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DOE G 440.2B-1A
9-19-05

IMPLEMENTATION GUIDE AVIATION PROGRAM PERFORMANCE INDICATORS (METRICS)

for use with

DOE O 440.2B, *Aviation Management and Safety*

[This Guide describes suggested nonmandatory approaches for meeting requirements. Guides are not requirements documents and may not be construed as requirements in any audit or appraisal for compliance with the parent Policy, Order, Notice, or Manual.]

U.S. Department of Energy
Washington, D.C. 20585

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INITIATED BY:
Office of Aviation Management/OMBE/CFO

FOREWORD

This Department of Energy (DOE) Aviation Program performance indicators interim guide is approved by the Office of Aviation Management (OAM) and is available for use by all DOE and National Nuclear Security Administration (NNSA) organizations and contractors. This interim guide is applicable to DOE O 440.2B, *Aviation Management and Safety*, dated 11-27-02.

Recommendations for changes, additions, or deletions should be submitted using DOE F 1300.3 (Attachment A) or by letter to:

Director, Office of Aviation Management
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585

This Guide provides information regarding the expectations of the Department on specific provisions of DOE O 440.2B. It identifies acceptable methods of implementing certain requirements of the Order regarding Aviation Program performance indicators (metrics). It identifies relevant principles and practices by referencing Government and non-Government standards. The discussions on methods and approaches and other information are intended to be useful in understanding and implementing performance indicators (metrics) required by the Order.

The use of this Guide will facilitate consistency in implementing the Order and help ensure that all of the Aviation Program performance indicator (metrics) provisions of the Order are addressed. This Guide will not supersede any requirements of the Order.

The statements in this Guide are not substitutes for requirements. If a statement or provision from this Guide is explicit in a contract or a plan required by a DOE rule, an enforceable obligation is created by those documents. Additionally, implementation plans that reference a procedure as the intended methodology to accomplish an action cause the referenced parts to become mandatory.

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1.0 INTRODUCTION

1.1 Background

OAM determined in 1999 that DOE/NNSA Aviation Program managers needed to develop and implement a system of performance measures or Indicators. These performance indicators provide managers a structured approach to understanding and measuring key processes for providing airworthy and safe aircraft, qualified and current flight and mission crews, and mission essential equipment that is ready to meet assigned program requirements. Indicators highlight processes that are not functioning optimally and identify where management attention is required.

In the end, performance indicators provide managers with quantifiable information to use as a basis for management decisions. After conducting studies and reviews of the DOE/NNSA aviation program and data systems deployed in the field, it was determined that the Department captured data but did not have an effective process to turn the data into information useful to managers. Working with the field elements, a working group developed a core set of performance indicators (metrics) for implementation at each site. In addition, it was determined that most of the existing data systems or records kept by the aviation managers (AvMs)and the contract organizations could be utilized to implement the performance indicators. This guidance document will assist field elements in implementing the Aviation Program performance indicators.

What is a performance indicator?

Simply stated, a performance indicator is a value or process to measure output and outcome, or, with respect to a goal, course and tempo. The purpose of performance indicators is to provide AvMs with a tool for improving the effectiveness and efficiency of the processes involved with safely delivering aircraft services. In addition, performance measurement can provide “leading indicators” so that actions can be taken early on in any one of the work processes to improve the product and provide information needed by senior managers to support aviation program goals. Performance indicators will also provide the OAM information necessary to promote and support aviation program goals throughout DOE and NNSA.

1.2 Characteristics of Good Indicators

Good indicators measure only what is important and focus only on key information that is of real value for managing production quality, quantity, timing, and cost, such as inputs, processes, and outputs.

Good indicators must be quantitative and be a measure that can be expressed as an objective value such as

- cardinal, ordinal, ratio;
- state, condition, rate, and trend.

A quantitative measure for DOE will be *operations scheduling effectiveness* (paragraph 3.0). Aviation Program performance indicators in this document are defined, and mutually understood, and agreed to by those involved in the processes being measured. Examples are:

- **Quantitative.** Supply response time (SRT) begins when a requisition document is date/time stamped by the aircraft supply clerk or procurement official and ends when the part is issued to maintenance personnel.

- **Defined and Mutually Understood.** Departure deviation is when actual departure time is 15 minutes or more from the published departure time. The measure conveys at a glance what it is measuring and how it is derived, which is the goal for all of the Aviation Program performance indicators.

- **Customer Wait Time and "What Does It Mean?" Concept.** During the development of DOE/NNSA Aviation Program performance indicators, senior managers agreed that new measures must be developed to reflect the time from order to receipt when customer requirements are satisfied. The process was based on the Department of Defense (DoD) concept of customer wait time (CWT), which was incorporated, wherever practical, throughout the DOE-NNSA performance indicators, such as mean time to repair, mean supply response time, etc.

Good indicators must encourage appropriate behavior, reward productive behavior, and discourage game playing; use economies of effort; and result in benefits that outweigh collection and analysis costs. Whenever possible, performance indicators should use existing data, employ a one-time entry of data, and be integrated with work processes.

Effective performance indicators facilitate trust and validate the participation of diverse organizations, and unlike a horse race, provide a management process for a common commitment to continuous improvement. The hallmark of DOE Aviation Program performance indicators is systematic identification and measurement of key processes that lead to the production of the ultimate product—an aircraft with flight and mission crew and equipment/proper configuration available to meet program missions. Implementing Aviation Program performance indicators provides managers at all levels quantifiable information to be used for decision making.

2.0 OVERVIEW

2.1 Defining the Product

What is DOE/NNSA's aviation product? It is readily available, safe, reliable, efficient aviation services. The Department will deliver airworthy aircraft operated by qualified flight and mission crews, configured and equipped for the mission (if applicable) and operationally ready to meet customer needs.

2.2 Processes

To deliver this product within the goals established by each field element requires

- dedicated, trained, proficient pilots, mechanics, and mission crews;
- logistics and/or procurement personnel able to execute purchases and contracts that keep parts and components flowing in a timely manner to support the pace of flight operations for each field element;
- effective planning, scheduling, and coordination between customers, service providers, flight and mission crews; and
- maintenance support essential to delivering services efficiently.

2.3 Calculating Assigned Hours

Most of the core indicators in this Guide are based on *assigned hours* measured monthly, quarterly, or annually by aircraft model and by total aircraft (fleet). For example:

- Measuring by aircraft:

  May—31 days × 24 hours × 1 (B-200) = 744 assigned hours

- Measuring by fleet:

  May—31 days × 24 hours × 7 (total aircraft) = 5208 assigned hours

NOTE: By using assigned hours throughout the Department, each organization's mission capable rate and aircraft availability rate will be based on the same formula, which provides consistency in the data.

2.4 Calculating Utilization

Utilization is calculated by three methods:

- total flight hours;
- flight hours and alert ground time combined; or
- flight hours and research and development (R&D) ground time combined.

Because of their missions, most DOE aviation operations use as a measure of efficiency total flight hours per year for calculating and reporting *cost per flight hour*. For unique operations that have dedicated aircraft and crews assigned to a 24/7 emergency response mission or operations engaged in R&D, however, total utilization (a combination of flight hours with alert or R&D ground hours) should be used to communicate efficiency.

Alert and R&D aircraft have two things in common:

- Aircraft generally fly much less per year.
- Operational and maintenance costs are generally much higher than flight operations not having these requirements.

Alert aircraft generally require additional pilots and greater expenditures in maintenance to ensure aircraft availability or drive a requirement for additional aircraft to be on-hand as back-up.

R&D aircraft may be airworthy but unavailable while sensors or other specialized equipment is installed and tested prior to any actual flying. Studies have shown that dedicated research aircraft will be configured with mission equipment (ME) and made ready for research operations for only 3 to 5 months each year. The rest of the time the aircraft is being configured for sensors, test equipment, or other research equipment or the installed equipment is undergoing testing, calibration, installation and removal, configuration, etc. As a result, the aircraft will achieve, on average, only about 150 to 250 flight hours per year but will have been dedicated to R&D activities for many more hours.

All of the aforementioned uses raise operations costs substantially as compared to normal flight operations that do not have these missions. Therefore, to properly track and report the total utilization and determine costs, the following definitions will be used:

- **Alert aircraft:** Federal or commercial aircraft under contract to the Government, configured and equipped to meet on-call, alert response (primary mission) requirements 24 hours a day, seven days a week, 365 days a year or aircraft designated by the program manager for an *alert mission* for a minimum of 24 hours. (Alert aircraft are normally assigned to emergency response missions such as firefighting, radiological and chemical response aircraft, transportation of national security response teams, facility security patrols, facility response team transportation, etc. In addition, these programs may require the aircraft to dispatch during night time and/or under instrument meteorological conditions.)
- **Alert utilization ground time:** Hours and parts thereof (measured in tenths) when an alert aircraft is:
    - Airworthy and configured for the primary mission (including the additional ME that must be operable) and not being utilized to meet other program needs.
    - The assigned flight crew and mission crew, if applicable, are readily available for deployment from a designated site to meet Federal program requirements.

- **R&D aircraft:** Federal or commercial aircraft under contract to the Government for the primary mission of supporting scientific, aeronautical, or environmental research programs (does not include personnel transport).

- **R&D utilization ground time:** Hours (and tenths of an hour) when an R&D aircraft is—

  - undergoing configuration,

  - configured with project equipment and undergoing ground operational checks such as project equipment calibration, and system tuning.

NOTE: For the sole purpose of determining if it qualifies to report R&D utilization, the aircraft—

- must be intended for use of the research project,

- is not being utilized to meet other program needs, and

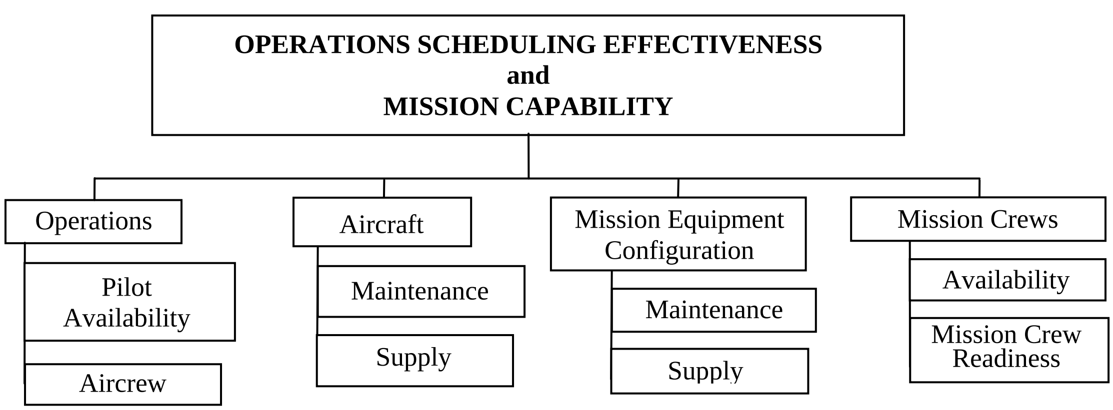
- is undergoing only the maintenance (including inspection), modification, testing, calibration or alteration associated with R&D project.

- **Total aircraft utilization time:** Hours (and tenths of an hour) when a Government aircraft has been employed in a ground and/or flight capacity (e.g., R&D or alert ground utilization plus flight time). NOTE: Total possible hours in any given day are 24 hours and in any given year are 8,760 hours for each aircraft.

2.5 Aviation Work Process Framework

The following chart depicts the framework of the work processes that must be measured to determine the effectiveness and efficiency of an aviation organization. From this framework the next chapters will define the indicators within each of these groups and provide information about each of the processes.

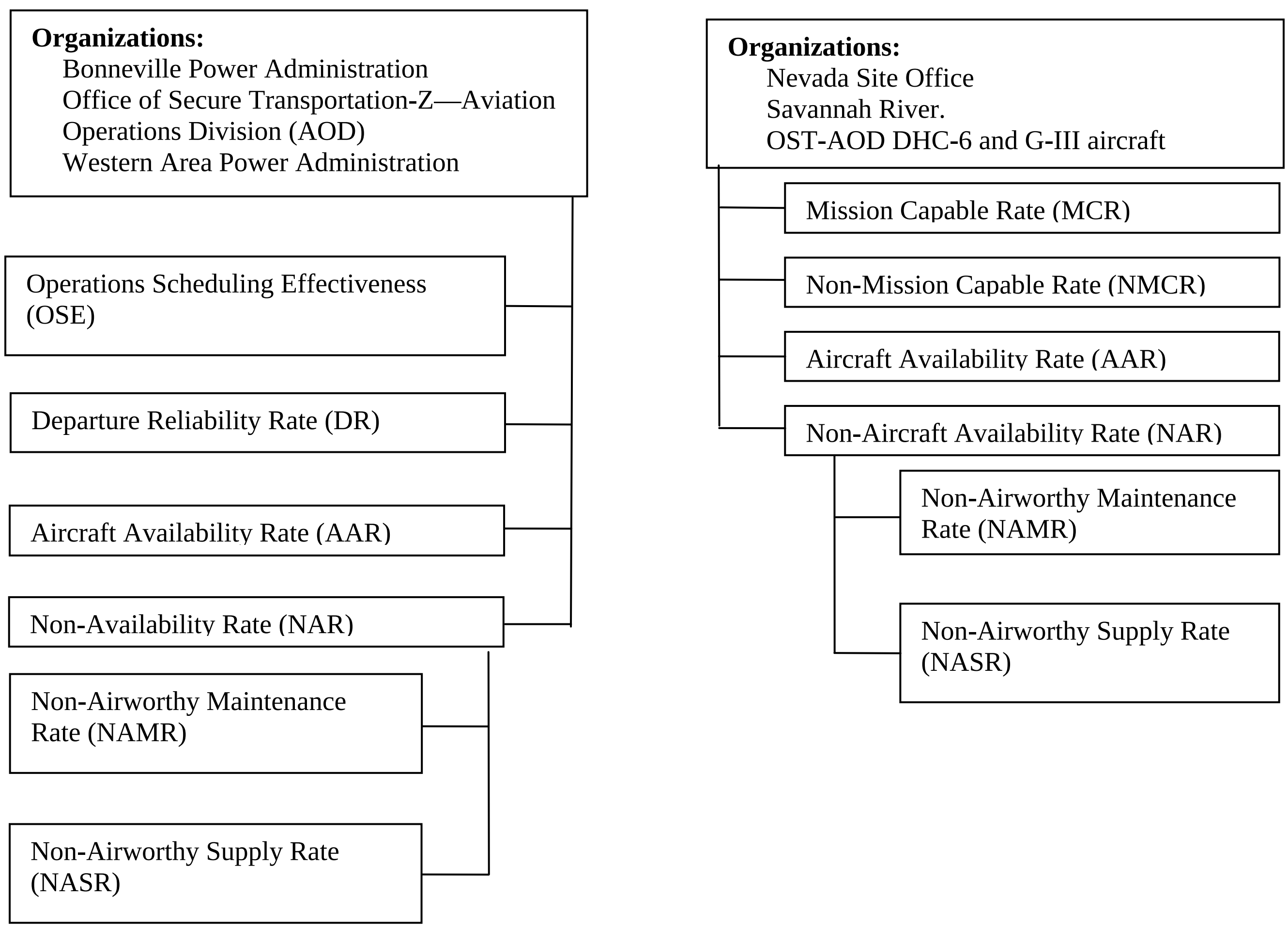
WORK PROCESS FRAMEWORK



2.6 Core Aviation Operations and Maintenance Performance Indicators Matrix

As discussed earlier in the Guide, DOE's aviation program is diverse with organizations owning from two aircraft to as many as seven aircraft. The program requirements for each organization are also diverse from a 24/7 rapid response to on-call as needed. Therefore, performance indicators applicable to one site may not be an effective measure for another. The following matrix indicates the core performance indicator by site.

CORE AVIATION PROGRAM PERFORMANCE INDICATORS BY SITE



3.0 CORE AVIATION OPERATIONS PERFORMANCE INDICATORS

3.1 Performance Indicators

DOE/NNSA aviation operations are diverse in terms of complexity of missions and types of aircraft used. Factors affecting performance are both within and outside the AvM's control. The following terms and indicators were developed to identify areas in which the AvM can measure the performance of the processes under the control of the AvM.

Performance Indicator: ***Operations Scheduling Effectiveness (OSE)****—the core performance indicator for the Power Marketing Administrations and Office of Secure Transportation (OST) aircraft operations combined with departure reliability rates.*

Definition: The number of scheduled missions accomplished divided by the number of missions scheduled multiplied by 100.

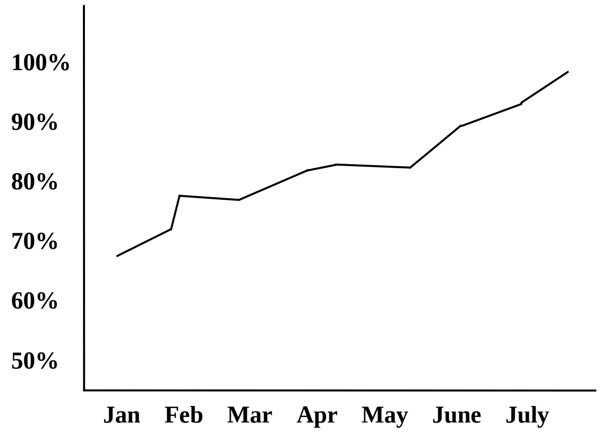
Goals: Site specific goals should be to increase the OSE, and the trend should be upward over time.

Data Location: Data records may be found at the AvM's office, central scheduling office, contractor's operations office or dispatch organization.

Factors that Effect the Measure: Weather cancellations, pilot availability, customer cancellations, aircraft availability, maintenance, etc.

OPERATIONS SCHEDULING EFFECTIVENESS EXAMPLE

$$\frac{950 \text{ (flights accomplished)}}{1000 \text{ (scheduled)}} = .95 \times 100 = 95\% \text{ OSE}$$



Performance Indicator: ***Departure (Dispatch) Reliability (DR)***—*primarily a core performance indicator for the Power Marketing Administrations and Office of Secure Transportation aircraft operations, but may be used by other organizations.*

Definition: The difference between the total departure times per the planned schedule and the actual departure times. Divide the on-time departures by the total departures.

Thresholds: Any flight delayed by more than 15 minutes from planned departure time.

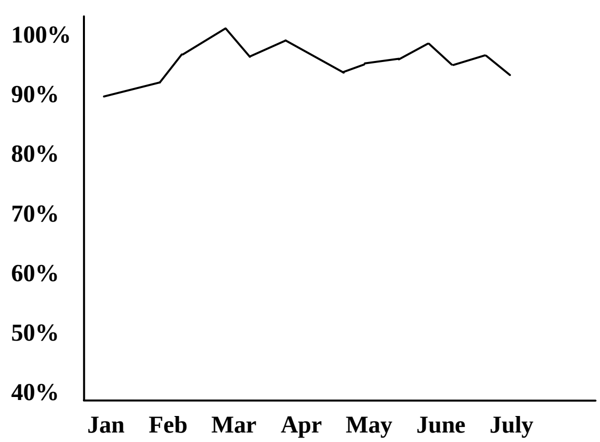
Goals: Site specific goals should be to increase the DR and the trend should be upward over time.

Data Location: Data records may be found at the AvM's office, central scheduling office, contractor's operations office, or contractor's dispatch organization.

Factors that Effect the Measure: Weather cancellations, customer cancellations, aircraft availability, maintenance, air traffic control delays, etc.

DEPARTURE (DISPATCH) RELIABILITY EXAMPLE

$$\frac{1750 \text{ (on-time)}}{2100 \text{ (total departures)}} = \times\ 100 = 83\%\ \text{DR}$$



2001 – DR Trend

Term: ***Mission Capable (MC)—****primarily applicable to security and emergency response missions.*

Definition: An airworthy aircraft with a readily available flight crew and mission crew, with operable mission essential equipment, if applicable, to meet the mission requirements.

Thresholds: MC time does not include non-mission capable hours. NMC hours include aircraft non-available hours (NAH) [maintenance downtime and supply downtime], flight crew non-availability (FCNA), mission crew non-availability (MCNA), mission essential equipment maintenance downtime-, and mission essential equipment supply downtime-.

Data Location: Data records may be found at the AvM's office, maintenance manager's or contractor's operations office, chief pilot records, mission scientist or mission crew records, maintenance records, or contractor's dispatch organization.

Factors that Effect the Product: Aircraft reliability, mission essential equipment reliability, logistics (supply), training schedules of flight and mission crews, maintenance, availability of personnel, etc.

Term: ***Non-Mission Capable (NMC)—****primarily applicable to security and emergency response missions.*

Definition: Any time the aircraft can not meet its mission requirements due to aircraft non-availability (maintenance downtime and supply downtime), -FCNA, -MCNA, mission essential equipment maintenance downtime-, and mission essential equipment supply downtime-.

Thresholds: The clock starts when management or dispatch becomes aware the aircraft is non-mission capable until the aircraft is returned to mission capable aircraft status.

Data Location: Data records may be found at the AvM's office, maintenance manager's or contractor's operations office, chief pilot records, mission scientist or mission crew records, maintenance records, or contractor's dispatch organization.

Factors that Effect the Product: Aircraft reliability, mission essential equipment reliability, logistics (supply), training schedules of flight and mission crews, maintenance, availability of personnel, etc.

Performance Indicator: ***Mission Capable Rate (MCR)—****core indicator for security and emergency response missions, primarily.*

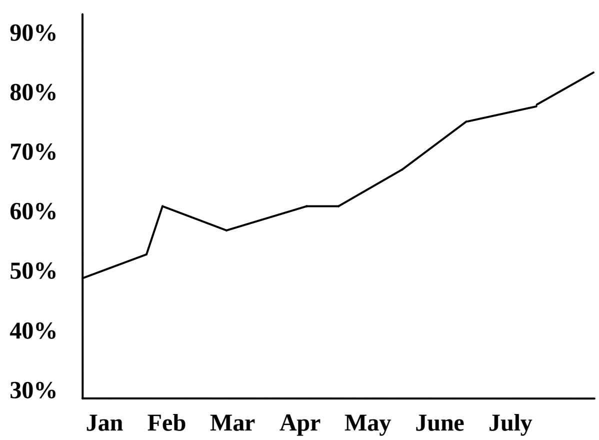
Definition: The proportion of assigned hours an aircraft is mission capable, measured in hours, to meet its mission requirements over a defined period of time (assigned hours) divided by total assigned hours × 100.

Goals: Site specific goals should be to increase the MCR by as much as economically possible and the trend should be upward over time.

$$\frac{\text{total mission capable hours}}{\text{total assigned hours}} \times 100 = \text{MCR}$$

2726 (TMC) hours/ 2976 (assigned) hours = × 100 = 91.5% MCR

(31 days × 24 hours × 4 (fleet) = 2976 (total assigned hours)



MCR Trend

Performance Indicator: ***Non-Mission Capable Rate (NMCR)****—core indicator for security and emergency response missions, primarily.*

Definition: The proportion of assigned hours an aircraft is non-mission capable to meet its mission requirements.

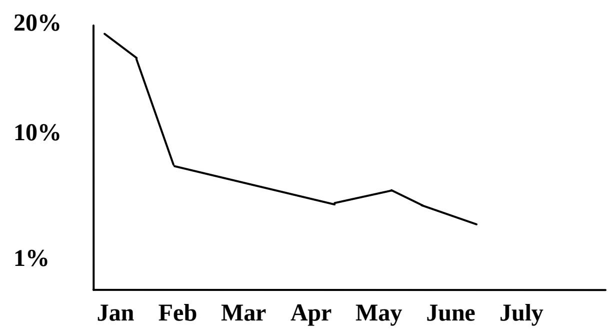
Goals: Site specific goals should be to reduce the NMCR by as much as economically possible and the trend should be downward over time.

Data Location: Data records may be found at the AvM's office, operations, maintenance manager’s or contractor's operations office, maintenance records, or contractor's dispatch organization.

Factors that Effect the Measure: Age of the aircraft, availability of parts, manufacturer defects, lack of qualified maintenance or inspection personnel, operational pace too high, poor maintenance scheduling, insufficient mission or flight personnel, etc.

NOTE: The AvM’s focus will be on the organization’s processes impacting the NMCR. What portion of the NMCR is due to scheduling, pilot availability, aircraft availability, mission crew availability, or mission essential equipment availability? Is the NMCR rate due to aircraft reliability of a particular system or operational factors? If the NMCR continues to escalate then the AvM will need to use the tools in the following sections and chapters to determine what corrective actions are necessary to reduce the NMCR.

$$\frac{\text{total non-mission capable hours}}{\text{total assigned hours}} \times 100 = \text{NMCR}$$



2001 NMCR Trend

3.2 Aviation Management Tool Kit for Troubleshooting Core Aviation Operation Performance Indicators.

The following paragraphs describe additional tools an AvM can use to troubleshoot the operational work processes, if NMCRs exceed organizational goals or Operational Scheduling Effectiveness Rates decrease. However, each organization will need to have information systems that can capture the data necessary to use the tools described in this section effectively. Without the proper data, troubleshooting the processes that affect the core operational rates will be difficult or impossible to accomplish.

Performance Indicator: ***Pilot Availability Rate****—key troubleshooting tool for diagnosing OSE rates and NMC rates.*

Definition: The percentage of time that the minimum required number of qualified and current pilots is available to meet defined (primary) mission requirements.

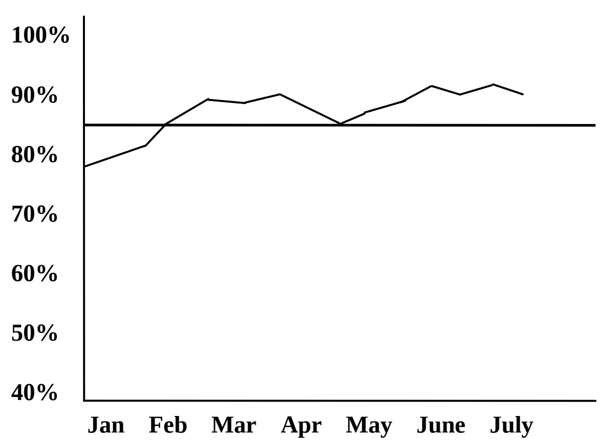
Goals: Site specific goals should be to maintain the pilot availability to meet primary and secondary mission needs, while controlling payroll costs.

Data Location: Data records may be found at the AvM's office, chief pilot's office, training office, contractor's operations office, pilot's records, or contractor's dispatch organization.

Factors that Effect the Measure: Vacation time, vacancies, duty-time limitations, sickness, operational pace, etc.

$$\frac{\text{12 pilots available}}{\text{15 pilots (\# of pilots employed)}} \times 100 = 80\% \text{ pilot availability for June 1, 2002}$$

PILOT AVAILABILITY RATE EXAMPLE



2001 PAR Trend

NOTE: The horizontal bar in the graph depicts the minimum percentage of available pilots required to meet mission requirements. To use this tool properly, statistical analysis of pilot requirements must be accomplished, see Appendix D.

Performance Indicator: ***Pilot Readiness-Proficiency (PRP)****—key troubleshooting tool for diagnosing pilot availability rates.*

Definition: To determine a PRP rate for an individual pilot, the number of required proficiency activities accomplished divided by the number of proficiency activities required. An alternative to a calculating a PRP rate would be to chart whether the pilot is on track to meet the proficiency goals, which gives the manager a visual cue to determine if a pilot is on track to meet organizational goals.

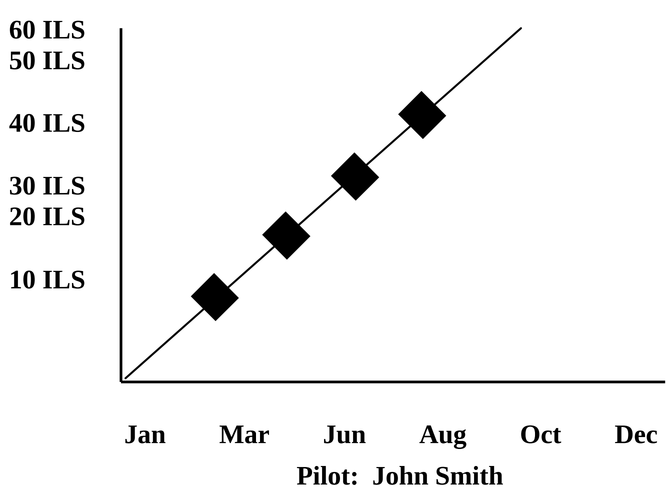
Goals: Site specific goals should be 100 percent (exception noted, if not).

Data Location: Data records may be found at the AvM's office, chief pilot's office, training office, contractor's operations office, pilot's records, or contractor's dispatch organization.

Factors that Effect the Measure: Pilot availability, aircraft availability, program funds, etc.

NOTE: This indicator is generally depicted a graph.

$$\frac{\text{35 ILS approaches accomplished}}{\text{50 ILS approaches required}} \times 100 = 70\%$$



Performance Indicator: ***Pilot Readiness Training (PRT)****—key troubleshooting tool for diagnosing pilot availability rates.*

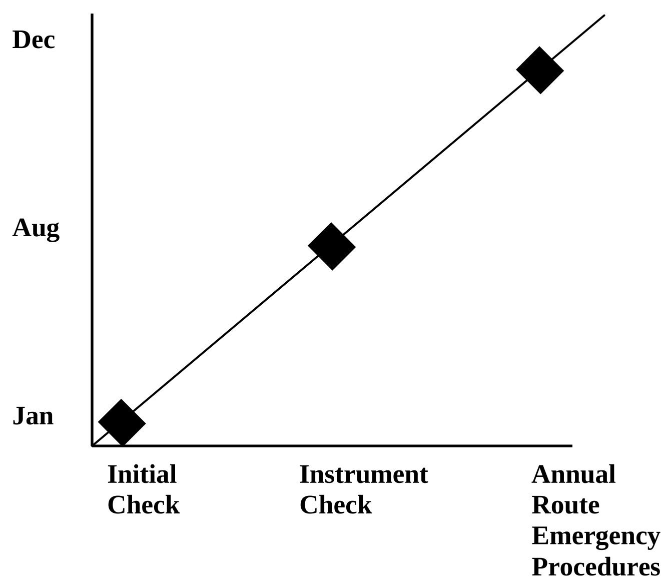
Definition: To determine a PRT rate for an individual pilot, the number of required training activities accomplished divided by the number of training activities required. An alternative to a calculating a PRT rate would be to chart whether the pilot is on track to meet the training goals, which gives the manager a visual cue to determine if a pilot is on track to meet organizational goals.

Goals: Site specific goals should be 100 percent (exception noted, if not).

Data Location: Data records may be found at the AvM's office, chief pilot's office, training office, contractor's operations office, pilot's records, or contractor's dispatch organization.

Factors that Effect the Measure: Pilot availability, aircraft availability, program funds, etc.

NOTE: This indicator is generally depicted in a graph.



Performance Indicator: ***Pilot Utilization Effectiveness (PUE)****—troubleshooting tool for diagnosing pilot availability rates.*

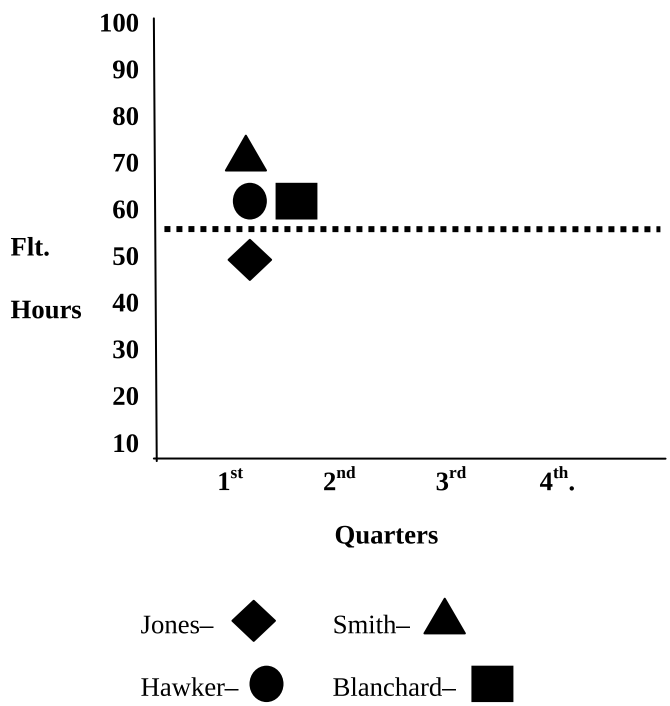
Definition: For an organization, the proportions of total flying hours accomplished by individual pilots by make and model per quarter.

Goals: Site specific goals should be to maintain the PUE, to meet pilot proficiency goals and utilization is balanced.

Data Location: Data records may be found at the AvM's office, chief pilot's office, training office, contractor's operations office, pilot's records, or contractor's dispatch organization.

Factors that Effect the Measure: Pilot availability, training requirements, proficiency requirements, aircraft availability, program funds, etc.

PILOT UTILIZATION CHART



Performance Indicator: ***Customer Scheduling Effectiveness (CSE)—****key troubleshooting tool for diagnosing Departure Reliability Rates.*

Definition: CSE is defined as the proportion of customer requirements for aviation services that result in schedule commitments for aircraft services as requested, and as modified through negotiation, or in cancellation.

Thresholds: Since many organizations receive several request per day for aircraft services, many of which do not meet DOE or Federal regulations for the use of government aircraft, a threshold was established to determine which customer request would be counted and which ones would not. The threshold for determining when a customer's request is valid is when a firm commitment was made by a customer for a valid request for specific aviation services by a qualified customer.

Goals: Site specific goals should be to increase the CSE and the trend should be upward over time.

Data Location: Data records may be found at the AvM's office, scheduling office, contractor's operation office, or the contractor's aircraft dispatch office.

Factors that Effect the Measure: Customer cancellations, aircraft availability, flight crew availability, cost justification, weather, emergencies, etc.

MAY 2001 CSE Report

$$\frac{\text{total scheduled commitments}}{\text{total customer requests}} \times 100 = \text{CSE}$$

$$\frac{\text{240 (total scheduled commitments)}}{\text{300 (total customer requests)}} \times 100 = 80\% \text{ CSE}$$

4.0 AIRCRAFT MAINTENANCE PERFORMANCE INDICATORS

4.1 General

Aircraft maintenance organizations are an integral part of an organization's aviation program. The single purpose of aircraft maintenance organization is aircraft readiness or commonly referred to as *availability*. From this single purpose come two primary objectives that Aircraft maintenance organizations are responsible for—

- Providing safe, flyable (airworthy) aircraft, in the proper configuration, when and where needed to satisfy an organization's program requirements.

- Maintaining a level of aircraft availability at some point beyond that of the organization's program requirements to provide aircraft for surge capacity or to meet other mission requirements.

4.2 Introduction

An aircraft is considered available, if it is airworthy and safe for flight. The difference between an aircraft that is available and one that is mission capable is, an aircraft that is mission capable, is one that is available (airworthy), with a qualified and current flight and mission crew, if applicable, mission essential equipment installed and operational, if applicable. Most of the indicators in the following chapter are based on assigned hours, which are measured monthly by aircraft model and by total aircraft (Fleet). For example:

- Per month (May): 31 days × 24 hours × 1 (B-200) = 744 assigned hours;.

- By fleet: 31 days × 24 hours × 7 (total aircraft) = 5208 assigned hours.

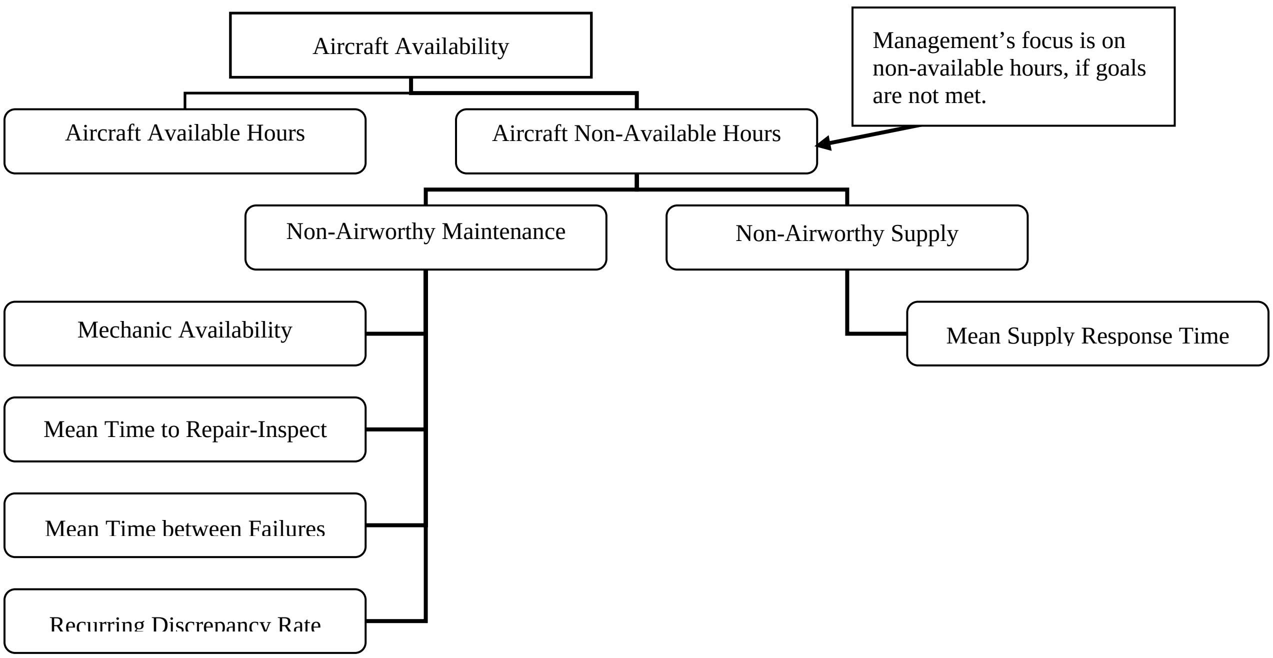
Maintenance indicators, where applicable, should be measured monthly, quarterly, and annually by model and by fleet. The maintenance manager can determine what the quarterly and annual average availability rates are, by taking the sum of the preceding three or twelve monthly reports and dividing by three or twelve, as applicable, to determine the average quarterly or annual aircraft availability rate.

The first task for the maintenance manager will be to separate available hours (AH) from non-available hours (NAH), the total hours in a month an aircraft or the fleet was not airworthy for flight due to a maintenance or supply (awaiting parts) problem. The maintenance manager will focus on NAHs (the NAH graphic below) to determine where the manager should focus to improve work processes. These measures will be discussed in this chapter.

4.3 Overview

The maintenance performance indicators chapter is designed to show managers what type of processes and data should be reviewed, and where to get the data. This chapter will provide you a broad overview of aircraft maintenance and some associated indicators that will make a manager's job easier to understand how well his or her organization is functioning and what processes require improvement. This does not mean that the performance indicators in this chapter are all of the aviation performance indicators that can measure the inputs, processes, or outputs of a maintenance organization. Each manager should evaluate their organization and determine if other measures should be incorporated to provide the information a manager needs to determine the effectiveness and efficiency of the maintenance organization.

NON-AVAILABLE HOURS



4.4 Mission

The aircraft maintenance team exists to provide safe, reliable aircraft and equipment to the organization and to optimize availability in a cost effective manner. All team members play a vital role in this process—from the newest mechanic in the maintenance organization to the quality control inspector—the focus is to provide a safe, reliable aircraft, in the proper configuration, and on time to meet mission and contingency requirements, cost effectively.

4.5 Maintenance Products

Maintenance products are the major elements maintenance organizations produce. They are divided into six product areas as follows:

- airworthy aircraft;
- serviceable aircraft and components;
- serviceable engines;
- serviceable ME;
- trained technicians, and
- other services.

Each of these product areas is divided into processes we track to ensure the health of our maintenance organization.

Term: ***Aircraft Available Hours (AAH)***

Definition: The time an aircraft is available for use (airworthy) and safe for operation.

Data Location: Data records may be found at the AvM's office, maintenance manager’s or contractor's operations office, maintenance records, or contractor's dispatch organization.

Factors that Effect the Product: Aircraft maintenance downtime, downtime due to aircraft supply, mechanic availability, operational pace, age of aircraft, etc.

Term: ***Non-Available Hours (NAH)***

Definition: The time an aircraft is non-available for use (not airworthy) or unsafe for operation.

Thresholds: The moment an aircraft, aircraft system, engine, propeller, avionic system, navigation system, or any component of or part of the aircraft, aircraft system, engine, propeller, avionic system, navigation system does not function or becomes damaged, worn, or deteriorates to cause an unsafe condition for flight or when an aircraft does not meet the regulatory equipment requirements for the type of operation being conducted.

Data Location: Data records may be found at the AvM's office, maintenance manager’s or contractor's operations office, maintenance records, or contractor's dispatch organization.

Factors that Effect the Product: Operational pace, operational environment, age of aircraft, operator errors, improper maintenance, etc.

EXAMPLE:

assigned hours - non-available hours = number of aircraft available hours

assigned hours [31 days × 24 hours × 1 (bell 206)] - 20 NAH = 724 aircraft available hours

Performance Indicator: ***Aircraft Availability Rate (AAR)—****core maintenance indicator for all aviation operations.*

Definition: The proportion of time an aircraft is available for use divided by the assigned hours multiplied by 100.

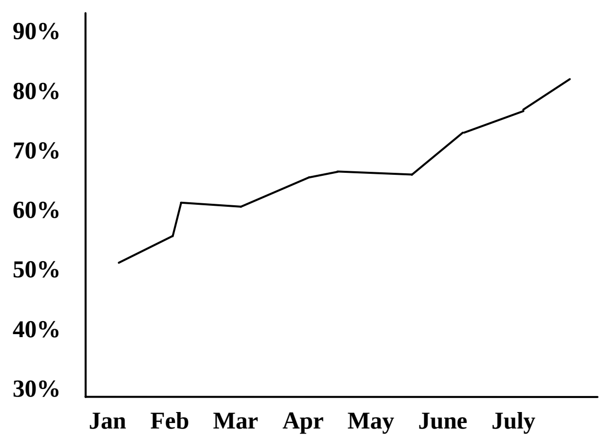
Goals: Site specific goals should be to increase the AAR by as much as economically possible and the trend should be upward over time.

Data Location: Data records may be found at the AvM's office, maintenance manager's or contractor's operations office, maintenance records, or contractor's dispatch organization.

Factors that Effect the Measure: Age of the aircraft, availability of parts, manufacturer defects, lack of qualified maintenance or inspection personnel, operational pace too high, poor maintenance scheduling, etc.

$$\frac{\text{available hours}}{\text{total assigned hours}} \times 100 = \text{AAR}$$

$$\frac{\text{6800 hrs. (AAH) (Fleet)}}{\text{8760 total assigned hours (Fleet)}} = .76 \times 100 = 76\%\ \text{AAR}$$



AAR Trend

Performance Indicator: ***Non-Availability Rate (NAR)***—*core maintenance indicator for all aviation operations*

Definition: The proportion of time an aircraft is non-available for use, for example:

100% - 85% AAR = 15% NAR

Goals: Site specific goals should be to reduce the NAR by as much as economically possible and the trend should be downward over time.

Data Location: Data records may be found at the AvM's office, maintenance manager's or contractor's operations office, maintenance records, or contractor's dispatch organization.

Factors that Effect the Measure: Age of the aircraft, availability of parts, manufacturer defects, lack of qualified maintenance or inspection personnel, operational pace too high, poor maintenance scheduling, etc.

NOTE: The maintenance manager's focus will be on the organization's processes impacting the NAR. What portion of the NAR is due to maintenance scheduling, mechanic availability, reliability (failure rates), maintenance or supply? Is the NAR rate due to aircraft reliability of a particular part or system? If the NAR continues to escalate then the AvM will need to use the tools in the following sections and chapters to determine what corrective actions are necessary to reduce the NAR.

4.6 Aviation Management Tool Kit for Troubleshooting Core Aviation Maintenance Performance Indicators.

The following paragraphs describe additional tools an AvM can use to troubleshoot aircraft availability issues, if Non-Available Rates exceed organizational goals. However, each organization will need to have information systems that can capture the data necessary to use the tools described in this section effectively. Without the proper data troubleshooting the processes that affect the core aircraft availability rates will be difficult or impossible to accomplish.

Term: ***Non-Airworthy Maintenance (NAM)***

Definition: Occurs when a maintenance action, including an inspection, is required on the aircraft, engine, propeller, or any component of or part of the aircraft, engine, or propeller that renders the aircraft non-airworthy or unsafe of operation.

Thresholds: The clock starts for NAM when the maintenance organization is notified or becomes aware that the aircraft, engine, propeller, or any component of or part of the aircraft, engine, or propeller is non-airworthy or unsafe because of a maintenance action; the clock stops when the aircraft, engine, or propeller is returned to service.

Data Location: Data records may be found at the AvM's office, maintenance manager's or contractor's operations office, maintenance records, or contractor's dispatch organization.

Factors that Effect the Measure: Age of the aircraft, availability of parts, manufacturer defects, lack of qualified maintenance or inspection personnel, operational pace too high, poor maintenance scheduling, operational environment, etc.

Performance Indicator: ***NAM Rate (NAMR)****—key troubleshooting tool to analyze non-available rate (NAR) issues.*

Definition: The NAM rate is derived by dividing your NAM hours by your total assigned hours and multiplying by 100 (NAM hours/total assigned hours × 100).

Goals: Site specific goals should be to reduce the NAMR, as much as economically possible, and the trend should be downward over time.

$$\frac{\text{NAM hours}}{\text{total assigned hours}} \times 100 = \text{NAMR}$$

$$\frac{\text{150 hrs. (NAM)}}{\text{189 total assigned hours}} \times 100 = 79\%\ \text{NAMR}$$

Performance Indicator: ***Mechanic Availability Rate***—*key troubleshooting tool to analyze non-airworthy maintenance rate (NAMR) issues.*

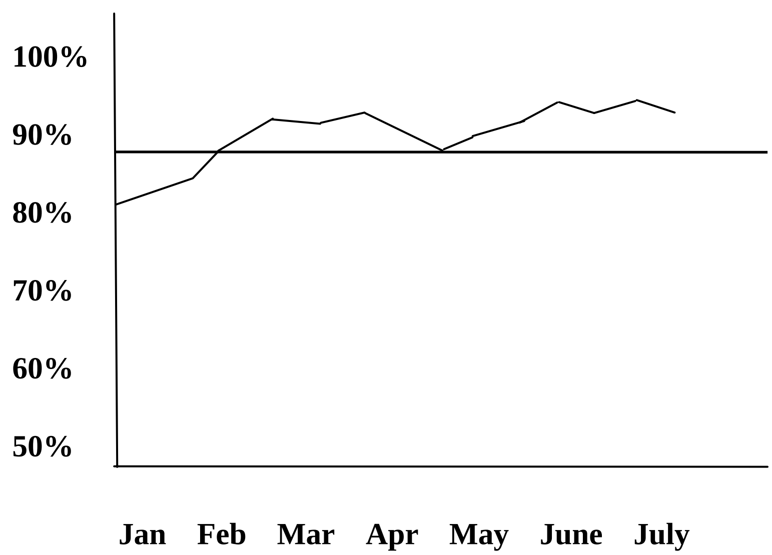
Definition: The percentage of time that the minimum required number of qualified and current mechanics is available to meet maintenance schedules or pace of operations.

Goals: Site specific goals should be to maintain the MA to meet program needs, while controlling payroll costs.

Data Location: Data records may be found at the AvM's office, director of maintenances office, training office, contractor's maintenance office, or employee's records.

Factors that Effect the Measure: Vacation time, duty-time limitations, job vacancies, sickness, operational pace, etc.

$$\frac{\text{12 mechanics available}}{\text{15 mechanics (required \# of mechanics)}} \times 100 = 80\ \%\ \text{MA rate}$$



2001—MAR Trend

NOTE: The horizontal bar in the graph depicts the minimum percentage of available mechanics required to meet maintenance requirements. To use this tool properly, statistical analysis of mechanic requirements must be accomplished. The key to this analysis is having data on mean time to repair or inspect your aircraft.

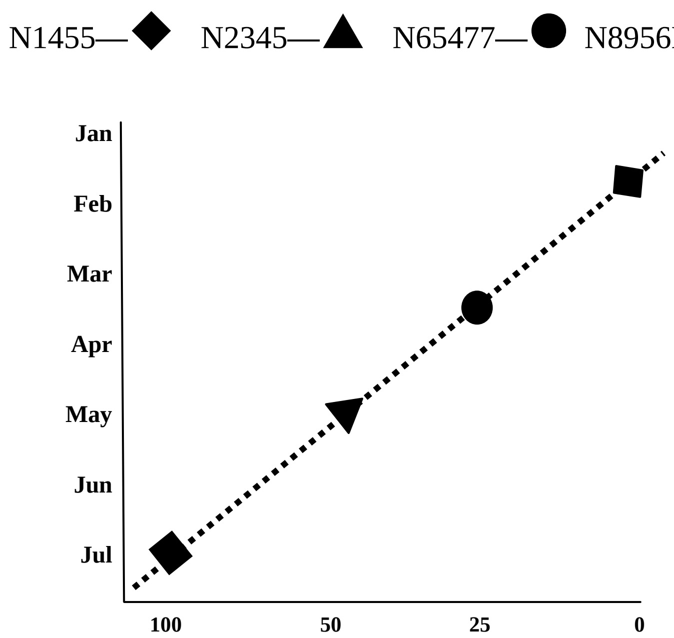
Performance Indicator: ***Time Left to Inspection****—key troubleshooting tool to analyze non-airworthy maintenance rate (NAMR) issues.*

Definition: The health of the aircraft fleet is a very important issue. In order to maintain aircraft availability high, it is important to properly manage your inspection flow to preclude several inspections coming due at the same time causing backlogs or grounding aircraft and impacting mission capability. Time left to inspection is graphically depicted by aircraft tail number. This information can be obtained from maintenance plans, scheduling and maintenance personnel. Fleet average time left to inspection should be close to 50 percent of the inspection interval and should be evenly staggered along a 45 degree slope.

Goals: Site specific goals.

Data Location: Data records may be found at the AvM's office, maintenance office, production control office, or contractors maintenance office.

Factors that Effect the Measure: Operational pace, mechanic availability, etc.



NOTE: The graph above depicts whether the maintenance manager or production control manager is maintaining a steady flow of product into the maintenance organization. If scheduling is not managed well, the maintenance organization could be overwhelmed and severely impact the organization's mission readiness.

Term: ***Time to Repair (TTR)***

Definition: The elapsed time it takes a person, shop, or vendor to make a repair on an aircraft, engine, propeller, or appliance, or part or component thereof that places the item in an airworthy condition, less the time spent waiting for parts. TTR is a specific value to be used in computing mean time to repair (MTTR).

Thresholds: A qualified and current mechanic or repairman is on-hand, who has the proper tools, repair or inspection data, and parts in-hand, if applicable, to do the work.

Data Location: Data records may be found in work orders, maintenance records, supply records, maintenance office data bases, Quality Control office, etc.

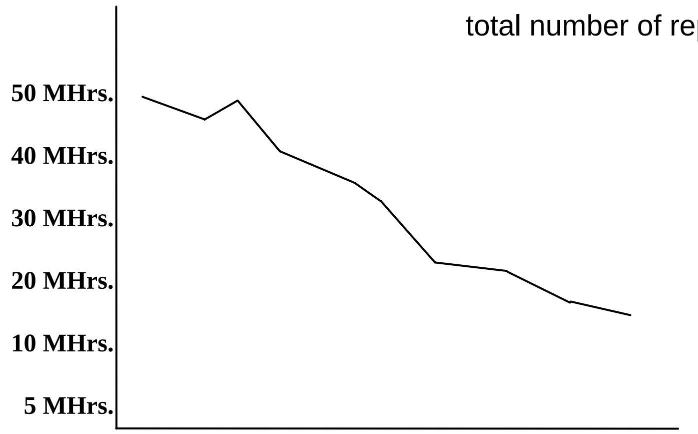
Factors that Effect the Measure: Maintenance and inspection personnel availability, aircraft reliability, age of aircraft, operating conditions, improper maintenance procedures, etc.

Performance Indicator: ***Mean Time to Repair (MTTR)—****key troubleshooting tool to analyze non-airworthy maintenance rate (NAMR) issues.*

Definition: Used in computing the maintainability of an aircraft, engine, propeller, or appliance, or any component of or part of an aircraft, engine, propeller, or appliance. The sum of TTRs divided by the total number of repairs.

Goals: Site specific goals should be to reduce the MTTR, as much as economically possible, and the trend should be downward over time.

$$\frac{\text{TTR + TTR + TTR + TTR}}{\text{total number of repairs}} = \text{MTTR}$$



Performance Indicator: ***Mean Time between Failures (MTBFs)****—key troubleshooting tool to analyze non-airworthy maintenance rate (NAMR) issues.*

Definition: The average elapsed time between failures of an aircraft, engine, propeller, or appliance or any component or part of an aircraft, engine, propeller, or appliance.

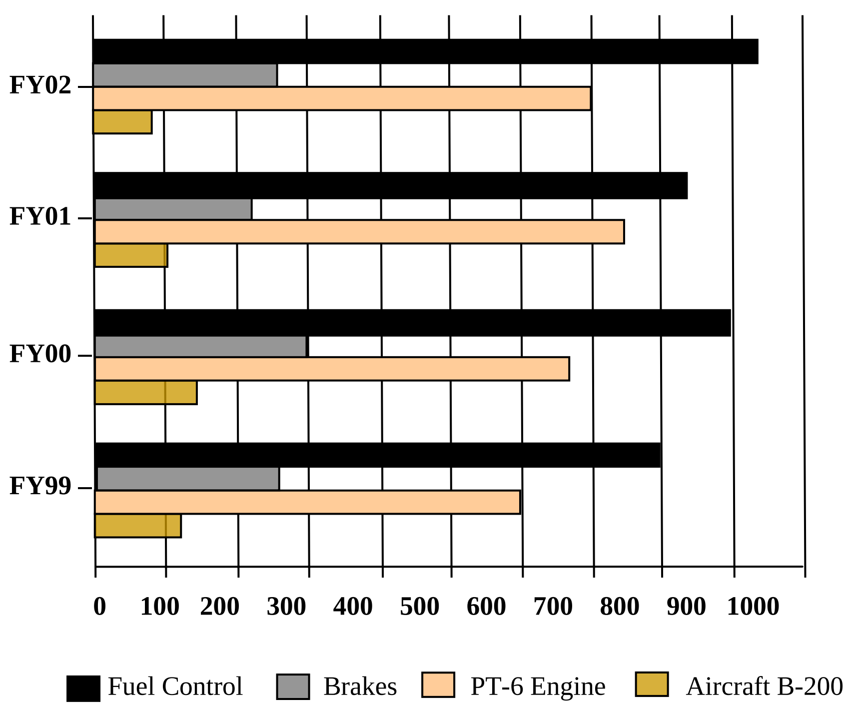
Thresholds: Any product is considered failed if it does not meet its design life limit or if no design life limit is established, fails to meet its intended function, form or fit.

Data Location: Maintenance records, component historical records, service difficulty reports, or maintenance data bases may be found at the contractor's site or in the Aviation Program manager's organization (Federal).

Factors that Effect the Measure: Aging aircraft, improper operation, improper inspection, improper maintenance, design or manufacturing defects, etc.

$$\frac{1^{st}\text{ failure time} + 2^{nd}\text{ failure time} + 3^{rd}\text{ failure time}}{\text{total failure}} = \text{MTBF}$$

MEAN TIME BETWEEN FAILURES



Term: ***Aircraft—****Recurring Discrepancy (ARD)*

Definition: When the same discrepancy occurs on two or more flights, within the span of five flights.

Thresholds: R&D activity of new systems or equipment excluded.

Data Location: Operations or maintenance records may be found at the contractor's site or in the Aviation Program manager's organization (Federal).

Factors that Effect the Measure: Poor troubleshooting of original discrepancy, unreliable parts, inadequate diagnosis of problem, etc.

Performance Indicator: ***Aircraft—****Recurring Discrepancy Rate (RDR)—key troubleshooting tool to analyze non-airworthy maintenance rate (NAMR) issues.*

Definition: The RD rate is derived by dividing your total number of RDs by the total number of discrepancies reported and multiplying by 100.

Goals: Site specific goals should be to reduce the RDR, as much as economically possible, and the trend should be downward over time.

$$\frac{\text{RD} + \text{RD} + \text{RD} + \text{RD}}{\text{total discrepancies}} \times 100 = \text{RDR}$$

Performance Indicator: *Maintenance Scheduling Effectiveness—troubleshooting tool to analyze non-airworthy maintenance rate (NAMR) issues.*

Definition: The number of scheduled maintenance actions accomplished as scheduled for each quarter.

Thresholds: A scheduled inspection that is accomplished within five working days or one week of its scheduled inspection time is considered as scheduled.

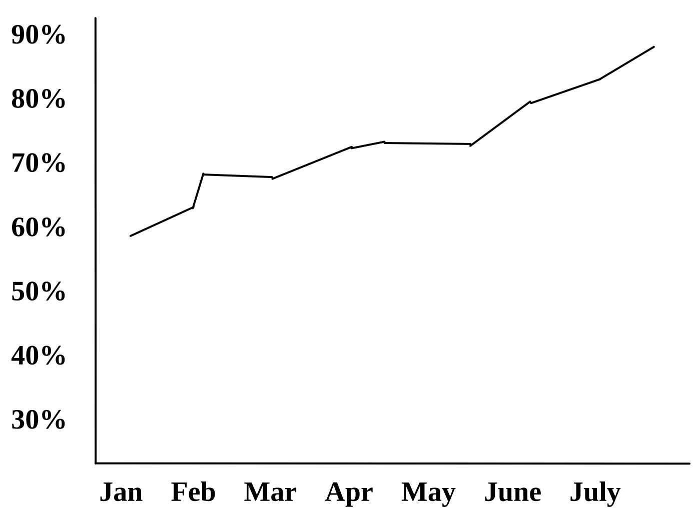
Goals: Site specific goals should be to increase the number of maintenance actions accomplished as scheduled as much as economically possible, and the trend should be upward over time.

Data Location: Data records may be found at the AvM's office, maintenance office, production control office, or contractor's maintenance office.

Factors that Effect the Measure: Operational pace, mechanic availability, etc.

$$\frac{\text{total maintenance actions accomplished as scheduled}}{\text{total maintenance actions scheduled}} \times 100 = \text{MSE}$$

$$\frac{\text{25 (total maintenance actions accomplished as scheduled)}}{\text{30 (total maintenance actions scheduled)}} \times 100 = 83.3\ \%\ \text{MSE}$$



Performance Indicator: ***Top Five Reported Discrepancies****—troubleshooting tool to analyze non-airworthy maintenance rate (NAMR) issues.*

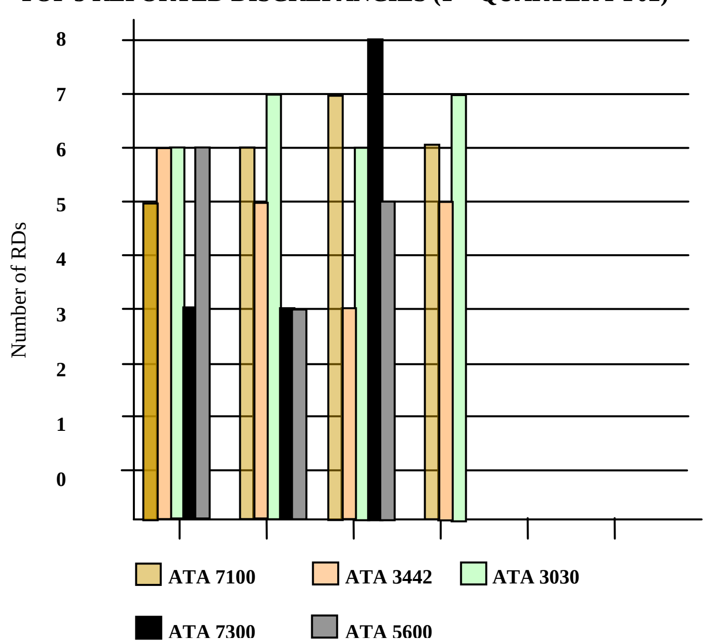
Definition: The top five discrepancies as reported by pilots or maintenance. The discrepancies should be converted to the Air Transport Association (ATA) Aircraft System/Component code. As an example: Write-up—fuel system leaking at filter. For data collection, convert write-up to ATA 7310–Engine Fuel Distribution.

Goals: Site specific goals should be to reduce the number of discrepancies reported as much as economically possible.

Data Location: Data records may be found at the AvM's office, director of maintenance's office, training office, contractor's maintenance office, or employee’s records.

Factors that Effect the Measure: Quality problems with a certain component, part or appliance within a system, age of aircraft, a lack of trained maintenance technicians, etc.

TOP 5 REPORTED DISCREPANCIES (1ST QUARTER FY02)



NOTE: This data should be used to focus on aircraft, engines, propellers, and systems that may be experiencing higher than normal reliability problems. It also may reflect a quality problem with certain components, parts or appliances within a system, poor troubleshooting, or a lack of trained maintenance technicians. This is raw data tracked by each aircraft and system for a particular month and plotted on a bar graph. This data should be used to reduce the number of failures or recurring discrepancies (RDs), so the numbers may initially be high at first. The goal is to lower the number steadily.

5.0 AIRCRAFT SUPPLY PERFORMANCE INDICATOR TOOL

The following paragraphs describe an additional tool an AvM can use to troubleshoot aircraft non-availability issues, if Non-Available Rates exceed organizational goals. However, each organization will need to have information systems that can capture the data necessary to use the tools described in this section effectively. Without the proper data, troubleshooting the processes that affect the core aircraft availability rates will be difficult or impossible to accomplish.

Term: ***Supply Response Time (SRT)***

Definition: A value used in computing mean supply response time, the elapsed time between issuance of a customer request (order) and satisfaction of that order.

Thresholds: From the time a parts request is approved or initiated until the request is filled.

Data Location: Maintenance or supply records or maintenance or supply data bases may be found at the contractor's site or in the Aviation Program manager's organization (Federal).

Factors that Effect the Measure: Procurement process, not-later-than (NLT) dates, long lead time OEM parts, older aircraft (parts not being manufactured), cost considerations, etc.

Performance Indicator: ***Mean Supply Response Time (MSRT)****—key troubleshooting tool to analyze non-airworthy maintenance rate (NAMR) issues*

Definition: Used in computing the effectiveness of supply for an aircraft, engine, propeller, or appliance or any component of or part of an aircraft, engine, propeller, or appliance. The sum of supply response times divided by the total number of supply responses.

Goals: Site specific goals should be to reduce the MSRT, as much as economically possible, and the trend should be downward over time.

$$\frac{\text{total number of supply response times}}{\text{total number of supply responses}} = \text{MSRT}$$

$$\frac{30\text{ min.} + 25\text{ min.} + 40\text{ min.} + 20\text{ min.} + 50\text{ min.} = 165\text{ min.}}{5} = 33\text{ min. MSRT}$$

Term: ***Non-Airworthy Supply (NAS)***

Definition: NAS occurs when parts are needed to complete a maintenance action on the aircraft or any component of or part of aircraft.

Thresholds: The clock starts for NAS from the time maintenance action is stopped due to a lack of parts; clock stops when the part is issued.

Data Location: Maintenance records or maintenance data bases may be found at the contractor's site or in the Aviation Program manager's organization (Federal).

Factors that Effect the Measure: Procurement process, NLT dates, long lead time OEM parts, older aircraft (parts not being manufactured), cost considerations, etc.

Performance Indicator: ***NAS Rate—****key troubleshooting tool to analyze NAR.*

Definition: The NAS rate is derived by dividing the NAS hours by the total assigned hours and multiplying by 100 (NAS hours/total assigned hours × 100).

Goals: Site specific goals should be to reduce the NAS rate, as much as economically possible, and the trend should be downward over time.

$$\frac{\text{NAS hours}}{\text{total assigned hours}} \times 100 = \text{NASR}$$

6.0 MISSION CREW INDICATORS

Chapters 6 and 7 describe additional aviation performance indicators, primarily for the use of security and emergency response missions, but can also be applicable to the Power Marketing Administrations power line patrol operations. These indicators provide AvMs methods of analyzing whether NMCRs exceed organizational goals. However, each organization will need to have information systems that can capture the data necessary to use the tools described in this section effectively. Without the proper data troubleshooting the processes that affect the core aircraft availability rates will be difficult or impossible to accomplish.

Performance Indicator: ***Primary Mission Crew Availability****—key troubleshooting tool to analyze NMCR issues*

Definition: The percentage of time that the minimum required number of mission crew are available to meet defined (primary) mission requirements, such as Emergency Response, Security, etc.

Goals: Site specific goals should be to maintain the MCA to meet program needs, while controlling payroll costs.

Data Location: Operations records or data bases may be found at the contractor's site or in the Aviation Program manager's organization (Federal).

Factors that Effect the Measure: Whether or not the mission crews are under the operational control of the aviation program management.

Performance Indicator: ***Mission Crew Readiness Proficiency—****key troubleshooting tool to analyze mission crew availability rates.*

Definition: For individual mission crew, the number of required proficiency events accomplished divided by the number of proficiency events required.

Goals: Site specific goals should be 100 percent (exception noted, if not).

Data Location: Operations records or data bases may be found at the contractor's site or in the Aviation Program manager's organization (Federal).

Factors that Effect the Measure: Whether or not the mission crews are under the operational control of the aviation program management, frequency of flying, utilization of available flight time, scheduling considerations and supervision.

Performance Indicator: ***Mission Crew Readiness Training—****key troubleshooting tool to analyze mission crew availability rates.*

Definition: For individual mission crew, the number of required training activities accomplished divided by the number of training activities required.

Goals: Site specific goals should be 100 percent (exception noted, if not).

Data Location: Operations records or data bases may be at the contractor's site or in the Aviation Program manager's organization (Federal).

Factors that Effect the Measure: Whether or not the mission crews are under the operational control of the aviation program management, frequency of flying, utilization of available flight time, scheduling considerations and supervision.

7.0 MISSION EQUIPMENT MAINTENANCE

Term: ***Mission Equipment (ME) Available Hours (ME-AH)***

Definition: The time ME is available for use (operational).

Data Location: Data records may be found at the AvM's office, maintenance manager's or contractor's operations office, maintenance records, or contractor's dispatch organization.

Factors that Effect the Product: Mission equipment maintenance downtime, downtime due to supply, mechanic availability, operational pace, age of equipment, etc.

Term: ***ME Non-Available Hours (ME-NAH)***

Definition: The time ME is unavailable for use (non-operational).

Thresholds: The moment ME or any component of or part of the ME does not function or becomes damaged, worn, or deteriorates to cause the equipment to malfunction or not operate to specifications.

Data Location: Data records may be found at the AvM's office, maintenance manager's or contractor's operations office, maintenance records, or contractor's dispatch organization.

Factors that Effect the Product: Operational pace, operational environment, age of equipment, operator errors, improper maintenance, etc.

Performance Indicator: ***ME Non-Availability Rate (ME-NAR)—****key troubleshooting tool to analyze NMC rates.*

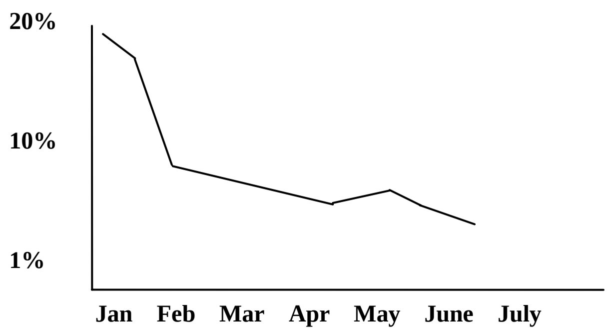
Definition: The proportion of time ME is not available for use.

Goals: Site specific goals should be to reduce the ME-NAR by as much as economically possible and the trend should be downward over time.

Data Location: Data records may be found at the AvM's office, maintenance manager's or contractor's operations office, maintenance records, or contractor's dispatch organization.

Factors that Effect the Measure: Age of the equipment, availability of parts, manufacturer defects, lack of qualified maintenance or inspection personnel, operational pace too high, poor maintenance scheduling, etc.

NOTE: The AvM's focus will be on the organization's processes impacting the ME-NAR. What portion of the ten percent ME-NAR is due to scheduling, mechanic availability, reliability (failure rates), maintenance or supply. Is the ME-NAR due to ME reliability of a particular part or system? Only by looking at the following indicators will the manager be able to determine what corrective actions are necessary to reduce the ME-NAR.



MeNAR Trend

Performance Indicator: ***ME Availability Rate (ME-AR)****—key troubleshooting tool to analyze NMC rates.*

Definition: The proportion of assigned hours to the hours ME is available for use.

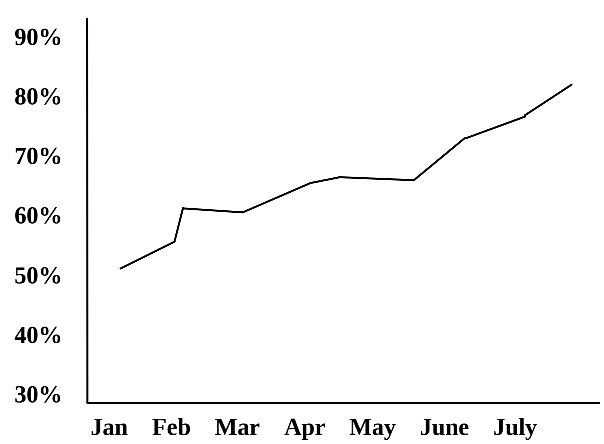
Goals: Site specific goals should be to increase the ME-AR by as much as economically possible and the trend should be upward over time.

Data Location: Data records may be found at the AvM's office, maintenance manager’s or contractor's operations office, maintenance records, or contractor's dispatch organization.

Factors that Effect the Measure: Age of the ME, availability of parts, manufacturer defects, lack of qualified maintenance or inspection personnel, operational pace too high, poor maintenance scheduling, etc.

$$\frac{\text{ME-AR}}{\text{total assigned hours}} \times 100 = \text{MeAR}$$

$$\frac{\text{520 hrs. (ME-AR)}}{\text{708 assigned hours}} = .73 \times 100 = 73\%\ \text{ME-AR}$$



MeAR Trend

Term: ***ME Non-Operable Maintenance (ME-NOM)***

Definition: Occurs when a maintenance action is required on the ME or any component of or part of the ME when the equipment is unable to meet mission performance requirements.

Thresholds: The clock starts for ME-NOM when ME becomes unable to meet mission performance requirements and stops when returned to service.

Data Location: Maintenance records or maintenance data bases may be found at the contractor's site or in the Aviation Program manager's organization (Federal).

Factors that Effect the Measure: Availability of technicians to commence repair, parts not on-hand, technical factors effecting the payload or equipment, or whether the equipment is owned by DOE/NNSA or by some other organization or agency.

Performance Indicator: ***ME-NOM Rate (ME-NOMR)—****key troubleshooting tool to analyze NMC rates.*

Definition: The ME-NOMR is derived by dividing the ME-NOM hours by the total assigned hours and multiplying by 100 (ME-NOM hours/total assigned hours × 100).

Goals: Site specific goals should be to reduce the ME-NOMR, as much as economically possible, and the trend should be downward over time.

$$\frac{\text{ME-NOM hours}}{\text{total assigned hours}} \times 100 = \text{ME-NOMR}$$

$$\frac{\text{200 hours (ME-NOM)}}{\text{500 NMC hours}} \times 100 = 40\ \%\ \text{ME-NOMR}$$

Term: ***ME Recurring Discrepancy (ME-RD)***

Definition: When the same discrepancy occurs on two or more flights, within the span of five flights.

Thresholds: R&D activity of new systems or equipment excluded.

Data Location: Maintenance records or maintenance data bases may be found at the contractor's site or in the Aviation Program manager's organization (Federal).

Factors that Effect the Measure: Whether the equipment is owned by DOE/NNSA or by some other organization or agency. Poor troubleshooting of original discrepancy, unreliable parts, inadequate diagnosis of problem, etc.

Performance Indicator: ***ME RD Rate (ME-RDR)—****key troubleshooting tool to analyze NMC rates.*

Definition: The ME-RDR is derived by dividing your total number of RDs by the total number of discrepancies reported and multiplying by 100 (total RDs / total discrepancies × 100).

Goals: Site specific goals should be to reduce the ME-RDR, as much as economically possible, and the trend should be downward over time.

$$\frac{\text{200 hours (ME-NOM)}}{\text{5208 assigned hours}} \quad \text{100 = ME-RDR}$$

Term: ***ME Non-Operable Supply (ME-NOS)***

Definition: ME-NOS occurs when parts are needed to complete a maintenance action on ME or any component of or part of ME.

Thresholds: The clock starts for ME-NOS from the time maintenance action is stopped due to a lack of parts; clock stops when the part is issued.

Data Location: Maintenance records or maintenance data bases may be found at the contractor's site or in the Aviation Program manager's organization (Federal).

Factors that Effect the Measure: Whether the equipment is owned by DOE/NNSA or by some other organization or agency.

Performance Indicator: ***ME-NOS Rate (ME-NOSR)**—key troubleshooting tool to analyze NMC rates.*

Definition: The ME-NOS rate is derived by dividing the ME-NOS hours by the total assigned hours and multiplying by 100 (ME-NOS hours/total assigned hours × 100).

Goals: Site specific goals should be to reduce the ME-NOS rate, as much as economically possible, and the trend should be downward over time.

$$\frac{\text{ME-NOS hours}}{\text{total assigned hours}} \times 100 = \text{ME-NOSR}$$

Term: ***ME Supply Response Time (ME-SRT)***

Definition: A value used in computing mean supply response time. The elapsed time between issuance of a customer request (order) and satisfaction of that order.

Thresholds: From the time a parts request is approved or initiated until the time the request is filled.

Data Location: Operational reports, maintenance or supply records, or data bases may be found at the contractor's site or in the Aviation Program manager's organization (Federal).

Factors that Effect the Measure: Whether the equipment is owned by DOE/NNSA or by some other organization or agency.

Performance Indicator: ***ME Mean Supply Response Time (ME-MSRT)**—troubleshooting tool to analyze NMC rates.*

Definition: Used in computing the effectiveness of supply for ME. The sum of supply response times divided by the total number of supply responses.

Goals: Site specific goals should be to reduce the ME-MSRT, as much as economically possible, and the trend should be downward over time.

$$\frac{\text{ME-SRT + ME-SRT + ME-SRT + ME-SRT}}{\text{total supply responses}} = \text{ME-MSRT}$$

$$\frac{\text{1 hour + 24 hours + 5 hours + 18 hours}}{4} = \text{12 hours ME-MSRT}$$

8.0 SAFETY PROGRAM INDICATORS

8.1 Prelude

The commitment to safety must start at the top of an organization. The single most important element of a successful safety program is the commitment of senior management. Safety cannot be dictated—it must be practiced. A successful safety program must be built on a foundation of trust between the Safety Officer, employees and management. Personnel at all levels must know that the reporting of incidents, near misses, occurrences, etc., can be accomplished without fear of reprisal or management playing a blame game. Safety program indicators differ slightly from the previous indicators discussed in this guidance, in that, the safety manager is trying to gather leading information (indicators) to predict trends and make corrective actions on the work processes before a major accident occurs. *Trailing indicators such as the fatal accident rate per 100,000 hours of operation or accident rate per 100,000 hours of operations may provide the analytical figures to make someone feel safe, but do not provide the necessary information needed to prevent accidents from occurring in the first place*.

Many requirements and thresholds for reporting and recording incidents and accidents have been established by DOE, the Federal Aviation Administration (FAA), and National Transportation Safety Board (NTSB). DOE requirements use many of the same definitions established in Title 49 CFR Part 830, which provides for uniformity between DOE and the outside aviation community. DOE already requires field elements and contractors to develop safety program measures, but do not address any specific work process category. The aviation safety program indicators discussed in this chapter are meant to provide leading indicators for the aviation safety professional to prevent or eliminate accidents and incidents. In some cases, the indicators will mirror statistics that are already being tracked in the field and at Headquarters.

Increased safety information (data) availability and accessibility will create opportunities for educating program managers on the use and interpretation of aviation safety data, as well as for describing how DOE’s flight crews, mechanics, and others work together to promote safety. A significant question examined during the development of this chapter is what aviation safety information would be useful in informing management and personnel about DOE’s aviation safety program. While concern about safety is most acute immediately following an accident or incident, safety also reflects the concerns of the customers that use DOE aircraft, and senior management’s view of DOE’s stewardship of its aviation programs. Whether or not aviation management and personnel believe that aviation safety concerns are justified given the high absolute levels of aviation safety, the senior management’s concerns are real and are likely to have a large impact on the discourse about DOE aviation safety.

8.2 Measuring Safety

OAM believes it is possible to identify or compile *safety indicators* that provide insights as to whether an organization is more or less likely to undertake unsafe practices. DOE is focused on three broad aspects of aviation operations that are believed to be important to safe operations: pilot competence, maintenance quality, and management attitude.

8.3 Normalizing Data

According to Federal Aviation Administration data, computation of an accident or incident rate requires normalizing information about the level of exposure to risk. For comparative purposes, it is essential that accident and incident data be normalized in some way, due to the diversity of DOE's aviation program and exposure to risk changes over time. One organization's exposure to risk in a particular time period will likely differ from that of another, because different organizations have different levels and types of activity. Measures of exposure to risk commonly used to normalize event data include number of flights, hours flown, passenger enplaned, and passenger miles flown. Most researchers prefer to use the number of flights (measured as departures) for normalizing data, rather than hours or miles flown, because the risk of accident for an aircraft is greatest during takeoff and landing. (*Aviation Safety Accessibility Study—A Report on Issues Related to Public Interest in Aviation Safety Data* (Office of System Safety Federal Aviation Administration, January 20, 1997)

For customers, the most relevant measure is also likely to be flight or a round trip. According to FAA studies—

Although a commercial aircraft spends only about six percent of its flight time in the takeoff, initial climb, final approach, and landing components of its flight, around 70 percent of "hull loss" accidents have occurred during these stages. Because of this, using an hours-flown-based measure or a mileage-based measure of risk can be misleading.

The previous statements are especially true at DOE when comparisons are being made between organizations that have different average flight lengths. Using an hourly-based measure will result in a commuter type operation, such as the one used by Bonneville Power Administration (BPA) that has very short average flight times but looks more risk prone in comparison to a major jet carrier flying longer stage lengths as is characteristic of the Office of Secure Transportation. This occurs because BPA with shorter average flights will make more takeoffs and landings per hour flown, and aircraft are most exposed to the risk of an accident or incident during takeoff and landing.

8.4 DOE Safety Measures and Data

It has been shown that the size and pace of operations makes it difficult to generate meaningful safety data in the field. Therefore, the OAM will make a data call for each field organization that uses government aircraft to submit data annually. The data will include number of accidents (NTSB Part 830), number of aviation fatalities, total hours flown and total landings. That data will be used by the OAM to formulate the following measures of safety.

Performance Indicator: ***Accident Rate per 1,000 Departures***

Definition: An occurrence between the time when the first passenger boards the aircraft and the last person disembarks; an occurrence which results in death or serious injury to aircraft occupants or substantial damage to the aircraft. Use total departures as a basis to determine rates. This data will be converted to 100,000 departure rates prior to reporting to any outside agency.

Goals: Site specific goals should be to reduce or eliminate accidents, and the trend should be downward over time.

Data Location: Data records may be found at the Aviation Safety Office, General Services Administration Aviation Accident and Incident Reporting System (AAIRS), DOE Occurrence Reporting Processing System (ORPS) reports, and the Aviation Operations office.

Factors that Effect the Measure: Personnel qualifications and experience, age of aircraft, quality of maintenance, operational pace, operating environment, etc.

Performance Indicator: ***Fatality Rate per 1,000 Departures***

Definition: Any injury associated with the operation or maintenance of an aircraft which results in death within 30 days of the accident. Use total departures as a basis to determine rates. This data will be converted to 100,000 departure rates prior to reporting to any outside agency.

Goals: Site specific goals should be to reduce or eliminate fatalities and the trend should be downward over time.

Data Location: Data records may be found at the Aviation safety office, GSA Aviation Accident and Incident Reporting System (AAIRS), DOE ORPS reports, and Aviation Operations office.

Factors that Effect the Measure: Personnel qualifications and experience, age of aircraft, quality of maintenance, operational pace, operating environment, etc.

Performance Indicator: ***Serious Injury Rate per 1,000 Departures***

Definition: Any injury associated with the operation or maintenance of an aircraft which:

- requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received;
- results in a fracture of any bone (except simple fractures of fingers, toes, or nose);
- causes severe hemorrhages, nerve, muscle, or tendon damage;
- involves any internal organ; or
- involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.

Use total departures as a basis to determine rates. This data will be converted to 100,000 departure rates prior to reporting to any outside agency.

Goals: Site specific goals should be to reduce or eliminate injuries and the trend should be downward over time.

Data Location: Data records may be found at the Aviation safety office, GSA AAIRS, DOE ORPS reports, and Aviation Operations office.

Factors that Effect the Measure: Personnel qualifications and experience, age of aircraft, quality of maintenance, operational pace, operating environment, etc.

8.5 Audit and Review Program Indicator.

This data provides useful information about current aviation program safety practices, the reporting of this data could provide a positive incentive for the level of effort organizations put into aviation safety. The degree of compliance with DOE and field level policies, in addition to FAA regulations, might be an indicator of an organization's diligence in the safety arena. However, it must be noted that there may be no relationship between appraisal and inspection results and the probability that an organization will have an accident in the future, especially if the aviation programs improve following appraisal and inspection findings.

Performance Indicator: ***Program Audit Findings Rate***

Definition: Total number of positive responses divided by the total number of audited items.

Goals: OAM's goal is to have each field element 95 percent complaint or better to those requirements that are applicable to the field organization. The goal should be to reduce or eliminate the number of findings and the trend should be downward over time.

Data Location: Data records (checklists, audit forms, etc.) may be found at the OAM, field element's Aviation safety office, or Aviation operations office.

Factors that Effect the Measure: Supervisory controls, management, personnel qualifications and experience, maintenance program complexity, complexity of operational rules, etc.

8.6 Field Element Safety Measures and Data

Each field organization should have an incident reporting system for feedback and continuous improvement of the work processes. In addition, each field organization that operates government aircraft should be using the DOE Accident and Incident Reporting System (AAIRS) to file accident, incident, hazard or safety concern reports. The field data and AAIRS data should be used by the Aviation Safety Officers to formulate the following measure of safety:

Performance Indicator: ***Incident Rate per 1,000 Departures***

Definition: An occurrence, other than an accident, associated with the operation or maintenance of an aircraft, which affects or could affect the safety of operations or maintenance. Use total departures as a basis to determine rates. This data will be converted to 100,000 departure rates prior to reporting to any outside agency.

Goals: Site specific goals should be to reduce or eliminate incidents and the trend should be downward over time.

Data Location: Data records may be found at the Aviation Safety Office, GSA Aviation Accident and Incident Reporting System (AAIRS), DOE ORPS reports, and Aviation Operations office.

Factors that Effect the Measure: Personnel qualifications and experience, age of aircraft, quality of maintenance, operational pace, operating environment, etc.

9.0 COST PERFORMANCE INDICATORS.

Performance Indicator: ***Cost per Flight Hour***

Definition: Total aviation costs divided by total hours flown for each aircraft.

Goals: Site specific goals should be to reduce the cost per hour and the trend should be downward over time.

Data Location: Data records may be found at the AvM's office, finance records, and contractor's office.

Factors that Effect the Measure: Age of aircraft, payroll costs, unscheduled maintenance costs, overhead, overhead charge rates, accident or incident damages and repairs, fuel prices, etc.

Performance Indicator: ***Cost per Mile***

Definition: The total aviation costs divided by total miles (statute miles) flown or patrolled.

Goals: Site specific goals should be to reduce the costs per mile and the trend should be downward over time.

Data Location: Data records may be found at the AvM's office, finance records, and contractor's office.

Factors that Effect the Measure: Age of aircraft, payroll costs, unscheduled maintenance costs, accident or incident damages and repairs, fuel prices, etc.

Performance Indicator: ***Cost per Pound (Cargo Operations)***

Definition: The total cost per flight hour multiplied by total cargo flight hours divided by total number of pounds transported.

Goals: Site specific goals should be to reduce the costs per pound and the trend should be downward over time.

Data Location: Data records may be found at the AvM's office, finance records, and contractor's office.

Factors that Effect the Measure: Whether or not cargo is carried, special handling requirements, area and scope of operations, etc.

Performance Indicator: ***Cost per Seat Mile***

Definition: The total flight hours multiplied by cost-per-flight hour divided by the sum of flight hours multiplied by miles per hour, times total number of personnel flown.

Goals: Site specific goals should be to reduce the costs per seat and the trend should be downward over time.

Data Location: Data records may be found at the AvM's office, contractor's office. dispatch office, and passenger manifest.

Factors that Effect the Measure: Whether or not personnel are carried, overhead, overhead charges, area and scope of operations, etc.

$$\frac{\text{flt hrs} \times 100\$ \text{ per flt hr} = \$400}{(4 \text{ flt hrs} \times 200 \text{ mph}) \times 60 \text{ personnel flown}} \quad \$\,.08 \text{ per seat mile}$$

Performance Indicator: ***Cost per Utilization Hour***

Definition: The cost per utilization hour is derived by dividing the sum of total of ground utilization (alert or R&D ground utilization hours) plus flight hours into the total aviation costs.

Goals: Site specific goals should be to reduce the program costs and the trend should be downward over time.

Data Location: Data records may be found at the AvM's office, finance records, and contractor's office.

Factors that Effect the Measure: Payroll costs (increased payroll for additional pilots), overhead, overhead charges, etc.

NOTE: Refer to Appendix A for definitions of alert and R&D aircraft.

Performance Term: ***Program Cost-benefit Analysis (Savings)***

Definition: The total number of dollars saved by using the aircraft over conventional means to accomplish a task or mission. The cost savings may include per diem expenses, lodging expenses, and reduced overtime. In addition, this cost measure may include analysis to show reductions in corporate lost revenues. This can be calculated using the difference between down time in infrastructure such as power lines by comparing time between repair using aircraft and conventional means.

Data Location: Data records may be found at the program manager's office, financial records, etc.

Goals: Site specific goals should be to maximize program costs savings through use of aircraft and the trend should be upward over time.

Factors that Effect the Measure: TBD

EXAMPLE 1

- **Scenario 1:** Dispatch is aware of a line fault at 9 a.m. The aircraft is dispatched at 9:15 a.m. to locate fault. At 10 a.m. aircraft crews identify location and type of fault and the equipment and personnel needed to correct fault. Crews arrive at 12noon and fix the fault. Total elapsed time is 3 hours.

- **Scenario 2:** Dispatch is aware of a line fault at 9 a.m. A crew is dispatched by truck at 9:15 a.m. to locate fault. At 12 noon truck crews identify location and type of fault and the equipment and personnel needed to correct fault. Crews arrive at 2 p.m. and fix the fault. Total elapsed time is 5 hours.

- **Findings**

  - Scenario 1 lost revenue 3 × $1M = $3M

  - Scenario 2 lost revenue 5 × $1M = $ 5M

  - $5M - $3M = $2M in costs savings (Total cost benefit).

EXAMPLE 2

- **Scenario 1:** The aircraft takes two hours to arrive on scene and can survey a ten square mile area by air in four hours. The aircraft and crew cost $ 1400 per hour. The total cost to the organization is $ 8,400.00.

- **Scenario 2:** A crew of 50 persons with hand sensors takes 6 hours to arrive on scene and it takes 14 hours to survey the site. The average cost per hour for each person is $ 38.50. The total cost of surveying the site by ground is $38,500.00.

- **Findings**

  - Scenario 1 Government costs = $ 8,400.00

  - Scenario 2 Government costs = $38,500.00

  - $38,500 - $8,400 = $ 30,100.00 in costs savings (total cost benefit).

APPENDIX A. ACRONYMS

AAH	aircraft available hours
AAR	aircraft availability rate
ARD	aircraft—recurring discrepancy
AvM	aviation manager
CSE	customer scheduling effectiveness
CWT	customer wait time
DoD	Department of Defense
FCNA	flight crew non-availability
MCA	mission capable aircraft
MCNA	mission crew non-availability
MCR	mission capable rate
ME	mission equipment
ME-OH	mission equipment—operational hours
ME-NOH	mission equipment—non-operational hours
ME-NOM	mission equipment—non-operable maintenance
ME-NOS	mission equipment—non-operable supply
ME-RDR	mission equipment—recurring discrepancy rate
MSRT	mean supply response time
MTBF	mean time between failure
MTTR	mean time to repair
NAH	non-airworthy hours
NAM	non-airworthy maintenance/maintenance downtime
NAMR	non-airworthy maintenance rate
NAS	non-airworthy supply / supply downtime

NASR	non-airworthy supply rate
NMC	non-mission capable
NLT	not later than (dates)
NNSA	National Nuclear Security Administration
OAM	Office of Aviation Management
RDR	recurring discrepancy rate
SRT	supply response time
TTR	time to repair

APPENDIX B. DEFINITIONS

aircraft accident—an occurrence in which a person dies or suffers serious injury or the aircraft receives substantial damage that takes place between the time when the first person boards an aircraft with the intention of flight and all persons have disembarked, and.

alert aircraft—a Federal aircraft or commercial aviation service aircraft under contract to the Federal government, that is configured (including any ME) to meet an alert response (primary mission) for an on-call program requirement of 24 hours a day, seven days a week, 365 days a year or is designated for an "Alert Mission" for a minimum of 24 hours or more by the program manager. (alert aircraft are normally assigned to emergency response missions such as firefighting, radiological and chemical response aircraft, transportation of national security response teams, facility security patrols, facility response team transportation, etc. In addition, these programs require the operation to be able to dispatch during night and instrument meteorological conditions.)

alert utilization ground time—that time, expressed in hours and tenths of an hour, an alert aircraft is:

- Airworthy and configured for the primary mission (including any ME, that must be operable) and not being utilized to meet other program needs; and
- The assigned flight crew and mission crew, if applicable, readily available for deployment from a designated site to meet Federal program requirements.

appliance—any instrument, mechanism, equipment, part, apparatus, appurtenance, or accessory, including communications equipment, that is used or intended to be used in operating or controlling an aircraft in flight and is not part of an airframe, engine, or propeller.

assigned hours (AH)—the number in a month, quarter, or year that an aircraft has been assigned to a field organization. For example, in the month of May:

$$31 \text{ days} \times 24 \text{ hours} \times (\text{\# same make and model}) = \text{assigned hours}$$

cannibalization—the act of taking a serviceable part from an aircraft, engine, propeller, or assembly to replace an unserviceable part on an aircraft, engine, propeller, or assembly, rather than using stores from supply.

conditional inspection—one that is required as a result of unusual events such as an over speed, hard landing, over torque, etc.

customer wait time (CWT)—the total elapsed between issuance of a customer request (order) and satisfaction of that order.

fatal injury—one that results in death within 30 days of an accident.

flight—the status of an aircraft from the time it leaves the ground until it touches down at a destination.

ground abort—a pre-flight condition when it is decided that the aircraft will not proceed with its intended mission.

in-flight abort—a condition during flight when it is decided that the aircraft will not complete its intended mission.

incident—an aircraft operation or maintenance occurrence (other than an accident) that affects or could affect operations or maintenance safety.

inspection—a method of qualifying the condition or status of an appliance and its systems and/or accessories to specific standards and requirements.

maintenance—inspection, overhaul, repair, preservation, and replacement of parts; does not include preventative maintenance.

maintenance scheduling effectiveness—a performance goal determined by dividing the total number of scheduled maintenance events that occurred on the date due by total number of scheduled maintenance events, and multiplying by 100.

$$\frac{\text{total on-time events}}{\text{total events scheduled}} \times 100$$

mean supply response time (MSRT)—used in computing the effectiveness of supply for an aircraft, engine, propeller, or appliance or any component of or part of an aircraft, engine, propeller, or appliance; the sum of supply response times divided by the total number of supply responses.

mean time between failures (MTBF)—used in computing the reliability of aircraft and equipment, it is the average elapsed time between failures of an aircraft, engine, propeller, or appliance or any component or part of an aircraft, engine, propeller, or appliance. The total elapsed time between failures of an aircraft, engine, propeller, appliance, or any component or part of an aircraft, engine, propeller, or appliance.

mean time to repair (MTTR)—used in computing the maintainability of an aircraft, engine, propeller, or appliance, or any component of or part of an aircraft, engine, propeller, or appliance. The sum of TTRs divided by the total number of repairs.

mission—a DOE/NNSA program requirement for which the aircraft was acquired to support.

mission capable (MC)—the aircraft is airworthy; the flight crew is available, certified, trained, and current; the mission crew is available, trained, and current; the mission essential equipment is operable.

mission capable rate—the proportion of assigned hours an aircraft, flight crew, mission crew, and mission essential equipment is operable to meet its mission requirements over a defined period of time (Assigned hours) minus the time the aircraft is non-available due to aircraft maintenance downtime, downtime due to aircraft supply, mission essential equipment maintenance downtime, downtime due to mission essential equipment supply, mission crew non-availability, or flight crew non-availability divided by total assigned hours × 100.

non-mission capable (NMC)—the aircraft is not available; the flight crew is not available, certified, trained, or current; the mission crew is not available, trained, or current; or mission essential equipment is not available.

non-mission capable rate (NMCR)—the proportion of assigned hours an aircraft is not able of meet primary or secondary mission requirements.

preventative maintenance—simple or minor repair or replacement of small standard parts not involving complex assembly operations.

repeat/recur—two or more occurrences (e.g., a discrepancy s on two or more consecutive flights).

reportable incident—an event resulting in damage valued at $500 or more to a Government-owned, -rented, or -leased aircraft or equipment or privately owned aircraft operated while on official business.

R&D aircraft—that which is under contract to the Federal government for a primary mission in support of scientific, aeronautical, or environmental research but does not transport personnel.

- **R&D utilization ground time:** Hours (and tenths of an hour) when an R&D aircraft is—
  - undergoing configuration,
  - configured with project equipment and undergoing ground operational checks such as project equipment calibration, and system tuning, or

  NOTE: For the sole purpose of determining if it qualifies to report R&D utilization, the aircraft—

  - must be intended for use of the research project,
  - is not being utilized to meet other program needs, and
  - is undergoing only the maintenance (including inspection), modification, testing, calibration or alteration associated with R&D project.

return to service—an entry made in the appropriate record by a qualified individual certifying that the appliance, system, or accessory is airworthy after accomplishing the required inspection, test, preventative maintenance or maintenance, IAW manufacturer's maintenance instructions, or instructions for continued airworthiness.

scheduled inspection/maintenance—evaluation and repair performed on a calendar, cycle, or hourly basis or a combination thereof.

serious injury—any harm or wound that—

- requires hospitalization for more than 48 hours, commencing within 7 days from the date of the injury was received;
- results in a fracture of any bone (except simple fractures of fingers, toes, or nose);
- causes severe hemorrhages, nerve, muscle, or tendon damage;
- involves any internal organ; or
- involves second- or third-degree burns, or any burns affecting more than five percent of the body surface.

special inspection—one that is performed after completing other maintenance, such as installation of a major component (e.g., replacement of binocular assembly, monocular assembly, intensifier tube, etc.).

substantial damage—harm or failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component. Engine failure or damage limited to an engine if only one engine fails or is damaged, bent fairings or cowling, dented skin, small punctured holes in the skin or fabric, ground damage to rotor or propeller blades, and damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wingtips are not considered "substantial damage" for the purpose of this part.

unscheduled maintenance—an inspection, overhaul, repair, preservation, and the replacement of parts, but excludes preventative maintenance, that occurs between scheduled inspection-maintenance.

APPENDIX C. REFERENCES

DOE G 120.1-5, *Guidelines for Performance Measurement*, dated 06-30-1996, PO-HR).

DOE G 151.1-1 V2, *Hazardous Survey and Hazards Assessments,* dated 08-21-1997.

DOE O 200.1, *Information Management Program*, dated 09-30-1996.

DOE O 224.2, *Auditing of Programs and Operations*, dated 03-22-2001.

DOE O 231.1A Chg 1, *Environment*, *Safety, and Health Reporting*, dated 06-03-2004, EH).

DOE M 231.1-2, *Occurrence Reporting and Processing of Operations Information,* dated 08-19-2003, EH).

DOE P 413.1, *Program and Project Management Policy for the Planning, Programming, Budgeting, and Acquisition of Capital Assets*, dated 06-10-2000.

DOE O 413.1A, *Management Control Program*, dated 04-18-2002.

DOE O 430.1B, *Real Property Asset Managemen*t, dated 09-24-2003.

DOE O 440.2B, *Aviation Management and Safety*, dated 11-27-2002.

DOE O 534.1B, *Accounting*, dated 01-06-2003.

OMB Circular A-11, Preparation, Submission and Execution of the Budget

OMB Circular A-11, Section 300, Planning, Budgeting, Acquisition, And Management of Capital Assets.

Public Law (P.L.) 103-62, Government Performance and Results Act of 1993 (GPRA)

P.L. 103-355, Federal Acquisition Streamlining Act of 1994, Title V (FASA V), which requires agencies to establish cost, schedule and measurable performance goals for all major acquisition programs, and achieve on average 90 percent of those goals. OMB policy for performance-based management is also provided in this section.

APPENDIX D. SAMPLE PILOT AVAILABLITY ANALYSIS

The following samples are provided to guide AvMs thru the statistical analysis necessary to determine the minimum number of pilots required to support the pace of operations. These samples are by no means a substitute for the actual problems encountered in maintaining a day to day or month to month flight schedule. However, statistically it shows the minimum level of effort required to meet the operational pace of the suggested scenarios.

SCENARIO # 1:

- Operation has two aircraft (one aircraft must be available 24/7);
- Each aircraft must have two qualified and current pilots to operate;
- Each pilot works a total of 40 hours per week;
- Each pilot is authorized overtime of 10 hours per week;
- Each pilot must have 10 hours of rest in any 24 hour period;
- The Chief Pilot is dedicated to management duties and only available 50 percent of his time for flight duties;
- Pilots work from 8 a.m. to 4 p.m. or 4 p.m. to 12 a.m. or 12 a.m. to 8 a.m.;
- The mission capable rate is 98.8 percent; and
- Operations are limited to VFR operations (average mission cancellations due to weather per year is 2 percent).

Other Data Assumptions Based on One Person:

- There are 105 weekend days + 9 holidays - 365 days per yr. = 251normal work days (NWD);
- Each pilot receives 3 weeks annual leave × 5 days = 15 - 251 = 236 NWD (minus Annual leave);
- Each pilot attends training for 2 weeks annually × 5 days = 10 - 236 = 226 NWD available (minus training);
- On average each pilot is out due to illness one week × 5 days = 5 - 226 = 221 NWD available (minus sick leave);
- Each pilot works 8 hours per NWD = 1768 hours available for flight duty
- Program requires 24 hours per day × 365 coverage = 8760 annual hours.

- 8760 / 1768 = 4.9 pilots × 2 pilots per shift = 9.8 pilots required to meet mission readiness.

NOTE: This does analysis did not consider the 10 hours per week authorized overtime.

SCENARIO # 2:

- Operation has two fixed-wing aircraft and one helicopter (one aircraft must be available 24/7) at one location; and
- One fixed-wing and one helicopter at another location (one aircraft must be available 24/7);
- Each aircraft must have two qualified and current pilots to operate;
- Each pilot works a total of 40 hours per week;
- Each pilot must have 10 hours of rest in any 24 hour period;
- Each pilot averages overtime of 10 hours per week (10/5 = 2);
- The Chief Pilot is dedicated to management duties and only available 50 percent of his time for flight duties;
- Pilots work during normal business hours 8 a.m. to 4 p.m. but two pilots at each location must be available for call response 24/7;
- The mission capable rate is 99.8 percent.
- Helicopter operations are limited to VFR operations (average mission cancellations due to weather per year is 2 percent); and
- Fixed-wing aircraft are capable of dispatch under IFR conditions.

Other Data Assumptions Based on One Person:

- There are 105 weekend days + 9 holidays - 365 days per yr. = 251normal work days (NWD);
- Each pilot receives 3 weeks annual leave × 5 days = 15 - 251 = 236 NWD (minus Annual leave);
- Each pilot attends training for 2 weeks annually × 5 days = 10 - 236 = 226 NWD available (minus training);
- On average each pilot is out due to illness one week × 5 days = 5 - 226 = 221 NWD available (minus sick leave);
- Each pilot works 10 hours per NWD = 2210 hours available for flight duty

- Program requires 24 hours per day × 365 days coverage at each location = 8760 annual hours × 2 locations = 17520 hours of coverage.
- 17520 / 2210 = 7.9 pilots × 2 pilots = 15.8 pilots required to meet mission readiness.

NOTE: This analysis consider the 10 hours per week authorized overtime.

SCENARIO # 3:

- Operation has seven fixed-wing aircraft of four different makes (one aircraft must be available 24/7 and one aircraft dedicated to R&D mission);
- Each aircraft must have two qualified and current pilots to operate;
- Each aircraft must have available flight crew during normal duty hours, except when down for maintenance;
- Each pilot works a total of 40 hours per week;
- Each pilot must have 10 hours of rest in any 24 hour period;
- Pilots are restricted to flying only one make and model;
- The Chief Pilot is dedicated to management duties and only available 50 percent of his time for flight duties;
- Flight operations, except alert aircraft, are scheduled during normal duty hours
- Pilots work during normal business hours 8 a.m. to 4 p.m. but two pilots must be available for call response 24/7;
- Aircraft Flight hours by model:
  - C-47—200 flight hours per year (AAR = 81.5%) R&D aircraft
  - C-47—220 flight hours per year (AAR = 88.9%)
  - B-17—400 flight hours per year (AAR = 84.5%)
  - (2) C-152—1500 flight hours per year (AAR = 75%)
  - F-22—350 flight hours per year (AAR = 86%)
- Average (Fleet) Aircraft Availability per year is 70.1% AAR

Other Data assumptions on one person:

- There are 105 weekend days + 9 holidays - 365 days per yr. = 251normal work days (NWD);
- Each pilot receives 3 weeks annual leave × 5 days = 15 - 251 = 236 NWD (minus Annual leave);
- Each pilot attends training for 2 weeks annually × 5 days = 10 - 236 = 226 NWD available (minus training);
- On average each pilot is out due to illness one week × 5 days = 5 - 226 = 221 NWD available (minus sick leave);
- Each pilot works 8 hours per NWD = 1768 hours available for flight duty
- C-47 (R&D) is available 7139.4 hours per year
- C-47 is available 7787.6 hours per year.
- B-17 is only available 7402.2 hours per year
- C-152 is only available 6570 hours × 2 aircraft = 13140 hrs per year
- F-22 is only available 7533.6 hours per year
- Total potential revenue hours for fleet is 44770.8 hours per year
- Alert program:
    - 24 hours per day × 365 coverage on the B-17 or back up plane = 8760 annual hour
    - aircraft × 8760 = 8760 work hours / 1768 × 2 pilots = 9.9 pilots to cover the alert plane
- Normal operations:
    - 5 aircraft × 8 normal work hours × 2 pilots × 251 NWD = 20080 normal work hours/1768 pilot hours = 11.4 pilots required
    - Total pilots required to meet all mission demands = 21.3 pilots
    - 20080 / 2210 = 9.1 pilots required. (This analysis considered the 10 hours per week authorized overtime.).
    - Total pilots required to meet all mission demands = 18.9 pilots