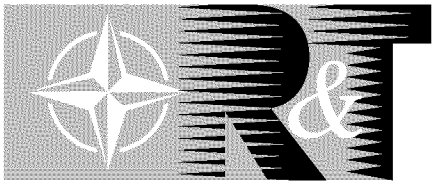
RTO-AG-300 Vol. 20
AC/323(SCI-010)TP/38

RTO-AG-300 Vol. 20

NORTH ATLANTIC TREATY ORGANIZATION



RESEARCH AND TECHNOLOGY ORGANIZATION

BP 25, 7 RUE ANCELLE, F-92201 NEUILLY-SUR-SEINE CEDEX, FRANCE

© RTO/NATO 2001

Single copies of this publication or of a part of it may be made for individual use only. The approval of the RTA Information Policy Executive is required for more than one copy to be made or an extract included in another publication. Requests to do so should be sent to the address above.

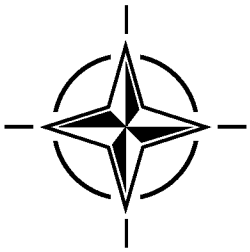
RTO AGARDograph 300

Flight Test Techniques Series – Volume 20

Logistics Test and Evaluation in Flight Test

(les Essais et l'évaluation de la logistique lors des essais en vol)

This AGARDograph has been sponsored by the SCI-055 Task Group, the Flight Test Technology Team of the Systems Concepts and Integration Panel (SCI) of RTO.



Published August 2001

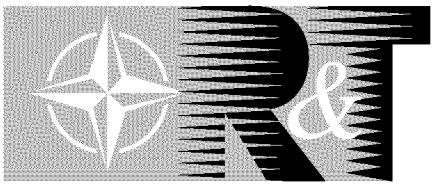
Distribution and Availability on Back Cover

This page has been deliberately left blank

Page intentionnellement blanche

RTO-AG-300 Vol. 20
AC/323(SCI-010)TP/38

NORTH ATLANTIC TREATY ORGANIZATION



RESEARCH AND TECHNOLOGY ORGANIZATION

BP 25, 7 RUE ANCELLE, F-92201 NEUILLY-SUR-SEINE CEDEX, FRANCE

RTO AGARDograph 300

Flight Test Techniques Series – Volume 20

Logistics Test and Evaluation in Flight Test

(les Essais et l'évaluation de la logistique lors des essais en vol)

Edited by

Michael A. Bourcier

This AGARDograph has been sponsored by the SCI-055 Task Group, the Flight Test Technology Team of the Systems Concepts and Integration Panel (SCI) of RTO.

The Research and Technology Organization (RTO) of NATO

RTO is the single focus in NATO for Defence Research and Technology activities. Its mission is to conduct and promote cooperative research and information exchange. The objective is to support the development and effective use of national defence research and technology and to meet the military needs of the Alliance, to maintain a technological lead, and to provide advice to NATO and national decision makers. The RTO performs its mission with the support of an extensive network of national experts. It also ensures effective coordination with other NATO bodies involved in R&T activities.

RTO reports both to the Military Committee of NATO and to the Conference of National Armament Directors. It comprises a Research and Technology Board (RTB) as the highest level of national representation and the Research and Technology Agency (RTA), a dedicated staff with its headquarters in Neuilly, near Paris, France. In order to facilitate contacts with the military users and other NATO activities, a small part of the RTA staff is located in NATO Headquarters in Brussels. The Brussels staff also coordinates RTO's cooperation with nations in Middle and Eastern Europe, to which RTO attaches particular importance especially as working together in the field of research is one of the more promising areas of initial cooperation.

The total spectrum of R&T activities is covered by the following 7 bodies:

- AVT Applied Vehicle Technology Panel
- HFM Human Factors and Medicine Panel
- IST Information Systems Technology Panel
- NMSG NATO Modelling and Simulation Group
- SAS Studies, Analysis and Simulation Panel
- SCI Systems Concepts and Integration Panel
- SET Sensors and Electronics Technology Panel

These bodies are made up of national representatives as well as generally recognised 'world class' scientists. They also provide a communication link to military users and other NATO bodies. RTO's scientific and technological work is carried out by Technical Teams, created for specific activities and with a specific duration. Such Technical Teams can organise workshops, symposia, field trials, lecture series and training courses. An important function of these Technical Teams is to ensure the continuity of the expert networks.

RTO builds upon earlier cooperation in defence research and technology as set-up under the Advisory Group for Aerospace Research and Development (AGARD) and the Defence Research Group (DRG). AGARD and the DRG share common roots in that they were both established at the initiative of Dr Theodore von Kármán, a leading aerospace scientist, who early on recognised the importance of scientific support for the Allied Armed Forces. RTO is capitalising on these common roots in order to provide the Alliance and the NATO nations with a strong scientific and technological basis that will guarantee a solid base for the future.

The content of this publication has been reproduced
directly from material supplied by RTO or the authors.

Published August 2001

Copyright © RTO/NATO 2001
All Rights Reserved

ISBN 92-837-1071-1

Printed by St. Joseph Ottawa/Hull
(A St. Joseph Corporation Company)
45 Sacré-Cœur Blvd., Hull (Québec), Canada J8X 1C6

Logistics Test and Evaluation in Flight Test

(RTO AG-300 Volume 20 / SCI-010)

Executive Summary

Flight testing continues to remain an essential step in the development or modification of an aircraft. Historically, considerable effort and expertise have been given to the operational utility of a system under test with little regard to supportability test and evaluation, except in areas of reliability and maintainability (R&M). R&M assessment generally is measured to determine specification compliance without a thorough assessment of the opportunities supportability design will provide in reducing overall system costs. As we test future aircraft or modifications assessing supportability just makes good sense. Sixty percent of the life cycle costs of systems are incurred in the area of supportability, including manpower, maintenance planning, training and training support, support equipment, facilities, computer resources, design interface, supply support, technical data, and packaging storage and transportation.

The purpose of this AGARDograph is to bring attention to a process of performing logistics test and evaluation (supportability assessment) while conducting flight tests. This AGARDograph presents an approach utilizing maintenance personnel, R&M engineers, and Human Factors (HF) engineering to document, rate and evaluate the supportability of any system under test. The consequences can be very effective in decision making for determining manpower, maintenance planning and support equipment purchases. The assessment may also drive system design changes making the aircraft more supportable. All this, if approached correctly, can reduce the costs of sustainment and improve operational availability.

les Essais et l'évaluation de la logistique lors des essais en vol

(RTO AG-300 Volume 20 / SCI-010)

Synthèse

Les essais en vol représentent toujours une étape indispensable dans le développement ou la modification d'un aéronef. Dans le passé, des efforts importants mettant en œuvre des compétences techniques considérables ont été consacrés à l'étude de l'intérêt opérationnel des systèmes à l'essai, mais sans attacher beaucoup d'attention à l'évaluation des possibilités de soutien, sauf en ce qui concernait la fiabilité et la maintenabilité (R&M). En général, l'évaluation de la R&M consiste à déterminer la conformité aux spécifications techniques d'un système donné, sans évaluation des possibilités de réduction des coûts globaux des systèmes qui sont offertes par une conception permettant d'augmenter les capacités de soutien. Il nous semble logique d'évaluer les capacités de soutien des futurs aéronefs et de leurs variantes. Près de soixante pour cent des coûts globaux de possession des systèmes sont consacrés à la capacité de soutien, y compris la main d'œuvre, la planification de la maintenance, la formation et le soutien de la formation, les équipements de soutien, les installations, les moyens informatiques, les interfaces de conception, les fournitures, les données techniques, les emballages, l'emmagasinage et le transport.

Cet AGARDographe a pour objectif d'attirer l'attention sur le processus des essais et de l'évaluation de la logistique (évaluation de la capacité de soutien) lors des essais en vol. Il présente une approche qui associe le personnel de maintenance, les ingénieurs R&M, et la conception ergonomique (HF) afin de documenter et d'évaluer la capacité de soutien de tout système à l'essai. Les résultats peuvent faciliter la prise de décisions concernant la main d'œuvre, la planification de la maintenance et l'achat de matériel de soutien. L'évaluation peut aussi servir de guide aux changements qui seraient à faire au niveau de la conception des systèmes pour augmenter la capacité de soutien des aéronefs. Moyennant une mise en œuvre judicieuse, l'ensemble de ces mesures est susceptible de réduire les coûts de soutien et de permettre une plus grande disponibilité opérationnelle.

Click inside the blue boxes to view the corresponding section

Contents

		Page
Executive Summary		**iii**
Synthèse		**iv**
List of Figures and Tables		**ix**
Preface		**x**
Abstract		**xi**
1.0	**Introduction**	**1**
1.1	Purpose	1
1.2	Scope	1
1.3	System Description	1
1.4	Document Organization	1
1.5	Test Concept	1
2.0	**General Information about the Structure and Contents of Chapters 3-12, The ILS Elements**	**5**
2.1	Introduction	5
2.2	General Information about the Disciplines Referenced in Chapters 3-12, The ILS Elements	8
2.2.1	Logistics Test	8
2.2.1.1	System Specifications and Logistics Test	8
2.2.1.2	Logistics Developmental Test and Evaluation (DT&E) of Data	9
2.2.2	Reliability and Maintainability	9
2.2.2.1	System RM&A Requirements	9
2.2.3	Human Factors (HSI)	9
2.2.3.1	Weapon System Human Factors Requirements	9
2.2.3.2	Human Factors Developmental Test and Evaluation (DT&E) Data	9
3.0	**Maintenance Planning (MP)**	**11**
3.1	Description	11
3.2	Objective	11
3.3	Logistics Test Measures (LTMs)	11
3.4	Reliability and Maintainability	11
3.4.1	Evaluation Measures	11
3.4.2	Measurement Criteria	13
3.4.3	Analysis Techniques and Tools	13
3.5	Human Factors	13
3.6	Logistics Test	13
3.6.1	Evaluation Measures	13
3.6.2	Measurement Criteria	14
3.6.3	Analysis Techniques and Tools	14
3.7	Overall Element Analysis	14
4.0	**Manpower and Personnel (M&P)**	**15**
4.1	Description	15
4.2	Objective	15
4.3	Logistics Test Measures (LTMs)	15
4.4	Reliability and Maintainability	15
4.4.1	Evaluation Measures	15
4.4.2	Measurement Criteria	16
4.4.3	Analysis Techniques and Tools	17

4.5 Human Factors 17
4.5.1 Evaluation Measures 17
4.5.2 Measurement Criteria 17
4.5.3 Analysis Techniques and Tools 17
4.6 Logistics 17
4.6.1 Evaluation Measures 17
4.6.2 Measurement Criteria 18
4.6.3 Analysis Techniques and Tools 18
4.7 Overall Element Analysis 18

5.0 Support Equipment (SE) 19
5.1 Description 19
5.2 Objective 19
5.3 Logistics Test Measures (LTMs) 19
5.4 Reliability and Maintainability 19
5.4.1 Evaluation Measures 19
5.4.2 Measurement Criteria 19
5.4.3 Analysis Techniques and Tools 20
5.5 Human Factors 20
5.5.1 Evaluation Measures 20
5.5.2 Measurement Criteria 20
5.5.3 Analysis Techniques and Tools 20
5.6 Logistics 20
5.6.1 Evaluation Measures 20
5.6.2 Evaluation Criteria 21
5.6.3 Analysis Techniques and Tools 21
5.7 Overall Element Analysis 21

6.0 Supply Support (SS) 23
6.1 Description 23
6.2 Objective 23
6.3 Logistics Test Measures (LTMs) 23
6.4 Reliability and Maintainability 23
6.4.1 Evaluation Measures 23
6.4.2 Measurement Criteria 23
6.4.3 Analysis Techniques and Tools 23
6.5 Logistics 24
6.5.1 Evaluation Measures 24
6.5.2 Measurement Criteria 24
6.5.3 Analysis Techniques and Tools 24
6.6 Overall Element Analysis 24

7.0 Technical Data (TD) 25
7.1 Description 25
7.2 Objective 25
7.3 Logistics Test Measures (LTMs) 25
7.4 Reliability and Maintainability 25
7.4.1 Evaluation Measures 25
7.4.2 Measurement Criteria 26
7.4.3 Analysis Techniques and Tools 26
7.5 Human Factors 26
7.5.1 Evaluation Measures 26
7.5.2 Measurement Criteria 26
7.5.3 Analysis Techniques and Tools 26
7.6 Logistics 26
7.6.1 Evaluation Measures 26
7.6.2 Measurement Criteria 27
7.6.3 Analysis Techniques and Tools 27
7.7 Overall Element Analysis 27

8.0 Training and Training Support (TTS) **29**
8.1 Description 29
8.2 Objective 29
8.3 Logistics Test Measures (LTMs) 29
8.4 Reliability and Maintainability 29
8.4.1 Evaluation Measures 29
8.4.2 Measurement Criteria 29
8.4.3 Analysis Techniques and Tools 30
8.5 Human Factors 30
8.5.1 Evaluation Measures 30
8.5.2 Measurement Criteria 30
8.5.3 Analysis Techniques and Tools 30
8.6 Logistics 30
8.6.1 Evaluation Measures 30
8.6.2 Measurement Criteria 31
8.6.3 Analysis Techniques and Tools 31
8.7 Overall Element Analysis 31

9.0 Computer Resources Support (CRS) **33**
9.1 Description 33
9.2 Objectives 33
9.3 Logistics Test Measures (LTMs) 33
9.4 Reliability and Maintainability 33
9.4.1 Evaluation Measures 33
9.4.2 Measurement Criteria 34
9.4.3 Analysis Techniques and Tools 35
9.5 Human Factors 35
9.5.1 Evaluation Measures 35
9.5.2 Measurement Criteria 35
9.5.3 Analysis Techniques and Tools 35
9.6 Logistics 35
9.6.1 Evaluation Measures 35
9.6.2 Measurement Criteria 35
9.6.3 Analysis Techniques and Tools 35
9.7 Overall Element Analysis 36

10.0 Facilities (FA) **37**
10.1 Description 37
10.2 Objective 37
10.3 Logistics Test Measures (LTMs) 37
10.4 Reliability and Maintainability 37
10.4.1 Evaluation Measures 37
10.4.2 Measurement Criteria 37
10.4.3 Analysis Techniques and Tools 37
10.5 Human Factors 37
10.5.1 Evaluation Measures 38
10.5.2 Measurement Criteria 38
10.5.3 Analysis Techniques and Tools 38
10.6 Logistics Test 38
10.6.1 Evaluation Measures 38
10.6.2 Measurement Criteria 38
10.6.3 Analysis Techniques and Tools 38
10.7 Overall Element Analysis 38

11.0 Packaging, Handling, Storage, and Transportation (PHS&T) **39**
11.1 Description 39
11.2 Objective 39
11.3 Logistics Test Measures (LTMs) 39

11.4 Reliability and Maintainability 39
11.4.1 Evaluation Measures 39
11.4.2 Measurement Criteria 39
11.4.3 Analysis Techniques and Tools 39
11.5 Human Factors 39
11.5.1 Evaluation Measures 40
11.5.2 Measurement Criteria 40
11.5.3 Analysis Techniques and Tools 40
11.6 Logistics 40
11.6.1 Evaluation Measures 40
11.6.2 Measurement Criteria 40
11.6.3 Analysis Techniques and Tools 40
11.7 Overall Element Analysis 40

12.0 Design Interface (DI) 41
12.1 Description 41
12.2 Objective 41
12.3 Logistics Test Measures (LTMs) 41
12.4 Reliability and Maintainability 41
12.4.1 Evaluation Measures 42
12.4.2 Measurement Criteria 44
12.4.3 Analysis Techniques and Tools 44
12.5 Human Factors 44
12.5.1 Evaluation Measures 45
12.5.2 Measurement Criteria 45
12.5.3 Analysis Techniques and Tools 45
12.6 Logistics 45
12.6.1 Evaluation Measures 45
12.6.2 Measurement Criteria 46
12.6.3 Analysis Techniques and Tools 46
12.7 Overall Element Analysis 46

13.0 Reporting Procedures 47
13.1 Introduction 47
13.2 Combined Test Force (CTF) Reporting 47
13.3 Logistics Test Squadron Reporting 47
13.4 Assistance in Writing Technical Reports 47
13.5 Acknowledgements 47

APPENDIX A – References and Bibliography 49

APPENDIX B – Logistics Test Data Sheet (LTDS) 53

APPENDIX C – Reliability, Maintainability, and Availability (RM&A) Parameters and Methods of Calculation 67

APPENDIX D – List of Acronyms 75

ANNEX – AGARD and RTO Flight Test Instrumentation and Flight Test Techniques Series A

List of Figures

		Page
Figures		
Figure 1	Logistics Elements	2
Figure 2	Data Analysis Plan Flow	3
Figure 3	Logistics Test Measures Numbering System	6
Figure 4	Reporting Procedures	47
Figure 5	Unit Reporting Procedures	48

List of Tables

Table		
Table 1	Logistics Test Measures (LTMs) Matrix	7

Preface

AGARDograph Series 160 and 300

The Systems Concepts and Integration (SCI) Panel has a mission to distribute knowledge concerning advanced systems, concepts, integration, engineering techniques, and technologies across the spectrum of platforms and operating environments to assure cost-effective mission area capabilities. Integrated defence systems, including air, land, sea, and space systems (manned and unmanned) and associated weapon and countermeasure integration are covered. Panel activities focus on NATO and national mid- to long-term system level operational needs. The scope of the Panel covers a multidisciplinary range of theoretical concepts, design, development, and evaluation methods applied to integrated defence systems.

One of the technical teams formed under the SCI Panel is dedicated to Flight Test Technology. Its mission is to disseminate information through publication of monographs on flight test technology derived from best practices which support the development of concepts and systems critical to maintaining NATO's technological and operational superiority. It also serves as the focal point for flight test subjects and issues within the SCI Panel and ensures continued vitality of the network of flight test experts within NATO.

These tasks were recognized and addressed by the former AGARD organization of NATO in the form of two AGARDograph series. The team continues this important activity by adding to the series described below.

In 1968, as a result of developments in the field of flight test instrumentation, it was decided that monographs should be published to document best practices in the NATO community. The monographs in this series are being published as individually numbered volumes of the AGARDograph 160 Flight Test Instrumentation Series.

In 1981, it was further decided that specialist monographs should be published covering aspects of Volume 1 and 2 of the original Flight Test Manual, including the flight testing of aircraft systems. The monographs in this series (with the exception of AG 237, which was separately numbered) are being published as individually numbered volumes of the AGARDograph 300 Flight Test Techniques Series.

At the end of each AGARDograph 160 Flight Test Instrumentation Series and AGARDograph 300 Flight Test Techniques Series volume is an annex listing all of the monographs published in both series.

Abstract

NEED

It has been understood and accepted that the number of design changes to new systems is generally very high in the early stages of development. While the overall costs of these changes are low in the developmental stage, these costs quickly escalate as systems move to initial fielding and production. All systems go through sequential cost stages. The stages are: (1) Research, Development, Test and Evaluation (RDT&E); (2) Acquisition; and (3) Operation and Maintenance (O&M). On an average, 60 percent of total life-cycle costs is consumed on O&M, which really means logistics support. Yet, during test and evaluation, attention to system performance factors and specifications have been consistently high, while little consideration has been placed on logistics factors and specifications. A structured approach to logistics test and evaluation is needed to capitalize on the correction of supportability factors that results in an optimum balance between performance and life-cycle costs. The approach should be integrated into the test program.

OBJECTIVE

The objective of this AGARDograph is to provide an introductory overview of logistics test and evaluation methods for supportability testing. This AGARDograph is an attempt to put into print the approach and techniques for a test team to execute logistics/supportability test and evaluation. To do so, the logistics/supportability test and evaluation process is subdivided into manageable functional areas and disciplines called Integrated Logistics Support (ILS) elements. The 10 ILS elements are: maintenance planning; manpower and personnel; support equipment; computer resources; facilities; packaging, handling, storage, and transportation; and design interface. Whether a program is a large one, like a new F-22 aircraft, or a small one, like a new 25K Loader, all logistics elements must be evaluated for applicability to the program. The only change between large and small programs is the depth of effort to be performed in each element. Examples will be provided to discuss the test and evaluation technique to each area and are adaptable to the reader's particular area of interest. This volume should complement the AG-300 Vol. 13 on "Reliability and Maintainability."

This page has been deliberately left blank

Page intentionnellement blanche

1.0 INTRODUCTION

This data analysis plan (DAP) was developed by the 412 LSS/LGLL, located at Edwards Air Force Base, California, United States. The 10 Integrated Logistics Support (ILS) elements defined in Air Force Instruction (AFI) 10-602 (Reference 1) were used as the baseline. This plan outlines and identifies procedures for testing supportability. Since it is widely accepted that 60 percent of all system costs are in the supportability arena, testing, for the purpose of reducing costs in supportability, is in the interest of all NATO countries. Producing the best operational availability (Ao) at the lowest support costs is in the services and national interest.

1.1 Purpose

The overall purpose of this DAP is to describe and identify the test methodology, criteria, and tools for evaluating and analyzing data collected for the 10 ILS elements associated with the weapon system. AFI 10-602 (Reference 1) describes and defines the 10 ILS elements in detail. Figure 1 depicts the relationship between the 10 ILS elements.

1.2 Scope

This DAP is designed to be used by the developmental test and evaluation (DT&E) and operational test and evaluation (OT&E) organizations to evaluate and analyze the 10 ILS elements supporting the weapon system. Both quantitative and qualitative data collected from the beginning to the end of the T&E effort will be used for the evaluations and analysis described in this plan. While this plan does describe testing, it is not intended to be used as a test plan.

1.3 System Description

The overall weapon system consists of the air vehicle, its support equipment, related facilities, materiel, software, services, and personnel required to ensure the weapon system can accomplish its intended operational role.

1.4 Document Organization

This document is divided into 13 chapters and 5 appendices:

Chapter 1: Introduction - States the purpose, scope, and organization of the DAP. Chapter 2: General Information - Contains general information about each of the participating disciplines addressed within chapters 3-12 and their ILS element evaluation and analysis approach. The disciplines addressed in this DAP include reliability and maintainability (R&M), human systems integration (HSI), and logistics. Chapter 2 also provides general information and descriptions for each of the subsections contained within chapters 3-12 of this DAP. Definitions of the logistics test measures (LTMs) referred to in Table 1 of this DAP are also described and defined.

Chapters 3 thru 12: The ILS Elements - Describes and defines the test methodology, criteria, and tools for evaluating and analyzing the data collected on the 10 ILS elements of the weapon system. This section is the main thrust of the DAP.

Chapter 13: Reporting Procedures - Addresses the reporting procedures for logistics test and evaluation (LT&E).

Appendices: The appendices to the plan include: Appendix A - References; Appendix B - Questionnaires; Appendix C – Reliability, Maintainablity and Availability (RM&A) Parameters and Methods of Calculation; and Appendix D - List of Acronyms.

1.5 Test Concept

The test concept used for evaluating the 10 ILS elements, as described in this DAP, is derived from the AFI 99-101 (Reference 2). The test concept involves evaluating and analyzing both the quantitative and qualitative information on the 10 ILS elements through the use of the LTMs, HSI, and R&M data.

The approach consists of using the quantitative (R&M) and qualitative (HSI and logistics) measures written by these disciplines to assess the overall logistics supportability of the weapon system or equipment/components. Figure 2 depicts this test concept.

Logistics test managers should consult with the SPO (Chief of Logistics) on each LTM of LT&E to determine specific areas to be evaluated to meet

ELEMENT INTERRELATIONSHIPS

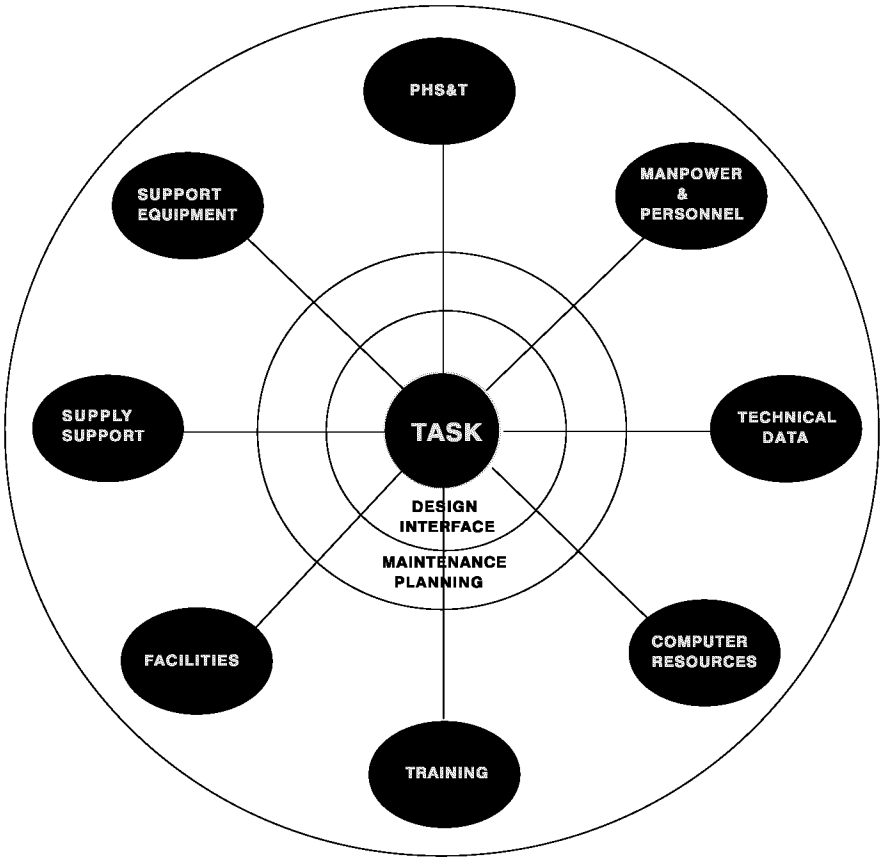


Figure 1 Logistics Elements

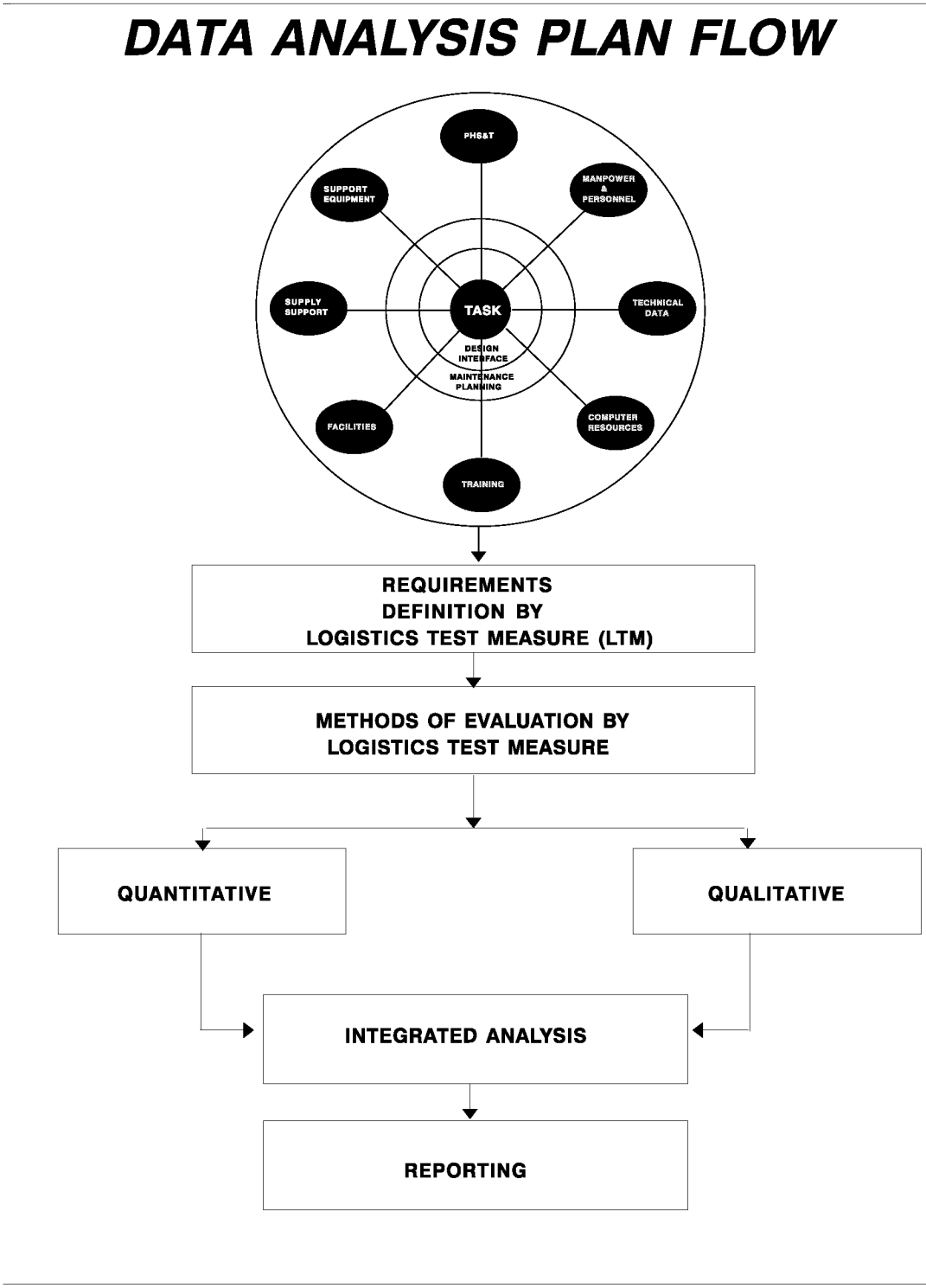


Figure 2 Data Analysis Plan Flow

customer requirements and needs. For example, in the ILS area of support equipment, does the SPO/COL want LTM 34 (safety) and LTM 35 (functionality) evaluated? It could be either or both.

Technical reports (TR) may be written by 2-digit work unit code (WUC), logistics control number (LCN), or system, subsystem, sub-subsystem number (SSSN) structure and organized by logistics elements (i.e., airframe/structure, engines, electrical) and grouping is permissable in areas like communications where radios, interphone, and SATCOM can be evaluated together. Grouping is done by similarity and driven by the quantity of data. Technical reports may by grouped and titled as following:

Support General	Weapons
Storage/Delivery	Built-In-Test
Oxygen	Propulsion
Communications	APU/JFS
Landing Gear	Flight Control Systems
Avionics	Gun Systems
Electrical	Environmental Systems
Gun Systems	Fuel
Integrated Diagnostics	

Deficiencies discovered during testing will be identified through one or more of the following methods: watch item tracking (WIT), deficiency reports (DRs), and publication change requests (PCRs).

Watch item listings are for identification of suspected or potential hardware and software deficiencies. Watch item tracking is used for early identification of potential DRs.

Deficiency reports will be initiated to identify known hardware or software deficiencies or recommended enhancements in various systems, subsystems, or support equipment.

Publication change requests will be initiated and controlled through the technical order validation and verification activity.

2.0 GENERAL INFORMATION ABOUT THE STRUCTURE AND CONTENTS OF CHAPTERS 3 - 12, THE ILS ELEMENTS

2.1 Introduction

This section provides general information about the structure and contents of chapters 3-12, the ILS elements. Specifically, it provides general information about each of the disciplines and how they relate to each of the ILS elements. The disciplines addressed include R&M, HSI, and logistics. This section also provides general information and descriptions of the subheadings addressed in chapters 3-12. Descriptions and definitions of the LTMs, as referred to in chapters 3-12 of this DAP, are also provided.

Chapters 3-12 of this DAP have the same layout and structure shown below for each of the 10 ILS elements discussed.

Description. Provides a detailed description of the ILS element. It also identifies the scope of the evaluations and analysis to be conducted under the DAP efforts.

Objective. Describes the overall objectives to be reached for the specific ILS element evaluated and analyzed. These objectives support the test methods referenced in Evaluation Measures section.

Logistic Test Measures (LTMs). The LTMs are the smallest unit of measurement on which the DAP is built. Each LTM is defined to partition each of the ILS elements into manageable and useful units of measure. The LTMs provide a method of measuring specific performance and supportability parameters for each of the 10 ILS elements. The LTMs support the evaluation measures referenced in the Evaluation Measures section, using the specified objectives defined in the Objectives section as a baseline. Identifies the LTMs used by each discipline, **logistics, R&M, and HSI** to perform the evaluation and analysis of the ILS elements. The LTMs identified in the ILS element chapters correlate to the LTM numbering system (Figure 3), LTM matrix (Table 1), and LTM definitions located in chapters 3-12.

Reliability and Maintainability. The R&M evaluations and analyses, as addressed in this DAP, will identify the measured R&M and highlight critical areas as the detail design evolves and matures through the incorporation of changes to improve R&M.

Evaluation Measures. Identifies the test measures for evaluating the specific performance and supportability aspects of the 10 ILS elements.

Measurement Criteria. Establishes and identifies the success criteria for evaluating the respective LTM. The identified criteria establishes the constraints and critical measures to be applied in the evaluation and analysis of the 10 ILS elements using the LTMs as a baseline.

Analysis Techniques and Tools. The logistic support analysis report (LSAR) database will be compared to the ILS analysis and evaluation activities conducted under this DAP. The LSAR database information, as defined in the contract, together with the RM&A data will be used to provide a comprehensive picture of the supportability aspects of the system. The LSAR database provides and identifies, both at the system and subsystem level, many quantitative RM&A and ILS requirements useful for the evaluations.

Human Factors (HSI). Human Factors is concerned with how people receive information through use of their senses, store this information, and process it in making decisions.

Logistics Test. Logistics (maintenance) efforts focus on assessing system supportability through direct man/machine interface. Logistics evaluates the 10 ILS elements from both a qualitative and quantitative perspective.

Evaluation Measures. *Do you want information in here?*

Measurement Criteria. *Ditto from above.*

Analysis Techniques and Tools. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments of a test-unique nature will be excluded from analysis. All comments applicable to production-representative aircraft or systems will be analyzed to determine the root cause of the deficiency. Data, when analyzed,

LOGISTICS TEST MEASURE (LTM)

NUMBERING SYSTEM

ELEMENT	LTM
MAINTENANCE PLANNING	10-19
MANPOWER & PERSONNEL	20-29
SUPPORT EQUIPMENT	30-39
SUPPLY SUPPORT	40-49
TECHNICAL DATA	50-59
TRAINING	60-69
COMPUTER RESOURCES	70-79
FACILITIES	80-89
PHS&T	90-99
DESIGN INTERFACE	100-109

Figure 3 Logistics Test Measures Numbering System

Table 1
LOGISTICS TEST MEASURES (LTMs) MATRIX

ELEMENTS	LOGISTICS TEST	R&M	HUMAN FACTORS
Chapter 3 Maintenance Planning	Scope Frequency Task Times	Reliability Maintainability	N/A
Chapter 4 Manpower and Personnel	Crew Size Adequacy AFSC and Skill Level	Reliability Maintainability Average Crew Size AFSC	Human Performance
Chapter 5 Support Equipment	Functionality Durability Setup/Disassembly	Reliability Maintainability	Ease of Use Handling Safety
Chapter 6 Supply Support	Source, Maintenance, and Recoverability (SMR) Codes Availability	Reliability	N/A
Chapter 7 Technical Data	Task Requirements Reference Material	Reliability Maintainability	Safety Effectiveness of Instructions
Chapter 8 Training and Training Support	Knowledge Training - Type 1&4 Proficiency Training	Reliability Maintainability	Safety
Chapter 9 Computer Resources Support	Functional Utility Resource Effectiveness	CRS Reliability CRS Maintainability Diagnostics System Adequacy	Ease of Use
Chapter 10 Facilities	Utilities Capacity	Reliability Maintainability	Safety
Chapter 11 Packaging, Handling, Storage, and Transportation (PHS&T)	Suitability	Reliability	Safety
Chapter 12 Design Interface	Machine/Machine Interface Design Interoperability	Reliability Maintainability	Human/Machine Interface Safety

can be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluation.

Overall Element Analysis. Describes how results from all three disciplines are combined to form a single-rating and conclusion for the element. Identification of impacts to the specific element, as well as impacts to the other ILS elements will be described.

2.2 General Information about the Disciplines Referenced in Chapters 3-12, The ILS Elements

2.2.1 Logistics Test

Logistics (maintenance) efforts focus on assessing system supportability through direct man/machine interface. Logistics evaluates the 10 ILS elements from both a qualitative and quantitative perspective. The specific qualitative and quantitative measures used are listed in the appendix B. Maintenance personnel orchestrate the day-to-day ILS element activities and collect data necessary for evaluating the air vehicle and system specifications.

2.2.1.1 System Specifications and Logistics Test

The following system specification paragraphs were used for guidance in developing the LT&E questionnaire and consequently the Logistics Test sections of this DAP for the system under test. Similar specifications for your system must be reviewed for developing logistics test sections of your DAP.

1. Logistics. The air vehicle and support equipment shall be designed with a primary goal of minimizing the life-cycle costs and to enhance the accomplishment of required maintenance. Items for which a recurring maintenance requirement is expected shall be so located and configured as to enhance fault isolation, servicing, removal and replacement without compromising rapid turnaround capability. Support equipment shall be configured to be compatible with the deployability requirements of the air vehicle.

2. Maintenance. The system, exclusive of aircraft engines, shall be compatible with two or three levels of maintenance. The organizational level of maintenance shall require a minimum of skill levels, personnel, and facilities. The System shall be provided with the capability of performing 100-percent fault isolation, to the line replaceable unit (LRU) level, at the organizational level using support equipment (SE), built-in-test (BIT), Technical Orders (T.O.s), or any combination of the three. The design shall allow access at the base level to areas that are normally inspected during a depot inspection.

3. Maintenance Manning. The system shall be designed such that it can be operationally maintained primarily by 3- and 5-level personnel using fully proceduralized job performance aid materials developed in accordance with system specifications.

4. Preventive Maintenance. The system shall employ a reliability centered maintenance (RCM). The system shall be designed such that scheduled inspection requirements shall be the minimum required to prevent degradation of equipment safety and capability levels. The system shall enable the maintenance preflight inspection to be accomplished by one 5-level mechanic in less than 2 hours, thruflight inspection in less than 1 hour, and the look phase of the postflight in less than 2 hours. No special tools shall be required for preflight, thruflight, or postflight inspections.

5. Supply. The design requirements shall favor maximum use of standard (common use) parts, SE accessories, and components unless single purpose/peculiar items are shown to be more cost effective. Transportation modes, policies, and procedures already in existence during the life cycle of the system will be used to support the system. Packaging for supply or resupply will conform to the principles of the most economical overall cost and necessary protection to prevent damage or deterioration during shipment and storage. Handling requirements will be compatible with the best commercial practices.

6. Facilities and Facilities Equipment. The design of the aircraft and aircraft support equipment shall consider maximum utilization of existing Air Force facilities. These facilities include, but are not limited to, alert facilities, training facilities, operations buildings, maintenance hangars, docks, shops, and test cells.

7. Training. The training of personnel shall be identified by the Instructional Systems Development (ISD) process and will be conducted by the Air Force. Contractor training (Type 1) shall be required for ISD, DT&E, and IOT&E personnel to safely operate, maintain, and evaluate the system.

8. Support Equipment. Support equipment functional characteristics, in addition to those specified herein, shall be specified in the SE General specification and SE item specification. The SE shall provide the operational support capability necessary

for the weapon system to meet its performance, availability, alert, turnaround, and maintainability requirements specified herein. This support capability shall be provided within the constraints of the deployment and maintenance concepts specified herein and Air Force personnel capabilities.

2.2.1.2 Logistics Developmental Test and Evaluation (DT&E) of Data

Logistics data will be collected through the use of logistics test data sheets (LTDS) questionnaires that are completed by maintenance personnel who perform maintenance tasks on the test article. The LTDSs will be completed for all specific test information sheet (TIS) test points identified in the integrated test plan.

2.2.2 Reliability and Maintainability

The R&M evaluations and analyses, as addressed in this DAP, will identify the measured R&M and highlight critical areas as the detail design evolves and matures through the incorporation of changes to improve R&M. The R&M test methods, as discussed within this DAP, are the test tools used to evaluate each R&M aspect of the 10 ILS elements and their ability to meet their specified reliability, maintainability, and performance levels of achievement.

2.2.2.1 System RM&A Requirements

All the quantitative system RM&A requirements are contained and identified in the reliability and maintainability allocations, assessment, and analysis reports. These reports contain comprehensive summaries of the system and subsystem level R&M and ILS parameters.

2.2.3 Human Factors (HSI)

Human Factors is concerned with how people receive information through use of their senses, store this information, and process it in making decisions. The primary focus of Human Factors is the evaluation of human/machine interaction during the performance of a task. The science of Human Factors is also called ergonomics. Human Factors is also concerned with the design of structures, communication systems, safety, and learning processes. Since the user of machines is man, human characteristics must be considered in their design and construction. The task which confronts Human Factors is to describe the special abilities and limitations of humans in such a way that design engineers can effectively incorporate the human operator as a component in the human/machine system.

2.2.3.1 Weapon System Human Factors Requirements

All weapon system Human Factors requirements are contained in the test article specification. The following is an example of a HSI air vehicle specification (AVS). The following examples are AVS paragraphs which applies to Human Factors and illustrates how Human Factors may be specified for a system:

1. Paragraph 3.3.7 Human Factors Engineering (HFE). Unless otherwise contractually specified, the general HFE requirements in MIL-STD-1472B (Reference 3), Section 4, and specific AVS paragraphs shall apply.

2. Paragraph 3.3.7.1 Crew system/workload integration. Crew workspaces shall be designed for maximum utility and efficient use by user personnel in the performance of system tasks. Displays shall provide the operator with clear indications of equipment or system conditions. The indications shall be within the perceptual capabilities of the operators. Controls shall provide the operators with means to control equipment or system conditions and shall be within the physiological and mental capabilities of the operators. Controls shall be compatible with their associated displays.

3. Paragraph 3.3.7.11 Human factors design for maintainability. The air vehicle shall be designed for maintainability as specified in MIL-STD-1472B, (Reference 3) paragraphs 5.9.1 through 5.9.11.2 and 5.9.11.5 through 5.9.18.

2.2.3.2 Human Factors Developmental Test and Evaluation (DT&E) Data

Human Factors data will be collected through the use of LTDS questionnaires distributed to maintenance personnel who perform maintenance on the test article. Logistics test data sheets will be completed for all test information sheets (TIS) test points identified in the flight test plan (FTP) or test and evaluation master plan (TEMP). The LTDSs will be reviewed by Human Factors and or Logistics test evaluators for completeness and accuracy. Data from the questionnaire will be loaded into the LTMS database for use in analysis of each ILS element.

This page has been deliberately left blank

Page intentionnellement blanche

3.0 MAINTENANCE PLANNING (MP)

3.1 Description

Maintenance planning (MP) includes all planning and analysis associated with the establishment of requirements for the overall support of the aircraft system throughout its life cycle. Maintenance planning describes the evolving maintenance concepts, plans, and requirements for on- and off-equipment maintenance for the system. Maintenance planning relies heavily on the reliability centered maintenance (RCM) principle that establishes maintenance tasks based on design reliability and logistic support analysis (LSA). These concepts and plans include the levels of maintenance, maintenance environment, limitations, constraints, requirements, failure diagnostic techniques, depot maintenance support, contractor support, and contractor warranties. The concepts and plans also address the extent and usage of support methods such as spares, T.O.s, facilities, SE, training, and other ILS elements. An evaluation of the impact of the other nine ILS elements on MP will be performed as outlined in section 3.6 of this element.

3.2 Objective

The purpose of the MP evaluation is to determine the effectiveness of the maintenance concept at the organizational and depot level to support the system. The evaluation will ensure that preventive MP is consistent with the RCM concept; support efforts and maintenance intervals are minimized; planned maintenance tasks are optimally structured; and preventive maintenance task times are standardized.

3.3 Logistics Test Measures (LTMs)

The following LTMs will be evaluated for the MP element:

Reliability & Maintainability
LTM 10 - Reliability
LTM 11 - Maintainability
Human Factors – None

Logistics Test
LTM 12 – Scope

LTM 13 - Frequency
LTM 14 - Task Times

3.4 Reliability and Maintainability

The following R&M characteristics and factors influence the MP element and are addressed in detail under section 3.4.1.

LTM 10 - Reliability (Hardware)
Mean Time Between Maintenance (Inherent) -- MTBM(I)
Mean Time Between Maintenance (Total Corrective) -- MTBM(C)
Mean Time Between Removal -- MTBR

LTM 11 - Maintainability
Maintenance Man-Hours per Flight Hour -- MMH/FH
Mean Man-Hours to Repair -- MMTR

3.4.1 Evaluation Measures

The following R&M characteristics and factors, which are quantitative in nature, provide a basis for relating the LTMs cited in section 3.3 to the MP logistic element of the aircraft system:

LTM 10 - Reliability

The aircraft system reliability will be evaluated under this LTM. This LTM evaluates the optimal reliability performance characteristics of the aircraft system. The objective is to determine if the planned reliability and ILS criteria for the MP element have been met.

Mean Time Between Maintenance (Inherent). MTBM(I) measures the mean time between unscheduled on-equipment maintenance actions caused by design or manufacturing defects with time expressed in aircraft flying hours. This measure includes:

- chargeable inherent maintenance actions
- unscheduled maintenance
- on-equipment maintenance (line or organizational level)
- time in flying hours.

MTBM(I) excludes test-unique actions. Test-unique actions are those actions that support engineering evaluations, modifications, etc. Maintenance actions that are in direct support of engineering test and evaluation of system or subsystem or component modifications, TO validation, or SE compatibility will be considered nonrelevant to both the

contractual and optional R&M evaluation. The following formula describes MTBM(I):

Formula 1:

$$MTBM(I) = \frac{TOTAL\ FLIGHT\ HOURS}{TOTAL\ INHERENT\ MAINTENANCE\ ACTIONS}$$

where:

MTBM(I) is the mean time between inherent maintenance actions. Total inherent maintenance actions are those failures which result from internal cause. These failures are the result of defective design or manufacture and will be coded with a Type 1 how malfunction code (HMC) and the appropriate action taken code (ATK). If a removed component is later found to be serviceable, the action will be changed to a NO-DEFECT maintenance action. There will be a maximum of one chargeable maintenance action with an ATK G and Type 1 HMC combination for a given WUC within a given job control number (JCN). Total inherent maintenance actions will be extracted from the system effectiveness data system (SEDS) failure summary report. Total flying hours will be extracted from the combined test force (CTF) debrief database and/or the aircraft R&M cyclic database.

Mean Time Between Maintenance (Total Corrective). MTBM(C) measures the weapon system reliability. MTBM(C) is mean time between unscheduled on-equipment corrective maintenance actions with time expressed as aircraft flying hours. Where total corrective maintenance actions is the sum total of the number of Type 1 (inherent), Type 2 (induced) and Type 6 (NO DEFECT, Cannot Duplicate [CND], or to facilitate other maintenance [FOM]) actions. Detailed descriptions and definitions of these types of maintenance actions are found under the SEDS Data Collection Procedure Guide. This measure includes:

- corrective maintenance actions (sum of inherent, induced, and no defect)
- unscheduled maintenance
- time in flying hours (production aircraft)
- on-equipment maintenance.

Formula 2:

$$MTBM(C) = \frac{TOTAL\ FLIGHT\ HOURS}{TOTAL\ CORRECTIVE\ MAINTENANCE\ ACTIONS}$$

where:

MTBM(C) is the mean time between maintenance with total corrective actions. Total flying hours can be obtained from the CTF debrief database and/or the aircraft R&M cyclic database. Total corrective maintenance actions are derived from SEDS failure reports, which include the sum of the inherent induced and no defect maintenance actions.

Mean Time Between Removal (MTBR). MTBR measures the mean time interval between removal of repairable components, with time expressed as aircraft flying hours. MTBR includes:

- production aircraft flying hours
- indicated failures (retest OK [RTOK])
- chargeable removals:
  - on equipment
  - repairable.

MTBR excludes:

- removals to facilitate other maintenance
- Time Complaince Technical Orders (TCTOs)
- scheduled maintenance
- nonrepairable components.

Formula 3:

$$MTBR = \frac{TOTAL\ FLIGHT\ HOURS}{TOTAL\ NUMBER\ OF\ REMOVALS}$$

where:

MTBR is the mean time between removals. Total flight hours can be obtained from the CTF debrief database and\or the aircraft R&M cyclic database. Total removals or retrieval maintenance actions can be derived from work field <1> of SEDS failure reports.

LTM 11 - Maintainability

Direct Maintenance Man-Hours per Flight Hour (DMMH/FH). DMMH/FH measures the maintenance hours per flight hour required to accomplish the maintenance activities directly related to the maintenance of the air vehicle system. DMMH/FH includes:

- Maintenance man-hours that are controllable through design, such as:
  - repair times
  - detection capability
  - isolation times
  - CND and RTOK rates
  - failure frequency
  - number of personnel required to perform a task
  - T.O.s and training.

- Maintenance man-hours for both scheduled and unscheduled maintenance attributed to corrective and or preventive actions and inspections.
- Time in flying hours.

DMMH/FH excludes:

- Maintenance man-hours to accomplish preflight, postflight, and thruflight inspections.

Formula:

$$DMMH / FH = \frac{TOTAL\ DIRECT\ MAINTENANCE\ MAN\text{–}HOURS}{TOTAL\ FLYING\ HOURS}$$

Mean Time to Repair (MTTR). MTTR measures the mean time required to complete a maintenance action. MTTR includes:

- Maintenance time that is controllable through design, such as:
  - repair times
  - detection capability
  - isolation times
  - CND and RTOK rates
  - failure frequency
  - number of personnel required to perform a task
  - T.O.s and training
- Maintenance man-hours from both schedule and unscheduled maintenance attributed to corrective and or preventive actions and inspections.

MTTR excludes:

- Maintenance man-hours to accomplish preflight, postflight, and thruflight inspections.

Formula :

$$MTTR = \frac{TOTAL\ MAINTENANCE\ TIME}{TOTAL\ MAINTENANCE\ ACTIONS}$$

The total maintenance time (clock hours) and the total maintenance actions will be computed from maintenance data recorded in the SEDS or core automated maintenance system (CAMS) database.

3.4.2 Measurement Criteria

The main objective of this ILS element, as it pertains to R&M, is to verify if the **planned** aircraft R&M allocations are met. The evaluation and analysis will identify any R&M trends/shortfalls which significantly impact supportability or the ability of the system to meet the specified R&M allocations. These objectives will be met by verifying the attainment of the technical R&M requirements/specifications, evaluation of the logistics questionnaires (LTDSs), DRs, and PCRs effecting the maintenance plan.

3.4.3 Analysis Techniques and Tools

Applications of SEDS and LSAR databases will assist in identifying R&M design-related shortfalls. Actual flight test values obtained from SEDS will be compared to predicted values to determine systems/components to be targeted for investigation using LCC analysis. Reliability and maintainability growth analysis programs, Weibull analysis, Pareto charts, SEDS listings and failure analysis data from FRACAS will be used to analyze maintenance data. When R&M shortfalls pertaining to maintenance planning are discovered, DRs will be generated and forwarded through the system program office (SPO), appropriate integrated product team (IPT), or system program manager (SPM).

3.5 Human Factors

The Air Force Flight Test Center (AFFTC) mission for Human Factors test and evaluation is to test system designs for compatible interaction among human, machine, and environment, assuring effective system operations by assigned Air Force personnel. This element examines planning and, therefore, is not an issue for Human Factors engineering.

3.6 Logistics Test

The MP evaluation will focus on the results of demonstrated maintenance actions and the impact those actions have on the maintenance concepts for the aircraft and related systems. The scope of scheduled inspections and maintenance actions, frequency of scheduled and unscheduled tasks, and the impact of task completion times will be considered during this evaluation.

The following LTMs influence the MP element and are addressed in detail in section 3.6.1:

LTM 12 - Scope
LTM 13 - Frequency
LTM 14 - Task Completion Times

3.6.1 Evaluation Measures

Logistics test measures 12, 13, and 14 will be evaluated to determine the effectiveness of scheduled

and unscheduled maintenance at the organizational level to support the system.

LTM 12 - Scope

Scope refers to the extent of coverage. This LTM is designed to evaluate the adequacy of scheduled and unscheduled maintenance actions in relation to task coverage and to identify requirements that should be added to or deleted from the particular tasks. Attention should be focused on whether or not coverage of the items was thorough enough without excessive requirements. Rate the adequacy of task coverage in relation to minimal/excessive requirements.

LTM 13 - Frequency

Frequency refers to the rate of occurrence. This LTM is designed to evaluate the adequacy of scheduled maintenance intervals on the particular item/system and to identify deficient areas requiring frequent unscheduled maintenance. By evaluating the frequency of scheduled maintenance intervals, we can determine whether the intervals are being optimized to prevent premature degradation to aircraft components and/or to prevent unnecessary aircraft downtime. Rate the frequency of the inspection/task performed for adequacy considering whether intervals are too long or too short.

LTM 14 - Task Completion Time

Task completion time refers to the time required to perform scheduled or unscheduled maintenance tasks. This LTM is designed to evaluate the adequacy of task time considering whether or not the completion time was reasonable. Tasks requiring excessive time to accomplish can negatively impact MP and will be identified under this LTM. Rate the adequacy of task completion time considering all unexpected circumstances that increased task completion time.

3.6.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDSs and there are no significant negative comments noted. Logstics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools. When evaluated with the R&M LTMs, MP can be properly assessed.

3.6.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

3.7 Overall Element Analysis

Overall element analysis will be a cumulative effort by all three disciplines. Individual results and conclusions reached by each discipline will be combined to form a single rating conclusion for the ILS element based on mission impact.

In order to make an accurate assessment of the MP element, the impact of all other ILS elements has to be taken into consideration. Maintenance Planning will be evaluated for each 2- and 3-digit WUC for each of the three disciplines (LT, R&M, and HF). In addition, data from the following elements will be combined to evaluate the impact of integrated ILS elements on MP:

1. Manpower & Personnel (M&P)
2. Support Equipment (SE)
3. Supply Support (SS)
4. Technical Data (TD)
5. Training and Training Support (TTS)
6. Computer Resources Support (CRS)
7. Facilities (FA)
8. Packaging, Handling, Storage, and Transportation (PHS&T)
9. Design Interface (DI)

Data that indicates problems with a WUC for any of the three disciplines will be evaluated across all the ILS elements from that WUC.

For Example: R&M data may indicate a high MTTR for a specific WUC. Data for that WUC will be examined for all 10 ILS elements in all disciplines. If, for example, logistics test data indicates training was less than adequate and HF data indicates SE was difficult to utilize, the combined impact of these elements across the three disciplines identify the problem which must be corrected to reduce the MTTR and positively influence R, M, and A for the task.

4.0 MANPOWER AND PERSONNEL (M&P)

4.1 Description

Manpower and personnel (M&P) pertains to the identification of military and civilian personnel requirements by Air Force Specialty Codes (AFSCs) and skill levels necessary to maintain/support the aircraft weapons system. Manpower and personnel requirements are identified through the LSA process for all tasks required to support the aircraft and related systems. Data will be collected and analyzed to evaluate M&P requirements during flight testing. These evaluations will assist in the establishment of manning for future aircraft maintenance operations.

4.2 Objective

To determine the quantity of personnel and skill levels required to accomplish maintenance/support tasks for the aircraft and related systems.

4.3 Logistics Test Measures (LTMs)

The following LTMs will be evaluated for the M&P element:

Reliability and Maintainability
LTM 20 - Reliability
LTM 21 - Maintainability
LTM 22 - Average Crew Size
LTM 23 - Air Force Specialty Code (AFSC)

Human Factors
LTM 24 - Human Performance

Logistics
LTM 25 - Crew Size Adequacy
LTM 26 - Air Force Specialty Code (AFSC) and Skill Level

4.4 Reliability and Maintainability

The following R&M characteristics and factors influence M&P element and are addressed in section 4.4.1:

LTM 20 - Reliability
Mean Time Between Maintenance (Total Corrective) -- MTBM(C)

LTM 21 - Maintainability
Direct Maintenance Man-Hours per Flight Hour -- DMMH/FH

LTM 22 - Average Crew Size
Maintenance Man-Hours (MMH)
Elapsed Times (ET)
Average Crew Size

LTM 23 Air Force Specialty Code (AFSC)

4.4.1 Evaluation Measures

The following R&M characteristics and factors, which are quantitative in nature, provide a basis for relating the LTMs cited in section 4.3 to M&P.

LTM 20 - Reliability

Increased aircraft system reliability has a direct payoff visible in fewer manpower demands, that is, a highly reliable system requires fewer maintenance man-hours. Reliability improvements increase the idle times for the particular AFSC technician responsible for repairs. Evaluation of both the R&M characteristics of the system, together superimposed on a graph with common ordinates (i.e., total flying hours), can help assess and present an overview picture of the M&P demands imposed on the aircraft system. The M&P element can be directly related to reliability by applying the following formula:

Mean Time Between Maintenance (Total Corrective). MTBM(C) is described in section 3.4.1

LTM 21 - Maintainability

Direct Maintenance Man-hours per Flight Hour. DMMH/FH is described in the section 3.4.1.

LTM 22 Average Crew Size

Average Crew Size. Crew size refers to the number of maintenance personnel used to perform a specific maintenance task. The average crew size represents the average number of maintenance personnel utilized for accomplishing a specific aircraft maintenance task(s). Maintenance man-hours (MMHs), together with elapsed repair times (ET) in hours required to complete each maintenance task, can be used to calculate average crew size numbers.

Maintenance Man-Hours (MMHs). Is a measure of repair times which considers the number MMHs expended in the repair of the aircraft system. Maintenance man-hours can be determined by evaluating the total MMHs utilized for a specific

Type 1 (inherent), Type 2 (induced), or Type 6 (NO DEFECT, CND, or FOM) maintenance action. The following formula applies:

Formula 6:

$$MMHt = \sum MMH \quad (MAN\text{–}HOURS)$$

where:

MMHt is the sum total of all maintenance man-hours consumed for a specific Type 1, Type 2, or Type 6 maintenance action/task accomplished.

Elapsed Times (ET). Is a measure of ET which considers the actual repair times in hours expended while performing a specific aircraft maintenance task. Elapsed times can be determined by summing the total repair hours for each Type 1, Type 2, or Type 6 maintenance task. The following formula applies:

Formula 7:

$$ETt = \sum ETi \quad (HOURS)$$

where:

ETt is the sum total of all maintenance hours expended for a specific Type 1, Type 2, or Type 6 maintenance task accomplished on the system during test.

Knowing MMHt and ETt, an average crew size for a specific task can be determined by using the following formula:

Formula 8:

$$AVERAGE\ CREW\ SIZE = \frac{MMHt\ (man\text{–}hours/specific\ task)}{ETt\ (hours/specific\ task)}$$

where:

average crew size represents the average number of maintenance personnel utilized for accomplishing a specific aircraft maintenance task(s).

LTM 23 - Air Force Specialty Code (AFSC)

LTM 23 identifies the percent of specific Air Force maintenance specialties and skill levels used to accomplish a specific task(s). Air Force Specialty Code data can be determined directly from SEDS. Skill levels can also be determined from the maintenance event listings by extracting the fourth digit of the AFSC code.

Air Force Specialty Code (AFSC). Is defined as a grouping of five digit numbers identifying special positions within the Air Force (AFP 36-2241, Volume 1, Reference 4). The objective of this measure is to identify what percentage of a specific task(s) is being accomplished by a specific Air Force specialty. For example, 70 percent of the towing task is being accomplished by crew chiefs (2A5X1). The following formula can be used to derive the AFSCs:

Formula 9:

$$AFSC = \frac{\sum AFSCi}{\sum AFSCt}$$

where:

AFSC identifies the percentage of a specific task(s), Type 1, Type 2 or Type 6, accomplished by a specific Air Force specialty.

AFSCi can be determined by summing the number of personnel within a given AF specialty (i.e., 2A6X5) used to perform a specific maintenance action/task (Type 1, Type 2 or Type 6). AFSCt is the summation of all Air Force specialties used to accomplish a specific maintenance task (Type 1, Type 2 or Type 6).

4.4.2 Measurement Criteria

LTM 20 - Reliability

All maintenance events will be evaluated individually and as groups (i.e., LCNs) to determine the M&P requirements based upon their reliability. Those maintenance events or groups of maintenance events which do not meet their allocated maintainability will receive top consideration in this evaluation.

LTM 21 - Maintainability

All maintenance events will be evaluated individually and as groups (i.e., LCNs) to determine the M&P requirements based upon their maintainability. Those maintenance events or groups of maintenance events which do not meet their allocated maintainability will receive top consideration in this evaluation.

LTM 22 - Average Crew Size

The crew size requirements contained within the aircraft LSAR database will be used for evaluation purposes. Specifically, the data contained in the LSA-075 Manprint, LSA-001 Annual Maintenance

Man-Hours (by skill specialty code and level of maintenance), and the LSA-002 Personnel and Skill Summary Records, will be used for the evaluation. The LSA records contain detailed M&P information for each maintenance action to be performed in the aircraft. Actual crew size calculations can be determined directly from the LTM formulas described in section 4.4.1 and the SEDS data.

LTM 23 – Air Force Specialty Code

The AFSC requirements contained within the aircraft LSAR database will be used for evaluation purposes. Specifically, the data contained in the LSA-075 Manprint, LSA-001 Annual Maintenance Man-Hours (by skill specialty code and level of maintenance), and the LSA-002 Personnel and Skill Summary Records, will be used for the evaluation. The LSA records contain detailed M&P information for each maintenance action to be performed in the aircraft. Actual AFSC calculations can be determined directly from the LTM formulas described in section 4.4.1 and the SEDS data.

4.4.3 Analysis Techniques and Tools

An evaluation of the results derived from the above referenced LTMs will be conducted to provide projections and detailed characteristics of the M&P element. For example, the following evaluations will be applied.

- Project the number of AFSCs needed at the first operational unit. The projections will be based on the accumulated data for each AFSC that was used in the performance of maintenance actions, for a period of time, at the CTF. For example, the number of man-hours, and AFSCs expended for accomplishing preventive and corrective maintenance actions for a specified period of time at the CTF (i.e., yearly rates), will be used for projecting the M&P requirements for the first unit. The information for making the estimates will be based on data collected through SEDS.

4.5 Human Factors

The following LTM influences the M&P element and is addressed in section 4.5.1:

LTM 24 - Human Performance

4.5.1 Evaluation Measures

Logistics test measure 24 will focus on the ability of maintenance personnel to perform tasks on the aircraft under all conditions using appropriate regulations and T.O.s.

LTM 24 - Human Performance

Human Performance refers to evaluation of the human/machine interface in the environment in which the system will be operated to include temperature extremes, high humidity, and precipitation. Rate the ability to perform the task in all environments while wearing personnel protective equipment.

4.5.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

4.5.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

4.6 Logistics

The following LTMs influence the M&P element and are addressed in section 4.6.1:

LTM 25 - Crew Size
LTM 26 - Air Force Specialty Code (AFSC) and Skill Level

4.6.1 Evaluation Measures

Logistics test measures 25 and 26 will be evaluated to determine the optimum quantity of personnel and AFSCs required to accomplish maintenance/support tasks for the aircraft and related systems.

LTM 25 - Crew Size Adequacy

Crew Size Adequacy refers to the technical order data (TOD)-specified number of personnel required

to facilitate task completion. This is designed to evaluate whether all manpower was effectively utilized; whether there were enough people assigned to ensure safe performance of the task; and if additional manpower is required. Rate the adequacy of the TOD-specified number of personnel required to perform the task.

LTM 26 - Air Force Specialty Code (AFSC) and Skill Level

Air Force Specialty Code and skill level is a 5-digit number identifying specialty positions within the Air Force. This is designed to indicate whether or not the appropriate AFSC(s) and skill level(s) have been assigned to the task. Rate the adequacy of the TOD-identified AFSC(s) and skill level(s) required to accomplish the maintenance task.

4.6.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

4.6.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

4.7 Overall Element Analysis

Overall element analysis will be a cumulative effort by all three disciplines. Individual results and conclusions reached by each discipline will be combined to form a single-rating conclusion for the ILS element based on mission impact. The M&P element directly impacts Maintenance Planning and will be taken into consideration when making an overall assessment of these elements.

5.0 SUPPORT EQUIPMENT (SE)

5.1 Description

Support equipment (SE) includes all equipment required to perform the support functions of the aircraft system, except those which are an integral part of the mission equipment. Support equipment includes all tools, special monitoring equipment, diagnostic and checkout equipment, associated multi-use end items, ground handling and maintenance equipment, repair kits, calibration equipment, manual and automated test equipment (ATE), support equipment for on- and off-equipment maintenance, and any related computer equipment and software programs required to support scheduled and unscheduled maintenance actions. This element also includes SE used during depot testing and manufacturing that supports the production and/or depot repair of the end items or components.

5.2 Objective

The purpose of this evaluation is to assure that the planned SE, both contractor- and government-furnished (CFE and GFE), effectively support the aircraft and associated systems. The evaluation will also determine if the SE is capable of supporting maintenance through functionality, compatibility, ease of use and safety; identify SE supportability problem areas and suggest possible corrective actions; and identify additional or alternative SE requirements. Any additional SE that becomes available during flight test or that was not included in the initial planning will also be evaluated.

5.3 Logistics Test Measures (LTMs)

The following LTMs will be evaluated for the SE element:

Reliability & Maintainability
LTM 30 - Reliability
LTM 31 - Maintainability

Human Factors
LTM 32 - Ease of Use
LTM 33 - Handling
LTM 34 - Safety

Logistics
LTM 35 - Functionality
LTM 36 - Setup/Disassembly

5.4 Reliability and Maintainability

The following R&M characteristics and factors influence the SE element and are addressed in detail in section 5.4.1.

LTM 30 - Reliability
Mean Time Between Maintenance (Inherent) -- MTBM(I)
Mean Time Between Maintenance (Total Corrective) -- MTBM(C)
Mean Time Between Removal -- MTBR

LTM 31 - Maintainability
Direct Maintenance Man-Hours per Flight Hour -- DMMH/FH
Mean Man-Hours to Repair - MTTR

5.4.1 Evaluation Measures

The following R&M characteristics and factors, which are quantitative in nature, provide a basis for relating the LTMs cited in section 5.3 to SE.

LTM 30 - Reliability

The aircraft system reliability will be evaluated under this LTM. This LTM evaluates the optimal reliability performance characteristics of the aircraft system. The objective is to determine if the planned reliability and ILS criteria have been met.

Mean Time Between Maintenance (Inherent). MTBM(I) is described in section 3.4.1.

Mean Time Between Maintenance (Total Corrective). MTBM(C) is described in section 3.4.1.

Mean Time Between Removal. MTBR is described in section 3.4.1.

LTM 31 - Maintainability

Direct Maintenance Man-Hours per Flight Hour. DMMH/FH is described in section 3.4.1.

Mean Time to Repair. MTTR is described in section 3.0.

5.4.2 Measurement Criteria

Maintenance tasks which require SE will be evaluated to determine what amount of SE will be needed to support the number of maintenance task. Those maintenance tasks whose frequency is more than expected will be the first candidates for such an analysis.

5.4.3 Analysis Techniques and Tools

Actual values for the R&M metrics will be obtained from SEDS.

5.5 Human Factors

The following LTMs will be evaluated by Human Factors for the SE element.

LTM 32 - Ease of Use
LTM 33 - Handling
LTM 34 - Safety

5.5.1 Evaluation Measures

Logistics test measures 32, 33, and 34 will be evaluated to determine the ability of the SE to be utilized effectively without risking personnel injury, equipment damage, or excessive fatigue.

LTM 32 - Ease of Use

Ease of use refers to the ability to utilize SE with minimal physical and mental workload. This is designed to evaluate the SE from the aspect of adequate access space for interfacing SE with the aircraft, SE visual and other communication links with personnel, efficient arrangement of controls and displays, and compatibility with personnel protective equipment requirements under various environmental conditions. Rate the adequacy of the SE in relation to adequate access space for interfacing SE with the aircraft, SE visual and other communication links with personnel, efficient arrangement of controls and displays, and compatibility with personnel protective equipment under various environmental conditions.

LTM 33 - Handling

Handling refers to the ability to move or transport the SE. This is designed to evaluate the adequacy of provisions for handles or other suitable means for grasping, handling, and carrying support equipment; considering biodynamics and weight limits for moving of equipment. Rate the adequacy of the SE in relation to handling/grasping surfaces provided and ease of transporting (either by hand-carry or by towing).

LTM 34 - Safety

Safety refers to SE design features and instructions that minimize the risk of personnel injury or equipment damage in any maintenance environment. This is designed to evaluate the adequacy of existing safety features. Identify potentially hazardous conditions requiring safety features and ensure the proper placement of warnings, cautions, and notes. Rate the adequacy of the SE design features and instructions for minimizing the risk of personnel injury or equipment damage in any maintenance environment.

5.5.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

5.5.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

5.6 Logistics

The following factors influence the SE element and are addressed in detail in section 5.6.1:

LTM 35 - Functionality
LTM 36 - Durability
LTM 37 - Setup/Disassembly

5.6.1 Evaluation Measures

Logistics test measures 35, 36, and 37 will be evaluated to determine the adequacy of the planned SE, both contractor- and government-furnished (CFE and GFE), in relation to effectively support the aircraft and associated systems.

LTM 35 – Functionality

Functionality refers to the form, fit, and function of the SE and its ability to operate as per design. This is designed to evaluate the adequacy of the SE in relation to the ability to position and adjust it at a safe, comfortable, and useable distance from the weapon system as well as perform its required function as it was designed to. Rate the adequacy of the SE in relation to positioning, adjustment, and performing its designated function.

LTM 36 - Durability

Durability refers to the resistance to wear of the specific piece of support equipment. This is designed to evaluate the durability of the SE, which impacts the SE availability. Rate the adequacy of the SE in relation to its durability.

LTM 37 - Setup/Disassembly

Setup/Disassembly refers to SE design features that promote ease and economy of maintenance in normal, adverse, and emergency maintenance environments. This is designed to evaluate the adequacy of the SE in relation to setup and disassembly times. Support equipment that requires an unreasonable amount of time to setup or disassemble will have a negative impact on the operational availability of the aircraft. Rate the adequacy of the SE in relation to ease and economy of maintenance considering setup and disassembly time.

5.6.2 Evaluation Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

5.6.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

5.7 Overall Element Analysis

Overall element analysis will be a cumulative effort by all three disciplines. Individual results and conclusions reached by each discipline will be combined to form a single rating conclusion for the ILS element based on mission impact.

The SE element directly impacts MP and DI, and will be taken into consideration when making the overall assessments of these elements.

This page has been deliberately left blank

Page intentionnellement blanche

6.0 SUPPLY SUPPORT (SS)

6.1 Description

Supply support (SS) is that provisioning process and effort which provides timely and adequate spare parts, components, items and equipment, and specific supplies to satisfy operation and maintenance functions during the life cycle of the weapon system. Supply support encompasses all management actions, processes, procedures, and techniques necessary to acquire, catalog, receive, store, transfer, issue, and dispose of aircraft-related parts, components, items and equipment. In simple terms, supply support is that provisioning process and effort that ensures that maintenance personnel has the right part, component, items and equipment at the right time, in the right place, in the right quantity, at the most economical cost.

Provisioning is a process or series of supply support actions that extend over a wide range of functions, including design, MP, supply, requirements determination, item entry control, procurement, cataloging, and control administration.

6.2 Objective

To evaluate and ensure that the planned supply provisioning process and efforts effectively support the aircraft system. The goal is to quantitatively and qualitatively evaluate the planned supply provisioning process and support, and report the results. This will include identifying the supply support deficiencies and possible corrective actions, and identifying additional and/or alternative supply support requirements.

6.3 Logistics Test Measures (LTMs)

The following LTMs will be evaluated for the SS element:

Reliability and Maintainability
LTM 40 - Reliability

Human Factors -- None

Logistics
LTM 41 - Source, Maintenance, and Recoverability (SMR) Codes
LTM 42 – Availability

6.4 Reliability and Maintainability

The following R&M characteristics and factors influence the SS element and are addressed in detail in section 6.4.1.

LTM 40 - Reliability
Mean Time Between Removal -- MTBR

6.4.1 Evaluation Measures

The following R&M characteristics and factors, which are quantitative in nature, provide a basis for relating LTMs cited in section 6.3 to SS.

LTM 40 - Reliability

The aircraft system reliability will be evaluated under this LTM. This LTM evaluates the optimal reliability performance characteristics of the aircraft system. The objective is to determine if the planned reliability and ILS criteria have been met.

Mean Time Between Removal. MTBR is addressed in section 3.4.1.

6.4.2 Measurement Criteria

Data collected will be analyzed and comparisons made of the relative demands made on the supply system for each piece of equipment removed or replaced within a specified maintenance action. Collected MTBR data will help to correlate and draw conclusions about the demands made on the aircraft supply system.

6.4.3 Analysis Techniques and Tools

Actual values for the R&M metrics will be obtained from SEDS. These values will be compared to the corresponding values contained within the LSAR database. All data required to compute these metrics will be stored within SEDS. In addition, the corresponding values from the LSAR database will be stored in SEDS, which will aid in the comparison process.

Maintenance event data for LTM 40 can also be broken down to the system and subsystem level and specified in SEDS listings. Mean time between removal can also be specified, if designed, in terms of specific HMC data such as 070 - broken; 105 - loose, damaged, or missing hardware; 254 - no output; 949 - computer memory error, etc., which are specified in the SEDS maintenance event listings. Other useful information which is also extracted from the SEDS maintenance listings include (a) information about failed equipment such as manufacturer's name (MFG), noun, serial number. and part number.; (b) information about the installed equipment such as manufacturer's name (MFG), noun, serial number. and part number.; and (c)

discrepancy information about the equipment repaired and replaced such as piece parts data.

6.5 Logistics

The following factors influence the SS element and are addressed in detail in section 6.5.1:

LTM 41 - Source, Maintenance, and Recoverability (SMR) Codes
LTM 42 - Availability

6.5.1 Evaluation Measures

Logistics test measures 41 and 42 will be evaluated to assure that the planned supply provisioning process and efforts effectively support the aircraft system.

LTM 41 - Source, Maintenance, and Recoverability (SMR) Codes

The source code identifies where the item is procured from (i.e., depot, local purchase, local manufacture). The maintenance code provides the repair level (i.e., organization or depot) for each aircraft part. The recoverability code provides information of how a part/component is to be disposed. Maintenance and recoverability are the primary codes to be evaluated under this LTM. This is designed to assess the appropriateness of the SMR code identified in the illustrated parts breakdown (IPB). Rate the appropriateness of the SMR code identified in the IPB (when performing removal tasks on equipment and repair tasks off equipment).

LTM 42 – Availability

Availability refers to having the required aircraft parts and consumables on hand to minimize aircraft downtime or degrade mission effectiveness. This is designed to identify deficiencies when attempting to acquire spares, consumable bench stock items, or suitable subs through the supply system. Rate the availability of spares, consumable bench stock items, and suitable subs through the supply system.

6.5.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

6.5.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

6.6 Overall Element Analysis

Overall element analysis will be a cumulative effort by all three disciplines. Individual results and conclusions reached by each discipline will be combined to form a single rating conclusion for the ILS element based on mission impact.

The SS element directly impacts MP and DI and will be taken into consideration when making the overall assessment of these element.

7.0 TECHNICAL DATA (TD)

7.1 Description

Technical data (TD) refers to recorded information used to translate system requirements into engineering and logistic considerations. Technical data is needed to develop, support, operate and maintain the weapon system. Technical data includes T.O.s, technical manuals (TMs) and engineering data (ED). The TD logistic element concerns itself with the evaluation of validated and verified T.O.s, TMs, and ED used in the maintenance, operation and support of the aircraft system. Technical orders and TMs include flight manuals, operator manuals, maintenance instructions, illustrated parts breakdown, and time compliance manuals required to operate, maintain, service, repair, overhaul and modify the system, subsystems, or equipment acquired to support the aircraft. Engineering data is recorded information regardless of form or character of engineering or technical nature. Engineering data includes specifications, drawings, test procedures, and computer programs which guide engineering personnel in performing operations and supporting aircraft tasks.

Validation is the process by which contractor personnel test TD for technical accuracy. Verification is the process in which TD is tested and approved by Government personnel for ease of use, understanding, adequacy of operation, maintenance, and support of systems, subsystems or equipment acquired for support of the test aircraft.

While the Human Factors evaluation of technical data development is important to logistics test, it is understood that technical documentation is in an early stage and will be improving continuously through the test program and, in fact, throughout the life of the aircraft. Conclusions arrived at during logistics test will represent a 'snap shot' or end of *initial* development of TD as opposed to fixed conclusions as found in other areas; for example, the SE element. The very fact that TD is constantly being revised highlights one of the features of a performance aid. Performance aids are easier to revise when procedures or equipment change than the maintenance person's learning already established by training.

7.2 Objective

To evaluate the adequacy and ability of TD provided by the contractor for performing maintenance tasks on the aircraft. The evaluation will focus on an overall assessment of the adequacy and ability of the TD to serve as a performance aid to the technician during maintenance and support of the aircraft system.

7.3 Logistics Test Measures (LTMs)

The following LTMs will be evaluated for the TD element.

Reliability and Maintainability
LTM 50 - Reliability
LTM 51 - Maintainability

Human Factors
LTM 52 - Safety
LTM 53 - Effectiveness of Instruction

Logistics Test
LTM 54 - Task Requirements
LTM 55 - Reference Material

7.4 Reliability and Maintainability

The following R&M characteristics and factors influence the TD element and are addressed in detail in section 7.4.1.

LTM 50 - Reliability
Mean Time Between Maintenance (Inherent) -- MTBM(I)
Mean Time Between Maintenance (Total Corrective) -- MTBM(C)
Mean Time Between Removal -- MTBR

LTM 51 - Maintainability
Maintenance Man-Hours per Flight Hour -- MMH/FH
Mean Man-Hours to Repair -- MMTR

7.4.1 Evaluation Measures

The following R&M characteristics and factors, which are quantitative in nature, provide a basis for relating the LTM cited in section 7.3 to TD.

LTM 50 – Reliability

The aircraft system reliability will be evaluated under this LTM. This LTM evaluates the optimal reliability performance characteristics of the aircraft system. The objective is to determine if the planned reliability and ILS criteria have been met.

Mean Time Between Maintenance (Inherent). MTBM(I) is described in section 3.4.1.

Mean Time Between Maintenance (Total Corrective). MTBM(C) is described in section 3.4.1.

Mean Time Between Removal. MTBR is described in section 3.4.1.

LTM 51 - Maintainability

Direct Maintenance Man-Hours per Flight Hour. DMMH/FH is described in section 3.4.1.

Mean Time to Repair. MTTR is described in section 3.4.1.

7.4.2 Measurement Criteria

Maintenance tasks which require TD to properly perform the maintenance will be included in this evaluation. Reliability and maintainability metrics will aid in determining the actual frequencies in comparison to predicted frequencies contained in the LSAR, and actual task time and crew size required to perform the maintenance task in comparison to predicted values contained in the TD.

7.4.3 Analysis Techniques and Tools

Actual values for the R&M metrics will be obtained from SEDS.

7.5 Human Factors

The following LTMs influence the TD element and are addressed in section 7.5.1.

LTM 52 - Safety
LTM 53 - Effectiveness of Instruction

7.5.1 Evaluation Measures

Logistics test measures 52 and 53 will be evaluated to determine the adequacy and ability of TOD to provide instructions that are clear, concise, and in a logical sequence while minimizing risk to personnel and equipment.

LTM 52 - Safety

Safety refers to instructions that minimize the risk of personnel injury or equipment damage in any maintenance environment. This is designed to evaluate the adequacy of TD procedures for proper placement of warnings, cautions, and notes.

LTM 53 - Effectiveness of Instructions

Effectiveness of instructions refers to the capability of TD instructions to aid in performing a task. This is designed to evaluate the adequacy of TD instructions considering the simplicity, accuracy, and relative ease of understanding in the performance of the task.

7.5.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

7.5.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for valuations.

7.6 Logistics

The following LTMs influence the TD element and are addressed in section 7.6.1.

LTM 54 - Task Requirements
LTM 55 - Reference Material

7.6.1 Evaluation Measures

Logistics test measures 54 and 55 will be evaluated to determine the adequacy and ability of TOD in performing maintenance tasks on the aircraft.

LTM 54 - Task Requirements

Task requirements refers to the personnel, provisions, and preparatory tasks necessary to facilitate task completion. This is designed to evaluate the adequacy of TOD identification of (a) the existence of required procedures and (b) the adequacy of the identification of task-related requirements (i.e., pre-existing conditions, proper tools, SE, consumables, AFSC(s), skill level(s), and other T.O.s for use during the same task). Rate the existence of required procedures and the adequacy of the identification of task-related requirements (i.e., pre-existing conditions, proper tools, SE, consumables, AFSC(s), skill level(s), and other T.O.s for use during the same tasks).

LTM 55 - Reference Material

Reference material refers to the supplemental data used in conjunction with technical procedures to facilitate task completion. This is designed to evaluate the existence, adequacy and accuracy of drawings, figures, and schematic/wiring diagrams required to facilitate task completion. Rate the adequacy of the drawings, figures, and

schematic/wiring diagrams for existence, accuracy, and value as a fault isolation aid.

7.6.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

7.6.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

7.7 Overall Element Analysis

Overall element analysis will be a cumulative effort by all three disciplines. Individual results and conclusions reached by each discipline will be combined to form a single rating conclusion for the ILS element based on mission impact. In order to make an accurate assessment of the TD element, the impacts on M&P, SE, and SS elements have to be taken into consideration.

This page has been deliberately left blank

Page intentionnellement blanche

8.0 TRAINING AND TRAINING SUPPORT (TTS)

8.1 Description

Training and training support (TTS) is the process, procedures, techniques, and equipment used to instruct personnel to operate and maintain the weapon system. The training program is a structured effort outlined in accordance with the guidance of Air Force Instruction (AFI) 36-2201 (Reference 5) which provides the guidelines to train both skilled and unskilled technicians to successfully perform aircraft maintenance tasks. This training program is composed of both formal and informal training. Formal training consists of classroom, observation, and hands-on instruction. Hands-on instruction makes use of maintenance training devices (i.e., engineering devices/simulators/mockups) and the actual air vehicle. Informal training consists of on-the-job training (OJT) designed to qualify maintenance technicians to perform maintenance tasks. Training will be a continuous process throughout the test program to include individual training, new equipment training, formal, and OJT.

8.2 Objective

The purpose of the training evaluation is to evaluate the effectiveness of the training program established to support the aircraft. Also, to determine if all training requirements have been adequately identified and the training program is of sufficient scope to meet day-to-day aircraft generation and contingency requirements.

The evaluation will assess the adequacy of Type 1 (contract/factory) and Type 4 (onsite/mobile) training; identify training deficiencies and possible corrective actions; and identify additional or alternative training requirements. Additionally, the evaluation is designed to determine if maintenance personnel are being provided the adequate knowledge and proficiency training to safely accomplish maintenance tasks. Through these evaluations, training shortfalls and corrective actions will be identified.

8.3 Logistics Test Measures (LTMs)

The following LTMs will be evaluated for the TTSelement:

Reliability and Maintainability
LTM 60 - Reliability
LTM 61 - Maintainability

Human Factors
LTM 62 - Safety

Logistics
LTM 63 - Knowledge Training - Type 1
LTM 64 - Knowledge Training - Type 4
LTM 65 - Proficiency Training

8.4 Reliability and Maintainability

The following R&M characteristics and factors influence TTS element and are addressed in section 8.4.1:

LTM 60 - Reliability
Mean Time Between Maintenance (Inherent) -- MTBM(I)
Mean Time Between Maintenance (Total Corrective) -- MTBM(C)
Mean Time Between Removal -- MTBR

LTM 61 - Maintainability
Task Times
Crew Size

8.4.1 Evaluation Measures

The following R&M characteristics and factors, which are quantitative in nature, provide a basis for relating LTMs cited in section 8.3 to TTS.

LTM 60 - Reliability

Mean Time Between Maintenance (Inherent). MTBM(I) is described in section 3.4.1.

Mean Time Between Maintenance (Total Corrective). MTBM(C) is described in the section 3.4.1.

Mean Time Between Removal. MTBR is described in the section 3.4.1.

LTM 61 – Maintainability

Task Completion Times. Task Completion Times is described in the section 3.6.1.

Average Crew Size. Average Crew Size is described in the section 4.4.1.

8.4.2 Measurement Criteria

Maintenance task which do not match the training received by the maintainer will be evaluated under this element. The impact and scope of this evaluation has to be determined.

8.4.3 Analysis Techniques and Tools

The SEDS will provide actual maintenance man-hours, repair times, task frequencies, and flight hours to compute the R&M metrics. When a deficient training procedure is identified, R&M metrics will be used to provide quantitative data as to the impact of the deficient training procedure.

8.5 Human Factors

The following LTM influence the TTS element and is addressed in section 8.5.1:

LTM 62 - Safety

8.5.1 Evaluation Measures

Logistics test measure 62 will be evaluated to determine the effectiveness of the training program and to ensure all safety-related training requirements have been adequately identified.

LTM 62 - Safety

Safety refers to the ability of maintenance personnel to minimize task of personal injury and/or damage to equipment while accomplishing various tasks on or around the aircraft. In order for training to be satisfactory, it must address safety issues pertinent to the task. This is designed to evaluate the existence and adequacy of task pertinent safety training. Rate the adequacy of task pertinent safety training.

8.5.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

8.5.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

8.6 Logistics

The following LTMs influence TTS element and are addressed in section 8.6.1:

LTM 63 - Knowledge Training (Type 1)
LTM 64 - Knowledge Training (Type 4)
LTM 65 - Proficiency Training

8.6.1 Evaluation Measures

Logistics test measures 63, 64, and 65 will be evaluated to determine the effectiveness of the training program established, to ensure all training requirements have been adequately identified, and to determine if the training program is of sufficient scope to meet day-to-day aircraft generation and contingency requirements.

LTM 63 - Knowledge Training (Type 1)

Knowledge Training (Type 1) refers to contractor-furnished training provided to give maintenance personnel a basic understanding of the theory of operation of their particular systems. Knowledge training also involves developing sound troubleshooting skills and preparing maintenance personnel for OJT. This is designed to evaluate the adequacy of the theory of operation training to prepare maintenance personnel for OJT. Rate the adequacy of contractor-furnished theory of operation training to prepare maintenance personnel for OJT.

LTM 64 - Knowledge Training (Type 4)

Knowledge Training (Type 4) refers to training provided by AETC field training detachments and is similar to Type 1 training in that it provides general task knowledge. This is designed to evaluate the adequacy of the theory of operation training to prepare maintenance personnel for OJT. Considerations for evaluating Type 4 training are identical to those used to evaluate Type 1 training. Rate the adequacy of field training detachment furnished theory of operation training to prepare maintenance personnel for OJT.

LTM 65 - Proficiency Training

Proficiency Training refers to training which teaches the hands-on skills necessary to accomplish portions of routine and critical tasks. Proficiency training is achieved through OJT. This is designed to evaluate the adequacy of task-applicable OJT received (contractor, FTD, cross-utilization training [CUT], and system upgrade training as a result of specific system modifications or enhancements). Rate the adequacy of task-applicable OJT training received (contractor, FTD, CUT, and system upgrade).

8.6.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

8.6.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

8.7 Overall Element Analysis

Overall element analysis will be a cumulative effort by all three disciplines. Individual results and conclusions reached by each discipline will be combined to form a single-rating conclusion for the ILS element based on mission impact.

The TTS element directly impacts MP and DI and will be taken into consideration when making the overall assessments of these elements.

This page has been deliberately left blank

Page intentionnellement blanche

9.0 COMPUTER RESOURCES SUPPORT (CRS)

9.1 Description

Computer resources support (CRS) is the hardware, software, personnel and facilities needed to operate and support an aircraft system. Computer resources support includes all designated computer hardware, software, and firmware embedded into or in support of the weapon system. Computer Resources Support also includes all documentation necessary to support and operate computer hardware, software, and firmware.

Computer hardware refers to the on-aircraft computers (i.e., LRUs) and microprocessors (i.e., integrated circuits [ICs]), single chip minicomputers (i.e., laptop computers), mainframe computers and peripherals (i.e., LAN networks, disk drivers). Computer software refers to the set of instructions and data necessary for the hardware to perform its required functions. Computer firmware is an integrated circuit made for a hardware unit and software or data integrated from a functional entity.

9.2 Objectives

The CRS element evaluates the operational and support capabilities of the various computer resource systems. The evaluations will center on the overall operational and support concepts of computer resources, the effectiveness of computer resources, quality and accuracy of data, and man/machine interface. The CRS evaluation will include evaluation of the built-in-test (BIT) system, all computer resources that interface with the test article, all off-equipment computer resources the maintainer may interface with to complete a task, and all test article systems involving computer resources.

9.3 Logistics Test Measures (LTMs)

The following LTMs will be evaluated for the CRS element:

Reliability & Maintainability
LTM 70 - CRS Reliability
LTM 71 - CRS Maintainability
LTM 72 - Diagnostic System Adequacy

Human Factors
LTM 73 - Ease of Use

Logistics
LTM 74 - Functional Utility
LTM 75 - Resource Effectiveness

9.4 Reliability and Maintainability

The following R&M characteristics and factors influence the CRS element and are addressed in detail in section 9.4.1:

CRS Reliability
CRS Maintainability
Diagnostics System Adequacy

9.4.1 Evaluation Measures

What will be evaluated under this element is the BIT system. In this element, the evaluation will primarily focus on the 2-digit level WUCs associated with computer resources. Evaluation to the 3, 4 or 5 WUC levels will be optional.

Additionally, the concept for evaluating the computer resource's ability to operate and support the system will be equated to the levels of R&M specified and measured for that specific computer resource. Simply put, the R&M characteristics of the computer resources and adequacy of the BIT system greatly influences the overall system's support, operation, and effectiveness. The assumption is made here that reliability and maintainability are inherent characteristics of computer resources and are essential in achieving overall mission and combat effectiveness, as well as achieving other characteristics such as speed, and navigation accuracy. A computer system that has poor R&M is not capable of fully operating and supporting the weapon system. For example, an aircraft is partially operating if a number of the computer resources (i.e., mission computers, electronic flight control system [EFCS]) are always being fixed (maintainability) or awaiting parts (reliability). The more reliable and maintainable a computer resource is, the better it operates and supports the weapon system.

Also, in this DAP the assumption is made that the functionality aspects of a computer resource are directly proportional to the inherent characteristics of their own built-in R&M attributes. That is, the electronic circuitry of a computer resource can not satisfactorily perform its designated functions (i.e., providing accurate measurements) unless it is designed with highly reliable electronic components. For example, an shop replacement unit (SRU) may be partially performing its functions (i.e., providing signals to another SRU) because it has poor reliable components, which equates to poor aircraft operation and support.

To support the evaluation, measured CRS R&M and ILS information will be used to help determine if the system is achieving its intended supportability, operations, and objectives. In this evaluation, CRS R&M and ILS characteristics will be translated into explicit supportability-related parameters that govern the operation and effectiveness of the aircraft system and each of its accompanying components.

LTM 70 – CRS Reliability

From an R&M standpoint, computer resources' reliability determines the aircraft system's ability to operate as planned. For the CRS element, the reliability of the aggregate or individual computer resources will be the baseline for which supportability will be defined. Under this element, the reliability parameters for the aggregate or individual CRS' systems will be evaluated and translated into supportability assessments using the following calculations:

$$FA = \frac{\text{Unconfirmed Faults}}{\text{Total Number of Faults Reported}} \times 100$$

Mean Time Between Maintenance (Inherent). MTBM(I) is described in the section 3.4.1.

Mean Time Between Maintenance (Total Corrective). MTBM(C) is described in section 3.4.1.

Mean Time Between Removals (MTBR). MTBR is described in section 3.4.1.

LTM 71 – CRS Maintainability

Maintainability influences mission effectiveness and readiness. Mission effectiveness and readiness can be equated, respectively, to the maintenance man-hour per flying hours (MMH/FH) and the mean man-hours to repair/restore (MMTR) functions during missions. MMH/FH and MMTR summaries of the CRS will be analyzed as follows:

Direct Maintenance Man-Hours per Flight Hour. DMMH/FH is described in section 3.4.1.

LTM 72 – Diagnostics System Adequacy

An analysis of the BIT system adequacy will be performed to determine the maintainability capabilities of the aircraft. Built-in-test usually serves two functions: (1) to monitor and report system status to an operator; and (2) to be used as a maintenance tool for system diagnostics and repairs. The objective of the assessment will be to determine the adequacy of the BIT system as a tool for conducting diagnostics and repairs. That is, its capability to confirm faults, locate and isolate the cause of the fault, and perform repairs. The following BIT factors of measures of false alarms (FA), percent of correct detection given a fault has occurred (Pcd), percent of correct fault isolation (and correct fault location) given correct detection (Pcfi), and mean time to fault locate (MTTFL) factors will be used to determine and assess the adequacy (i.e., system effectiveness) of the BIT system.

Measures of false alarms (FA). False alarms are faults, where upon investigation, it is found the fault cannot be confirmed. May be expressed as a total number, percentage, rate of occurrence, probability of occurrence, etc.

Formula 7: (Percentage)

$$Pcd = \frac{\text{Number of Correct Detections}}{\text{Total Number of Confirmed Faults}} \times 100$$

Percent of correct detection (Pcd) given that a fault has occurred: The number of correct detections divided by the total number of confirmed faults times 100 (to express the quotient as a percent).

Formula 8: (Percentage)

$$Pcfi = \frac{\text{Number of Correct Fault Isolations}}{\text{Number of Correct Detections}} \times 100$$

Percent of correct fault isolation (Pcfi) (and correct fault location) given correct detection: The number of correct fault isolations (and/or correct fault locations) divided by the number of correct detections

Formula 9: (Percentage)

$$MTTFL = \frac{\text{Total Time Reqd to Locate Faults}}{\text{Total Number of Faults}}$$

Mean Time to Fault Locate *(MTTFL):* The total amount of time required to locate faults divided by the total number of faults.

Formula 10: (Mean)

Missing formula??

9.4.2 Measurement Criteria

The main objective of this evaluation is to identify any CRS supportability trends/shortfalls or technical voids which will significantly impact the ability of the system to meet its specified R&M and ILS requirements. These objectives will be met by verifying attainment of the technical CRS R&M and ILS performance requirements specified and defined in the aircraft specifications and LSAR database. Additionally, application of the formulas established and defined for the other nine ILS elements under this DAP will be used for evaluation purposes. This element will also look closely at the failure rates experienced during testing (i.e., DT&E).

9.4.3 Analysis Techniques and Tools

Applications of the SEDS and LSAR databases in assisting to identify R&M, ILS and BIT design-related shortfalls and targets for subsequent design corrections will be used for the evaluation.

9.5 Human Factors

The following LTM influences the CRS element and is addressed in section 9.5.1:

LTM 73 - Ease of Use

9.5.1 Evaluation Measures

Logistic test measure 73 will be evaluated to determine the adequacy of the BIT system to perform maintenance tasks in fault diagnosis.

LTM 73 - Ease of Use

Ease of use refers to the ability of the maintenance person to understand and effectively use the BIT system to perform maintenance tasks in fault diagnosis. This LTM is designed to evaluate the usefulness of the BIT system as a fault isolation aid. Rate the adequacy of the BIT system as a fault isolation aid.

9.5.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

9.5.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

9.6 Logistics

The following LTMs influence the CRS element and are addressed in detail in section 9.6.1:

LTM 74 - Functional Utility
LTM 75 - Resource Effectiveness

9.6.1 Evaluation Measures

Logistics test measures 74 and 75 will be evaluated to determine the adequacy and overall operational and support concepts of the computer resources and the effectiveness of the computer resources.

LTM 74 - Functional Utility

Functional utility refers to the capability of a particular system to function as per design. This is designed to evaluate the adequacy of automated/initiated diagnostic systems in relation to accurate and efficient fault detection, reporting, isolation, recording, and correlating of malfunctions. Rate the adequacy of air vehicle automated/initiated diagnostics in relation to accurate and efficient fault detection, reporting, isolation, recording, and correlating of malfunctions.

LTM 75 - Resource Effectiveness

Resource Effectiveness refers to the ability of computer resources that interface with the test article to efficiently operate and support the aircraft system. This is designed to evaluate the computer resources that interface with the test article for effectiveness in uploading and downloading data and information from various systems, both on- and off-equipment. Rate the adequacy of the hardware and software utilized upload and download data and information from various systems, both on- and off-equipment.

9.6.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

9.6.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

9.7 Overall Element Analysis

Overall element analysis will be a cumulative effort by all three disciplines. Individual results and conclusions reached by each discipline will be combined to form a single-rating conclusion for the ILS element based on mission impact.

The CRS element directly impacts the MP and DI elements, and will be taken into consideration when making the overall assessment of these elements.

10.0 FACILITIES (FA)

10.1 Description

Facilities (FA) consists of all permanent and semipermanent structures required to support the weapon system. The aircraft facility requirements have been determined through the logistics support analysis (LSA) process using the operational and maintenance needs of the weapons system as baseline. Examples of aircraft facility requirements needing evaluation include maintenance hangars, fuel pits, engine run pads, wash racks, parking ramps, and fuel cells.

These FAs must be able to support the operational and support concepts of the weapon system as identified in the Integrated Logistics Support Plan (ILSP).

10.2 Objective

The objective of the FA evaluation is to determine if the planned FAs adequately support the needs of the weapon system. The evaluation will identify facility shortcomings and possible corrective action and the need for additional or alternative facilities.

10.3 Logistics Test Measures (LTMs)

The following LTMs will be evaluated for the FA element:

Reliability and Maintainability
LTM 80 - Reliability
LTM 81 - Maintainability

Human Factors
LTM 82 - Safety

Logistics Test
LTM 83 - Utilities
LTM 84 - Capacity

10.4 Reliability and Maintainability

The following R&M characteristics and factors influence the FA element and are addressed in detail in section 10.4.1.

LTM 80 - Reliability
Mean Time Between Maintenance (Inherent) -- MTBM(I)
Mean Time Between Maintenance (Total Corrective) -- MTBM(C)
Mean Time Between Removal -- MTBR

LTM 81 - Maintainability
Direct Maintenance Man-Hours per Flight Hour -- DMMH/FH
Mean Man-Hours to Repair - MTTR

10.4.1 Evaluation Measures

The following R&M characteristics and factors, which are quantitative in nature, provide a basis for relating the LTMs cited in section 10.3 to FA.

LTM 80 - Reliability

The aircraft system reliability will be evaluated under this LTM. This LTM evaluates the optimal reliability performance characteristics of the aircraft system. The objective is to determine if the planned reliability and ILS criteria have been met.

Mean Time Between Maintenance (Inherent). MTBM(I) is described in the section 3.4.1.

Mean Time Between Maintenance (Total Corrective). MTBM(C) is described in section 3.4.1.

Mean Time Between Removal. MTBR is described in section 3.4.1.

LTM 81 - Maintainability

Direct Maintenance Man-Hours per Flight Hour. DMMH/FH is described in section 3.4.1.

Mean Time to Repair. MTTR is described in the Maintenance Planning section 3.4.1.

10.4.2 Measurement Criteria

Maintenance tasks which require a facility to properly perform the maintenance will be included in this evaluation. Reliability and maintainability metrics will aid in determining if the proper number of facilities will be available to perform the required amount of maintenance.

10.4.3 Analysis Techniques and Tools

Actual values for the R&M metrics will be obtained from SEDS.

10.5 Human Factors

The following LTM influence the Facilities element and is addressed in section 10.5.1.

LTM 82 - Safety

10.5.1 Evaluation Measures

LTM 82 - Safety

Safety refers to all safety-related factors designed into facilities to ensure a safe and healthful work area for personnel. This LTM is designed to evaluate the adequacy of facilities in relation to fire protection equipment, ease of exit and entry, sufficient ventilation, sufficient emergency equipment (eyewashes, first aid kits), etc. Rate the adequacy of the facilities safety provisions considering fire protection equipment, ease of exit and entry, sufficient ventilation, sufficient emergency equipment (eyewashes, first aid kits), etc.

10.5.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

10.5.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

10.6 Logistics Test

The following LTMs influence the FA element and are addressed in detail in section 10.6.1:

LTM 83 - Utilities
LTM 84 - Capacity

10.6.1 Evaluation Measures

Logistics test measures 83 and 84 will be evaluated to determine if the planned facilities adequately support the needs of the weapon system.

LTM 83 - Utilities

Utilities refers to the test site utilities (i.e., water, high pressure air, temperature and humidity control, lighting, electrical, etc.) and their ability to support the air vehicle and SE. This is designed to evaluate the adequacy of site utilities and identify shortcomings that could indicate additional planned facilities requirements. Rate the ability of the site utilities (high pressure air, temperature and humidity control, lighting, electrical, etc.) to support the air vehicle and SE.

LTM 84 - Capacity

Capacity refers to the test site facility size. This is designed to evaluate the adequacy of the test site facility size and layout considering ease of aircraft movement, ability to utilize SE around the aircraft, and equipment storage space (including both SE and parts). Rate the adequacy of the test site facility size and layout considering ease of aircraft movement, ability to utilize SE around the aircraft, and equipment storage space (including both SE and parts).

10.6.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

10.6.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

10.7 Overall Element Analysis

Overall element analysis will be a cumulative effort by all three disciplines. Individual results and conclusions reached by each discipline will be combined to form a single-rating conclusion for the ILS element based on mission impact.

In order to make an accurate assessment of the FA element, the impacts on MP and DI elements has to be taken into consideration.

11.0 PACKAGING, HANDLING, STORAGE, AND TRANSPORTATION (PHS&T)

11.1 Description

Packaging, handling, storage, and transportation (PHS&T) encompasses the requirements, resources, processes, procedures, design considerations, and methods to ensure that all system equipment and support items are preserved, packaged, handled, stored, and transported properly. This element includes all special provisions, containers (reusable and disposable), and supplies necessary to support packaging, preservation, storage, handling, and/or transportation of prime mission equipment, test and support equipment, spares and repair parts, personnel, technical data, and mobile facilities. In essence, this element basically covers the initial distribution of products and the transportation of personnel and materials for maintenance purposes.

11.2 Objective

The purpose of this evaluation is to ensure that PHS&T effectively supports the aircraft. The evaluation will determine the capability of the PHS&T equipment to support maintenance (including suitability, safety, and ease of use); determine if the procedures used comply with the best commercial standards; identify PHS&T-related deficiencies and possible corrective actions; and identify additional or alternative PHS&T requirements.

The PHS&T evaluations will be accomplished during Climatic Lab and All-Weather deployments because all shipments for these activities are required to comply with applicable MIL-STDs.

11.3 Logistics Test Measures (LTMs)

The following LTMs will be evaluated for the PHS&T element:

Reliability & Maintainability
LTM 90 - Relaibility

Human Factors
LTM 91 - Safety
Logistics
LTM 92 - Suitability

11.4 Reliability and Maintainability

The following R&M characteristics and factors influence the PHS&T element and are addressed in detail in section 11.4.1.

LTM 90 - Reliability
Mean Time Between Maintenance (Inherent) -- MTBM(I)
Mean Time Between Maintenance (Total Corrective) -- MTBM(C)
Mean Time Between Removal -- MTBR

11.4.1 Evaluation Measures

The following R&M characteristics and factors, which are quantitative in nature, provide a basis for relating the LTMs cited in section 11.3 to PHS&T.

LTM 90 - Reliability

The aircraft system reliability will be evaluated under this LTM. This LTM evaluates the optimal reliability performance characteristics of the aircraft system. The objective is to determine if the planned reliability and ILS criteria have been met.

Mean Time Between Maintenance (Inherent). MTBM(I) is described in section 3.4.1.

Mean Time Between Maintenance (Total Corrective). MTBM(C) is described section 3.4.1.

Mean Time Between Removal. MTBR is described in section 3.4.1.

11.4.2 Measurement Criteria

Maintenance tasks, which require PHS&T to properly perform the maintenance, will be included in this evaluation. Reliability and maintainability metrics will aid in determining if the proper PHS&T is being perform adequately to support required maintenance.

11.4.3 Analysis Techniques and Tools

Actual values for the R&M metrics will be obtained from SEDS.

11.5 Human Factors

The following LTM influence the PHS&T element and is addressed in detail in section 11.5.1.

LTM 91 - Safety

11.5.1 Evaluation Measures

LTM 91 - Safety

Safety refers to the PHS&T procedures which ensure minimal risk to personnel and equipment. This was designed to evaluate the adequacy of safeguards for PHS&T of equipment, parts, and hazardous materials. Rate the adequacy of safeguards for PHS&T of equipment, parts, and hazardous materials.

11.5.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

11.5.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

11.6 Logistics

The following LTM influences the PHS&T element and is addressed in section 11.6.1.

LTM 92 - Suitability

11.6.1 Evaluation Measures

LTM 92 - Suitability

Suitability refers to the appropriateness of the PHS&T of parts and equipment. This is designed to evaluate the adequacy of packaging materials and procedures to prevent deterioration or damage of parts and/or equipment during shipment and storage. Rate the adequacy of packaging materials and procedures to prevent damage to parts and equipment during shipment and storage.

11.6.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

11.6.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

11.7 Overall Element Analysis

The PHS&T element directly impacts MP and DI and will be taken into consideration when making the overall assessments of these elements.

12.0 DESIGN INTERFACE (DI)

12.1 Description

Design interface (DI) encompasses the techniques, processes, and procedures undertaken to ensure that air vehicle supportability[1] is addressed in the systems engineering process. In other words, the DI element monitors the weapon system design process to ensure that logistic-related design parameters are fully integrated into the weapon system and equipment design. The DI element is unique in that it cross-references to the other nine ILS elements. That is, SS, SE, and the other ILS elements are input functions to the DI element. The DI element is also unique in that it specifically integrates the following logistic-related design parameters to the aircraft supportability, operational performance and support cost requirements:

- Reliability and Maintainability (R&M)
- Human Factors (HSI)
- Energy
- Survivability
- Standardization and Interoperability
- Test and Evaluation (T&E)

For example, the R&M design parameters relate to the DI element in that these characteristics influence the supportability requirements (system design characteristics and planned logistic resources), operational performance (mission effectiveness, system availability) and economics (life-cycle cost) of the weapon system. Survivability relates to the DI element in that it addresses those logistics-related design parameters required to preserve survivability of the weapon system. The energy subelement addresses the design characteristics of the aircraft system that cause it to require and consume critical energy resources, such as petroleum and fuels, liquid oxygen, hydraulic fluids, etc. Interoperability and standardization relates to the DI element in that it addresses the systems ability to interface, operate, and be supported by inventory or off-the-shelf standard equipment and spare parts.

12.2 Objective

The objective of the DI element is to determine if the overall weapon system and its associated equipment operates, interfaces, and is supported by inventory or off-the-shelf standard equipment and spare parts.

The ultimate objective is to assess that all aircraft system supportability requirements provide an opportunity for reducing logistics support costs and/or enhance system readiness. In the context of this DAP, the following criteria apply.

Criteria 1. Aircraft system supportability evaluations will be related only to the logistics-related design parameters of R&M, Human Factors, and Logistics testing with the help of the other nine ILS elements. The evaluations will attempt to identify any design requirement related deficiencies and/or possible corrective actions. Any design requirements related deficiencies will be assessed for impact on logistic support resource requirements.

Criteria 2: In line with the DT&E objectives, the analyses provided here will focus only on evaluating the system supportability design requirements (i.e., attainment of technical performance objectives such as system design characteristics and planned logistic resources). Operational Test & Evaluation (OT&E) of the system's operational effectiveness objectives (i.e., mission effectiveness and system suitability) will not be evaluated under this element.

12.3 Logistics Test Measures (LTMs)

The following LTMs will be evaluated for the DI element:

Reliability & Maintainability
LTM 100 - Reliability
LTM 101 - Maintainability

Human Factors
LTM 102 - Human/Machine Interface
LTM 103 - Safety

Logistics
LTM 104 - Machine/Machine Interface
LTM 105 - Design
LTM 106 – Interoperability

12.4 Reliability and Maintainability

The following R&M characteristics and factors influence the DI element and are addressed in detail in section 12.4.1.

LTM 100 - Reliability
Mean Time Between Maintenance (Inherent) -- MTBM(I)
Mean Time Between Maintenance (Total Corrective) -- MTBM(C)
Mean Time Between Removal -- MTBR

LTM 101 - Maintainability
Direct Maintenance Man-Hours per Flight Hour -- DMMH/FH
Mean Man-Hours to Repair.-- MMTR

[1] Supportability is the degree to which system design characteristics and planned logistic resources meet system peacetime readiness and wartime utilization requirements.

12.4.1 Evaluation Measures

The aircraft system's supportability and operational effectiveness (i.e., suitability and readiness objectives) are functions and determinants of the system's R&M characteristics and ILS elements. Reliability and maintainability and ILS characteristics influence and interact with the system engineering process. Accordingly, collected R&M and ILS information can help determine if the logistic support requirements are being reduced and attained. In this DAP, R&M and ILS objectives will be translated into explicit supportability-related design parameters that govern the design of the system and each of its accompanying components, and into logistic support parameters than can help determine the development, test and evaluation, and health of the aircraft system.

LTM 100 - Reliability

From a logistics standpoint, reliability is a measure of the aircraft system's ability to operate as planned under the defined operational and support concept using specified resources. Logistics reliability is the baseline from which supportability is defined. It is through logistics reliability that we determine what will fail and at what intervals it will fail.

Reliability Analysis Summary (Hardware). A list of failure modes that have the greatest impact upon the system's hardware reliability will be compiled. The information provided in the list will be the basis for identifying problem areas needing emphasis, changes or modifications. The following list of problem areas, used for the reliability analysis, will be extracted from the following SEDS and LSAR data products, to include the material improvement program (MIP) and service reports (SR) data products:

SEDS

- Top 25 problem areas
- AMTS (Active Manhour Task Summary)
- CMP (Component Discrepancy Report) Analysis (FMECA)
- Reliability Failure Summaries

LSAR

- Reliability Centered Maintenance (RCM)
- Failure Mode Effects and Criticality

Note: Detailed description of the SEDS products listed above will not be provided here. These are described and defined in detail under the SEDS user's manuals. The SEDS user's manuals can be obtained through the engineering R&M section. Equally, the LSAR MIL-STD 1338 1A/2A/2B (Reference 6) addresses in more detail the RCM and FMECA processes and how they are established. The RCM and FMECA data products/results are obtained from the LSAR-050 and LSAR-055 products contained within the aircraft LSAR database.

Reliability Analysis Summary (Software). This factor will be used to measure the software reliability component of the total aircraft system's reliability (i.e., hardware plus software reliability). Under this element, only OFP/flight software related reliability will be evaluated. Software-induced failures, as defined within the context of this paper, refer to those induced failures that result from the combination of the environment and design faults within the software. An environmental failure in software occurs when environmental conditions (i.e., altitude flying, maintenance actions, etc.) create a set of inputs causing faults within the sections of software code to be executed. A software design failure is a result of a set of inputs which the designers/programmers did not account for properly.

Software reliability analysis will use the software failures reported in the SEDS maintenance actions but not necessarily reported via the MIPs or SRs. These data are recorded in SEDS workfields <4B through 5B>. All data is severity coded 1 through 5 in SEDS, but only codes 1 and 2 are used for performing reliability calculations.

Mean Time between Maintenance (Total Corrective). Mission effectiveness is also influenced by reliability. Mission effectiveness can be described in terms of mean time between maintenance (MTBM). The MTBM(C) is the mean time between unscheduled, on-equipment corrective maintenance actions, with time expressed as aircraft flying hours. Where total corrective maintenance actions is the sum total of the number of Type 1 (inherent), Type 2 (induced) and Type 6 (no defect), CND, or FOM maintenance actions. Detailed descriptions and definitions of these types of maintenance actions are found under the SEDS Data Collection Procedure Guide. The MTBM(C) summaries will also be provided under this report to supplement the above hardware reliability analysis. MTBM(C) includes:

- corrective maintenance actions (sum of inherent, induced, and no defect)
- unscheduled maintenance
- time in flying hours (production aircraft)
- on equipment.

Formula 1:

$$MTBM(C) = \frac{\text{Total Flight Hours}}{\text{Total Corrective Maintenance Actions}}$$

where:

MTBM(C) is the mean time between maintenance with total corrective actions. Total flying hours can be obtained from CTF maintenance debrief Form 207 and R&M cyclic database. Total corrective maintenance actions are derived from SEDS failure reports, which include the sum of the inherent, induced and no defects.

Mean Time Between Removal/Restore (MTBR). Mission readiness and supportability is also influenced by reliability. Mission readiness and supportability can be described in terms of MTBR. The MTBR measures the mean time interval between removal of repairable components, with time expressed as aircraft flying hours. The MTBR reflects the removal or restoration readiness of repairable and non-repairable equipment from the weapon system. The MTBR, thus, reflects the removal and restoration rate (i.e., readiness). The MTBR is the mean time interval between removal of any repairable or nonrepairable equipment for indicated or actual item or equipment failures. MTBR includes:

- production aircraft flying hours
- indicated failures (RTOK)
- chargeable removals:
  - on equipment
  - repairable.

MTBR excludes:

- removals to facilitate other maintenance
- TCTOs
- scheduled maintenance
- nonrepairable components.

Formula 2:

$$MTBR = \frac{\text{Total Flight Hours}}{\text{Total Number of Removals}}$$

where:

MTBR is the mean time between removals. Where MTBR indicates the number of equipment removed from the aircraft throughout a specified number of flying hours. Flight hours are the number of flying hours for a specified production aircraft. The hours are aircraft flight hours for aircraft equipment or equipment operating hours. Equipment removals are the number of equipment removed from the supply system to install on the aircraft during the specified flight hours. Total flight hours can be obtained from the CTF maintenance debrief Form 207 and R&M cyclic database. Total removals or retrieval maintenance actions can be derived from workfield <1> of SEDS failure reports.

LTM 101 - Maintainability

Maintenance Analysis Summary. Maintenance analysis summaries will consist of a series of analyses detailing maintenance actions such as repairs, inspections, or otherwise maintenance tasks that support the weapon system. This analysis will help identify areas of high maintenance actions. The summaries will utilize the inputs recorded in the SEDS, LSAR, MIPs, and SRs records. The following parameters will be analyzed, as a minimum, and will be used to generate information for performing the analysis:

- task descriptions and identification of functions, interval, and levels of repair
- task frequencies
- task resources identification by:
  - spares and repair parts
  - skill specialties
  - man-hours and elapsed times.

Mission Supportability. Mission supportability is influenced by maintainability. Mission supportability is also influenced by reliability, that is, the MTBR functions during a mission. Mission supportability, in terms of maintainability, is measured in elapsed repair times (ET), which considers the repair times in hours involved in

aircraft system repairs. Elapsed repair times can be determined by summing the total repair hours in performing each Type 1, Type 2 or Type 6 maintenance tasks. Use formula 3 below.

Formula 3:

$$ETt = \sum ETi \text{ (hours)}$$

where:

ETt is the sum total of all maintenance hours accumulated for the test fleet or for a specific production aircraft. ETt includes the summation of all hours accumulated in the performance of Type 1, Type 2, and Type 6 maintenance actions. Where ETi (in hours) is the total maintenance hours used in performing Type 1, Type 2, and Type 6 maintenance actions.

Critical Maintenance Analysis Summary. A list identifying critical support and supportability-related design factors or failure modes will also be provided. The list will provide a summary of maintenance tasks that *exceed specified threshold levels* such as frequency, elapsed time or annual maintenance man-hours. The critical maintenance task analysis will break each maintenance action into specific subtasks in order to identify skill requirements, elapsed times, task frequencies, personnel required at each maintenance level, and the character of the repair actions (inspections, scheduled, unscheduled, etc.). This task will consist of detailed analysis of the operation and maintenance tasks required for supporting the aircraft system. The summaries will utilize the inputs recorded in the SEDS, LSAR, MIPs and SRs. The specific objectives of this analytical activity will include but will not limited to identifying:

- personnel types such as AFSC, skill levels, number and usage factors
- elapsed task times summaries
- man-hour conversions to manpower requirements
- spares/repair identification to support the system
- total flying hours (per fleet, per production, etc.)
- unscheduled maintenance summaries (MMH/FH)
- scheduled maintenance summaries (i.e., support general, inspections)
- average maintenance downtime per aircraft (hours)
- maximum maintenance downtime per aircraft (hours)
- maintenance actions by WUC
- maintenance frequencies per tasks (i.e., monthly, annual) per flight hours
- maintenance task time in hours, years, etc.
- replacement rates for systems/subsystems
- logistic support resources used for each task.

Maintainability Analysis Summary. An analysis of the aircraft BIT system adequacy will be performed to determine the maintainability capabilities of the aircraft. Built-in-test usually serves two functions: (1) to monitor and report system status to an operator; and (2) to be used as a maintenance tool for aircraft system diagnostics and repairs. The objective of the assessment will be to determine the adequacy of the aircraft BIT system as a tool for conducting diagnostics and repairs. That is, its capability to confirm faults, locate and isolate the cause of the fault, and perform repairs. Built-in-test factors of measures of FA, Pcd given a fault has occurred, Pcfi (and correct fault location) given correct detection, and MTTFL will be used to determine and assess the (system/subsystems) integrated diagnostics effectiveness.

Percent BIT Accurate. Percent BIT accurate is described in the Appendix C.

12.4.2 Measurement Criteria

The main objective of this ILS element, as it pertains to R&M, is to verify if the **planned** aircraft R&M allocations are met. The evaluation and analysis will identify any R&M trends/shortfalls which significantly impact supportability or the ability of the system to meet the specified R&M allocations. These objectives will be met by verifying the attainment of the technical R&M requirements/specifications, evaluation of the logistics questionnaires (LTDSs), DRs, and PCRs effecting the maintenance plan.

12.4.3 Analysis Techniques and Tools

Applications of SEDS and LSAR databases, which assist in identifying R&M and ILS design-related shortfalls and targets for subsequent design corrections, will be used.

12.5 Human Factors

The following LTMs influence the DI element and are addressed in detail in section 12.5.1.

LTM 102 - Human/Machine Interface
LTM 103 - Safety

12.5.1 Evaluation Measures

Logistics test measures 102 and 103 will be evaluated to determine the adequacy of the air vehicle design for minimizing discomfort, distraction, and other factors which degrade human performance or increase error.

LTM 102 - Human/Machine Interface

Human/Machine Interface refers to interaction that takes place between humans and the air vehicle during operation and maintenance. This is designed to evaluate the air vehicle design features for unrestricted physical and visual access to components and ease of access to high maintenance areas. Rate the adequacy of air vehicle design features for unrestricted physical and visual access to components and ease of access to high maintenance areas.

LTM 103 - Safety

Safety refers to the ability of the air vehicle design to minimize risk of personnel injury and equipment damage while accomplishing required tasks on or around the aircraft. This is designed to evaluate the adequacy of design features to minimize risk of personnel injury and equipment damage, and to identify potentially hazardous conditions requiring correction. Rate the adequacy of the design features to minimize risk of personnel injury and equipment damage considering the conditions' hazard potential.

12.5.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

12.5.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

12.6 Logistics

The following LTMs influence the DI element and are addressed in section 12.6.1:

LTM 104 - Machine/Machine Interface
LTM 105 - Design
LTM 106 – Interoperability

12.6.1 Evaluation Measures

Logistics test measures 104, 105, and 106 will be evaluated to determine the adequacy of the air vehicle design characteristics and for an opportunity to reduce logistics support costs and/or enhance system readiness.

LTM 104 - Machine/Machine Interface

Machine/Machine Interface refers to the relative positioning of line replaceable units (LRUs) and line replaceable modules (LRMs) on the air vehicle and their impact on unhindered operation and maintenance. This is designed to evaluate the operation, removal, and replacement of LRUs/LRMs and equipment in regard to interference from other LRUs/LRMs (cables, hydraulic lines, structures or equipment which required removal to facilitate other maintenance). Rate the adequacy of the relative positioning of LRUs/LRMs for the purpose of unhindered operation and maintenance.

LTM 105 - Design

Design refers to the adequacy of system/component design characteristics in relation to life-cycle cost. This is designed to evaluate the adequacy of the overall design characteristics of the air vehicle and to identify design deficiencies (potential and confirmed) that could lead to premature failures and increase life cycle cost. Examples of deficiencies to be identified should include chaffing conditions, insufficient tolerances, heat damage, etc. Rate the adequacy of system/component design characteristics.

LTM 106 - Interoperability

Interoperability refers to the condition where SE of other military services and allied forces must be compatible with the aircraft and its SE. For example, there is a specific test requirement for U.S. Army field refueling vehicles to both accept fuel from the aircraft and to provide a refueling capability to the aircraft at small austere airfields. This interoperability will be tested and evaluated during the course of DT&E. In general, other situations will arise where non-Air Force equipment may be used to service and repair the aircraft. Rate the ability of the weapon system and its SE to utilize aerospace

ground equipment (AGE) of other military services and allied forces.

12.6.2 Measurement Criteria

Each LTM will be considered satisfactory when rated 5 or higher on the LTDS and there are no significant negative comments noted. Logistics teset measures rated 4 or below, or having significant negative comments, will be analyzed in accordance with the procedures in Analysis Techniques and Tools.

12.6.3 Analysis Techniques and Tools

Logistics test measures rated 4 or below, or having significant negative comments, will be analyzed to determine their validity. All comments determined to be the result of a test-unique nature will be excluded from analysis. All comments applicable to a production-representative condition will be analyzed to determine root cause of the deficiency. Data, when analyzed, should be grouped by systems (i.e., electrical, ECS, aircraft power plants, avionics, airframe, etc.). The LTMS database will be used as a source of information for evaluations.

12.7 Overall Element Analysis

Overall element analysis will be a cumulative effort by all three disciplines. Individual results and conclusions reached by each discipline will be combined to form a single rating conclusion for the ILS element based on mission impact.

In order to make an accurate assessment of the DI element, the impacts on all other ILS elements have to be taken into consideration. Maintenance planning will be evaluated for each 2- and 3-digit WUC for each of the three disciplines (R&M, HSI, and LT). In addition, data from the following elements will be combined to evaluate the impact of integrated ILS elements on Design Interface:

1. Manpower & Personnel (M&P)
2. Support Equipment (SE)
3. Supply Support (SS)
4. Technical Data (TD)
5. Training and Training Support (TTS)
6. Computer Resources Support (CRS)
7. Facilities (FA)
8. Packaging, handling, storage, and transportation (PHS& T)

13.0 REPORTING PROCEDURES

13.1 Introduction

This section is designed to provide information on logistics test reporting whether in the form of a TR, technical letter report (TLR), or test and evaluation results sheet (TERS). There are two reporting procedures that must be considered and followed. Figure 4 depicts the procedures to follow as it applies to your test project It is important to know what documentation your customer expects and the historical significance of the test program.

13.2 Combined Test Force (CTF) Reporting

Guidelines have generally been established on reporting T&E results within each specific CTF. Check with your test project manager on the procedures for reporting logistics test results. Your test information may be incorporated into a single TR published by the CTF. Participation in the report coordination meeting is a must to ensure your data is accurately understood and reported. Figure 4 depicts the review and flow of this information.

13.3 Logistics Test Squadron Reporting

Guidelines for reporting from within the organizations vary slightly and are depicted in the Figure 5. Coordination and reviews within the Logistics Squadrons should occur prior a technical review is scheduled.

13.4 Assistance in Writing Technical Reports

AFFTC-TIH-97-01, *The Author's Instruction to Writing AFFTC Technical Reports* (Reference 7), should be referred to for help in writing any report. This guide can be obtained from 412 Test Wing Technical Publications Department.

13.5 Acknowledgements

I'd like to thank and give credit to the many folks at the AFFTC who spent time editing and critqueing this document. I cannot mention them all but will mention Mr. James Papa, Mr. Roger Crane, Technical Sergeant Margie Roesch, and Chief Master Sergeant Richard Backs. Their expertise and dedication to the subject of Logistics Test and Evaluation helped to elevate the value and disciplined approach to the testing of logistics supportability.

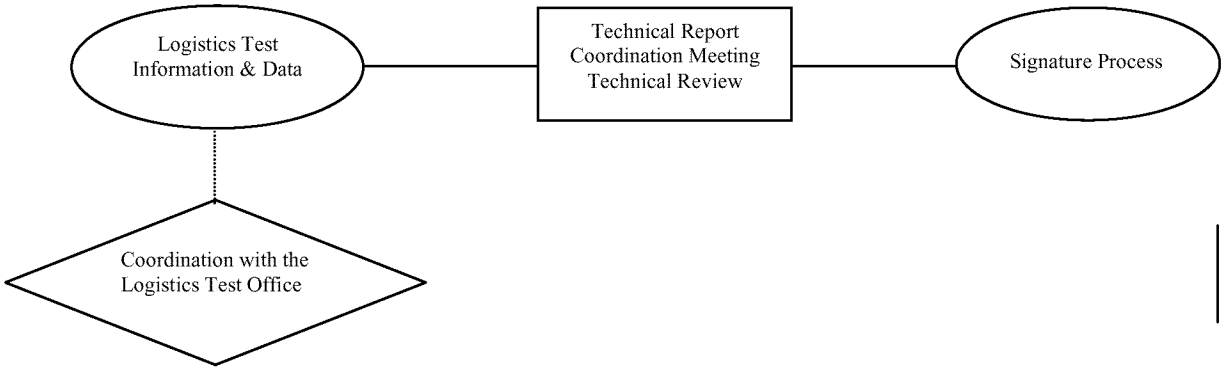


Figure 4 Reporting Procedures

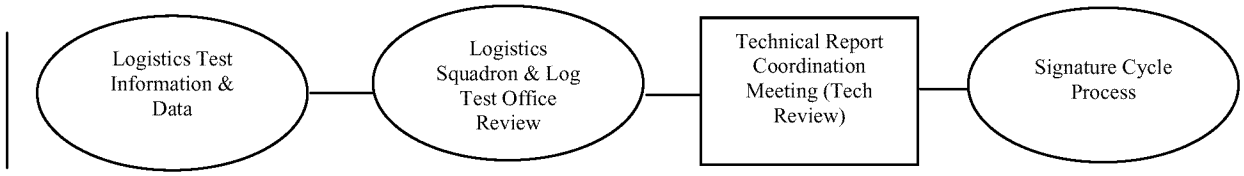


Figure 5 Unit Reporting Procedures

APPENDIX A

REFERENCES AND BIBLIOGRAPHY

This page has been deliberately left blank

Page intentionnellement blanche

REFERENCES

1. AFI 10-602, *Determining Logistics Support and Readiness Requirements*, June 1994.

2. AFI 99-101, *Developmental Test and Evaluation,* November 1996.

3. Military Standard, Human Engineering Design Criteria for Military Systems, Equipment, and Facilities, MIL-STD-1472B, 31 December 1974.

4. AFP 36-2241, *Volume I, Promotion Fitness Examination (PFE) Study Guide*, July 1999.

5. AFI 36-2201, Developing, Managing, and Conducting Training, April 1997.

6. Military Standard, Logistic Support Analysis, MIL-STD-1388-1A/2A, 15 Oct 1973.

7. AFFTC-TIH-97-01, *Writing AFFTC Technical Reports*, Revision 4, AFFTC, Edwards AFB, California, October 1997.

BIBLIOGRAPHY

DoDI, 5000-2, *Acquisition Management Policies and Procedures*, August 1993.

Baily, Robert W. Ph.D., *Human Performance Engineering*, Prentice Hall, 1989.

Norusis, Marija J., The SPSS Guide To Data Analysis For SPSS/PC+, 1991.

Weiskamp, Keith, The FOXPRO Companion, 1990.

APPENDIX B

LOGISTICS TEST DATA SHEET (LTDS)

This page has been deliberately left blank

Page intentionnellement blanche

LOGISTICS TEST DATA SHEET (LTDS)

DT&E ☐ OT&E ☐ Contractor ☐

Name: _____ Employee #: _____ Years Exp: _____

Sex: M ☐ F ☐ Grade: ____ AFSC: _____ Date (D/M/Y): _____

Phone: _____ DTIS #: _____LCN (1st 4 #s): _____

JCN: _____ Task: _____

Evaluator Review: _____Day ☐ Night ☐ Temp: ___F Precip: Yes ☐ No ☐

LOGISTICS TEST MEASURES (LTM) RATING DEFINITIONS

INSTRUCTIONS: This questionnaire is designed to assess concerns with aircraft maintenance. The following scale will be used for your evaluation:

Very Unsatisfactory	Unsatisfactory	Marginally Unsatisfactory	Marginally Satisfactory	Satisfactory	Very Satisfactory
1	**2**	**3**	**4**	**5**	**6**
----------Unsatisfactory Range----------			**----------Satisfactory Range----------**		

Please use the following criteria when responding to the attached questions. Respond by entering the number corresponding to the scale descriptions ABOVE.

N/A – Not applicable

VERY UNSATISFACTORY – indicates the product or area is inadequate and requires major improvements such as redesign or rewrites.

UNSATISFACTORY – indicates the product or area is inadequate and requires improvements.

MARGINALLY UNSATISFACTORY – indicates the product or area is inadequate and minor improvements are required to make it more helpful to maintenance personnel.

MARGINALLY SATISFACTORY – indicates although the product or area is adequate, minor improvements would make it more helpful to maintenance personnel.

SATISFACTORY – indicates the product or area performs its intended function.

VERY SATISFACTORY – indicates there is little room for improvement.

Logistics (L) – measures weapon system/subsystem performance and supportability.
Human Factors Engineering (HSI) – measures man-machine interface.
Environmental (E) – measures the weapon system/subsystem's effects on the environment.

Please provide comments to support rating after each question.

DATABASE USE ONLY			
Entered by (initials)	DR Required?	PCR Required?	Date maintenance notified:

Very Unsatisfactory	Unsatisfactory	Marginally Unsatisfactory	Marginally Satisfactory	Satisfactory	Very Satisfactory
1	2	3	4	5	6
----------Unsatisfactory Range----------			----------Satisfactory Range----------		

1 - MAINTENANCE PLANNING

N/A 1 2 3 4 5 6

LTM 10 - Reliability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Subjectively assess the actual measured reliability characteristics of the system, and their relation to the established and planned reliability characteristics.

LTM 11 - Maintainability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Subjectively assess the actual measured maintainability characteristics of the system, and relation to the established and planned maintainability requirements.

LTM 12 - Scope: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Evaluate task coverage in relation to essential versus excessive requirements.

LTM 13 - Frequency: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐

How adequate was the frequency with which the inspection or task was performed.

LTM 14 – Task Time: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Evaluate task time considering all unexpected circumstances that increased task completion time.

Very Unsatisfactory	Unsatisfactory	Marginally Unsatisfactory	Marginally Satisfactory	Satisfactory	Very Satisfactory
1	2	3	4	5	6
----------Unsatisfactory Range----------			----------Satisfactory Range----------		

2 - MANPOWER AND PERSONNEL

N/A 1 2 3 4 5 6

LTM 20 – Reliability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Subjectively assess changes in reliability and rate the relation to manpower demands.

LTM 21 – Maintainability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Subjectively assess the maintainability and its relation to manpower demands.

LTM 22 – Average Crew Size: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Assess the average number of personnel required to perform this maintenance task.

LTM 23 – AF Specialty Code: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Rate the adequacy of a specific AF maintenance specialty and skill level used to accomplish this maintenance task.

LTM 24 – Human Performance: (HSI) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Rate the ability to perform the task in all environments while wearing personnel protective equipment.

LTM 25 – Crew Size Adequacy: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the technical order data (TOD) specified number of personnel required to perform the task.

LTM 26 – AFSC and Skill Level: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the TOD identified AFSC(s) and skill level(s) required to accomplish the maintenance task.

Very Unsatisfactory	Unsatisfactory	Marginally Unsatisfactory	Marginally Satisfactory	Satisfactory	Very Satisfactory
1	2	3	4	5	6
----------Unsatisfactory Range----------			----------Satisfactory Range----------		

3 - SUPPORT EQUIPMENT (SE)

N/A 1 2 3 4 5 6

LTM 30 – Reliability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Subjectively assess the reliability of specific support equipment.

LTM 31 – Maintainability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Subjectively assess the maintainability characteristics of the support equipment relationship to established and planned maintainability characteristics.

LTM 32 – Ease of Use: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Rate the adequacy of the SE in relation to adequate access space for interfacing SE with the aircraft, SE visual and other communication links with personnel, efficient arrangement of controls and displays, and compatibility with personal protective equipment under various environmental conditions.

LTM 33 – Handling: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the SE in relation to handling/grasping surfaces provided and ease of transporting (either by hand-carry or towing).

LTM 34 – Safety: (HSI) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the SE design features and instructions potential to minimizing the risk of personnel injury or equipment damage in any environment.

LTM 35 – Functionality: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the SE in relation to positioning, adjustment, and performance of its designated function.

LTM 36 – Durability: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the SE's durability.

LTM 37 – Setup/Disassembly: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the SE in relation to ease of maintenance considering setup and disassembly times.

Additional Comments:_____
_____
_____
_____

Very Unsatisfactory	Unsatisfactory	Marginally Unsatisfactory	Marginally Satisfactory	Satisfactory	Very Satisfactory
1	2	3	4	5	6
----------Unsatisfactory Range----------			----------Satisfactory Range----------		

4 - SUPPLY SUPPORT

N/A 1 2 3 4 5 6

LTM 40 – Reliability: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Rate system reliability, are the planned system reliability and the ILS criteria being met

.

LTM 41 – SMR Codes: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Rate the appropriateness of the SMR code identified in the IPB (when performing removal tasks on equipment and repair tasks off equipment).

LTM 42 – Availability: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Rate the availability of spares, consumable bench stock items, and suitable-subs through the supply system.

Additional Comments:_____

_____

_____

_____

Very Unsatisfactory	Unsatisfactory	Marginally Unsatisfactory	Marginally Satisfactory	Satisfactory	Very Satisfactory
1	2	3	4	5	6
----------Unsatisfactory Range----------			----------Satisfactory Range----------		

5 - TECHNICAL ORDER/DATA

N/A 1 2 3 4 5 6

LTM 50 - Reliability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Subjectively assess the actual maintenance frequency in comparison to predicted frequency contained in LSAR.

LTM 51 - Maintainability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Subjectively assess evaluation of the actual task time and crew size required to perform the maintenance task in comparison to the values contained in the technical data.

LTM 52 - Safety: (HSI) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the technical data procedures for proper placement of warnings, cautions and notes.

LTM 53 – Effectiveness of Instructions: (HSI) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the technical data instructions for simplicity, accuracy, and clarity.

LTM 54 – Task Requirement: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Rate (a) the existence of required procedures and (b) the adequacy of the identification of task related requirements (i.e., pre-existing conditions, proper tools, support equipment, consumables, AFSC(s), skill level(s), and other technical orders for use during the same task).

LTM 55 – Reference Material: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the drawings, figures, and schematic/wiring diagrams for accuracy and value as a fault isolation aid.

Additional Comments:_____
_____
_____
_____

Very Unsatisfactory	Unsatisfactory	Marginally Unsatisfactory	Marginally Satisfactory	Satisfactory	Very Satisfactory
1	2	3	4	5	6
----------Unsatisfactory Range----------			----------Satisfactory Range----------		

6 – TRAINING AND TRAINING SUPPORT

	N/A	1	2	3	4	5	6
LTM 60 - Reliability: (R&M)	☐	☐	☐	☐	☐	☐	☐
LTM 62 - Safety: (HF)	☐	☐	☐	☐	☐	☐	☐
LTM 63 – Knowledge Training (Type 1): (L)	☐	☐	☐	☐	☐	☐	☐
LTM 64 - Knowledge Training (Type 4): (L)	☐	☐	☐	☐	☐	☐	☐
LTM 65 – Proficiency Training: (L)	☐	☐	☐	☐	☐	☐	☐

Rate the actual task frequency in comparison to predicted frequency contained in LSAR.

Rate the adequacy of task pertinent safety training.

Evaluate the contractors "theory of operation" training effectiveness to prepare maintenance personnel for OJT on this task.

Evaluate the Field Training Detachment "theory of operation" training effectiveness to prepare maintenance personnel for OJT on this task.

Evaluate the OJT training received for this task (contractor, FTD, cross-utilization training CUT", and system upgrade).

Additional Comments:_____
_____
_____
_____

Very Unsatisfactory	Unsatisfactory	Marginally Unsatisfactory	Marginally Satisfactory	Satisfactory	Very Satisfactory
1	2	3	4	5	6
----------Unsatisfactory Range----------			----------Satisfactory Range----------		

7 - COMPUTER RESOURCES

N/A 1 2 3 4 5 6

LTM 70 – CRS Reliability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Rate the reliability of the CRS system against planned parameters.

LTM 71 – CRS Maintainability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Rate the maintainability of the CRS system against the MTBM, MTBMC, and MTTR parameters.

LTM 72 – Diagnostic System Adequacy: (BIT) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Rate the adequacy of the diagnostics system to determine fault reporting and troubleshooting support..

LTM 73 – Ease of Use: (HSI) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Rate the adequacy of the BIT system as a fault isolation aid.

LTM 74 – Functional Utility: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Rate the adequacy of air vehicle automated/initiated diagnostics in relation to accurate and efficient fault detection reporting, isolation, recording and correlating of malfunctions.

LTM 75 – Resource Effectiveness: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Rate the adequacy of the hardware and software utilized to upload and download data and information from various systems, both on- and off-equipment.

Additional Comments:_____
_____
_____
_____

Very Unsatisfactory	Unsatisfactory	Marginally Unsatisfactory	Marginally Satisfactory	Satisfactory	Very Satisfactory
1	2	3	4	5	6
----------Unsatisfactory Range----------			----------Satisfactory Range----------		

8 - FACILITIES

N/A 1 2 3 4 5 6

LTM 80 - Reliability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Subjectively assess the reliability of facility systems that are required to correctly perform maintenance.

LTM 81 – Maintainability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Subjectively assess the maintainability of facilities required to correctly perform the maintenance task.

LTM 82 - Safety: (HF) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Evaluate the facilities safety provisions for fire protection equipment, ease of exit and entry, sufficient ventilation and sufficient emergency equipment (eyewashes, first aid kits).

LTM 83 - Utilities: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Rate the ability of the site utilities (high pressure air, temperature and humidity control, lighting, electrical, etc.) to support the air vehicle and support equipment.

LTM 84 - Capacity: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Evaluate test facility size and layout for ease of aircraft movement, ability to utilize SE around the aircraft, and equipment storage space (including both SE and parts).

Additional Comments:_____
_____
_____
_____

Very Unsatisfactory	Unsatisfactory	Marginally Unsatisfactory	Marginally Satisfactory	Satisfactory	Very Satisfactory
1	2	3	4	5	6
----------Unsatisfactory Range----------			----------Satisfactory Range----------		

9 - PHS&T

N/A 1 2 3 4 5 6

LTM 90 - Reliability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Subjectively assess the PHS&T influence on system reliability characteristics.

LTM 91 - Safety: (HSI) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Subjectively assess the PHS&T influence on system reliability characteristics.

LTM 92 - Suitability: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the packaging materials and procedures used to prevent damage to parts and equipment during shipment and storage.

Comments: _____
_____
_____
_____
_____

Very Unsatisfactory	Unsatisfactory	Marginally Unsatisfactory	Marginally Satisfactory	Satisfactory	Very Satisfactory
1	2	3	4	5	6
----------Unsatisfactory Range----------			----------Satisfactory Range----------		

10 - DESIGN INTERFACE

N/A 1 2 3 4 5 6

LTM 100 - Reliability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Subjectively assess the system's ability to operate as intended under the defined operational and support concept.

LTM 101 - Maintainability: (R&M) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Subjectively evaluate the ability of an item to be retained in or restored to specified condition when maintenance is performed by personnel with the specified skill levels, using prescribed procedures and resources.

LTM 102 – Human/Machine Interface: (HSI) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the air vehicle design features for physical and visual access of components.

LTM 103 – Safety: (HSI) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the design features used to minimize risk of personal injury and equipment damage.

LTM 104 – Machine-Machine Interface: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate the relative positioning of LRUs or LRMs for unhindered operation and maintenance.

LTM 105 – Design: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Evaluate system/component design characteristics.

LTM 106 – Interoperability: (L) ☐ ☐ ☐ ☐ ☐ ☐ ☐
Rate the ability of the weapon system and its support equipment to utilize aerospace ground equipment (AGE) of other military services and allied forces.

Additional Comments:_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

This page has been deliberately left blank

Page intentionnellement blanche

APPENDIX C

RELIABILITY, MAINTAINABILITY, AND AVAILABILITY (RM&A) PARAMETERS AND METHODS OF CALCULATION

This page has been deliberately left blank

Page intentionnellement blanche

RELIABILITY, MAINTAINABILITY, AND AVAILABILITY (RM&A) PARAMETERS AND METHODS OF CALCULATION

INTRODUCTION

This document describes the quantitative RM&A parameters which will be evaluated during developmental test and evaluation (DT&E). It includes a detailed description of the terms, definitions and formulas for each RM&A parameter. The data sources for each parameter in the calculations is also provided.

RELIABILITY

MTBM(I) - Mean Time Between Maintenance (Inherent)

Definition: MTBM(I) measures the mean time between unscheduled, on-equipment maintenance actions caused by a design or manufacturing defect, with time expressed as total production aircraft flight hours. This measure includes:

- chargeable inherent maintenance actions
- unscheduled maintenance
- on-equipment (line or organization level)
- time in flying hours (production aircraft).

Exclude: Test-unique actions.

Formula 1:

$$\text{MTBM(I)} = \frac{\text{TOTAL FLIGHT HOURS}}{\text{TOTAL INHERENT MAINTENANCE ACTIONS}}$$

Question: What are test-unique actions?

Answer: Actions to support engineering evaluations, modifications, etc. Maintenance actions that are in direct support of engineering test and evaluation of subsystem or component modifications, technical order (T.O.) validation, or support equipment (SE) compatibility demonstration will be considered nonrelevant to both the contractual and operational RM&A evaluation.

Question: What are inherent maintenance actions?

Answer: Failures which result from an internal cause. These failures are the result of defective design or manufacture and will be coded with a Type = 1 How Malfunction Code (HMC) and the appropriate Action Taken Code (ATK). If a removed component is later found to be serviceable, the action will be changed to a NO-DEFECT maintenance action. There will be a maximum of one chargeable maintenance action with an ATK G and Type = 1 HMC combination for a given work unit code (WUC) within a given job control number (JCN).

Sources:

- Total Flying Hours: Combined Test Force (CTF) Maintenance Debrief Form 207, R&M cyclic database.
- Total Inherent Maintenance Actions: System Effectiveness Data System (SEDS) Failure Summary Report.

MTBM(C) - Mean Time Between Maintenance (Total Corrective)

Definition: MTBM(C) measures the mean time between unscheduled, on-equipment corrective maintenance actions, with time expressed as total production aircraft flight hours. The number of corrective maintenance actions is the sum of the number of inherent, induced and no defect maintenance actions. This measure includes:

- corrective maintenance actions (sum of inherent, induced, no defect)
- unscheduled maintenance
- time in flying hours (production aircraft).
- on equipment.

Formula 2:

$$\text{MTBM(C)} = \frac{\text{TOTAL FLIGHT HOURS}}{\text{TOTAL CORRECTIVE MAINTENANCE ACTIONS}}$$

Question: What are induced maintenance actions?

Answer: Failures which are caused by an external condition and not by an internal failure pattern. These actions are coded with a Type = 2 HMC and the appropriate ATK. If a component removed due to an induced failure is later found to be serviceable, the action taken will be changed to a NO-DEFECT maintenance action. There will be a maximum of one chargeable maintenance action with an ATK G and Type = 2 HMC combination for a given WUC within a given JCN.

Question: What are no-defect maintenance actions?

Answer: Failures which result from indicated malfunctions, which later can not be duplicated or components removed to facilitate others maintenance. Time compliance technical order (TCTO) and scheduled maintenance tasks are considered support general and are not included in this category.

Sources:

- Total Flying Hours: CTF Maintenance Debrief Form 207, R&M cyclic database.
- Total Corrective Maintenance Actions: SEDS Failure Summary Report. This is the sum of the inherent, induced, and no-defect actions.

MTBR - Mean Time Between Removal

Definition: MTBR measures the mean time interval between removal of repairable components, with time expressed as total production aircraft flying hours. This measure includes:

- production aircraft flying hours
- includes indicated failures (retest OK [RTOK])
- chargeable removals

- on equipment
- repairable.

Exclude:

- removals to facilitate other maintenance
- TCTOs
- scheduled maintenance
- nonrepairable components.

Formula 3:

$$\text{MTBR} = \frac{\text{TOTAL FLIGHT HOURS}}{\text{TOTAL NUMBER OF REMOVALS}}$$

Sources:

- Total Flying Hours: CTF Maintenance Debrief Form 207, R&M cyclic database.
- Total Removals: Retrieval on work field 1 from SEDS database.

MCSP - Mission Completion Success Probability

Definition: MCSP is the probability that a scheduled mission will be completed without experiencing an on-equipment failure or performance degradation that results in the aircraft being unable to complete the planned mission objectives.

Because of the test unique environment of DT&E/IOT&E an analytic model will be used to evaluate MCSP performance. The system program office (SPO) may use the contractor developed model (Probabilistic Monte Carlo simulation) and HQ AFOTEC may use its own model (LCOM). The CTF R&M engineers may not evaluate MCSP. The CTF contribution will be to provide data to HQ AFOTEC which they will use to calculate MCSP. This approach may be approved by the JRMET (Joint Reliability and Maintainability Evaluation Team).

MAINTAINABILITY

DMMH/FH - Direct Maintenance Man-hours per Flight Hour

Definition: DMMH/FH measures the number of man-hours expended by maintenance in direct support of the air vehicle and its engine(s) per aircraft flight hour. This measure includes:

- scheduled maintenance
- unscheduled maintenance
- organizational level maintenance man-hours.
- intermediate level maintenance man-hours.

Exclude: test unique tasks such as:

- Instrumentation maintenance
- deferred manufacturing, and system modification.

Formula 3:

$$\text{DMMH / FH} = \frac{\text{TOTAL CHARGEABLE MAN–HOURS}}{\text{TOTAL FLYING HOURS}}$$

Sources:

- Total Maintenance Man-Hours: From SEDS Active Man-Hour Task Summary (AMTS), Chart 4.
- Total Flight Hour: CTF Maintenance Debrief Form 207, R&M cyclic database.

MMTR - Mean Man-Hours to Repair

Definition: MMTR measures the mean time required to complete an unscheduled maintenance action. This includes:

- corrective man-hours
- organizational level
- intermediate level.

Exclude:

- TCTO
- nonchargeable actions.

Formula 4:

$$\text{MMTR} = \frac{\text{TOTAL CORRECTIVE MAINTENANCE MAN–HOURS}}{\text{TOTAL CORRECTIVE MAINTENANCE ACTIONS}}$$

Sources:

- Total Corrective Maintenance Man-Hours: SEDS AMTS.
- Total Corrective Maintenance Actions: SEDS Failure Summary. This is a sum of the Type = 1, Type = 2, and Type = 6 maintenance actions.

BIT – Built-In-Test

Definition: Bit adequacy is the ability to accurately detect and isolate malfunctions without false indications.

- **BIT Detection (BIT-D)** - The percent of occurrences in which BIT correctly detects a malfunction.

- **BIT Isolation (BIT-I)** - The percent of occurrences in which BIT correctly isolates a detected malfunction to the failed LRU.

- **BIT False Indication (BIT-FI)** - The percent of occurrences in which BIT indicated a malfunction when none existed (can not duplicate [CND] or retest OK [RTOK]).

Question: What is an occurrence?

Answer: An occurrence is an indication of an aircraft fault by the BIT system. Every maintenance action will be documented on an AFSC Form 258 and the appropriate BIT code will be recorded as an occurrence. The following code combinations will be used to calculate the BIT measures.

BIT Codes:

#1: BIT detected a malfunction when one existed.
#2: BIT failed to detect a malfunction when one existed (BIT was designed to detect this malfunction).
#3: BIT correctly isolated to the failed LRU.
#4: BIT did not isolate to the failed LRU.
#5: BIT indicated a malfunction when none existed (verified by CND).
#6: BIT indicated a malfunction when none existed (verified by RTOK).
#7: BIT not applicable.

The following characters will follow either of the 3 and 4 BIT codes above described. These characters reflect the techniques performed during the accomplishment of a maintenance task:

A. BIT and Fault Isolation Manual correctly isolated to the failed LRU

B. BIT and/or Fault Isolation Manual assisted in the isolation process. Technical orders and SE were also used to correctly isolate to a failed LRU (or the LRU's wiring, software, etc.).

C. The Fault Isolation Manual did not isolate to the malfunction without other T.O.s (such as wiring diagrams) and/or SE. Primary source of troubleshooting was NOT the Fault Isolation Manual.

D. Contractor assisted or provided isolation or fix. (Established T.O. procedures have not been effective)

Formula 5:

$$\text{BIT DETECTION RATE} = \frac{\sum(1)}{\sum(1+2)}$$

Formula 6:

$$\text{BIT ISOLATION RATE} = \frac{\sum(3)}{\sum(3+4)}$$

Formula 7:

$$\text{BIT FALSE INDICATION RATE} = \frac{\sum(135+136+145+236+246)}{\sum(135+136+145+236+246+1)}$$

NOTES:

- BIT Code 3A would include = Code 3 + Code A
- BIT Code 3B would include = Code 3 + Code B
- BIT Code 4C would include = Code 4 + Code C

Sources:

The source of the BIT codes is in block 24 of the AFSC Form 258. The BIT code data will be extracted from the SEDS database and manipulated as appropriate.

LTM 72 - Diagnostics System Adequacy

An analysis of the BIT system adequacy will be performed to determine the maintainability capabilities of the aircraft. BIT usually serves two functions: (1) to monitor and report system status to an operator; and (2) to be used as a maintenance tool for system diagnostics and repairs. The objective of the assessment will be to determine the adequacy of the BIT system as a tool for conducting diagnostics and repairs. That is, its capability to confirm faults, locate and isolate the cause of the fault, and perform repairs. BIT factors of measures of false alarms (FA), percent of correct detection given a fault has occurred (Pcd), percent of correct fault isolation (and correct fault location) given correct detection (Pcfi), and mean time to fault locate (MTTFL) will be used to determine and assess the adequacy (i.e., system effectiveness) of the BIT system.

Measures of False Alarms (FA). False alarms are faults, where upon investigation, it is found the fault cannot be confirmed. May be expressed as a total number, percentage, rate of occurrence, probability of occurrence, etc.

Formula 7: (Percentage)

$$FA = \frac{\text{Unconfirmed Faults}}{\text{Total Number of Faults Reported}} \times 100$$

Percent of Correct Detection given that a fault has occurred (Pcd): The number of correct detections divided by the total number of confirmed faults times 100 (to express the quotient as a percent).

Formula 8: (Percentage)

$$Pcd = \frac{\text{Number of Correct Detections}}{\text{Total Number of Confirmed Faults}} X\ 100$$

Percent of Correct Fault Isolation (and correct fault location) given correct detection (Pcfi): The number of correct fault isolations (and/or correct fault locations) divided by the number of correct detections.

Formula 9: (Percentage)

$$Pcfi = \frac{\text{Number of Correct Fault Isolations}}{\text{Number of Correct Detections}} X\ 100$$

Mean Time to Fault Locate (MTTFL): The total amount of time required to locate faults divided by the total number of faults.

Formula 10: (Mean)

$$MTTFL = \frac{\text{Total Time Reqd to Locate Faults}}{\text{Total Number of Faults}}$$

AVAILABILITY

Definition: Availability is measured in terms of Full Mission Capable rate, Mission Capable rate, and Maintenance per sortie. Compliance with these requirements shall be determined during ISO (initial squadron operations) and ORE (operational readiness evaluation). ISO will begin with the delivery of the first production aircraft to the activation site and end with IOC (initial operational capability). CTF contribution will be to provide data to HQ AFOTEC which they will use to calculate the availability.

APPENDIX D

LIST OF ACRONYMS

This page has been deliberately left blank

Page intentionnellement blanche

LIST OF ACRONYMS

Abbreviation	Definition
AETC	Air Education and Training Command
AFFTC	Air Force Flight Test Center
AFI	Air Force Instruction
AFOTEC	Air Force Operational Test and Evaluation Center
AFSC	Air Force Specialty Code
AFTO	Air Force Technical Order
AGE	aerospace ground equipment
AMTS	Active Man-Hour Task Summary
ATE	automated test equipment
ATK	action take code
AVS	air vehicle specification
Ao	operational availability
BIT	built-in-test
CAMS	core automated maintenance system
CFE	contractor-furnished equipment
CMP	component discrepancy report analysis
CND	can not duplicate
CRS	computer resources support
CTF	combined test force
CUT	cross-utilization training
DAP	data analysis plan
DI	design interface
DMMH/FH	direct maintenance man-hours per flight hour
DR	deficiency report
DT&E	developmental test and evaluation
DTIS	detailed test information sheet
ECS	environmental control system
ED	engineering data
EFCS	electronic flight control system
ET	elapsed time
ExT	excessive time
FA	facilities/false alarm
FOM	facilitate other maintenance
FTP	flight test plan
GFE	government-furnished equipment
HFE	Human Factors Engineering
HMC	how malfunction code
HSI	human systems engineering
IC	integrated circuit
ILS	integrated Logistics support

LIST OF ACRONYMS (Continued)

Abbreviation	Definition
ILSP	Integrated Logistics Support Plan
IOC	initial operational capability
IOT&E	initial operational test and evaluation
IPB	illustrated parts breakdown
IPT	Integrated Product Team
ISD	instructional systems development
ISO	initial squadron operations
LCN	logistics control number
LRU	line replaceable unit
LSA	Logistics support analysis
LSAR	Logistics support analysis report
LT&E	Logistics test and evaluation
LTDS	Logistics test data sheet
LAN	local area network
LRM	line replaceable module
JCN	job control number
JRMET	joint reliability and maintainability evaluation team
LTM	Logistics test measure
M&P	manpower and personnel
MCSP	mission completion success probability
MIP	Material Improvement Program
MMH	maintenance man-hours
MMH/FH	maintenance man-hours per flight hour
MMTR	mean man-hours to repair
MP	maintenance planning
MTTFL	mean time to fault locate
MTBM	mean time between maintenance
MTTR	mean time to repair
MTBM(I)	mean time between maintenance (inherent)
MTBM(C)	mean time between maintenance (total corrective)
MTBR	mean time between removal
NATO	North Atlantic Treaty Organization
O&M	operations and maintenance
OFP	operational flight program
OJT	on-the-job training
ORE	operational readiness evaluation
OT&E	operational test and evaluation
PCR	publication change request
Pcd	percent of correct detection
Pcfi	percent of correct fault isolation

LIST OF ACRONYMS (Concluded)

Abbreviation	Definition
R&M	reliability and maintainability
RCM	reliability-centered maintenance
RDT&E	research, development, test and evaluation
RM&A	reliability, maintainability, and availability
RTOK	retest OK
SATCOM	satellite communication
SE	support equipment
SEDS	System Effectiveness Data System
SPM	system program manager
SPO	system program office
SR	service reports
SSSN	system, subsystem, sub-subsytem number
SS	supply support
SMR	source, maintenance, and recoverability
SRU	shop replaceable unit
TD	technical data
TEMP	test and evaluation master plan
TIS	test information sheet
TR	technical report
TM	technical manual
TTS	test and training support
TCTO	time compliance technical order
TLR	technical letter report
TERS	test and evaluation results sheet
T.O.	technical order
TOD	technical order data
WIT	watch item
WUC	work unit code
PHS&T	packaging, handling, storage and transportation

This page has been deliberately left blank

Page intentionnellement blanche

Annex

AGARD and RTO Flight Test Instrumentation and Flight Test Techniques Series

1. Volumes in the AGARD and RTO Flight Test Instrumentation Series, AGARDograph 160

Volume Number	Title	Publication Date
1.	Basic Principles of Flight Test Instrumentation Engineering (Issue 2) Issue 1: edited by A. Pool and D. Bosman Issue 2: edited by R. Borek and A. Pool	 1974 1994
2.	In-Flight Temperature Measurements by F. Trenkle and M. Reinhardt	1973
3.	The Measurements of Fuel Flow by J.T. France	1972
4.	The Measurements of Engine Rotation Speed by M. Vedrunes	1973
5.	Magnetic Recording of Flight Test Data by G.E. Bennett	1974
6.	Open and Closed Loop Accelerometers by I. Mclaren	1974
7.	Strain Gauge Measurements on Aircraft by E. Kottkamp, H. Wilhelm and D. Kohl	1976
8.	Linear and Angular Position Measurement of Aircraft Components by J.C. van der Linden and H.A. Mensink	1977
9.	Aeroelastic Flight Test Techniques and Instrumentation by J.W.G. van Nunen and G. Piazzoli	1979
10.	Helicopter Flight Test Instrumentation by K.R. Ferrell	1980
11.	Pressure and Flow Measurement by W. Wuest	1980
12.	Aircraft Flight Test Data Processing - A Review of the State of the Art by L.J. Smith and N.O. Matthews	1980
13.	Practical Aspects of Instrumentation System Installation by R.W. Borek	1981
14.	The Analysis of Random Data by D.A. Williams	1981
15.	Gyroscopic Instruments and their Application to Flight Testing by B. Stieler and H. Winter	1982
16.	Trajectory Measurements for Take-off and Landing Test and Other Short-Range Applications by P. de Benque D'Agut, H. Riebeek and A. Pool	1985
17.	Analogue Signal Conditioning for Flight Test Instrumentation by D.W. Veatch and R.K. Bogue	1986
18.	Microprocessor Applications in Airborne Flight Test Instrumentation by M.J. Prickett	1987
19.	Digital Signal Conditioning for Flight Test by G.A. Bever	1991

2. Volumes in the AGARD and RTO Flight Test Techniques Series

Volume Number	Title	Publication Date
AG237	Guide to In-Flight Thrust Measurement of Turbojets and Fan Engines by the MIDAP Study Group (UK)	1979

The remaining volumes are published as a sequence of Volume Numbers of AGARDograph 300.

Volume Number	Title	Publication Date
1.	Calibration of Air-Data Systems and Flow Direction Sensors by J.A. Lawford and K.R. Nippress	1988
2.	Identification of Dynamic Systems by R.E. Maine and K.W. Iliff	1988
3.	Identification of Dynamic Systems - Applications to Aircraft Part 1: The Output Error Approach by R.E. Maine and K.W. Iliff	1986
	Part 2: Nonlinear Analysis and Manoeuvre Design by J.A. Mulder, J.K. Sridhar and J.H. Breeman	1994
4.	Determination of Antenna Patterns and Radar Reflection Characteristics of Aircraft by H. Bothe and D. McDonald	1986
5.	Store Separation Flight Testing by R.J. Arnold and C.S. Epstein	1986
6.	Developmental Airdrop Testing Techniques and Devices by H.J. Hunter	1987
7.	Air-to-Air Radar Flight Testing by R.E. Scott	1992
8.	Flight Testing under Extreme Environmental Conditions by C.L. Henrickson	1988
9.	Aircraft Exterior Noise Measurement and Analysis Techniques by H. Heller	1991
10.	Weapon Delivery Analysis and Ballistic Flight Testing by R.J. Arnold and J.B. Knight	1992
11.	The Testing of Fixed Wing Tanker & Receiver Aircraft to Establish their Air-to-Air Refuelling Capabilities by J. Bradley and K. Emerson	1992
12.	The Principles of Flight Test Assessment of Flight-Safety-Critical Systems in Helicopters by J.D.L. Gregory	1994
13.	Reliability and Maintainability Flight Test Techniques by J.M. Howell	1994
14.	Introduction to Flight Test Engineering Edited by F. Stoliker	1995
15.	Introduction to Avionics Flight Test by J.M. Clifton	1996
16.	Introduction to Airborne Early Warning Radar Flight Test by J.M. Clifton and F.W. Lee	1999
17.	Electronic Warfare Test and Evaluation by H. Banks and R. McQuillan	2000
18.	Flight Testing of Radio Navigation Systems by H. Bothe and H.J. Hotop	2000

19.	Simulation in Support of Flight Testing by D. Hines	2000
20.	Logistics Test and Evaluation in Flight Testing by M. Bourcier	2001

At the time of publication of the present volume, the following volumes are in preparation:

Flying Qualities Flight Testing of Digital Flight Control Systems

Rotorcraft/Ship Compatibility Testing

Flight Test Measurement Techniques for Laminar Flow

Optical Air Flow Measurement in Flight

Flight Testing of Night Vision Systems

Unique Aspects of Flight Testing of Unmanned Aerial Vehicles/Unmanned Combat Aerial Vehicles

Aircraft-Stores Certification Testing

Selection of a Flight Test Instrumentation System

Testing of Precision Airdrop Systems

Flight Testing of Tactical Laser Systems

This page has been deliberately left blank

Page intentionnellement blanche

REPORT DOCUMENTATION PAGE

1. Recipient's Reference	2. Originator's References	3. Further Reference	4. Security Classification of Document
	RTO-AG-300 AC/323(SCI-010)TP/38 Volume 20	ISBN 92-837-1071-1	UNCLASSIFIED/ UNLIMITED

5. Originator Research and Technology Organization
North Atlantic Treaty Organization
BP 25, 7 rue Ancelle, F-92201 Neuilly-sur-Seine Cedex, France

6. Title
Logistics Test and Evaluation in Flight Test

7. Presented at/sponsored by
the SCI-055 Task Group, the Flight Test Technology Team of the Systems Concepts and Integration Panel (SCI) of RTO.

8. Author(s)/Editor(s)	9. Date
Michael A. Bourcier	August 2001

10. Author's/Editor's Address	11. Pages
Air Force Flight Test Center 225 North Flighline Rd Edwards AFB, CA 93524 United States	102

12. Distribution Statement There are no restrictions on the distribution of this document. Information about the availability of this and other RTO unclassified publications is given on the back cover.

13. Keywords/Descriptors

Logistics support
ILS (Integrated Logistics Support)
Maintenance
Flight tests
Cost engineering
Weapons systems
Logistics management
Logistics planning
Project management
Integrated systems
Life cycle costs
Maintainability
Human factors engineering
Decision making
Criteria
Management systems
Methodology
Supportability

14. Abstract

The objective of this AGARDograph is to provide an introductory overview of logistics test and evaluation methods for supportability testing. This AGARDograph is an attempt to put into print the approach and techniques for a test team to execute logistics/supportability test and evaluation. To do so, the logistics/supportability test and evaluation process is subdivided into manageable functional areas and disciplines called Integrated Logistics Support (ILS) elements. The 10 ILS elements are: maintenance planning; manpower and personnel; support equipment; computer resources; facilities; packaging, handling, storage, and transportation; and design interface. Whether a program is a large one, like a new F-22 aircraft, or a small one, like a new 25K Loader, all logistics elements must be evaluated for applicability to the program. The only change between large and small programs is the depth of effort to be performed in each element. Examples will be provided to discuss the test and evaluation technique to each area and are adaptable to the reader's particular area of interest. This volume should complement the AG-300 Vol. 13 on "Reliability and Maintainability."

This page has been deliberately left blank

Page intentionnellement blanche

NORTH ATLANTIC TREATY ORGANIZATION

RESEARCH AND TECHNOLOGY ORGANIZATION
BP 25 • 7 RUE ANCELLE
F-92201 NEUILLY-SUR-SEINE CEDEX • FRANCE
Télécopie 0(1)55.61.22.99 • E-mail mailbox@rta.nato.int

DIFFUSION DES PUBLICATIONS
RTO NON CLASSIFIEES

L'Organisation pour la recherche et la technologie de l'OTAN (RTO), détient un stock limité de certaines de ses publications récentes, ainsi que de celles de l'ancien AGARD (Groupe consultatif pour la recherche et les réalisations aérospatiales de l'OTAN). Celles-ci pourront éventuellement être obtenues sous forme de copie papier. Pour de plus amples renseignements concernant l'achat de ces ouvrages, adressez-vous par lettre ou par télécopie à l'adresse indiquée ci-dessus. Veuillez ne pas téléphoner.

Des exemplaires supplémentaires peuvent parfois être obtenus auprès des centres nationaux de distribution indiqués ci-dessous. Si vous souhaitez recevoir toutes les publications de la RTO, ou simplement celles qui concernent certains Panels, vous pouvez demander d'être inclus sur la liste d'envoi de l'un de ces centres.

Les publications de la RTO et de l'AGARD sont en vente auprès des agences de vente indiquées ci-dessous, sous forme de photocopie ou de microfiche. Certains originaux peuvent également être obtenus auprès de CASI.

CENTRES DE DIFFUSION NATIONAUX

ALLEMAGNE
Streitkräfteamt / Abteilung III
Fachinformationszentrum der Bundeswehr, (FIZBw)
Friedrich-Ebert-Allee 34
D-53113 Bonn

BELGIQUE
Coordinateur RTO - VSL/RTO
Etat-Major de la Force Aérienne
Quartier Reine Elisabeth
Rue d'Evère, B-1140 Bruxelles

CANADA
Services d'information scientifique pour la défense (SISD)
R et D pour la défense Canada
Ministère de la Défense nationale
Ottawa, Ontario K1A 0K2

DANEMARK
Danish Defence Research Establishment
Ryvangs Allé 1, P.O. Box 2715
DK-2100 Copenhagen Ø

ESPAGNE
INTA (RTO/AGARD Publications)
Carretera de Torrejón a Ajalvir, Pk.4
28850 Torrejón de Ardoz - Madrid

ETATS-UNIS
NASA Center for AeroSpace Information (CASI)
Parkway Center
7121 Standard Drive
Hanover, MD 21076-1320

FRANCE
O.N.E.R.A. (ISP)
29, Avenue de la Division Leclerc
BP 72, 92322 Châtillon Cedex

GRECE (Correspondant)
Hellenic Ministry of National Defence
Defence Industry Research & Technology General Directorate
Technological R&D Directorate
D.Soutsou 40, GR-11521, Athens

HONGRIE
Department for Scientific Analysis
Institute of Military Technology
Ministry of Defence
H-1525 Budapest P O Box 26

ISLANDE
Director of Aviation
c/o Flugrad
Reykjavik

ITALIE
Centro di Documentazione Tecnico-Scientifica della Difesa
Via XX Settembre 123a
00187 Roma

LUXEMBOURG
Voir Belgique

NORVEGE
Norwegian Defence Research Establishment
Attn: Biblioteket
P.O. Box 25, NO-2007 Kjeller

PAYS-BAS
NDRCC
DGM/DWOO
P.O. Box 20701
2500 ES Den Haag

POLOGNE
Chief of International Cooperation Division
Research & Development Department
218 Niepodleglosci Av.
00-911 Warsaw

PORTUGAL
Estado Maior da Força Aérea
SDFA - Centro de Documentação
Alfragide
P-2720 Amadora

REPUBLIQUE TCHEQUE
DIC Czech Republic-NATO RTO
VTÚL a PVO Praha
Mladoboleslavská ul.
Praha 9, 197 06, Česká republika

ROYAUME-UNI
Dstl Knowledge Services
Kentigern House, Room 2246
65 Brown Street
Glasgow G2 8EX

TURQUIE
Millî Savunma Başkanliği (MSB)
ARGE Dairesi Başkanliği (MSB)
06650 Bakanliklar - Ankara

AGENCES DE VENTE

NASA Center for AeroSpace Information (CASI)
Parkway Center
7121 Standard Drive
Hanover, MD 21076-1320
Etats-Unis

The British Library Document Supply Centre
Boston Spa, Wetherby
West Yorkshire LS23 7BQ
Royaume-Uni

Canada Institute for Scientific and Technical Information (CISTI)
National Research Council
Document Delivery
Montreal Road, Building M-55
Ottawa K1A 0S2, Canada

Les demandes de documents RTO ou AGARD doivent comporter la dénomination "RTO" ou "AGARD" selon le cas, suivie du numéro de série (par exemple AGARD-AG-315). Des informations analogues, telles que le titre et la date de publication sont souhaitables. Des références bibliographiques complètes ainsi que des résumés des publications RTO et AGARD figurent dans les journaux suivants:

Scientific and Technical Aerospace Reports (STAR)
STAR peut être consulté en ligne au localisateur de ressources uniformes (URL) suivant:
http://www.sti.nasa.gov/Pubs/star/Star.html
STAR est édité par CASI dans le cadre du programme NASA d'information scientifique et technique (STI)
STI Program Office, MS 157A
NASA Langley Research Center
Hampton, Virginia 23681-0001
Etats-Unis

Government Reports Announcements & Index (GRA&I)
publié par le National Technical Information Service
Springfield
Virginia 2216
Etats-Unis
(accessible également en mode interactif dans la base de données bibliographiques en ligne du NTIS, et sur CD-ROM)

Imprimé par St-Joseph Ottawa/Hull
(Membre de la Corporation St-Joseph)
45, boul. Sacré-Cœur, Hull (Québec), Canada J8X 1C6

NORTH ATLANTIC TREATY ORGANIZATION

RESEARCH AND TECHNOLOGY ORGANIZATION
BP 25 • 7 RUE ANCELLE
F-92201 NEUILLY-SUR-SEINE CEDEX • FRANCE
Telefax 0(1)55.61.22.99 • E-mail mailbox@rta.nato.int

DISTRIBUTION OF UNCLASSIFIED RTO PUBLICATIONS

NATO's Research and Technology Organization (RTO) holds limited quantities of some of its recent publications and those of the former AGARD (Advisory Group for Aerospace Research & Development of NATO), and these may be available for purchase in hard copy form. For more information, write or send a telefax to the address given above. **Please do not telephone**.

Further copies are sometimes available from the National Distribution Centres listed below. If you wish to receive all RTO publications, or just those relating to one or more specific RTO Panels, they may be willing to include you (or your organisation) in their distribution.

RTO and AGARD publications may be purchased from the Sales Agencies listed below, in photocopy or microfiche form. Original copies of some publications may be available from CASI.

NATIONAL DISTRIBUTION CENTRES

BELGIUM
Coordinateur RTO - VSL/RTO
Etat-Major de la Force Aérienne
Quartier Reine Elisabeth
Rue d'Evère, B-1140 Bruxelles

CANADA
Defence Scientific Information Services (DSIS)
Defence R&D Canada
Department of National Defence
Ottawa, Ontario K1A 0K2

CZECH REPUBLIC
DIC Czech Republic-NATO RTO
VTÚL a PVO Praha
Mladoboleslavská ul.
Praha 9, 197 06, Česká republika

DENMARK
Danish Defence Research Establishment
Ryvangs Allé 1, P.O. Box 2715
DK-2100 Copenhagen Ø

FRANCE
O.N.E.R.A. (ISP)
29 Avenue de la Division Leclerc
BP 72, 92322 Châtillon Cedex

GERMANY
Streitkräfteamt / Abteilung III
Fachinformationszentrum der Bundeswehr, (FIZBw)
Friedrich-Ebert-Allee 34
D-53113 Bonn

GREECE (Point of Contact)
Hellenic Ministry of National Defence
Defence Industry Research & Technology General Directorate
Technological R&D Directorate
D.Soutsou 40, GR-11521, Athens

HUNGARY
Department for Scientific Analysis
Institute of Military Technology
Ministry of Defence
H-1525 Budapest P O Box 26

ICELAND
Director of Aviation
c/o Flugrad
Reykjavik

ITALY
Centro di Documentazione Tecnico-Scientifica della Difesa
Via XX Settembre 123a
00187 Roma

LUXEMBOURG
See Belgium

NETHERLANDS
NDRCC
DGM/DWOO
P.O. Box 20701
2500 ES Den Haag

NORWAY
Norwegian Defence Research Establishment
Attn: Biblioteket
P.O. Box 25, NO-2007 Kjeller

POLAND
Chief of International Cooperation Division
Research & Development Department
218 Niepodleglosci Av.
00-911 Warsaw

PORTUGAL
Estado Maior da Força Aérea
SDFA - Centro de Documentação
Alfragide
P-2720 Amadora

SPAIN
INTA (RTO/AGARD Publications)
Carretera de Torrejón a Ajalvir, Pk.4
28850 Torrejón de Ardoz - Madrid

TURKEY
Millî Savunma Başkanliği (MSB)
ARGE Dairesi Başkanliği (MSB)
06650 Bakanliklar - Ankara

UNITED KINGDOM
Dstl Knowledge Services
Kentigern House, Room 2246
65 Brown Street
Glasgow G2 8EX

UNITED STATES
NASA Center for AeroSpace Information (CASI)
Parkway Center
7121 Standard Drive
Hanover, MD 21076-1320

SALES AGENCIES

NASA Center for AeroSpace Information (CASI)
Parkway Center
7121 Standard Drive
Hanover, MD 21076-1320
United States

The British Library Document Supply Centre
Boston Spa, Wetherby
West Yorkshire LS23 7BQ
United Kingdom

Canada Institute for Scientific and Technical Information (CISTI)
National Research Council
Document Delivery
Montreal Road, Building M-55
Ottawa K1A 0S2, Canada

Requests for RTO or AGARD documents should include the word 'RTO' or 'AGARD', as appropriate, followed by the serial number (for example AGARD-AG-315). Collateral information such as title and publication date is desirable. Full bibliographical references and abstracts of RTO and AGARD publications are given in the following journals:

Scientific and Technical Aerospace Reports (STAR)
STAR is available on-line at the following uniform resource locator:
http://www.sti.nasa.gov/Pubs/star/Star.html
STAR is published by CASI for the NASA Scientific and Technical Information (STI) Program
STI Program Office, MS 157A
NASA Langley Research Center
Hampton, Virginia 23681-0001
United States

Government Reports Announcements & Index (GRA&I)
published by the National Technical Information Service
Springfield
Virginia 22161
United States
(also available online in the NTIS Bibliographic Database or on CD-ROM)

Printed by St. Joseph Ottawa/Hull
(A St. Joseph Corporation Company)
45 Sacré-Cœur Blvd., Hull (Québec), Canada J8X 1C6

ISBN 92-837-1071-1