RELIABILITY, AVAILABILITY, MAINTAINABILITY, AND COST (RAM-C) RATIONALE REPORT

OUTLINE GUIDANCE

Version 1.0

February 28, 2017

Office of the Deputy Assistant Secretary of Defense for Systems Engineering

Washington, D.C.

Distribution Statement A. Cleared by DOPSR, Case # 17-S-1312. Distribution is unlimited.

The following RAM-C Report outline was prepared by the Office of the Deputy Assistant Secretary of Defense for Systems Engineering for use by Department of Defense acquisition programs. The outline includes guidance and expectations regarding appropriate details to include in each section.

The program may use this document as a template or establish a RAM-C Report template that includes the recommended content.

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**Reliability, Availability, Maintainability, and Cost (RAM-C) Rationale Report**

**Month dd, yyyy**

**Program Name – ACAT Level**

**RAM-C Rationale Report**

**Version \_\_\_**

**Attached To Program Name System Engineering Plan**

**Supporting Milestone \_**

**and**

**[Appropriate Phase Name]**

**SEP Dated Month dd, yyyy, SEP Version Xx**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

SUBMITTED BY

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| --- | --- | --- | --- |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Name  Lead Systems Engineer | \_\_\_\_\_\_\_\_\_\_\_\_  Date | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Name  Product Support Manager | \_\_\_\_\_\_\_\_\_\_\_\_  Date |
|  |  |  |  |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Name  Business Financial Manager | \_\_\_\_\_\_\_\_\_\_\_\_  Date | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Name  Program Manager | \_\_\_\_\_\_\_\_\_\_\_\_  Date |

concurrence

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| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Name  Program Executive Officer or Equivalent | \_\_\_\_\_\_\_\_\_\_\_\_  Date |

component approval

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| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Name  Title, Office | \_\_\_\_\_\_\_\_\_\_\_\_  Date |

Expectation: The RAM-C Rationale Report should be attached to the SEP and approved at an appropriate level as determined by the program office.

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# Executive Summary

Expectation: The information for the Executive Summary is obtained from the body of this document. The purpose from Section 2.1 (Purpose) is entered here.

## Sustainment KPP Assessment

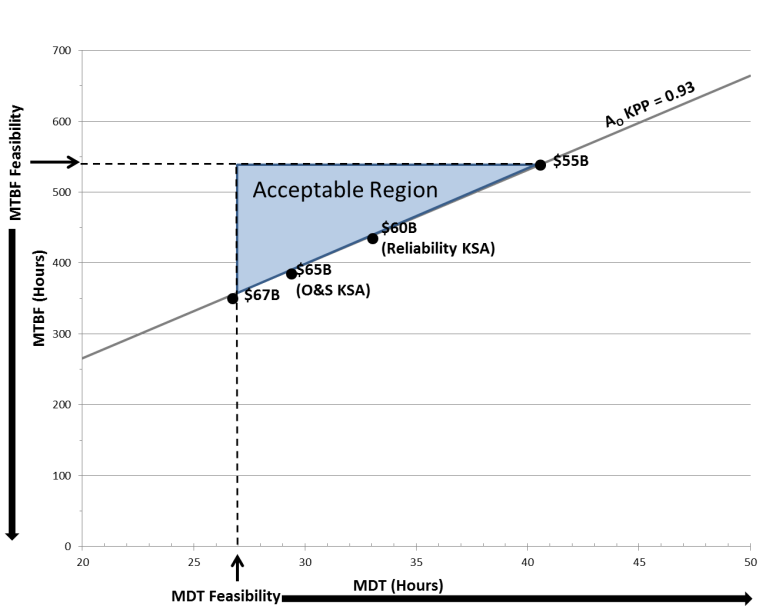
Expectations: The list of Sustainment Key Performance Parameters (KPPs) and supporting Key System Attributes (KSAs) and Additional Performance Attributes (APAs) and their values should be extracted from Table 3.2-1 (Sustainment Parameters Table). The Composite Model Estimate of the new system and Predecessor (Legacy) System values should be obtained from Section 5 (Feasibility). Identify and discuss any thresholds that are not feasible e.g., the mission reliability estimate shown in red.

Table 1.1-1 Sustainment KPPs (sample aviation parameters and values based on continuous usage)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Draft CDD, CDD or CPD* | | | *Feasibility Results* | |
| Parameter | | Threshold | Composite Model  Estimate | Predecessor (Legacy)  System |
| KPP | Materiel Availability | 0.65 | 0.67 | 0.58 |
| KPP | Operational Availability | 0.80 | 0.80 | 0.73 |
| KSA | Mission Reliability | 46 | 40 | 18 |
| KSA | Logistics Reliability | 3.5 | 4.2 | 2.5 |
| APA | Maintenance Burden | 9.0 | 8.0 | 15 |
| APA | Corrective Maintenance | 0.5 | 0.5 | 1.0 |
| KSA | O&S Cost | $423.7M | $471.4M | $722.6M |

## Summary

Based on the detailed analysis conducted in the body of this document, summarize whether the Joint Capabilities Integration and Development System (JCIDS) sustainment parameters are validated and feasible. Identify any significant issues in the Operational Mode Summary/Mission Profile (OMS/MP), failure definitions, or Maintenance Approaches. Identify any issues with specific sustainment parameters and associated recommendations provided to the requirements developers or other stakeholders. For updates to the RAM-C at the RFP Release Decision Point, MS B, and MS C summarize notable program changes that influenced the outcomes of the RAM-C analysis. Provide the results of trade study to illustrate the acceptable region for R&M parameters consistent with the AO and Operations and Support (O&S) cost thresholds.



Expectation: If significant issues are discovered during the development of this report, the program should work with the cognizant Requirements Developer, JCIDS Requirements Manager, DCAPE, and other DoD Component to resolve them before the report is submitted for approval. Summarize any remaining significant issues from sections 3.2 (CONOPs and OMS/MP), 3.3 (Maintenance Concept and Planning Factors), 4 (Validation), and 5 (Feasibility). Illustrate the trade study conduct in section 6. For recommendations to specific sustainment parameters, refer to section 7.

Figure 1-1 Relationship Between Sustainment Parameters and Cost (sample)

# Introduction

## Purpose

Provide a brief overview of the purpose of this version of the report and the JCIDS documentation (i.e., Draft Capability Development Document (CDD), CDD, or Capability Development Document (CPD)) that it supports.

Expectations: The RAM-C Rationale Report should provide a quantitative basis for reliability, availability, and maintainability requirements, as well as improve cost estimates and program planning. RAM-C rationale reports are to be developed and attached to the SEP at MS A, RFP Release Decision Point, MS B, and MS C.

## Changes

List changes to the RAM-C in Table 2.2-1 since the last update or indicate that this report is the initial release. The RAM-C may be updated due to changes in supporting documents i.e., changes to the OMS/MP or JCIDS documentation (user requirements).

Table 2.2-1 RAM-C Update Record

|  |  |  |  |
| --- | --- | --- | --- |
| Revision Number | Date | Description of Changes | Approved By |
| 001 | 1/1/15 | Updated OMS/MP required a re-assessment of mission reliability | XYZ |
|  |  |  |  |
|  |  |  |  |

## Preparers

List the RAM-C Rationale Report preparers in Table 2.3-1. Add additional rows if needed.

Table 2.3-1 RAM-C Preparers and Organizations

|  |  |  |
| --- | --- | --- |
| Function | Preparer | Organization |
| R&M Engineer | Name | Organization Name and Code |
| Product Support Specialist | Name | Organization Name and Code |
| Cost Analyst | Name | Organization Name and Code |

# Program Information

Expectation: Section 3 (Program Information) provides the data and information needed to develop the rationale that program’s sustainment parameters are valid (Section 4) and feasible (Section 5). As part of the process for developing the report, provide a list of acronyms in Annex A and a list of references in Annex B.

## System Description

Using the reference design concept from or that will be in the Acquisition Strategy, identify major subsystems that are subject to R&M requirements. The system description should be user-oriented and operational and should include all elements of the system, including Government-furnished and contractor-furnished hardware (whether developmental or not), system software, operating and support documentation, and the crew and maintainer personnel.

## Sustainment Parameters

In Table 3.2-1, list the sustainment parameters as stated in the JCIDS documentation (Draft CDD, CDD, or CPD). During the MSA Phase, the data gathering should begin as soon as preliminary inputs are available from the (user) e.g., from working versions or informal review of the Draft CDD.

Include the source of the sustainment parameters. For example: The sustainment parameters, definitions, and thresholds with units in Table 3.2-1 were obtained from the Program Name Draft CDD version xx, dated Month dd, yyyy.

Table 3.2-1 Sustainment Parameters (sample aviation parameters and values based on continuous usage)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter1 | | Definition (samples) | JCIDS Threshold | Units |
| KPP | Materiel Availability | Measure of the percentage of the total inventory of a system operationally capable, based on materiel condition, of performing an assigned mission. | 0.65 |  |
| KPP | Operational Availability | Measure of the percentage of time that a system or group of systems within a unit are operationally capable of performing an assigned mission e.g. uptime/(uptime + downtime). | 0.80 |  |
| KSA | Mission Reliability |  | 46 | Hours |
| KSA | Logistics Reliability | Total number of items removed from the aircraft that cause a demand to be placed on the supply system divided by the total number of flight hours. | 3.5 | Hours |
| APA | Maintenance Burden |  | 9 |  |
| APA | Corrective Maintenance2 |  | 2.0 | Hours |
| KSA | O&S Cost3 |  | $423.7M | 2013 Dollars |
| Notes:  1. Include all relevant KPP, KSA and APA sustainment parameters and associated information including definitions (e.g. Failure definitions, mission duration, etc.) and rationale. Refer to the JCIDS manual.  2. Corrective Maintenance (Mct or MTTR) Include the tasks included in downtime, e.g., crypto load, start-up, active repair, verification of repair.  3. Include the type of dollars (e.g., then year, present year) and the units. | | | | |

Expectations: For each of the parameters, list the notes, rationale, and assumptions stated in the JCIDS documentation, e.g., the inclusion or exclusion of GFE or COTS, average sortie duration or mission time, failure definition. Per the JCIDS Manual, the parameters should be measurable, testable, and support efficient and effective T&E. Indicate whether the Failure Definition and Scoring Criteria (FD/SC) have been developed. If so, ensure that the definitions in the JCIDS documentation are consistent with the FD/SC. Ensure the rationale provided in the Draft CDD/CDD/CPD is adequate (see JCIDS Manual Appendix D to Enclosure F “Endorsement Guide to the Sustainment KPP” dated February 12, 2015, including errata as of December 18, 2015).

## OMS/MP

Summarize the Operational Mode Summary/Mission Profile (OMS/MP) and environment expected for the materiel solution. An accurate and thorough OMS/MP, based on the Concept of Operations (CONOPs) or combat scenario deemed to be the most representative, is critical to ensuring the fielding of new equipment that will meet the User’s needs. Highlight any special conditions of use, such as any unique high-intensity cycles of use within a mission or from the Concept of Employment (CONEMP) that would affect the sustainment of the system. In Table 3.3-1, summarize the mission time from the OMS/MP. The mission reliability parameter should be based on the planned mission time(s), or appropriate life units (miles, cycles, etc.) and be traceable to the appropriate DoD Architecture Framework (DoDAF) viewpoints (reference JCIDS Manual table C-C-1). Provide the frequency for each Task or Function which should take into account the OPTEMPO, indicating how often each task or function will be performed. Provide the information source(s) with version and date.

Include the sources for the OMS/MP e.g. The information provided in Tables 3.3-1 and 3.3-2 were obtained from the Program Name OMS/MP version xx, dated [date].

Table 3.3-1 Operational Mode Summary (sample land system functions)

|  |  |  |  |
| --- | --- | --- | --- |
| Tasks or Functions | Frequency | Duration  (hours) | Total Time  (hours) |
| Extended Tactical Movement |  |  |  |
| Combat Replenishment Operation (CRO) |  |  |  |
| Deliberate Attack – Fix & Isolate Enemy |  |  |  |
| Exploitation |  |  |  |
| Sustainment Replenishment Operation (SRO) |  |  |  |
| Deliberate Attack – Urban Environment |  |  |  |
| **Total** |  |  |  |

Summarize the expected environmental profiles. Summarize the external and internal conditions (such as temperature, humidity, shock vibration, etc.) either natural or man-made, or self-induced, that influences the form, operational performance, reliability or survival of an item. A sample for operating temperature is provided in Table 3.2-2.

Table 3.3-2 Summary of Environmental Data (sample land system environment)

|  |  |  |
| --- | --- | --- |
| Operating Temperature | | |
| **Climate** | Operating Climate Temperature | % Use |
| Basic | -25°F to 110°F | 85% |
| Hot | Up to 130°F | 10% |
| Cold | Down to -50°F | 3% |
| Severe Cold | Down to -60°F | 2% |

Expectation: Programs should analyze how the OMS/MP and environmental factors will affect the system in terms of loads and stresses it encounters and then note the factors from the OMS/MP and environmental profile that will be used during the validation and feasibility assessment for the sustainment parameters of the system. Typical factors include operating time, average sortie duration, duty cycles, and expected environments. The information is used to determine if adjustments are needed to account for differences in mission and/or operating environment conditions.

## Maintenance Concept and Planning Factors

List the maintenance concept planning factors for the system and source of the values.

Expectations: The planning factors and their values used to determine Mean Down Time (MDT) and other maintainability KSAs or APAs are needed to validate Ao and Am and should provide a realistic, definitive, and uniform basis to determine downtime. The planning factors should support the sustainment capabilities as viewed by the user, maintainer, supplier and transportation providers, taking into account constraints (e.g., preventative maintenance, reset time, periodic depot maintenance) and limitations (e.g., “core” requirements, statutory requirements).

# Validation

Expectations: This section will contain the detailed assessment of the sustainment parameters to ensure they are valid. The parameters should be consistent with the CONOPS, CONEMP, OMS/MP, environmental profiles, product support strategy, planned inventory, operating hours (mission durations) and planned downtimes. In addition, the parameters should support each other, as shown by calculation and/or M&S and be traceable to the appropriate JCIDS document.

## Operational Availability (AO)

Expectation: Determining the value for Operational Availability requires a comprehensive analysis of the system and its planned CONOPS, including the planned operating environment, operating tempo, and reliability and maintenance concepts. The logistics reliability and maintainability KSAs/APAs used in the AO calculations do not require independent validation. However, they are assessed for feasibility in Section 5.2.

Provide the equation used to determine Ao. For complex Ao calculations, provide the inputs and outputs from any simulation models that may have been used to determine Ao. Using the R&M values from Table 3.2-1 along with other input parameters as needed, calculate the expected Ao.

Placeholder for Ao equation

In Table 4.1-1, provide the JCIDS Ao threshold value, input parameters, and calculated Ao value.

Table 4.1-1 AO Validation (sample aviation values)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **JCIDS AO Threshold** |  | **CalculatedAO** | **Input Parameters2** | | |
| **MFHBF1**  **Threshold** | **MDT** | |
| **MTTR** | **ALDT** |
| 0.8 | 0.8 | 8.4 | 0.9 | 1.2 |
| Note:  1. Use appropriate service definitions for failures that influence AO. In most cases this value of MTBF will not be the same as the logistics reliability value unless all events that place a demand on the supply system also affect AO.  2. List additional input parameters or assumptions needed for the Ao calculation. | | | | | |

Describe the rationale for the level of reliability stated in the draft CDD/CDD/CPD. Provide the supporting rationale for the mean down time. Compare the calculated AO value to the threshold value and verify if the calculated AO is equal to or greater than the JCIDS AO threshold.

## Materiel Availability (AM)

Expectation: Materiel Availability covers the timeframe from placement into operational service through the planned end of service life. Materiel Availability may be equivalent to Operational Availability if the total number of a system or group of systems within a unit is the same as the total inventory, e.g., one command and control center, one fixed land-based radar.

Provide the equation used to determine AM. For complex AM calculations, provide the inputs and outputs from any simulation models that may have been used to determine AM.

Placeholder for AM equation

Describe the data sources used. Provide supporting rationale demonstrating the link between AM, Reliability, Maintainability, and Product Support Strategy. In Table 4.2-1, provide the JCIDS AM threshold value, input parameters, and calculated AM value.

**Table 4.2-1 AM Validation (sample aviation values)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **JCIDS AM Threshold Value** |  | **CalculatedAM** | **AM Inputs** | | | | | | |
| **Up Assets** | | | | **Down Assets1** | | **Total Assets** |
| CONOPS | Op Systems for Training | Attrition  Reserve | Pre-positioned  Assets | | Total  Average  Annual  Down  Assets | Total Average Annual Assets |
| 0.65 | 0.65 | 102 | 12 | 22 | 20 | | 84 | 240 |
| Notes:  1. The average number of unavailable assigned assets, based on assumed planned depot, flight-line downs, or shipyard cycles | | | | | | | | | |

Compare the calculated AM value to the threshold value in Table 4.2-1 and verify if the calculated AM is equal to or greater than the JCIDS AM.

## Reliability

Provide the assumptions (e.g., inclusion of GFE/CFE), equations, and models used to determine mission reliability. Ensure that the FD/SC used is consistent with the definitions provided in Section 3.2. For repairable systems (including system-of-systems), describe the most stringent mission duration, composition, and the definition of success and failure of the mission. Ensure that the model uses the expected mission duration. In most cases, a reliability block diagram should be developed and used to validate the mission reliability. Compare the calculated value of the mission reliability to the threshold in table 4.3-1 and assess if the results support the threshold. Ensure that the continuous value validated here supports the value used to determine Ao.

For one-shot or single use non-repairable systems (i.e. throwaway items), ensure the mission reliability supports calculation of any higher-level probability thresholds (e.g., probability of kill, mission effectiveness, success rates). Validation of mission reliability should also ensure the threshold is consistent with user needs, CONOPs, and maintenance concept planning factors.

Table 4.3-1 Mission Reliability Validation (sample)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **JCIDS Mission Reliability Threshold Value** |  | **Mission Reliability Inputs** | | |
| **Calculated Mission Reliability Value** | **Mission Duration** | **Probability1 of Success or Continuous Value** |
|  |  |  |  |
| Note:  1. If JCIDS mission reliability is defined as a probability of success, use the continuous value in this block. If JCIDS mission reliability is defined as a continuous value, use probability of success in this block. | | | | |

## Operations and Support (O&S) Cost

List the sustainment KPP-related input parameters (e.g., reliability, repair time per failure, quantity of systems, operating hours) used in the Program Office baseline O&S cost estimate. Compare the input parameters to the information provided in section 3.2.

If the input parameters are consistent, obtain the baseline O&S cost estimates. Compare the calculated O&S cost value to threshold. If the calculated values are consistent, the O&S cost values are validated. If they are not consistent, determine the cause of the inconsistency, e.g., discrepancies in input parameters.

## Summary

Summarize the results of sections 4.1 – 4.4, noting any parameters where the threshold exceeds the calculated value. If the calculated value (AO, AM, or O&S cost) does not support the threshold, determine the appropriate input parameters that would be needed and coordinate the information with the Requirements Developer (Manager) and/or user representative.

# Feasibility

Expectations: This section will contain the detailed assessment of the sustainment parameters to ensure they are feasible. The parameters should be assessed for feasibility by determining if all the sustainment parameters can be implemented in the system under consideration consistent with state of the art and technical maturity. This document does not address the overall feasibility of program schedule or cost issues.

## Composite System Model

Develop and include a reliability block diagram and a composite model of the new system using legacy data, analogous subsystem or system data, and other R&M data as applicable. Obtain the best available data at the system and subsystem (for example 2 level Work Unit Code (WUC) levels). Describe how the model of the composite system was developed including the sources of data, and document the subsystem details in Annex C.

## Reliability and Maintainability (R&M) Feasibility

Using the composite model and the details documented in Annex C, provide the summary level numbers for reliability and maintainability in Table 5.2-1. Determine feasibility by verifying if the “Assessed System” R&M values support the applicable JCIDS thresholds.

Expectation: Legacy data should be carefully reviewed to obtain an accurate estimate of reliability and maintainability. Typical areas to review include: unit quantities, operating versus clock time, removals to facilitate other maintenance, operating environment, age of equipment, differences in technology, etc.

Table 5.2-1 R&M Feasibility (If more than one alternative is possible, insert tables as needed.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Reliability1 | | Maintainability | |
|  | Mission Reliability  (MFHBA) | Logistics Reliability  (MFHBF) | Maintenance Burden (MMH/FH) | Corrective Maintenance  (MTTR) |
| Assessed System2 |  |  |  |  |
| JCIDS Threshold |  |  |  |  |
| Legacy System3 |  |  |  |  |

Notes  
1. Use appropriate life units (hours, miles, cycles, etc.)

2. Highlight any cell in red if the assessed system value does not meet the JCIDS Threshold

3. If applicable, enter legacy system data for each sustainment parameter

## Operations and Support (O&S) Cost Feasibility

O&S costs consist of sustainment costs incurred from the initial system deployment through the end of system operations. Consistent with CAPE guidance, include all costs of operating, maintaining, and supporting a fielded system. Provide sources of information, assumptions, and the reliability value used for the estimate. Complete table 5.3-1 and determine feasibility by verifying if the “Estimated O&S Cost” value is equal to or less than the applicable JCIDS threshold.

Expectation: O&S costs analysis should be based on the most recent version of the Cost Assessment and Program Evaluation (CAPE) Operating and Support Cost Estimating Guide. If available for comparison, the O&S Cost KSA data should be consistent with the capability solution’s life cycle cost estimate (LCCE), Cost Analysis Requirements Data (CARD) and/or the CAPE independent cost estimate (ICE).

Table 5.3-1 O&S Cost Feasibility (sample aviation values)  
(If more than one alternative is possible, insert columns as needed.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Cost Element | JCIDS O&S Cost1 Threshold Value |  | Alternative 1  Estimated2 O&S Cost Value | Legacy O&S Cost Value |
| 1.0 Unit Level Manpower |  | 139.4 | 155.5 |
| 2.0 Unit Operations |  | 102.1 | 143.0 |
| 3.0 Maintenance |  | 30.2 | 59.6 |
| 3.1 Consumable Materials and Repair Parts |  | 3.3 | 6.5 |
| 3.2 Depot Level Repairables |  | 10.4 | 20.5 |
| 3.3 Intermediate Maintenance (External to Unit-Level) |  | 5.2 | 10.3 |
| 3.4 Depot Maintenance |  | 8.2 | 16.2 |
| 3.5 Other Maintenance |  | 3.0 | 6.2 |
| 4.0 Sustaining Support |  | 98.1 | 107.7 |
| 5.0 Continuing System Improvements |  | 32.6 | 56.3 |
| 6.0 Indirect Support |  | 38.9 | 50.8 |
| Total3 | 423.7 (BY 2013$) | 471.4 (BY 2013$) | 632.6 (BY 2013$) |
| Notes 1. Highlight any cell in red if the assessed system value does not meet the JCIDS Threshold 2. Include the type of dollars and the units | | | | |

## Operational Availability (AO) and Materiel Availability (AM) Feasibility

Using the results of the R&M feasibility assessment in Section 5.2, along with other input parameters as needed, calculate the feasibility estimate for AO. Using modeling and simulation, perform a feasibility assessment for AM. For this assessment, data are only required at the system or system-of-systems level instead of the subsystem level. Complete Table 5.4-1 and assess if AO and AM are feasible. Provide the outputs of any simulation models used.

Expectation: The analysis should show that AM is feasible based on the expected downtime (scheduled and unscheduled) for the primary system, primary training asset(s), and the planned calendar time that any backup assets will be in periodic depot maintenance.

Table 5.4-1 AO and AM Feasibility (sample)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | JCIDS Threshold Value |  | Estimated Value1 | Legacy Value |
| AO |  |  |  |  |
| AM |  |  |  |  |
| Note 1. Highlight any cell in red if the estimate value does not meet the JCIDS Threshold | | | | |

## Feasibility Summary

Summarize the results of the RAM-C feasibility assessment process. Identify any issues with specific sustainment parameters. If the parameters (AO, AM, R, M, or O&S cost) are not feasible, conduct a trade study (see Section 6) to determine potential parameters that can satisfy the AO and O&S cost thresholds. Coordinate the information with the Requirements Developer (Manager) and/or user representative.

Expectation: Coordinate with the Requirements Developer and other affected stakeholders prior to formal submittal of this report if analysis shows that some values are not feasible.

# Trade Studies

A RAM-C analysis includes a trade study that documents the sensitivity analysis that shows the range of R&M parameters (e.g., MTBF and MDT) that will satisfy the AO threshold, using the constituent elements and assumptions of the Ao equation provided in Section 4.1. Provide the results of the sensitivity analysis (see Figure 6-1) illustrating the trade space for reliability and maintainability along with the associated O&S costs. Note: costs shown in Figure 6-1 refer to the O&S costs for the associated reliability values, not the O&S cost for all maintenance events.

Expectation: The RAM-C report will document the supporting rationale for the JCIDS sustainment parameters. The focus of the trade studies in the RAM-C report will be the sensitivity analysis made between the sustainment parameters (reliability, availability, maintainability, and O&S cost).

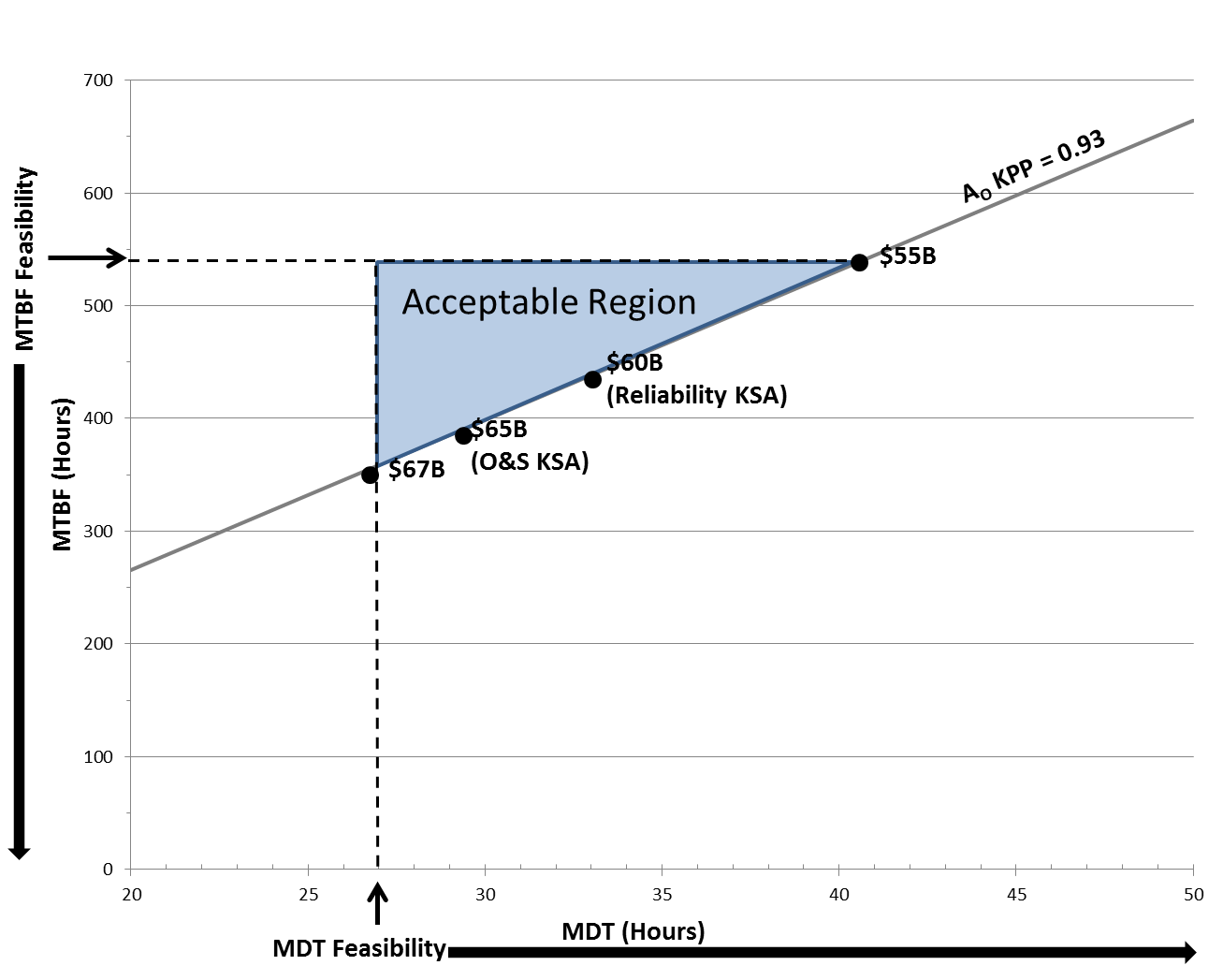


Figure 6-1 Relationship Between Sustainment Parameters and Cost (sample)

# Summary

Summarize the results of the RAM-C process. Identify any significant degraders to availability and mission success and the top drivers O&S costs along with any actions in process to mitigate these. Identify any issues with specific sustainment parameters and the recommendations and feedback that have been provided to the requirements developers.

Expectation: At the completion of the RAM-C process, all the thresholds should have been validated and aligned to support Ao, AM, O&S costs, and mission success requirements. The thresholds should be feasible and consistent with the state of the art and technical maturity. The sustainment parameters should be balanced to support Ao and O&S costs.

##### Appendix A – Acronyms

Provide a list of the acronyms used in the report.

ACAT Acquisition Category

ALDT Administrative and Logistics Delay Time

AO Operational Availability

AoA Analysis of Alternatives

AM Materiel Availability

APA Additional Performance Attribute

BIT Built In Test

CAPE Cost Assessment and Program Evaluation

CDD Capability Development Document

CONEMP Concept of Employment

CONOPS Concept of Operations

CPD Capability Production Document

CRO Combat Replenishment Operation

FD/SC Failure Definition/Scoring Criteria

ICD Initial Capability Document

JCIDS Joint Capability Integration Development System

KPP Key Performance Parameter

KSA Key Supporting Attribute

LCSP Life Cycle Support Plan

MCT Mean Corrective Time

MDT Mean Down Time

MLDT Mean Logistics Delay Time

MS Milestone

MFHBF Mean Flight Hours Between Failure

MFHBOMF Mean Flight Hour Between Operational Mission Failure

MMH/FH Maintenance Man Hours per Flight Hour

MTBF Mean Time Between Failure

MTTR Mean Time To Repair

O&S Operating and Support

OMS/MP Operational Mode Summary/Mission Profile

OSD Office of the Secretary of Defense

R&M Reliability and Maintainability

RAM-C Reliability, Availability, Maintainability, and Cost

RFP Request For Proposal

SEP Systems Engineering Plan

SRO Sustainment Replenishment Operation

TAT Turn Around Time

TMRR Technology Maturation and Risk Reduction  
WUC Work Unit Code

##### Appendix B – Documentation, References, and Tools

**Documentation** - List the program documents with date and version number in Table B-1. Note relevant sections of the document that were used to develop the RAM-C rationale.

Table B-1 Resource Documents (sample documents)

|  |  |  |
| --- | --- | --- |
| Document | Date/Version | Relevant Sections to RAM-C |
| CDD |  |  |
| CONOPs |  |  |
| OMS/MP |  |  |
| AoA Study Plan |  |  |
| AoA Guidance |  |  |
| AoA Report |  |  |
| Acquisition Strategy |  |  |
| SEP |  |  |
| LCSP |  |  |
| Etc. |  |  |

Expectation: Program should list program documentation sources that were used in the RAM-C process. Relevant sections of each provide a quick and easy understanding of source material.

**References** – Program should list all sources and references for calculations, policy, and any other analysis used to develop the RAM-C rationale.

**Tools –** In Table B-2, identify the tools the program plans to use in the RAM-C process.

Table B-2 RAM-C Tools

|  |  |
| --- | --- |
| Tool | Purpose |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

##### Appendix C – Composite Model Details

Table C-1 Composite Model Details (Sample aviation WUC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Reliability1 | | Maintainability | | Total Downtime (MDT) | O&S Costs  (3.0) |
| Subsystem  (2-Digit WUC) | Mission Reliability  (MFHBA) | Logistics Reliability  (MFHBF) | Maintenance Burden (MMH/FH) | Corrective Maintenance  (MTTR) |
| 11 Airframes |  |  |  |  |  |  |
| 12 Furnishings |  |  |  |  |  |  |
| 13 Landing Gear |  |  |  |  |  |  |
| 14 Flight Control/Lift System |  |  |  |  |  |  |
| 15 Hydraulic Propellers |  |  |  |  |  |  |
| 22 Engine |  |  |  |  |  |  |
| *List Remaining subsystems* |  |  |  |  |  |  |
| **Assessed System2** |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **JCIDS Threshold** |  |  |  |  |  |  |
| **Legacy System3** |  |  |  |  |  |  |
| Notes 1. Use appropriate life units (hours, miles, cycles, etc.)  2. Highlight any cell in red if the assessed system value does not meet the JCIDS Threshold.  3. If applicable, enter legacy system data for each sustainment parameter. | | | | | | |