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RESEARCH AND TECHNOLOGY ORGANIZATION

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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.

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Edited by
Michael A. Bourcier

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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.

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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**
Overview		**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.

Overview

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."

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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."

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