicable) the sortie(s) to return to home base or go to the next onload base.) This mission schedule is, in effect, a system capability assessment because the schedule is generated using HQ MAC estimates of the airlift system's capability. Thus, the flying units do not typically receive levels of tasking which would require them to decide how much of it the unit can do. Instead, the units receive a "resolved" unit schedule of the task to which they assign aircrew names and aircraft tail numbers. The unit schedule is, in effect, an extract from the overall system schedule.

The parameter inputs to the MAC mission flow generator are estimates of unit capabilities. Some of the estimates are based on the authorized resources of the units rather than the actual resources in their possession. Additionally, other factors may affect the estimates. For example, the aircraft "ute" rate has been influenced in the past by factors within the JCS and the theatre commands that were not based on unit capabilities or resource availability. Thus, it is possible for the MAC mission flow generator to overtask the units especially at high wartime "ute" rates. (During peacetime, localized contingencies or JCS exercises such as Grenada or Reforger are not large enough to tax the whole airlift "system" and, thus, the units are not overtasked.) AFIRMS proposes to assess the schedule produced by HQ MAC's mission flow generator and, in effect, validate the parameters used to produce it. The user could then modify parameter inputs based on the AFIRMS capability assessments and run the airlift mission flow generator again.

The MAC airlift system has two types of units: flying and support units. The flying units possess the aircraft, aircrews, and home base support to maintain and service the aircraft. The support units provide the aircraft servicing and passenger and cargo processing at the onload, enroute, and offload bases (i.e., bases without MAC flying units). The MAC airlift support units at Ramstein, Lajes, and Hickam are examples of these units. In addition to these fixed support units, mobile support teams or elements (i.e., Airlift Control Elements or ALCEs) are provided at the temporary onload/enroute/offload bases that do not have the resources (i.e., people and equipment) needed to support the MAC aircraft transiting through the base. Thus, without the support units and ALCE teams, the flying units could not perform their tasks. Therefore, the capability of a MACAF or MAC is more than the aggregation of the individual flying unit capabilities. Instead, the capability of the airlift system consists of the individual capabilities of the flying units, support units, and elements.

The MAC airlift system has two semi-autonomous parts: the 21st AF airlift system and the 22nd AF airlift system. Each may lend the other assistance in the form of deployable aircraft, aircrews, and/or support elements, but the MACAF's capability should aggregate into a MAC capability for strategic airlift.

The aggregation of individual unit capability to derive the MAJCOM's capability is one of the key concepts of AFIRMS. However, there are some units in MAC that complicate the aggregation concept. Questions remain about how the support units are to be included; how the Reserve associate units are to be assessed; whether or not the Reserve associate units are a factor in the active unit's assessment; how the CRAF is assessed and/or included; etc. More analysis will be needed in this area.

3.1.4 Strategic Airlift - AFIRMS Metric. The proposed metric is missions. Metric alternatives are, in order of preference, flying hours, sorties, and ton-miles. Missions, flying hours, and sorties can be obtained directly from the mission tasking. Ton-miles must be calculated from the mission tasking. The advantages and disadvantages of each metric are discussed in Section 3.7.

3.2 Tactical Airlift. Tactical airlift is the air movement of combat units, material and passengers within a theatre. The mission encompasses the basic tasks of: logistical airlift of cargo and passengers, airborne operations (e.g., airdrop, airland, etc), tactical aeromedical evacuation, and special air support. The C-130 aircraft is the usual vehicle performing this mission. MAC's C-141 units do not usually perform this mission but, because they possess tactical capability, they are occasionally used in this role. The C-5 aircraft may, on rare occasions, move some cargo within the theatre. The CRAF is not used for this mission.

3.2.1 Tactical Airlift - Organization. Unlike the strategic airlift mission, MAC does not retain direct control of the tactical airlift forces once the units arrive in the theatre. (However, HQ MAC still has considerable influence because the theatre Commander of Airlift Forces (COMALF) is appointed by the commander of MAC.) The theatre commander-in-chief (CINC) has direct control and tasks the units through the Air Force component commander (e.g., USAFE in Europe). The theatre COMALF, working for the Air Force component commander, does the actual tasking of the tactical units. In

peacetime, MAC controls the tactical units but the tasking and control is delegated by the appropriate MACAF to a MAC Airlift Division (ALD) in the theatre (a small theatre such as Alaska or Panama has a Military Airlift Group). What makes this arrangement work is the fact that the COMALF and ALD commander are the same person. During peacetime he wears his ALD hat and puts on his COMALF hat for exercises and crises. Like the strategic airlift units, the unit's control of the aircraft and aircrews is passed to the theatre COMALF/ALD when they depart the home base (in theatre) and it is not regained until the aircraft and aircrew arrive back at the theatre home base.

3.2.2 Tactical Airlift - Tasking. During exercises and crises, the COMALF receives the cargo tasking from the theatre CINC and converts it into mission tasking for the units. In peacetime, the MAC ALD gets the cargo tasking (in the form of airlift requests) from the Air Force theatre MAJCOM and other services and DoD agencies in the theatre. The ALD staff then converts it into mission tasking for the units. The cargo tasking is tons and passengers to be moved from an origin to a destination.

The tactical airlift units are also tasked by the USAF WMP and unit DOC statements in terms of flying X hours per day per aircraft.

3.2.3 Tactical Airlift - Capability Assessment. The capability assessment process for tactical airlift is the same as strategic airlift. The COMALF/ALD (crisis/peacetime) receives the movement tasking (cargo and passengers) and develops a movement table or mission flow for the units. The mission flow tasking is transmitted to the units as a section of the Air Tasking Order (ATO). Like strategic airlift, the flying units also need cargo onload and offload support. Also like strategic airlift, the capability of theatre tactical airlift appears to be a system capability rather than an aggregation of individual unit capability. However, this observation is not as persuasive as in the case of strategic airlift and more analysis is needed to determine the best way to find the theatre capability for tactical airlift.

3.2.4 Tactical Airlift - AFIRMS Metric. The proposed metric for tactical airlift, as for strategic airlift, is mission. However, sorties have more significance than flying hours in tactical airlift and, therefore, the metric alternatives are reprioritized, i.e., sorties and flying hours. If the estimated flying time is not computed by the mission flow process for the ATO, some computation may be needed to obtain flying hours from the mission tasking. Ton-miles is not considered a viable metric for assessing a tactical airlift capability because, except for the pure airlift mission, the tactical missions are constrained by considerably more than just Allowable Cabin Load (ACL). The advantages of each metric are discussed in Section 3.7.

3.3 Aeromedical Airlift. Aeromedical evacuation is the movement of patients under medical supervision to or between medical treatment facilities by air. When this movement is done within a theatre, it is tactical aeromedical airlift. When the movement is between theatres or within the Continental United States (CONUS), it is strategic aeromedical airlift. Consequently, aeromedical airlift is a task or mission of both strategic and tactical airlift units. The aeromedical airlift mission has been separated from the strategic and tactical airlift missions because MAC (1) has specialized units that perform nothing but the aeromedical airlift mission, and (2) the tasking for these units has different origins and is processed differently than the normal airlift tasking.

This does not imply that the assessment metric will be any different or that AFIRMS will process them any differently. The purpose of separating this mission from the "airlift" umbrella is to focus on their unique differences such as their use of civilian resources and to ensure that aggregated MAC capability assessments can be functionally decomposed, when necessary.

3.3.1 Aeromedical Airlift - Organization and Tasking. The 375th Aeromedical Airlift Wing (AAW) provides C-9A aircraft and crews for medical evacuation by air in the US and overseas. The 375th AAW has squadrons or detachments in each of the overseas theatres and in the CONUS. (The CONUS unit also has an Air

Force Reserve Associate unit that provides augmentation.) During peacetime, the 375th AAW provides almost all of the aeromedical airlift. However, the C-9A capability is only part of the total aeromedical airlift capability available during crisis or contingencies. MAC C-141 and C-130 units are also capable of providing aeromedical airlift.

Inter-theatre movement normally uses the C-141 aircraft; however, when there are special patient needs, the C-9A aircraft may be used. Tactical aeromedical evacuation is normally done by the theatre C-9A and C-130 units; however, C-141 aircraft are often used when long ranges and/or large numbers of patients are involved. Also, depending on the urgency and need during a crisis, the CRAF could even be used to transport patients with less critical wounds (e.g., "walking wounded").

Tactical aeromedical airlift tasking is given to the COMALF by the theatre Joint Medical Regulating Office (JMRO) and the Joint Transportation Board (JTB) during crises (the JTB allocates the airlift assets among the competing theatre agencies needing airlift). In peacetime, the MAC Airlift Division (ALD) gets the tasking from the theatre MAJCOM Surgeon General to move patients for the Air Force and other services and DoD agencies in the theatre. The tasking is then part of the overall tactical airlift mission flow schedule. A theatre Aeromedical Evacuation Control Center (AECC) provides the necessary coordination of medical operations between the medical facilities, the JMRO, the aeromedical evacuation units providing the medical crews for in-flight care, and the airlift units or ALCEs providing the aircraft. Whenever possible, the AECC is collocated with the ALCC.

Strategic aeromedical airlift is coordinated between the theatre JMROs and the CONUS medical authorities (i.e., ASMRO). When approved, HQ MAC/MACAF and COMALF/ALD coordinate the tasking and execution of the mission.

Within the CONUS, the process is similar but with different agencies. The CONUS equivalent to the JMRO called an Armed Services Medical Regulating Office or ASMRO gives the tasking to the MAC Surgeon General and the 375th AAW. The 375th AAW and the AECC then schedule the missions for the C-9 aircraft.

The aeromedical airlift units are also tasked by the USAF WMP and unit DOC statement in terms of flying X hours per day per aircraft.

3.3.2 **Aeromedical Airlift - AFIRMS Metric.** The proposed metric for the aeromedical airlift units is missions. Metric alternatives are flying hours and sorties. Ton-miles is not applicable to aeromedical airlift. The advantages and disadvantages of each metric are discussed in Section 3.7.

Interviews confirmed that mission is the metric of choice. Like the strategic airlift mission, sorties and flying hours are used to describe the missions but were not thought to be an appropriate metric for measuring aeromedical airlift unit readiness/capability. However, they can be used as alternate metrics to maintain commonality within the strategic and tactical airlift missions.

There will be some problems collecting data for the C-9A units. Their spares are provided through contractor support. In addition, one-third of the airports used in the CONUS are civilian airfields. Fuels capability in this environment for the C-9A is not straightforward. Further analysis in the C-9A and aeromedical airlift is needed.

3.4 **Special Operations Forces (SOF).** The Special Operations mission is not a part of the Airlift mission area but, instead, is a separate mission area of its own. Special operations units conduct covert, unconventional, tactical operations against both strategic and tactical targets. They may support conventional operations or they may be used independently when the use of conventional forces are inappropriate or infeasible. In addition, MAC has strategic and tactical airlift aircrews that can, when required, perform some special missions to augment the Special Operations units (e.g., less covert, more conventional tactical missions).

3.4.1 SOF - Organization and Tasking. The Air Force Special Operations Force consists of five active duty and two Air Force Reserve squadrons stationed around the world. Five squadrons are in the CONUS, one squadron is in Europe, and one squadron is in the Pacific. The active duty units are part of the 2nd Air Division, which, in turn, is a subordinate unit of the 23rd AF and HQ MAC. Though HQ MAC and the 23rd AF are responsible for the SOF units in peacetime for training, they do not task them or control them on their operational missions. For contingencies, the CONUS SOF squadrons deploy to the theatre of operations. When in place, all Air Force SOF units are under the operational control of a theatre Joint Unconventional Warfare Task Force (JUWTF) commander reporting directly to the theatre CINC.

In peacetime, their tasking comes from the JCS and other government agencies through HQ MAC and the 23rd AF for the CONUS units or the theatre MAJCOM for the overseas units. Execution of the mission is controlled by the unit and the "customer". During contingencies, the Air Force SOF units are tasked by the JUWTF commander. The tasking is mission oriented and typically can be completed in one sortie. However, that is not always the case as some missions may need more than one sortie.

The Air Force SOF squadrons are tasked by the USAF WMP and unit DOC statement in terms of sorties per aircraft per day, i.e., sortie rates.

3.4.2 SOF - AFIRMS Metric. The proposed metric for the Special Operations units is mission. The alternative metric is sorties. Flying hours are not an alternate metric because it was deemed not appropriate by the special operations personnel interviewed. Ton-miles is not applicable to the Special Operations mission. The advantages and disadvantages of each metric are discussed in Section 3.7.

3.5 Air Rescue and Recovery (ARR) & Weather Reconnaissance. Air Rescue and Recovery and Weather Reconnaissance do not fit into the tactical or strategic mission category. Rather, they are in a "special tasks" category that supports both the strategic and tactical missions. The combat rescue and recovery of downed aircrews during contingencies and peacetime search and rescue are the missions of the ARR squadrons and detachments. Rescue operations are geographically oriented and are often a joint and/or combined operation with other services and/or countries. Multiple units are often involved in an operation and are directed by the area/theatre rescue coordination center. There are three MAC (and one Reserve) squadrons that performs weather reconnaissance of storms and hurricanes or typhoons for the Air Weather Service and aerial sampling as directed by HQ USAF.

3.5.1 ARR and Weather Reconnaissance - Organization and Tasking. Rescue units and Weather Reconnaissance units worldwide are part of the by 23rd AF. The rescue units in the US are tasked by 23rd AF while the overseas rescue squadrons are controlled and tasked by the MAJCOM and the Rescue Coordination Center in each theatre. The weather reconnaissance squadrons are tasked directly by the weather warning centers, i.e., the Global Weather Center at Offutt AFB, the National Hurricane Center in Miami, and the Joint Typhoon Warning Center on Guam. When the mission tasking is received, the unit schedules and generates the sorties to support the mission.

The USAF WMP and unit DOC statement tasking for the rescue and weather reconnaissance squadrons is expressed as sorties per aircraft per day, i.e., sortie rates.

3.5.2 ARR and Weather Reconnaissance - AFIRMS Metric. The proposed metric for the Air Rescue and Weather Reconnaissance units is missions. The alternative metric is sorties. Flying hours is not an alternate metric because it was not favorably received by the personnel interviewed. Ton-miles is not applicable to the Air Rescue or Weather Reconnaissance mission. The advantages and disadvantages of each metric are discussed in Section 3.7.

3.6 **Operational Support Airlift (OSA).** Operational support airlift is the transport of cargo and passengers in support of command or management functions. The primary aircraft used are the C-12, C-21, and C-23. Its purpose is to provide priority airlift for critical small cargo and/or Air Force managers/executives and commanders to airfields where it is not appropriate, feasible, and/or practicable to use larger airlift aircraft such as the C-130 or C-141. The peacetime and wartime mission is the same. OSA excludes the airlift provided by aircraft assigned to attache missions and military advisory groups, and the presidential airlift provided by the 89th Military Airlift Wing (89th MAW).

3.6.1 **OSA - Organization and Tasking.** The organization of the OSA units can be described in one word: fragmented. In the CONUS, the OSA airlift detachments are located at 20+ bases. Overseas, the OSA airlift is similarly dispersed within the theatres. While the OSA detachments are decentralized, the tasking and control is centralized. In fact, the OSA tasking process is very similar to the strategic and tactical airlift tasking process. The airlift requests come to the HQ MAC (in CONUS) or the theatre ALD/COMALF (overseas and Alaska), the missions are flowed/scheduled, and the units generate the aircraft and aircrews for the schedule. (The airlift MACAFs (21st/22nd AFs) are not involved in the CONUS tasking because the OSA units belong to the 375th AAW and, in turn, the 23rd AF.)

The USAF WMP and unit DOC statement tasking for the OSA units is in terms of flying hours per aircraft per day, i.e., "ute" rates.

3.6.2 **OSA - AFIRMS Metric.** The proposed metric for Operational Support Airlift is missions. Metric alternatives are flying hours and sorties. Ton-miles is not applicable to the Operational Support Airlift mission. The advantages and disadvantages of each metric are discussed in Section 3.7.

Further analysis is needed in this area to determine if OSA units should be included in AFIRMS and to determine how (and if) unit capability can be assessed. Some problems that will have to be overcome before the OSA units can be included in AFIRMS are:

a. Many of the C-21 aircraft are contractor leased and supported. Therefore, aircraft spares data may be non-existent.

b. Many of the airfields the OSA aircraft land at are civilian airports. Thus, the fuels capability for the OSA detachments is to be determined.

3.7 **The Metrics for MAC AFIRMS.** Four metrics are evaluated in this report: Missions, sorties, flying hours, and ton-miles. The advantages and disadvantages of each are discussed below. In reading those pros and cons, please keep in mind the type of capability being measured and the AFIRMS approach to capability measurement both of which are discussed in Section 2. Appendix A expands on some of the issues in determining the metrics or units of measure.

An overwhelming majority of personnel interviewed chose missions as the preferred metric. In addition, the mission metric was the only metric that had MAC-wide and, possibly, Air Force-wide application. Sorties was a close choice for the tactical missions while flying hours was the preferred second choice for the non-tactical missions. However, sorties could not be used in all tasking scenarios. Flying hours could be used in all scenarios but it was a poor third choice in the tactical area and even in the non-tactical areas it rated only a distant second. Ton-miles as a metric had a few advocates in HQ MAC/XO and XP for planning, programming, and budgeting purposes. Ton-miles also had the advantage of being used in the Defense Secretary's Defense Guidance (DG) and within Congress when discussing strategic airlift. However, even the MAC/XO and XP interviewees did not see ton-miles as a useful metric for unit level capability assessments. Ton-miles appeared to be useful only as a HQ MAC budgeting and programming metric.

3.7.1 Definition of the Metrics.

a. Mission. A mission is the dispatching of one or more aircraft to accomplish one particular task. An aircraft dispatched on a mission may fly one or more sorties; each sortie may be one or more hours long. MAC has defined an airlift mission to include those sorties (and flying hours) needed to send an aircraft to the first onload base (if applicable), thence to the last offload base, and, finally, to the next onload base or return to home base.

b. Sortie. An operational flight by one aircraft.

c. Flying Hour. One hour of flight by a single aircraft.

d. Ton-mile. A ton-mile is the movement of a short ton (i.e., 2000 pounds) of cargo and/or passengers one nautical mile between an origin and a destination. For example, a C-141 mission airlifting 20 tons of cargo between onload base Y and offload base Z,with a enroute distance of 1000 nautical miles, has provided 20,000 ton-miles of airlift. The enroute distance includes only the distance between base Y and base Z.

3.7.2 The Mission Metric.

Missions advantages:

a. The units are scheduled/tasked by missions. Thus, it can be directly obtained from the unit mission tasking.

b. It is an output of the flying unit.

c. The positioning/depositioning sorties and/or flying hours are included in the mission.

d. It is a common term, well understood by all Air Force users. It is a clear concept for expressing unit readiness/capability assessments.

e. If accepted, it would be the only common, MAC-wide metric.

f. After modification to the LPP AFIRMS algorithms, it will be common with the fighter metrics.

g. It can be used fairly easily for making gross feasibility estimates with cargo tasking requirements.

h. It is compatible with the AFIRMS and the Air Force Mission Area Analysis (MAA) approach to capability measurement, i.e., unit level assessments and aggregation for command level assessments.

i. Mission is the preferred metric of the MAC interviews.

Missions disadvantages:

a. It is not a USAF War Mobilization Plan (WMP) or unit Designed Operational Capability (DOC) statement tasking metric.

b. It is not a metric used by the Defense Guidance (DG) or Congress for programming or budgeting for airlift.

3.7.3 The Sortie Metric.

Sortie advantages:

a. The units are scheduled/tasked by missions. Thus, sorties can be directly obtained from the unit mission tasking.

b. It is a USAF WMP and unit DOC statement tasking metric for Rescue, Weather Reconnaissance, and Special Operations units.

c. It is an output of the flying unit.

d. The positioning/depositioning sorties are included in the mission.

e. It is a common term, well understood by all Air Force users. It is a clear concept for expressing unit readiness/capability assessments.

f. It is compatible with the tactical fighter metrics.

g. It is compatible with the AFIRMS and the Air Force MAA approach to capability measurement, i.e., unit level assessments and aggregation for command level assessments.

Sorties disadvantages:

a. It would not be a MAC-wide metric.

b. It is not obtained from the cargo requirements tasking without generating a mission flow and, thus, is not usable for making airlift feasibility estimates.

c. It is not a metric used by the DG or Congress for programming or budgeting for airlift.

3.7.4 The Flying Hour Metric.

Flying hour advantages:

a. The units are scheduled/tasked by missions. Thus, flying hours can be directly obtained from the unit airlift mission tasking. (This may apply only to the strategic airlift mission schedule.)

b. It is a USAF WMP and unit DOC statement tasking metric for Strategic Airlift, Tactical Airlift, Aeromedical Airlift, and Operational Support Airlift units.

c. It is an output of the flying unit.

d. The positioning/depositioning flying hours are included in the strategic airlift mission (though likely,it is not known if the flying hours are included in the tactical airlift mission tasking).

e. It is a common term, well understood by all Air Force users. It is an acceptable concept for expressing unit readiness/capability assessments.

f. It is compatible with the AFIRMS and the Air Force MAA approach to capability measurement, i.e., unit level assessments and aggregation for command level assessments.

g. It is a metric used by the DG and the Congress for the programming or budgeting for other than strategic airlift capability.

h. Flying hours is used to compute the resource usage.

Flying hours disadvantages:

a. It would not be a MAC-wide metric.

b. It is not obtained from the cargo requirements tasking without generating a mission flow and, thus, is not usable for making airlift feasibility estimates.

c. It is not compatible with the tactical fighter metrics.

3.7.5 The Ton-mile Metric.

Ton-mile advantages:

a. It is easily computed from the cargo requirements tasking and, thus, is used for making airlift feasibility estimates.

b. It is the metric used by the DG and the Congress for the programming or budgeting for strategic airlift capability.

c. It is the metric currently used by the joint planning community to express the strategic airlift system requirement and capability. (However, neither the HQ MAC planners nor the operations people used the term during the interviews to describe a mission or a unit's capability.)

d. It is the metric recommended by the MAC Capability Assessment System Study Report (see reference c in Section 1.4).

Ton-mile disadvantages:

a. Units can not be tasked in ton-miles.

b. It is not a USAF WMP and unit DOC statement tasking metric for any units.

c. It can not be a MAC-wide metric. Ton-miles is only applicable to the Strategic Airlift and part of the Tactical Airlift missions.

d. It is not an output of the flying unit. A unit generates missions, sorties, and flying hours on which some cargo may or may not be carried.

e. The airlift positioning/depositioning sorties and flying hours are not included the ton-mile computations.

f. It is a common term, well understood by all MAC users (but not all Air Force users). In spite of this, it is still an ambiguous metric for expressing unit readiness/capability assessments.

g. It can not be made compatible with the tactical fighter metrics.

h. It is not compatible with the AFIRMS and the Air Force MAA approach to capability measurement, i.e., unit level assessments and aggregation for command level assessments.

i. It was the last metric choice of the people interviewed.

SECTION 4. SUMMARY

In conclusion, the recommended readiness/capability assessment metric for the MAC unit mission tasks of strategic, tactical, aeromedical, and operational support airlift, special operations, air rescue and recovery, and weather reconnaissance is mission. In addition, sorties and flying hours are recommended as alternate metrics to use as HQ MAC and HQ USAF may need them in readiness assessments and dollars-to-readiness exercises. (For example, flying hours may be needed as a pricing mechanism for the dollars-to-readiness function of AFIRMS.) The use of ton-miles as a metric seems to be applicable only as a HQ MAC budget planning and programming aid. Ton-miles is not a viable unit capability assessment metric nor is it usable as a dollars-to-readiness budgeting metric.

The metrics alternatives for each mission task and the advantages and disadvantages of each metric are summarized below in Table 4-1 and Table 4-2, respectively.

Table 4-1

RECOMMENDED METRICS BY MISSION TASK

MISSION TASK	PRIMARY METRIC	METRIC ALTERNATIVES		
		1ST	2ND	3RD
Strategic Airlift	Missions	Flying Hours	Sorties	Ton-miles
Tactical Airlift	Missions	Sorties	Flying Hours	-
Aeromedical Airlift	Missions	Flying Hours	Sorties	-
Special Operations	Missions	Sorties	-	-
Air Rescue/Wx Recce	Missions	Sorties	-	-
Operational Support Airlift	Missions	Flying Hours	Sorties	-

Table 4-2

METRIC ADVANTAGES AND DISADVANTAGES MATRIX

Advantages/Disadvantages	Mission	Sortie	Flying Hour	Ton-Mile
Advantages				
A unit tasking or scheduling metric	X	X	X	
Obtained directly from unit tasking	X	X	X	
A WMP/DOC tasking metric		X	X	
An output of the Air Force unit	X	X	X	
Usable for feasibility estimates	X			X
Includes mission position/deposition	X	X	X	
A very common term understood and used by all Air Force users	X	X	X	
A clear concept for expressing readiness/capability assessments	X	X	X	
Preferred metric by the interviewers	X			
Has commonality with fighter metrics	X	X	X	
Would have commonality MAC-wide	X			
Used to compute resource usage			X	
Used in DG and Air Force budget			X	X
Compatible with unit level assessment	X	X	X	
Currently used as an airlift metric				X
Recommended metric by MAC study				X
Disadvantages				
Can not be used to task units				X
Not a WMP/DOC tasking metric	X			X
Would not have commonality MAC-wide		X	X	X
Not a direct output of Air Force unit				X
Not usable for feasibility estimates		X	X	
Omits mission position/deposition				X
Not understood by all Air Force users				X
An ambiguous concept for expressing readiness/capability assessments				X
Not compatible with fighter metrics			X	X
Not usable for unit level assessment				X
Least preferred metric of interviews				X
Not a DG/budget term	X	X		

A. ISSUES IN DETERMINING THE UNITS OF MEASURE.

A.1 Identifying Units of Measure. We narrowed the topic of defining the AFIRMS metric in Section 2 by noting that it must include the tasking under which the assessment occurs and by excluding factors beyond the initial launch of the aircraft. This leaves issues about the unit of measure itself. These issues include:

- Presentation of the result
- Translation from one unit of measure to another
- Levels of detail
- The use of multiple units of measure.

Each of these issues will be addressed in turn. By way of illustration, we will consistently refer to the choice of sorties as a metric made for United States Air Forces Europe (USAFE) fighter and reconnaissance units.

A.2 Presentation of the Result. For simplicity of expression, AFIRMS has presented its assessments for USAFE in terms of sorties for readiness and in terms of a graphic multi-day plot of sorties for sustainability. Two issues related to this approach have so far been set aside in favor of more critical matters. At some future time, these deferred issues will need consideration. The two issues are:

a. The results, especially when dealing with a large force, vary with Force Structure. This variation may require that the results be normalized to a fixed Force Structure in the future. That possibility has not been addressed in USAFE, and will not be addressed here. Final resolution of this question will require human engineering based on more data than is now available.

b. The graphic presentation of sustainability does not provide a clear method for supporting two of the extended functions of the capability assessment carried out by AFIRMS. The extended functions are:

   (1) Decision support -- if the computer is asked to provide decision support by evaluating alternative what-if actions, it must have a clear numeric standard to evaluate. The computer cannot provide an evaluation based on the appearance of a graphic presentation;

(2) Plots showing changes in sustainability over time -- the plots of sustainability are already over time (e.g., the time from day 0 to day 30) and now another time (the calendar day on which day 0 occurs) must be shown as well.

To visualize the problem, it might help the reader to first imagine some plot over time such as that of pulse rate for each of the first 30 minutes after starting to exercise.. Now add a plot of the same thing for a test conducted a week later (perhaps using color to distinguish the weeks). The point being illustrated will be clearer if the lines cross a few times. Figure A-1 illustrates a sample result using a dashed line for the test in the second week. But now if we continue to add more lines to distinguish the weeks, the results will be illegible.

It is difficult to describe or imagine a plot in which the line drawn for any one week can be clearly distinguished from, or compared to, the line for the preceding and following weeks. (A possible exception is a three dimensional graphic in which there is relatively steady change in one direction. But that is a condition on which the system designer cannot depend, even if adequate graphics are available.

Again, the best approach in these areas has yet to be humanly engineered. One suggested approach for sustainability is to simply get the sum of all sorties flown in the period. Since that is a single number plots of progress over time are no problem at all. Other single number answers are possible.

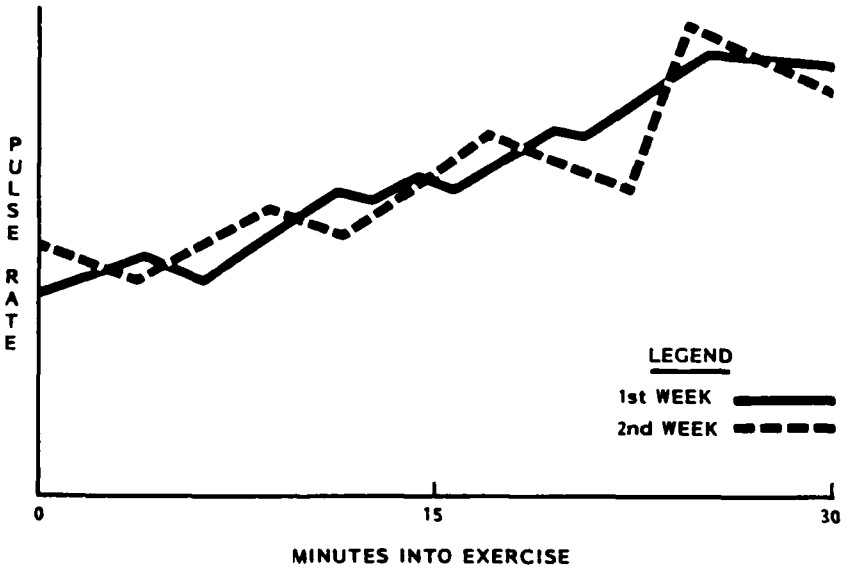

Figure A-1. Tracking Changes in Sustainability

These issues are considered to establish a complete background. The issues are relevant to the current studies in two ways:

a. The capability assessment for MAC airlift units may not be compatible with the USAFE fighter unit capability assessment. For example, USAFE fighter aircraft normally fly their sorties for the same base and operate as part of the same wing throughout any task. On the other hand, MAC airlift aircraft normally fly most of their sorties from other bases and are not controlled by the owning wing when away from home base. Thus, most of the airlift units sorties are supported by several wings.

b. The compatibility of multiple units of measure (e.g., sorties and ton-miles) displayed on the same screen is questionable. Further, even if the unit of measure were common to bombers, fighters, and airlift units, would the combined display of fighter, airlift, and bomber sorties still be meaningful? (AFIRMS has already confirmed that displaying capability assessments for many different fighter and reconnaissance aircraft with multiple missions is meaningful, e.g., an F-4 sortie is compatible with an F-111 sortie.)

Both within MAJCOMs and over multiple MAJCOMs, careful consideration is needed to establish how (if at all) sorties can be combined with ton-miles -- or other types of sorties. In addition, equal consideration must be given to the use of normalized units of measure with non-normalized units of measure.

A.3 Translation From One Unit of Measure to Another. Whatever unit of measure is chosen, there are likely to be other units of measure into which it can be converted. This would occur by either:

- Measuring the resources needed to achieve the measured result (to a logistician, a sortie may look like a requirement for a given supply of fuel and munitions);
- Summing an element of the mission such as the sorties or flying hours needed to complete the mission;
- Multiplying two elements of the mission such as the tonnage carried time the distance traveled, i.e., ton-miles. (The distance traveled may be longer than the distance between cargo onload and offload. In other words, the distance traveled may also include the distance traveled by the aircraft to go to the cargo onload point and to go from the cargo offload to the next onload point or home station.)

Selecting a single metric is not to disparage any of the others. The objective is to find a metric from which many users can readily calculate the figure with which they work.

A.4 Levels of Detail. On a scale from infinitesimal detail to sweeping generalization, there is a level of detail appropriate to each level of command. Since more detailed data can often be summed to obtain the more general view, there is no need for all levels of command to use identical metrics. The only requirements are that:

- Aggregation from one level to another must be feasible.
- Each level should have a detail appropriate to its needs.

A.5 Multiple Units of Measure -- The Problem of Obtaining an Overview. If, as seems probable, multiple metrics are adopted, the problem of providing a simple overview of capability my arise. References to the percent of Air Force units which are C-rated as C1 or C2 conceal the differences in mission of combat wings, medical units, and logistics units. Where the issue is one of detail, adding one kind of tactical fighter sortie to another, most observers will find acceptance easy. Adding fighter sorties to airlift ton-miles may not be so acceptable.

One answer is simply to say that the addition will not happen. Another is to convert all metrics to the equivalent of C1 or C2 and continue as though no mixing were occurring. Still a third is to assign a weight to different metrics. The problem is likely to have the greatest impact when the metrics are used outside the Air Force. Air Force personnel can recognize and assess a mix of metrics, but Congress and the Executive Branch may want to answer questions such as "dollars to readiness" in a way which allows one number to stand for readiness.

The answer to this question can be and has been deferred. The existence of the question argues, however, for seeking to generalize the choice of metric wherever possible rather than to try to carefully split hairs.

END

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