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Lessons Learned From the Developmental Flight Testing of the Improved Tactical Air Launched Decoy

Bradley S. Hutson
University of Tennessee - Knoxville

To the Graduate Council:

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Ralph Kimberlin, Major Professor

We have read this thesis and recommend its acceptance:

George Garrison, Richard Ranaudo

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

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LESSONS LEARNED FROM THE DEVELOPMENTAL FLIGHT TESTING OF THE IMPROVED TACTICAL AIR LAUNCHED DECOY

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Bradley S. Hutson
August 2003

DISCLAIMER

The information and technical data contained in this thesis are the result of actual events pertaining to the Developmental Flight Testing of the Improved Tactical Air Launched Decoy. The findings, conclusions, and recommendations expressed herein are the opinion of the author and may or may not represent the official position of the Naval Air Warfare Center, Naval Air Systems Command, or the Department of the Navy.

ACKNOWLEDGEMENTS

I wish to thank all those who assisted me in the preparation of this thesis. I wish to express my gratitude to the United States Naval Test Pilot School for initiating my post-graduate opportunity and to Dr. Richards who initially encouraged me to pursue the Master of Science in Aviation Systems program. I would also like to thank Dr. Kimberlin for serving as my major professor for this thesis and to Mr. Ranaudo and Dr. Garrison for serving on my committee. I would especially like to thank Betsy Harbin for all the help and encouragement she provided during my post-graduate study.

ABSTRACT

The purpose of this thesis is to examine the test team responsibilities and decisions made in the planning, execution, and reporting of test results for the Developmental Flight Testing of the Improved Tactical Air Launched Decoy (ITALD). Information gathered as lead Flight Test Engineer for the series of ITALD flight test events is the primary data source for the opinions formulated in this thesis. Test team decisions, influenced by training, budget constraints, test schedules, and changes in production contractors were analyzed to determine their effect on the flight test program. The Development Test guidance obtained from Department of Defense (DoD) Regulation 5000.2-R, the teachings of the United States Naval Test Pilot School, and other DoD acquisition documentation were reviewed to evaluate test team responsibilities and the approach that was taken throughout the flight test program.

The ITALD Developmental Flight Test program that is examined in this paper consisted of two series of flight tests, the ITALD Baseline Demonstration Flight Test program, which occurred in 1996, and the ITALD DT-IIIE Flight Test Program, which occurred in 1998. Both series of tests are examined since they are similarly related in test team structure, planning and conduct of test, and test results. The major difference between the two series of tests was the reporting of the test results. This will be discussed in detail within this paper.

While the ITALD flight test program was successful in determining what deficiencies existed and what improvements needed to be incorporated, there were a

number of lessons learned that were generated. The primary issues that developed were the need to develop a coordinated test philosophy and the necessity to improve communication within the Integrated Program Team. These, along with other lessons learned are discussed within the body of this paper and in the conclusions and recommendations sections.

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LIST OF ACRONYMS AND ABBREVIATIONS

APM (SE)	Assistant Program Manager for Systems Engineering
APM (T&E)	Assistant Program Manager for Test and Evaluation
AUR	All Up Round
CNO	Chief of Naval Operations
COMNAVAIR	Commander Naval Air (Systems Center)
COMNAVAIRWARCEN	Commander Naval Air Warfare Center
CTP	Critical Technical Parameters
DoD	Department of Defense
DT	Development Test
DT&E	Development Test and Evaluation
ECP	Engineering Change Proposal
EMI	Electromagnetic Interference
IMI	Israel Military Industries
IPT	Integrated Program Team
ITALD	Improved Tactical Air Launched Decoy
ITER	Improved Triple Ejection Rack
MNS	Mission Needs Statement
MR	Mission Relation
MS	Milestone
NAVAIRSYSCOM	Naval Air Systems Command
NAWCWD	Naval Air Warfare Center Weapons Division
ORD	Operational Requirements Document
OT&E	Operational Test and Evaluation
PEO	Program Executive Officer
PM	Program Manager
PMA	Program Manager for Acquisition
RF	Radio Frequency
TALD	Tactical Air Launched Decoy
TEMP	Test and Evaluation Master Plan
T&E	Test and Evaluation
TSPI	Time Space Position Information
USNTPS	United States Naval Test Pilot School

1.0 INTRODUCTION

1.1 BACKGROUND

In November 1995, the Naval Air Systems Command (NAVAIRSYSCOM) tasked the Naval Air Warfare Center Weapons Division (NAWCWD) to conduct Baseline Demonstration Flight Tests on the Improved Tactical Air Launched Decoy (ITALD) ADM-141C. The ITALD was a result of an Engineering Change Proposal (ECP) to the ADM-141A Tactical Air Launched Decoy (TALD). The prime contractor for development of the ITALD was Brunswick Corporation, Defense Division in Costa Mesa California with Israel Military Industries (IMI) as the major subcontractor. The first ITALDs were actually delivered to the Navy in 1993 for initial testing, but a variety of test failures and design modifications delayed the program until the latter part of 1995. By this time, Brunswick Corporation had made the decision to get out of the defense business with the present ITALD contract expiring at the end of January 1996. The result of this was that the Baseline Demonstration Flight Tests had to be completed by 31 January 1996. From 24 through 31 January 1996, six air launches were conducted, completing that portion of the Flight Test program.

In 1998, NAWCWD was again tasked by NAVAIRSYSCOM to conduct Developmental Test (DT) IIIE on the ITALD. IMI was now the prime contractor. From 17 September to 19 October 1998 nine air launches were conducted.

1.2 PURPOSE AND LIMITATIONS TO SCOPE

The purpose of this paper is to examine the test planning, conduct, and reporting of test results for only a portion of the ITALD Developmental Test program. This examination is limited to ITALD Flight Test events that occurred in January 1996 and in September through October 1998. It is intended to point out the limitations, deficiencies, and benefits discovered as a result of these tests. It is not the intention of this paper to discredit or persecute any person or organization. The purpose is to compile and examine information in order to develop a series of lessons learned for use in future developmental test programs.

The information and data collected for this paper is limited to that which was observed and formulated by the author of this paper during the test events discussed herein. The author has limited knowledge of the activities and dealings of persons or organizations outside of the immediate test team. While a basic overview of the Department of Defense (DoD) Acquisition Policies will be presented, only that which pertains to the intent of this paper will be discussed and analyzed. The acquisition documentation referenced in this paper is that which was in effect at the time of the conduct of the two discussed test sequences.

1.3 WEAPON SYSTEM DESCRIPTION

The TALD is a high speed, unpowered flight vehicle that was developed by Brunswick Defense for the U.S. Navy and placed into service in 1997. The ITALD, figure 1-1, is an advanced version of the TALD with incorporated ECP changes.

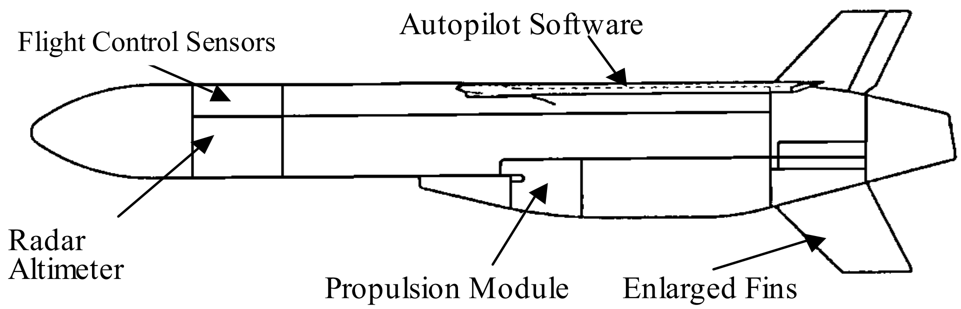

Figure 1-1. ITALD Vehicle

The ECP added additional flight control sensors, pitch autopilot software, radar altimeter, propulsion module, and a reconfigured ventral fin to the TALD design.

The non-recoverable ITALD weighs approximately 350 lbs and is 92 inches in length, 15 inches in height and 10 inches in width. The vehicle is powered by a 150 lb thrust gas turbine engine that utilizes JP-10 fuel. The ITALD is delivered as a fully fueled, all up round in a storage container. It is ready for use after being programmed and checked with a portable decoy programmer. The ITALD is carried with the wings in a folded position and is capable of being launched from an F/A-18 aircraft using an Improved Triple Ejection Rack (ITER). The decoy is capable of left or right turns, climbs and dives, and various offset maneuvers. The ITALD is used to improve strike aircraft survivability by misdirecting enemy air defenses, shielding strike aircraft, bringing up enemy radars for anti-radiation missile attack, and depleting air defense ordnance assets. The ITALD test vehicles used during the testing, and referred to in this paper, were production representative with the exception of the Radio Frequency (RF) augmentation system which was replaced with a payload simulator, telemetry unit, a flight termination system, tracking beacon, and ballast.

1.4 TEST TEAM STRUCTURE

For ITALD flight testing, a team was formed at NAWCWD to become part of the Integrated Program Team (IPT) established for the ITALD program. An IPT is comprised of individuals from multiple competencies within an organization and is led by a Team Leader. The IPT is responsible for products in accordance with Program Manager guidelines. While table 1-1 lists only a portion of the overall IPT, these were the positions that were primarily involved with the Flight Test events conducted at NAWCWD. Also participating was the Contractor test team (Either Brunswick Defense or Israel Military Industries).

Table 1-1. IPT Positions

Position	Organization
Program Manager	(PMA-208)
APM (SE)	(PMA-208)
IPT Lead	(PMA-208)
Program Coordinator	(NAWCWD)
Systems Engineer	(NAWCWD)
Flight Test Engineer	(NAWCWD)
Project Officer	(NAWCWD)
Project Pilot	(NAWCWD)
Analysis Engineers	(NAWCWD)
Test Conductor	(NAWCWD)
In-Service Engineer	(NAWCWD)
EMI Engineer	(NAWCWD)

1.5 DoD ACQUISITION POLICY OVERVIEW

DoD 5000.2-R[6] governed the DoD Acquisition Policy during the planning, conduct, and reporting of the 1996 Baseline Demonstration Flight Tests and the 1998 DT-IIIE Flight Tests. This document describes how an acquisition program will be executed. For the purposes of this paper, the sections referring to acquisition timeframes, required documentation, team formation, Developmental Test and Evaluation (DT&E), and Operational Test and Evaluation (OT&E) will be reviewed.

1.5.1 Milestones

The acquisition process is structured in phases separated by major decision points referred to as milestones. A milestone is a major management decision point in the overall acquisition process. For an acquisition program, the Program Manager develops the program's baseline parameters at Milestone I (MS I). The baseline parameters include cost, schedule, and performance objectives and thresholds for a system in its production configuration. The baseline is reviewed and revised for each subsequent milestone. Throughout the acquisition process, DT&E and OT&E personnel are involved at some level to ensure the success of the test program. While DT&E is more involved early in a program, OT&E has the responsibility to assess the programs requirements to ensure that they remain within the goals of satisfying the primary mission of the warfighter. A summary of the test phases in relation to milestone approvals and the level of involvement by DT&E and OT&E can be seen in figure 1-2.

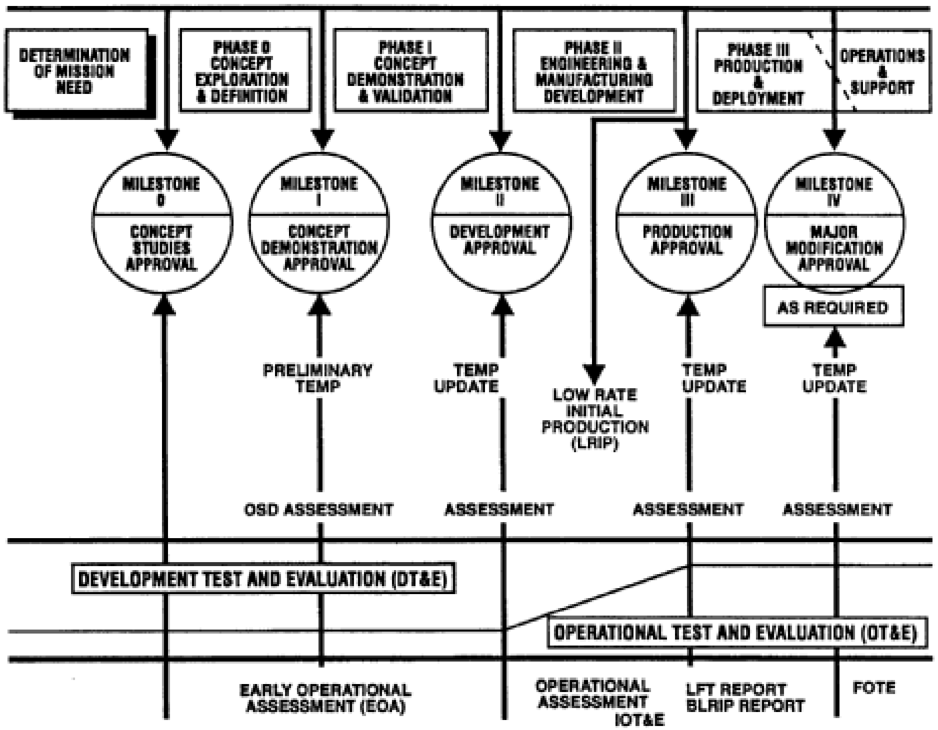

Figure 1-2. Acquisition Process[5]

1.5.2 Documentation

An acquisition program is structured around a series of documents that establish the need for the program, the desired goals, and the method to reach those goals. Four of these documents will be discussed, as they are the primary documents that define a test program. They are the Mission Needs Statement (MNS), Operational Requirements Document (ORD), Test and Evaluation Master Plan (TEMP), and Detailed System Specification. The primary document used during the test phase of a program is the TEMP as it is the basic planning document for all Test and Evaluation (T&E) related to a DoD system acquisition. The following definitions briefly describe each of the four documents mentioned above:

- MNS: defines projected needs for a capability in broad operational terms of mission objectives and general capabilities providing a clear military worth[8].

- ORD: describes the overall mission area, the type of system proposed and the anticipated operational and support concepts in sufficient detail for program and logistics support planning and includes a brief summary of the mission need[8]. At program initiation and at each milestone, the ORD documents the *thresholds* and *objectives* and minimum acceptable requirements for a proposed system.

Threshold performance parameters are minimally acceptable requirements or minimally acceptable levels of performance required by a test article or system to provide a system capability that will satisfy the validated mission need[5].

Objectives are levels of performance established by the user above the threshold that, if achieved, will provide measurable benefits of additional operational capability, operations and support[5].

- TEMP: documents the overall structure and objectives of the T&E program. It provides a framework within which to generate detailed T&E plans and it documents schedule and resource implications associated with the T&E program. The TEMP identifies the necessary DT&E, OT&E, and live fire T&E activities. It relates program schedule, test management strategy and structure, and required sources to: (1) Critical operational issues; (2) Critical technical parameters;

(3) Objectives and thresholds derived from the ORD; (4) Evaluation criteria; and (5) Milestone decision points[6].

- Detailed System Specification: establishes the performance, design, T&E, storage, packaging, handling and transportation requirements for a system.

A flowchart depicting the hierarchy of these documents in the acquisition process can be seen in figure 1-3.

1.5.3 Reporting of Deficiencies

In preparation for OT&E, the deficiencies discovered during DT&E are rated by their impact to the safe and successful operation and deployment of the product being tested. The deficiencies are rated as Part I, Part II, or Part III with a Part I deficiency being the most severe which must be corrected, temporarily waived by the Chief of Naval Operations (CNO) office responsible for the product, or receive a no-planned correction disposition prior to proceeding with OT&E. A description of the deficiency ratings can be found in the appendix.

1.5.4 Developmental Test and Evaluation Responsibilities

DT&E programs shall:

(1) Identify potential operational and technological capabilities and limitations of the alternative concepts and design options being pursued;

(2) Support the identification of cost-performance trade-offs by providing analyses of the capabilities and limitations of alternatives;

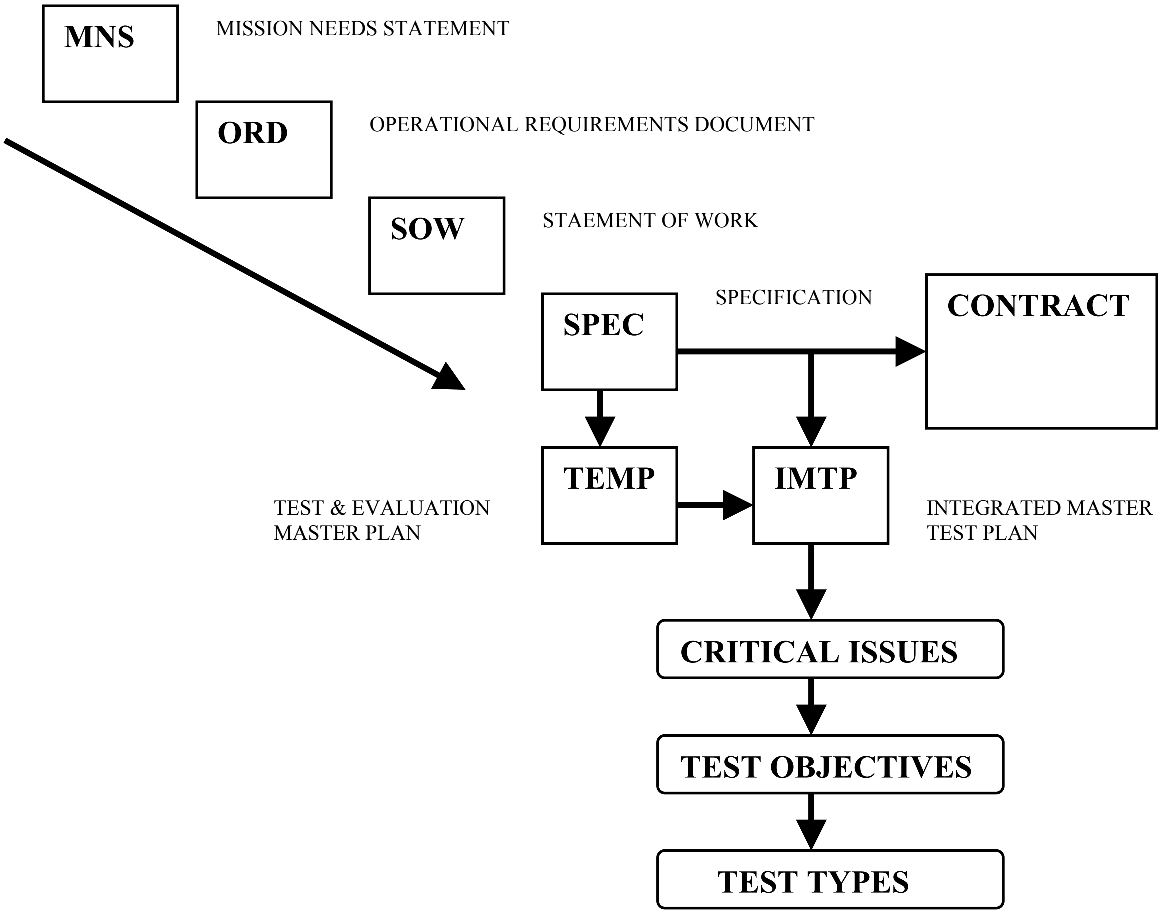

Figure 1-3. Requirements Flowchart

(3) Support the identification and description of design technical risks;

(4) Assess progress toward meeting Critical Operational Issues, mitigation of acquisition technical risk, achievement of manufacturing process requirements and system maturity;

(5) Assess validity of assumptions and conclusions from the analysis of alternatives; and,

(6) Provide data and analysis in support of the decision to certify the system ready for operational test and evaluation[6].

1.5.5 Operational Test and Evaluation Responsibilities

The primary purpose for OT&E is to determine the operational effectiveness and suitability of a system under realistic conditions and to determine if the minimum acceptable operational performance requirements as specified in the ORD have been satisfied[6].

2.0 TEST OVERVIEW

For the Baseline Demonstration Flight Tests conducted in 1996[1] and the DT-IIIE Flight Tests conducted in 1998[2], the test scenarios and data collection methods were similar. Each test event would consist of an ITALD vehicle loaded with a preprogrammed mission. Each ITALD vehicle would be of the same configuration, but each test scenario would be unique, utilizing the following variables:

1) Launched from various aircraft wing stations and ITER launch rack positions, and at different speeds and altitudes.
2) Freeflight with varying preprogrammed altitudes, speeds, maneuvers (climbs, dives, turns and offsets), and times of flight.

The primary data collected during the flights were Rawinsonde weather data, ITALD telemetry, and Time Space Position Information (TSPI). Secondary data collected consisted of real time chase pilot reports, pilot debriefs, and chase camera video.

The information in the following test summaries is taken from the final test reports for the 1996 and 1998 series of flight tests[3, 4]. Although many of the results are similar, the evaluation and reporting of the results may seem inconsistent. These inconsistencies will be discussed in more detail later in this paper.

2.1 BASELINE DEMONSTRATION FLIGHT TEST, 1996

The ITALD Baseline Demonstration Flight Test Program was conducted at NAWCWD Pt. Mugu between 24 January and 31 January 1996. The plan was to launch six All-Up-Round (AUR) ITALD test vehicles from an F/A-18 aircraft during six separate flight test events. The test results are summarized in the following paragraphs.

Seven test missions were conducted to accomplish five of the six planned missions. The results of the seven missions consisted of five completed flights, one post launch engine failure (due to a faulty engine igniter) and one hang fire (due to a faulty wire in the launch ejector rack). For the five successful flights, the ITALD performance was satisfactory and met specification requirements including safe and stable launch, wings open, engine start, and execution of the programmed flight profiles. There was no degraded performance for the flight profiles that were completed. The following is a summary of the ITALD's performance assessment:

- ITALD satisfactorily met or exceeded the range, endurance, heading error, and maximum speed requirements of the specification.
- Based on limited testing or reduced requirements, the ITALD satisfactorily met the specification requirements in the areas of launch envelope, aircraft separation, and lateral maneuver capability[3].

Recommendations included demonstrating terrain following over land and a recommendation that the specified heading drift rate tolerance of X degrees/minute (the exact specification is not required for the purpose of this paper) be tightened for any follow-on development contracts to provide a tactically usable product to the Fleet.

Other recommendations were reported but are not included here since they are not relevant to the purpose of this paper.

2.2 DT-IIIE FLIGHT TEST, 1998

The ITALD DT-IIIE Flight Test Program was conducted at NAWCWD Pt. Mugu, CA and NAWCWD China Lake, CA from 17 September to 19 October 1998. The plan was to launch eight AUR ITALD test vehicles from an F/A-18 aircraft during eight separate flight test events. The test results are summarized in the following paragraphs.

Ten test missions were conducted to accomplish seven of the eight planned missions. The results of the ten missions consisted of seven completed flights, one post launch engine failure (due to unknown causes), one hang fire (due to a gyro system failure), and one premature ground impact during a terrain following profile possibly due to a defective radar altimeter. All planned test objectives were accomplished. However, the ITALD free flight performance revealed significant deficiencies. These deficiencies could be summarized into two major categories: (1) failure to guide within the effective envelope of the active electronic payload and (2) high failure rate both out of the container and in flight. In all, eight Part I deficiencies and one Part II deficiency were identified.

Of the eight Part I deficiencies, five will be mentioned since they pertain to the purpose of this paper. They are:

- Excessive drift rate
- Limited free-flight reliability of the ITALD
- Engine start failure
- Gyro system failure
- Terrain following deficiency (suspected radar altimeter)

The ITALD met all the requirements of the specification against which it was tested except in seven particular areas, of which only one will be mentioned due to its relevance to this paper. The free-flight reliability requirement failed to meet the specification limit by over 23%.

Recommendations included finding the cause for the deficiencies discovered during testing, correcting all the Part I deficiencies as soon as possible, and correcting the Part II deficiency as soon as practicable.

3.0 DISCUSSION OF PRIMARY TEST ISSUES

3.1 COMPARISON OF TEST ISSUES

The following paragraphs will discuss the many issues that arose as a result of the Baseline Demonstration Flight Tests in 1996 and the DT-IIIE Flight Tests in 1998. These two series of tests are both discussed because there is a direct link between them, and many of the decisions made during the 1998 flight test program occurred as a direct result of issues that arose or events that occurred during the 1996 flight test program. The primary difference between the two series of tests was that in 1996 the prime contractor (Brunswick Corporation) was nearing the end of its contract with the government and all contractor support was due to end on 31 January 1996. Therefore, there was a rush to flight test the ITALD vehicles prior to the termination of the contract, and to demonstrate that the first article ITALD vehicles met the design specifications prior to a changeover in prime contractors. In the 1998 series of tests, the purpose of the flight tests was to demonstrate that the first article ITALDs produced by the new prime contractor met the design specification requirements and that the ITALD program was ready to proceed into OT&E.

Table 3-1 contains a list of test issues or concerns that surfaced as a result of the 1996 Baseline Demonstration Flight Tests and the 1998 DT-IIIE Flight Tests. Some of these issues are included to demonstrate the difference in mindset between the on-site test team during the 1996 flight tests and the test team during the 1998 flight tests. Some of the issues listed are the same in 1996 testing as in 1998 testing. Many of these issues will be discussed further in the follow on paragraphs.

Table 3-1. Test Issue Comparison

#	1996 **Baseline Demonstration Flight Tests**	1998 **DT-IIIE Flight Tests**
1	ORD requirements not reviewed for mission effectiveness	ORD requirements not reviewed for mission effectiveness
2	Test to specification	Test to specification and mission effectiveness
3	United States prime contractor	Foreign prime contractor
4	On-site test team personnel did not include a Project Pilot or Flight Test Engineer that was a Test Pilot School graduate	On-site test team personnel included both a Project Pilot and a Flight Test Engineer that were Test Pilot School graduates
5	Multiple pilots flying test missions	Same pilot flying all test missions
6	Minimal on-site test team Flight Test Engineer and Project Pilot involvement in program prior to flight test planning	Minimal on-site test team Flight Test Engineer and Project Pilot involvement in program prior to flight test planning
7	ECP vice new vehicle but limited requirements changes	ECP vice new vehicle but limited requirements changes
8	Good NAWCWD test team coordination with prime contractor	Limited NAWCWD test team coordination with prime contractor
9	Report of Test Results written primarily by analyst team with limited input by Flight Test Engineer or Project Pilot	Report of Test Results written primarily by Flight Test Engineer and Project Pilot with inputs from analyst team
10	Good test team access to prime contractor documentation	Limited test team access to prime contractor documentation (contractual issues and location of production facility)
11	Extremely limited time to complete test program (1 month to complete test plan and conduct flight tests)	Test program time schedule tight but adequate to complete testing
12	Minimal funding appropriated to produce final test report	Funding available to properly complete final test report
13	Final ITALD test vehicle configuration verified and flight clearance authorized prior to flight testing	ITALD launch flight clearance revoked 1 month prior to flight testing due to contractor undisclosed change in test vehicle

The following paragraphs will state a test issue followed by a discussion as to what effect it had during one or both of the flight test sequences (1996 and/or 1998).

3.2 TEST DOCUMENTATION

In approximately fiscal year 1990 the decision was made to proceed with an ECP change to the TALD. This change included a modification to the existing TALD vehicle in which an engine was added, thus producing an ITALD. With the engine, the ITALD's effective flight range more than tripled. An ORD[9] was generated for the ITALD program with new performance characteristics established. A new set of Critical Technical Parameters (CTP) was generated for evaluation during DT&E and was incorporated into a newly formulated TEMP[10]. For each CTP a threshold and objective was developed. The issue arose that, although the objective for the horizontal navigation accuracy (a.k.a. drift rate) was adequate to meet operational requirements, the threshold of X degrees/minute was inadequate for the required mission of the ITALD. The threshold established for the ITALD was the same as the threshold established years earlier for the TALD program even though the ITALD flew more than three times the distance of the TALD. Since the TALD flew at much shorter distances, the drift rate was not critical to the success of its mission. However this same drift rate could make the ITALD operationally ineffective for its mission if it drifted too far off the desired course. The main concern is that the when the ITALD ORD was generated, one of the major CTPs was not thoroughly researched. This resulted in an inadequate threshold requirement for the ITALD drift rate. When the TEMP was generated, the ORD CTPs were accepted as is and incorporated into the TEMP. The thresholds should have been more thoroughly scrutinized as the TEMP was being generated. As stated in the NAVAIR instruction for T&E[13], "The TEMP is the fundamental document for planning the conduct of test and evaluation and forms a contract between the user, the Developing Authority (refers to Commander, COMNAVAIR and Naval Aviation PEOs) and operational tester. *Correction of* known errors, incomplete requirements description, or *incorrect thresholds in the TEMP must be performed prior to commencement of testing*". The personnel developing the ORD and TEMP did not adequately review the ITALD's primary mission, thus rendering it potentially ineffective in fulfilling its primary mission. As for the TEMP review, it was the responsibility of both the DT&E and OT&E communities. From the DT&E perspective, the responsibility for reviewing the TEMP not only included the Program Manager (PM) at NAVAIR but also the test team at NAWCWD. As stated in reference (13), COMNAVAIRWARCEN shall "Review TEMPs to *provide guidance* to the APM (T&E) and the PM *on test capability enhancements* required to achieve program objectives and milestones". It is obvious that either a thorough review of the TEMP CTP thresholds either did not occur or was not conducted by the appropriate personnel. It is not known for sure why this occurred, but the author of this paper suspects that it may have been a funding issue in which there was not enough funds, time nor personnel available to perform a proper TEMP review.

3.3 TEST PHILOSOPHY

The ITALD drift rate was a concern that surfaced only after the 1998 DT-IIIE flight tests. During the Baseline Demonstration flight tests in 1996, the purpose of the testing was to verify that the ITALD test vehicles met the requirements of the specification[11]. Whether or not the ITALD had the capability to successfully complete its primary mission was not even examined. If it met the requirements of the design specification and the threshold requirements in the TEMP, then it was considered successful for this phase of testing. However, in the 1998 DT-IIIE flight testing, the test team at NAWCWD not only tested for specification compliance but also evaluated whether the ITALD could successfully fulfill its mission. This is better known as applying a Mission Relation (MR) to a characteristic of a system under test. When writing the final Report of Test Results, this became a contentious issue between the test team members at NAWCWD and the PM office at NAVAIR. The view of the PM office was that the purpose of DT&E was to primarily test for specification compliance, and it was the task of the OT&E community to test for mission effectiveness. This was in reference to DoD 5000.2-R[6] which clearly states that the primary purpose of OT&E is to determine the operational effectiveness and suitability of a system. In addition to this disagreement in test philosophy, the PM office questioned the test team at NAWCWD as to why the issue of mission relation did not arise during the 1996 Baseline Demonstration flight tests. This was a very valid question, and it was understandable why the PM office was confused over the two very different test philosophies seen in the 1996 testing and the 1998 testing.

The primary reason for this difference in test philosophies is that in 1998 testing the Flight Test Engineer and the Project Pilot were both graduates of the U.S. Naval Test Pilot School (USNTPS). In the 1996 test phase, neither the Flight Test Engineer nor the Project Pilot was a USNTPS graduate. At first, it may seem like being a USNTPS graduate would not be an issue in regards to how a system is tested. But it is how the students at USNTPS are taught that is the key factor in determining how a system under test is evaluated. USNTPS instructs the students to apply a mission relation when evaluating a characteristic of a system under test. As stated in the USNTPS report writing guide[12], "the Mission Relation is probably the most important part of the evaluation in that it justifies the conclusion and the recommendations. It is the test team's opinion, based upon their experience with the intended mission, of the degree to which the characteristic under evaluation will enable the equipment to fulfill its mission". The applying of mission relations to characteristics of systems under test was taught at USNTPS and was designed to be utilized during any test phase, whether it is DT&E or OT&E. During the 1996 Baseline Demonstration flight tests, the NAWCWD test team was operating under the test philosophy of only testing to system specifications during DT&E. With that said, it became the responsibility of the NAWCWD test team to provide answers to the PM office as to why mission relation was being applied to the testing of the ITALD systems (in 1998), and why this was being done during the DT&E phase of testing.

The PM office viewed the purpose of the DT-IIIE testing to be for specification compliance only. They viewed testing done during OT&E as the means for evaluating ITALD's mission. The NAWCWD test team presented some of the following information to the PM office as documented support for their argument that testing for mission relation should be done during both DT&E and OT&E. (The following list of referenced material may be extensive but is provided in order to demonstrate to the reader that enough documentation existed to justify the NAWCWD test team's test philosophy);

(1) DoD 5000.2-R, Section 3.4.2, DT&E responsibilities:
"Identify potential *operational* and technical *capabilities* and limitations of the alternative concepts and design options being pursued".

(2) DoD 5000.2-R, Section 3.4.2, DT&E responsibilities:
"*Assess progress toward meeting Critical Operational Issues*, mitigation of acquisition technical risk, achievement of manufacturing process requirements and system maturity".

(3) DoD 5000.2-R, Section 3.4.3, Certification of readiness for OT&E:
"The developing agency shall prepare a DT&E Report, and *formally certify that the system is ready for the next dedicated phase of operational test and evaluation* to be conducted by the DoD Component operational test activity".

(4) DoD 5000.2-R, Section 3.4.3, Certification of readiness for OT&E:
"A *mission impact analysis of criteria and thresholds that have not been met* shall be completed prior to certification for operational tests".

(5) NAVAIR INST 3960.2C, Preparation for OT&E:

"*In addition to verifying compliance with system specifications, DT&E shall demonstrate*, to the maximum extent possible, *the TEMP requirements, thresholds and level of system development necessary for a successful OT&E phase*. While the system configuration must be the same as the OT&E to follow, test conditions should also reflect the OT&E environment. *Results of DT&E will describe the readiness of the system to enter OT&E and reflect its probability of success*.

(6) NAVAIR INST 3960.2C, OT Readiness Review Preparation Checklist:

"The results of DT&E indicate that the system will perform successfully in OT"

and

"All Part I deficiencies are corrected or CNO (sponsor) has waived the timing of correction or agreed to a no planned correction disposition"

(7) USNTPS Report Writing Guide "The Write Stuff":

As a rule, *the test team should* strive to evaluate (that is, to *write conclusions regarding the suitability of*) characteristics of direct interest.

(8) USNTPS Report Writing Guide "The Write Stuff":

In reference to writing report paragraphs; "First define the problem (the deficiency)…Then ask yourself "*how does this impact the mission*?"… Now that you know the mission impact you should be able to define a level of deficiency (i.e. select Part I, II, etc)…"

(9) USNTPS Report Writing Guide "The Write Stuff":

Each subject of an evaluation should contain a concluding statement. *If the item or characteristic enhances or degrades mission suitability this should be explained in the "mission relation" and reflected in the conclusion*. There are five possible conclusions for an evaluation paragraph:

- the characteristic is "Satisfactory";
- it is an "Enhancing Characteristic";
- it is a Part III deficiency;
- it is a Part II deficiency or;
- it is a Part I deficiency.

NAWC classifies deficiencies as Part I, Part II, or Part III *based on the severity of their impact on the mission suitability of the aircraft or system*.

(10) USNTPS Report Writing Guide "The Write Stuff":

A Part I deficiency "Indicates a deficiency, the correction of which is necessary because it adversely affects: The *capability of the* aircraft or *system to accomplish its primary or secondary mission*".

A Part II deficiency "Indicates a deficiency of lesser severity than a Part I which does not substantially reduce the ability of the aircraft or system *to accomplish its primary or secondary mission* but the correction of which will *result in significant improvement in the* operational cost, *effectiveness*, reliability, maintainability, or safety *of the* aircraft or *system*, or requires significant operator compensation to achieve the desired level of performance; however, the aircraft or *system being tested* *is still capable of accomplishing its mission with a satisfactory degree of safety and effectiveness*.

(11) USNTPS Report Writing Guide "The Write Stuff": Spec Compliance "Whereas the rest of the presentation provides the test team's opinion, this section states how the results compared with other published standards or performance requirements".

As seen in the above references, the NAWCWD test team felt it was their responsibility during DT&E (for the 1998 tests) to not only test to specification compliance but to also test for mission effectiveness. Whereas numbers 1 through 6 above are more open to interpretation, the primary argument from NAWCWD can be seen in numbers 7 through 11 above. It is through these references (stressed extensively at USNTPS) that the NAWCWD test team formulated their test philosophy and, therefore, interpreted other DoD documentation regarding DT&E (numbers 1 through 6 above) as support for this philosophy. Ultimately, this test philosophy should have been discussed between the NAWCWD test team and the NAVAIR PM office prior to the start of flight testing. Figure 3-1 summarizes the test philosophy of the NAWCWD test team during the 1998 DT-IIIE testing.

As to why the NAWCWD test team and the NAVAIR PM office did not come to a common understanding of test philosophy is due to the perceptions each had of DT&E responsibilities. The PM office followed their interpretation of the guidance set forth in the DoD 5000.2-R acquisition document. The NAWCWD test team

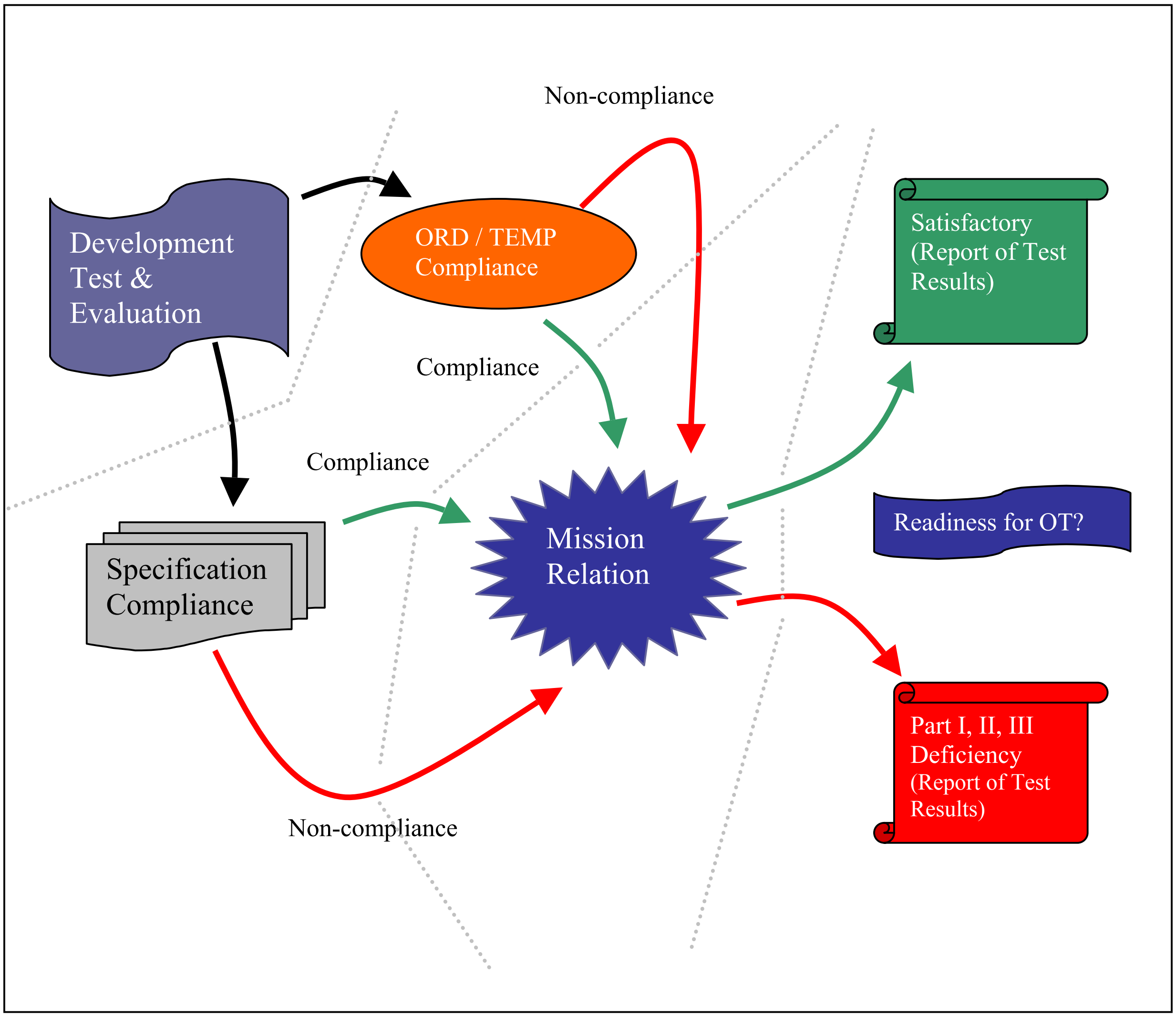

Figure 3-1. DT&E Test Responsibilities

followed their interpretation of DoD 5000.2-R and also the guidance taught at USNTPS. It is understandable that both the NAWCWD test team and the PM office thought that their interpretation of DT&E responsibilities was correct. The guidance presented in DoD 5000.2-R and in the USNTPS teachings needs to be looked at in more detail so that DT&E responsibilities can be better understood in the future.

3.4 TEST REPORTING

At the conclusion of both the 1996 Demonstration Flight Tests and the 1998 DT-IIIE Flight Tests, a final Report of Test Results was written[3,4]. The report structure and method in which deficiencies were categorized differed between the 1996 and 1998 reports. After the 1998 report was written, the PM office was shocked to find such a difference in the test results from that which was reported in 1996. The testing performed in 1996 was very similar to that performed in 1998 with very similar results. The 1996 report had satisfactory results while the 1998 report showed the ITALD to be deficient in many ways. This was extremely confusing to the PM office. How could similar results be reported so differently? There were a number of reasons why this occurred. The main two reasons were, (1) Different personnel writing the report, and (2) A difference in testing philosophy. In 1996, the report was written by the NAWCWD test team analysts. Their conclusions were a result of testing to specification compliance. There was no input into the report by the Project Officer or the Flight Test Engineer (although their input may not have changed the report results) mostly due to program funding constraints and quick departure from the test team to work on other projects. In 1998, the report was written by two USNTPS graduates (the Project Officer and the Flight Test Engineer) along with inputs by the test team analysts. This was key to the difference in reporting the results. As a result of USNTPS teachings, the Project Officer and the Flight Test Engineer approached the 1998 testing with a different test philosophy and therefore reported the test results differently. This test philosophy is described in more detail in paragraph 3.3. The primary result of this was that the ITALD was not only tested for specification compliance, but also for mission effectiveness. This meant that some similar test results that were previously (in 1996) classified as satisfactory were now reported as deficiencies. The test report deficiencies were classified as either Part I, Part II, or Part III, depending on their severity (refer to the appendix for deficiency classification definitions). This deficiency classification became a point of contention between the NAWCWD test team and the PM office. The final 1998 Report of Test Results indicated eight Part I deficiencies and one Part II deficiency. Although many of these were easily correctable by the contractor, the issue remained that the ITALD program could not proceed into OT&E prior to resolving all the Part I deficiencies. The PM office, after seeing similar test results to the 1996 flight tests, were expecting a report with satisfactory results and a recommendation to proceed with OT&E. As a result of these expectations and a very unexpected final report, numerous meetings and discussions took place between the NAWCWD test team and the PM office. Not only was the classification of deficiencies an issue, but also the structure of the report itself was questioned. While the report was written in the Report of Test Results style taught at USNTPS, many of the readers were not familiar with this style of writing. The PM office saw it as being too critical of the ITALD system. The PM office felt that reporting deficiencies pertaining to mission effectiveness should not be included in DT&E. They stated that testing for mission effectiveness was the responsibility of OT&E. The NAWCWD test team response to this has already been discussed in paragraph 3.3. A reluctant PM office eventually agreed to release of the final report and began the process of resolving the Part I deficiencies. Discussion between the NAWCWD test team and the PM office about test philosophy and reporting style prior to commencement of testing could have prevented many of the controversial issues that arose after test completion.

3.5 IPT COMMUNICATION/INTERACTION

The following IPT issues arose during either one or both of the 1996 Baseline Demonstration Flight Tests or the 1998 DT-IIIE Flight Tests:

(1) Prime Contractor change

In 1996 the Prime Contractor was Brunswick Corporation located in Costa Mesa, California. This location was very convenient for the NAWCWD test team located approximately 100 miles away. The nearby location made interaction with the contractor almost effortless. In 1998, however, the Prime Contractor was Israel Military Industries located in Israel. This made NAWCWD test team interaction with the contractor much more difficult. Most communication was done by email. This was adequate until the PM office requested that all correspondence go through their office first, prior to going to the contractor. This may have been a contractual issue having to do with contractor support and deliverables. However, this resulted in many delays to requested information from the contractor. Ultimately, this lack of communication and foreign country location led to a two-month slip in the test schedule. The contractor had made a small change to the physical location of a connector on the exterior of the ITALD test vehicles. This was not discovered until the test vehicles were delivered to the NAWCWD test site. Upon discovery of the unauthorized change, the NAVAIR flight clearance was revoked. To further complicate the issue, the requested documentation (change descriptions and schematics) describing the changes to the ITALDs was still in Israel. Obtaining this documentation was difficult because it was not part of the Contract Data Requirements List (CDRL) for deliverables to the U.S. Government. Eventually this matter was resolved and a new flight clearance was granted, but the two-month slip in the test schedule exhausted funds from an already tight budget.

(2) Funding utilization

In the 1996 Baseline Demonstration Flight Tests, the NAWCWD test team was not fully funded to produce a thorough final Report of Test Results. This resulted in the projects Flight Test Engineer and the Project Officer to move on to other projects, leaving the test team analysts to produce the report with no flight test input. It is not known whether inputs from these other key members of the test team would have changed the reporting of the results.

In the 1998 DT-IIIE Flight Tests, the funding was available to thoroughly analyze the data and receive inputs from all members of the test team. This resulted in a much different report than that seen in 1996.

(3) IPT location and Communication

Throughout both the 1996 and 1998 flight test programs, the PM, the Assistant Program Manager for Systems Engineering (APM-SE), and the IPT lead were located at NAVAIR in Patuxent River, MD. The remaining core members (for flight testing) of the IPT were all located at NAWCWD in Pt. Mugu, CA. This occasionally presented problems in communicating primary issues between IPT members. As an example, the PM office had difficulty in understanding what tasks were being accomplished daily by the NAWCWD test team. While the Project Coordinator and System Engineer at NAWCWD spoke almost daily with the IPT lead, the large separation in locations prevented personal interaction with many IPT members. This prevented the PM office IPT lead from making frequent trips to NAWCWD to see in person what activities were being accomplished, what difficulties arose on a daily basis, and how the funding was being utilized by the NAWCWD test team. A number of issues could have been easily resolved had the IPT members been more centrally located so that the IPT members could see what issues affected each other and the program. Having IPT members spend more time at each other's work sites could alleviate some of the communication issues.

(4) Schedule management

In both the 1996 Baseline Demonstration Flight Tests and the 1998 DT-IIIE Flight Tests, schedule management was an issue. In 1996, the primary schedule issue was that the Primary Contractor (Brunswick Corporation) was getting out of the defense business and the contract with them ended 30 January 1996. Due to a series of aircraft separation flight test failures, the Baseline Demonstration Flight Tests were forced to start in late January and be completed within one week. In the 1998 DT-IIIE Flight Tests, schedule was an issue but not as rushed as in the 1996 tests. The main issue with the schedule slips is that ultimately one part of the program must be hurried to meet a deadline. Usually this means the flight test part of the program, as it is one of the final requirements to be met prior to proceeding into the next program milestone. The primary concern here is that flight testing is very hazardous and schedule slips ultimately lead to cutting corners. Although no major safety issues arose as a result of the hurried schedule in 1996, it does not mean that the hazards were not there. Sometimes luck plays an important role in these types of events.

As stated in the Integrated Program Team Manual[7], "In planning and managing schedules, IPTs must strike the right balance between optimism and realism. When in doubt, realism must always prevail. Nearly all activities should be event driven, as opposed to time or date driven. Date or time driven planning differs from event driven planning in that it over-emphasizes schedule and requires that plans adjust to meet the schedule".

3.6 IPT STRUCTURE

The structure of the IPT for the 1996 Baseline Demonstration Flight Tests and the 1998 DT-IIIE Flight Tests were similar. The basic structure is outlined in paragraph 1.4 of this paper. While many of the core IPT members worked consistently on the ITALD program through the years, some members were brought in just prior to the start of flight testing in both 1996 and 1998. Two key positions that this applied to were the Project Officer and the Flight Test Engineer. For both series of tests, new personnel filled these key positions a few months prior to the scheduled start of flight testing. This is important because the personnel in these two primary test positions had very little time to review documentation, develop a flight test plan, and interact with the IPT on test expectations. In 1996, this was not as significant since the test philosophy was to only test to specification compliance. But for the 1998 flight tests, the Project Officer and the Flight Test Engineer were recent USNTPS graduates with a philosophy of testing to both specification compliance and mission effectiveness. (The Flight Test Engineer was the same for both series of tests but had attended USNTPS in 1997). As previously mentioned in this paper, this difference in test philosophy ultimately led to a controversial final Report of Test Results after the 1998 DT-IIIE Flight Tests. What is important to note here is that test team personnel with specialized training can provide guidance to an IPT and bring a different perspective to the team on how to approach the purpose of the tests. However, this can only be accomplished if these specially trained individuals are introduced to the IPT early in a test program. As for the ITALD program, had the proper personnel been given early access to the TEMP review when it was being generated, a lot of the post 1998 test results would not have been so controversial. Another issue to note here is that when an IPT is formed, it is the responsibility of both the PM and the field test activity (in this case, NAWCWD) to provide the proper personnel to form the test team. On smaller acquisition programs like ITALD, two problems usually arise. One is the amount of funding available to support an all-inclusive IPT, and the other is the availability of personnel to form the IPT. For the ITALD program, both of these were limited. Since the PM had limited funding and could not provide for full time employment for all the IPT personnel, some members worked on other test programs and therefore did not put their full dedication into the ITALD program. They were only assigned full time to the ITALD program for a limited period of time in order to accomplish a specific milestone in the program (i.e. flight testing).

4.0 LESSONS LEARNED/DISCUSSION

As a result of the 1996 Baseline Demonstration Flight Test and 1998 DT-IIIE Flight Test programs, a number of lessons learned can be formulated. Discussed below are some of them as they pertain to DT&E.

(1) *Clearly Define the Purpose of the Te*st

This needs to be accomplished early in the test planning stage. Why is the test being done? If the purpose of the 1998 DT-IIIE flight tests were more clearly defined and understood by both the NAWCWD test team and the PM office, then a number of the post-flight reporting issues may never have developed.

(2) *Must clearly define the test goal*.

Is the testing taking place in order to test only to specification compliance? Or is the goal of the test team to also determine whether a system under test is adequate to successfully proceed into OT&E. Should the system be tested to determine whether it has the capability of successfully completing its predetermined mission? In other words, test the system for mission relation. Overall, clearly define the test exit criteria.

(3*) The IPT should agree on how the deficiencies are to be classified*.

This should be agreed upon prior to testing. What is considered a Part I, Part II, or Part III deficiency? What criteria are to be used in making this determination? Who will make the final decision on the deficiency classification?

If clearly defined, there will be limited discussion over whether a deficiency is a Part I, II, or III.

(4) *Major program documentation should be thoroughly reviewed*.

All major documentation such as the ORD, TEMP, and System Specification should be reviewed early in the program with qualified personnel. All too often, if the program is small (i.e. ITALD) the development and review of documents such as the TEMP falls to the inexperienced or newly hired to "break them in" to the acquisition test process. For the TEMP, in particular, the review process should include representatives from the DT&E and OT&E communities. At some point, this should also include personnel from the test activity that will be conducting the testing. The review of the Critical Test Parameters must be reviewed for technical content and operational effectiveness. This was not adequately accomplished with the ITALD program resulting in a critical threshold parameter being overlooked.

(5) *IPT training should be consistent*.

As discovered in the ITALD program, some members of the 1998 DT-IIIE NAWCWD test team had received training that presented them with a different test philosophy than other members of the IPT. In particular, the Flight Test Engineer and the Project Pilot had both been trained at USNTPS. Their approach to DT&E testing was inconsistent with the views of the PM office. Other members of the IPT, especially from the PM office should, at a minimum, receive a short course of the type taught at USNTPS. Since most Flight Test Engineers and Test Pilots who are trained at USNTPS eventually work on programs established by NAVAIR, it would be beneficial if the personnel in the NAVAIR PM offices understood the basic test philosophy taught there. As stated in the IPT manual[7] "Members respect the views and contributions of others, and team building is practiced through formal and informal training experiences. Members recognize they are collectively and individually accountable for their products (as opposed to simply expending effort or enforcing compliance with processes or standards). Key to achieving these characteristics is thorough program planning, proper allocation of resources and most of all, training of the team members".

(6) *Post-test reporting should be agreed upon prior to test completion*.

At the end of the 1998 ITALD DT-IIIE Flight Test program, the NAWCWD test team wrote a Report of Test Results. It was written in the style taught at USNTPS. The PM office did not approve of the style in which the report was written. It was not written in the same format as the 1996 Baseline Demonstration Flight Test Report. Although the PM office stated that they did not agree with the report style, it may have had more to do with the fact that the 1996 report had satisfactory results while the 1998 report was somewhat critical of the ITALD's test performance. Whatever the reason for the disagreement was, it could have been avoided if the reporting style would have been discussed in detail prior to test commencement.

(7*) IPT communication should be improved*.

While the general separation of the IPT members was significant, it was still possible to communicate by telephone or e-mail. The communication referred to here was the lack of understanding of what various IPT members' tasks were in the test process. The PM office did not fully understand what the personnel at NAWCWD did on a daily basis. They did not understand all the details that went into preparing for flight test operations. Likewise, the NAWCWD test team did not fully understand the tasking and politics associated with coordinating an acquisition program. It would have been beneficial if the IPT members were more co-located so that they could interact more closely and get a better understanding of each other's positions.

(8) *A process for resolving conflicts should be established.*

Throughout the 1996 and 1998 ITALD Flight Test programs, a number of conflicts arose between IPT members. Most of the conflicts were small in nature, but some, such as the 1998 Report of Test Results, were quite extensive. It was during these times that a well-established process for conflict resolution would have been beneficial. As stated in the IPT manual[7] "A process for conflict resolution is established at the start of the effort, and contentious issues are raised and addressed early". The following quote is also from the IPT manual[7], which very accurately summarizes the conflict that occurred after the 1998 DT-IIIE flight tests. "An example might be where several team members, backed up by technical competency leadership, feel strongly that a technical compromise under consideration is unacceptable for reasons of long term product integrity". This accurately refers to the type of conflict that arose over the NAWCWD test team philosophy of testing to mission effectiveness prior to releasing the product to OT&E. This issue, along with others, could have been resolved more easily if a conflict resolution process would have been in place early in the program and if some of the preventable conflicting issues would have been discussed prior to test commencement. Overall, the key to resolving conflict is the general acceptance by all team members that their overarching objective is to do what is best for their product and customer[7].

(9) *The need for OT&E involvement early in the program is crucial*.

As seen by the ITALD program, if OT&E would have been more actively involved in scrutinizing documentation, such as the TEMP, many of the issues that arose could have been alleviated. A major example is the threshold set in the TEMP (and ORD) for drift rate allowance. If reviewed properly by the users of the system, OT&E, this discrepancy may have been resolved early in the program and the result would have been large cost savings with minimal schedule change. As stated in DoD Regulation 5000.2-R, "Operational Test Agencies shall participate early in program development to provide operational insights to the program office and to acquisition decision makers".

(10) *Contract deliverables need to be better defined*.

The major issue here occurred during the 1998 DT-IIIE flight test program in which the contractor made a change to the location of a connector on the external skin of the ITALD. This was not discovered until the ITALD test vehicles were delivered from Israel just prior to start of flight testing. The documentation recording the change remained in Israel and was not part of the Contract Data Requirements List (CDRL) of items to be delivered to the U.S. Government. This resulted in a delay to the program until the contract issues could be resolved and the documents delivered. If the contract had been more thoroughly reviewed for required CDRL deliverables, this issue may never have arisen.

(11) *A well-defined test philosophy needs to be established for DT&E.*

DoD Regulation 5000.2-R needs to give more guidance as to what objectives are to be accomplished during DT&E. As it is presently written, the DT&E requirements are vague and open to interpretation. This was a major cause of the test philosophy issue that arose out of the 1998 ITALD DT-IIIE flight tests. While USNTPS instructs students to test to *mission relation*, whether it is in DT&E or OT&E, DoD Regulation 5000.2-R gives the impression that testing to specification compliance is the only requirement for DT&E. Whether or not the system is adequate to perform its mission is irrelevant. Any mission-related issues are relegated to OT&E. This obvious mismatch in direction between DoD Regulation 5000.R and USNTPS teachings should be corrected so that future test philosophy issues do not arise.

(12) *Program scheduling needs improvement*.

While program scheduling is one of the most difficult tasks of a PM office, there are some improvements that can be made. In the 1996 ITALD Baseline Demonstration Flight Tests, completion of test activities was constrained to a defined date. There were no mishaps that occurred during this test phase, but it will never be known if luck was present and the hazards never surfaced. The test may get accomplished, but a number of safety issues may be overlooked. Testing to a very tight schedule only opens the way for cutting corners and developing potentially hazardous situations. In planning and managing schedules, IPTs must present the right balance between optimism and realism. When in doubt, realism must always prevail[7]. Testing should focus more on accomplishment of events as opposed to meeting a pre-defined date. This is referred to as event-driven planning. Nearly all activities should be even-driven, as opposed to time or date driven. Date or time driven planning differs from event driven planning in that it over-emphasizes schedule and requires that plans adjust to meet the schedule[7]. This results in plans being modified in order to meet the schedule, often adding risk to the activity. The establishment of risk reduction techniques can be used as a tool to prevent changes to test planning in order to meet schedule.

5.0 CONCLUSIONS

The Developmental Flight Testing of the ITALD system was a relative success. While many issues arose during the 1996 Baseline Demonstration Flight Tests and the 1998 DT-IIIE Flight Tests, the system was thoroughly tested and the end result brought about changes that will enhance its capabilities for the Fleet. Many of the issues that arose may have been avoided had the IPT communicated better throughout the test program. Communication in a number of areas seemed to be lacking. The type of final Report of Test Results and what was expected to be included in the report was never discussed. The method of classifying deficiencies discovered during testing was not determined prior to the start of testing. The amount of involvement of the OT&E community was very limited with little discussion as to what their exact role would be in the early phases of the test program. Also, the expected exit criteria at the conclusion of both series of tests were never thoroughly discussed or agreed upon. It was just assumed that the testing would be accomplished and the program would proceed to the next phase. In the 1996 Baseline Demonstration Flight Tests this is exactly what occurred. The ITALD system successfully met the specification requirements and all parties were satisfied. It was two years later during the DT-IIIE Flight Tests that the majority of issues arose. It was here that the primary issues of test philosophy arose. This could have been avoided had the IPT discussed it prior to test commencement. The problem lies in the fact that there were two very different test philosophies in the DT&E community at the time. One was generated from DoD Regulation 5000.2-R and the other was generated from the teachings at USNTPS. Arguments can be made for both points of view but the end result is the same for the IPT, no well-defined test philosophy. The PM office confusion over the reporting of test results was understandable. The flight tests conducted in 1998 had similar results as the earlier 1996 flight tests but the results were reported much differently. The NAWCWD test team had the responsibility of explaining this difference to the PM office. They relayed their interpretation of DoD Regulation 5000.2-R as an integrated part of and in support of the USNTPS test philosophy. The primary argument from the NAWCWD test team was that DT&E testing is not only done to satisfy specification compliance, as vaguely stated in DoD Regulation 5000.2-R, but also done to test for mission relation, as taught at USNTPS, to determine whether the system under test will successfully accomplish its primary mission.

Other concerns that evolved during testing included scheduling and documentation review. In the 1996 Baseline Demonstration Flight Tests there was an extremely compact test schedule with an immovable end date. This added more risk to the program and safety could easily have been compromised. In the 1998 DT-IIIE Flight Tests a schedule slippage occurred due the contractor making a structural change to the ITALD test vehicle without informing the Government. Although this did not cause a major impact to the schedule, the flight test clearance was terminated and contractual issues developed regarding documentation deliverables. Documentation was also an issue within the Government. The ORD and TEMP were not thoroughly reviewed early in the program resulting in a critical test threshold being overlooked. It was over this threshold that the major test controversy developed.

Throughout this paper, a number of issues were discussed that arose out of both the 1996 and 1998 flight test programs, but a majority of them surfaced as a result of the test philosophy issue. This cannot be stressed enough. DoD Regulation 5000.2-R and the teachings of USNTPS were not integrated in a way that allowed for easy interpretation of test purpose. The end result was confusion and controversy over how the test results were reported.

Ultimately, better pre-test communication and IPT training could have aided in developing a more clearly defined purpose of test which may have made the post-test analysis and reporting much less controversial.

6.0 RECOMMENDATIONS

While the ITALD flight test program was successful in many ways, there were a number of lessons learned. Improvements can be made in the way an IPT operates and a test program is managed.

The following recommendations are made so that future test programs can avoid some of the issues that developed during the Developmental Flight Testing of the ITALD.

1. Integrate the teachings of USNTPS and the direction presented in DoD Regulation 5000.2-R into one integrated test philosophy for DT&E.
2. Provide proper training for IPT members in areas directly related to the operation of the program with which they are involved.
3. Develop a direct line of communication between IPT members with frequent information updates.
4. Early in the program, establish a method for conflict resolution.
5. Establish test exit criteria during the planning phase prior to test commencement.
6. Get the OT&E community involved early in the test program with thorough review of test documentation and integral dialog with DT&E personnel on the mission of the system under test so that better development test programs can be developed.
7. Come to an agreement early in the test program as to what data products and types of reports are expected from the test team.

8. Get a clearly defined purpose of test early in the test program.
9. Establish a well-defined method for determining deficiency classification.
10. Develop more realistic test schedules to account for unexpected setbacks that may occur.
11. Scrutinize the contractor quality assurance at the production facility to avoid issues from developing after the system to be tested has been delivered to the customer.
12. Thoroughly review the contractor's CDRL with program technical personnel prior to contract signing to ensure proper documentation is delivered.

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APPENDIX

DESRIPTION OF DEFICIENCIES

The following deficiency ratings are defined in the report writing guide[12] for Report of Test Results:

Part I: Indicates a deficiency, the correction of which is necessary because it adversely affects:

- Airworthiness of the aircraft or system.
- The capability of the aircraft or system to accomplish its primary or secondary mission.
- The safety of the crew or the integrity of essential subsystems. In this regard, a real likelihood of injury or damage must exist. Remote possibilities or unlikely sequences of events shall not be used as a basis for safety items.

Part II: Indicates a deficiency of lesser severity than a Part I which does not substantially reduce the ability of the aircraft or system to accomplish its primary or secondary mission, but the correction of which will result in significant improvement in the operational cost, effectiveness, reliability, maintainability, or safety of the aircraft or system, or requires significant operator compensation to achieve the desired level of performance; however, the aircraft or system being tested is still capable of accomplishing its mission with a satisfactory degree of safety and effectiveness.

Part III: Indicates a deficiency which is minor or that appears too impractical or costly to correct in this model but which should be avoided in future designs. Included are violations of specifications for use by the contract negotiator in final settlement of the contract.

VITA

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