NAVAL RESEARCH LABORATORY

NAVAL CENTER FOR SPACE TECHNOLOGY

Environmental Requirements Document (ERD) for DITP Flight and Target Subsystems and Components

NCST-D-DT004 **8 December 1999**

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RECORD OF CHANGES

REVISION LETTER	DATE	TITLE OR BRIEF DESCRIPTION	ENTERED BY
—	8 October 1998	Draft for Review	A. Posselt
—	13 January 1999	Draft Revisions	J. Corey
—	20 January 1999	Added Design Requirements	J. Corey
—	15 February 1999	Incorporated review feedback	J. Corey
—	5 March 1999	Incorporated EMI/EMC revisions	J. Corey
—	1 April 1999	Restructured ERD format	J. Corey
—	10 May 1999	Added 4/6 review comments	J. Corey
—	9 September 1999	Incorporated comments	J. Corey
—	9 November 1999	Incorporated comments from R. Mader	J. Corey
—	8 December 1999	Incorporated PSS EA comments	J. Corey

TABLE OF CONTENTS

Section	Title	Page
1.0	**INTRODUCTION**	**1-1**
1.1	Overview	1-1
1.2	Purpose	1-1
1.3	Scope	1-1
1.4	Definitions	1-2
1.5	DITP Implementation Concept	1-3
1.6	DITP Flight Demonstration Configuration	1-3
1.7	Points of Contact	1-3
2.0	**APPLICABLE DOCUMENTS**	**2-1**
2.1	Government Documents	2-1
2.1.1	Specifications, Standards, and Handbooks	2-1
2.1.1.1	Specifications	2-1
2.1.1.2	Standards	2-1
2.1.2	Other Government Publications	2-1
2.1.3	Other Government Documents, Drawings, and Publications	2-2
2.2	Non-Government Documents	2-2
2.2.1	American Society of Mechanical Engineers (ASME)	2-2
2.2.2	Institute of Electrical and Electronic Engineers (IEEE)	2-2
2.2.3	Institute of Interconnecting and Packaging Electronic Circuits (IPC)	2-2
2.3	Order of Precedence	2-3
3.0	**REQUIREMENTS**	**3-1**
3.1	Electrical Environment	3-1
3.1.1	EMI/EMC	3-1
3.1.2	Particle Radiation	3-1
3.2	Thermal Environment	3-1
3.3	Pressure Design Environment	3-4
3.3.1	Venting	3-4
3.3.2	Design, Proof, and Burst Pressure	3-5
3.4	Acceleration Environment	3-5
3.4.1	Non-Operational	3-5
3.4.1.1	Component Static Accelerations	3-5
3.4.1.2	System and Subsystem Static Accelerations	3-5
3.4.2	Operational	3-6
3.5	Acoustic Environment	3-6
3.6	Random Vibration Environment	3-6
3.6.1	Non-Operational	3-6
3.6.2	Operational	3-7
3.7	Shock Environment	3-7
3.8	Humidity Environment	3-7
3.9	Cleanliness Environment	3-7
3.9.1	Flight System (TBR)	3-7
3.9.2	Flight Target System (TBR)	3-7
3.9.3	Outgassing	3-7
3.10	Dormant State Environment (TBR)	3-7
3.11	Recovery Environment	3-7
3.11.1	Flight System	3-7
3.11.2	Flight Target System	3-7

TABLE OF CONTENTS (Continued)

Section	Title	Page
4.0	ACRYONYMS AND ABBREVIATIONS	4-1

LIST OF FIGURES

Number	Title	Page
Figure 1-1	DITP Flight System	1-2
Figure 1-2	DITP System Configuration Item Hierarchy	1-3
Figure 1-3	DITP Flight Demonstration Configuration	1-4
Figure 3-1	Pressure vs. Altitude (TBR)	3-4
Figure 3-2	Non-Operational Component Mass Acceleration Curve	3-5
Figure 3-3	Non-Operational Random Vibration Spectrum	3-6

LIST OF TABLES

Number	Title	Page
Table 1-1	Points of Contact	1-5
Table 3-1	EMI/EMC Requirements for Space Systems	3-1
Table 3-2	Bus Mounted Components	3-2
Table 3-3	Seeker Module Mounted Components	3-3
Table 3-4	Flight Bus System	3-3
Table 3-5	Target Bus System	3-3
Table 3-6	Pressure and Vacuum Environments	3-4
Table 3-7	Pressure Decay and Repressurization Rates	3-4
Table 3-8	Design, Proof, and Burst Pressures	3-5
Table 3-9	Non-Operational System and Subsystem Static Acceleration	3-6
Table 3-10	Shock Levels	3-7
Table 3-11	Contamination Exposure Duration	3-7
Table 3-12	Cleanliness Requirements	3-8

1.0 INTRODUCTION

1.1 Overview. This Environmental Requirements Document (ERD) defines the environmental requirements for systems, subsystems, and components to be used on the Discriminating Interceptor Technology Program (DITP). Under the aegis of the Ballistic Missile Defense Organization (BMDO) Advanced Technology Director (TOS), DITP is being implemented with the prime objective of supporting both Theater Missile Defense (TMD) and National Missile Defense (NMD) interceptor seeker upgrade needs. DITP is developing advanced technology sensors and a sensor fusion processor. It will demonstrate, for the first time, data fusion from miniaturized, collocated, dissimilar sensors on an interceptor platform. During ground and flight demonstrations, DITP will demonstrate interceptor-based discrimination against simulated threats[1].

DITP includes Executive Agents (EAs) identified by the BMDO TOS to provide government furnished equipment (GFE) as well as technical expertise to support the successful completion of the overall program goals. The Naval Research Laboratory (NRL) serves as the Test Bed Integrator (TBI) and is responsible for the integration and test of the DITP technologies to demonstrate system level objectives. BMDO TOS, NRL, EAs, and contract support representative will be called upon to participate in the overall program management.

DITP includes the following advanced seeker technology subsystems:

- Passive Sensor Subsystem (PSS), Air Force Research Laboratory/VSSS (Kirtland) (AFRL/VSSS (Kirtland))
- Laser Radar Subsystem (LADAR), U.S. Army Space and Missile Defense Command (Huntsville) (SMDC-TC-SR)
- Fusion Processor and Algorithms Subsystem (FP&A), Air Force Research Laboratory/IFEA (Rome) (AFRL/IFEA (Rome))

Passive Sensor Subsystem (PSS) - The PSS is a single-color infrared (IR) sensor. It consists of a 256 x 256 pixel medium wavelength IR (MWIR) and long wavelength IR (LWIR) HgCdTe focal plane array with read-out integrated circuit and a malleable signal processor (MSP) for signal conditioning, integer signal processor, sensor controller, steering mirror, and interface to the fusion processor via Myrinet crossbar network.

Laser Radar Subsystem (LADAR) - The LADAR subsystem is a short pulse, direct detection Angle-Angle-Range (AAR) imaging LADAR. It consists of a frequency-doubled Nd:YAG laser transmitter, a multi-pixel intensified photo diode (IPD) receiver with a 10 x 10 pixel focal plane array, steering mirror, robust discrimination algorithms, thermal batteries, a LADAR control MSP, and associated optics.

Fusion Processor & Algorithms Subsystem (FP&) - The FP&A is a gigaflop-capable floating point processor consisting of wafer-scale signal processors (WSSP) communicating through a crossbar Myrinet to the sensor. The majority of computer processing and signal processing for the seeker technology subsystems is performed by the FP&A. The algorithms consist of most of the software/firmware required to provide acquisition, tracking, and discrimination of target clusters.

1.2 Purpose. This ERD establishes requirements for the environmental testing of DITP systems, subsystems, and components and defines the responsibility for implementing an environmental test program that can be tailored according to the criticality of the item and the level of hardware or software provided (i.e., complete flight system, seeker, bus, payload instrument, or component). It is the responsibility of each DITP Subsystem Manager or Lead Engineer to ensure that the applicable hardware or software developer plans and implements an organized environmental test program meeting the guidelines of this document.

1.3 Scope. This ERD applies to all DITP flight systems, subsystems, and components and encompasses flight hardware and Ground Support Equipment (GSE) developed under the cognizance of the TBI, along with BMDO's Executive Agents (EAs), DITP industry partners, and other subcontractors for the DITP.

a. This ERD is not applicable to non-flight related DITP research and development (R&D) activities, prototypes or brassboards, system test beds, algorithms, or any special-purpose "not-for-flight" data analysis systems.

1. Discrimination is defined as the process of sensing and identifying the number of objects in a scenario and separating the threat(s) from countermeasures, decoys, and other debris.

b. Controls described herein may not always be applicable to all DITP project elements. Exceptions may be granted on a case-by-case basis by the DITP TBI.

c. This plan applies to the TBI's internal DITP developmental efforts, to the TBI's subcontractors and suppliers, to the EA's, and to any industry partners or subcontractors

1.4 Definitions. For the purposes of this ERD, the following definitions shall apply:

- A component is a functional item that is viewed as a complete and separate entity for the purpose of manufacturing, maintenance, or record keeping. Examples of components are the LADAR assembly, FPA assembly, all mirror/bracket assemblies, and all bus mounted electronic boxes.
- A subsystem is an assembly of functionally related components. It consists of two or more components which may include interconnection items, i.e., wire harness. Examples of subsystems are the Optical Bench Assembly (OBA), all electronics deck assemblies, and all Module assemblies.
- A system is an assembly of functionally related subsystems. It consists of two or more subsystems which may include interconnection items, i.e., wire harness. Examples of such systems are the Flight System (FS) assembly, the Flight Target System (FTS) assembly, and both Launch Vehicle (LV) assemblies.
- The Flight System (FS) is comprised of the Seeker subsystems, bus subsystems, supporting subsystems, and ground support equipment. The DITP flight system is detailed in Figure 1-1.
- The Flight Target System (FTS) is comprised of the target objects that will be used during the flight demonstration, a bus/dispenser that supports the objects through launch and initialization for deployment and dispersal, supporting subsystems (launch vehicle supplied components above the boost motor) that provide interfaces with the launch vehicle and deployment functions, and ground support equipment necessary for pre-launch checkout.

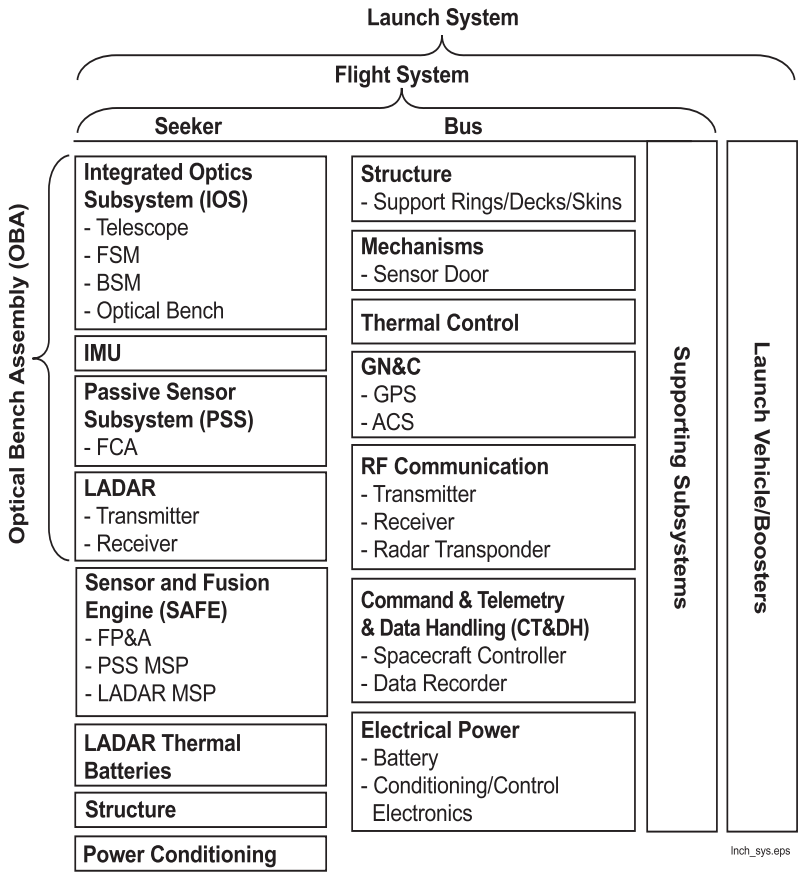

Figure 1-1. DITP Flight System

1.5 DITP Implementation Concept. Prior to developing the flight subsystems, the EAs will develop advanced technology components at a brassboard level. After integration and test by the TBI, the brassboard-level advanced technologies (PSS, LADAR, and FP&A) will undergo formal ground demonstration discrimination and designation proof-of-concept using both simulated scenarios and targets of opportunity[2]. The purpose of the demonstration is to validate performance parameters of key components (laser, detector arrays, processors) to verify key subsystem interfaces and to obtain data to check proposed timelines.

Subsequent development will lead to flight hardware for each subsystem (PSS, LADAR, and FP&A). This flight hardware will be integrated and tested with the IOS in various configurations in preparation for formal ground demonstration against approved target scenarios. After successful ground demonstration, the flight hardware will be integrated to and checked out with the Flight System bus and finally integrated to and checked out with a launch vehicle. Upon successful checkout, exo-atmospheric flight demonstration will be performed. The goal of the technology demonstration is fusion and processing of passive and active seeker sensors combined with the ability to discriminate against multiple, combined targets.

1.6 DITP Flight Demonstration Configuration. Figure 1-2 identifies the DITP configuration hierarchy. Figure 1-3 provides a breakdown of the DITP flight demonstration configuration.

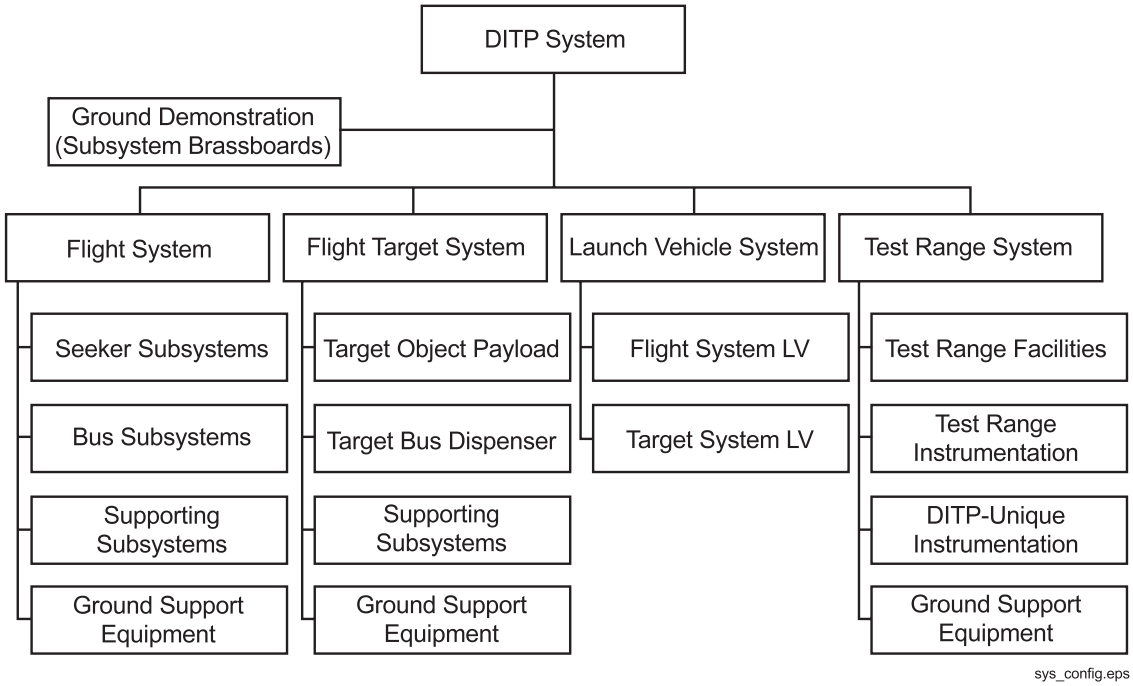

Figure 1-2. DITP System Configuration Item Hierarchy

1.7 Points of Contact. The personnel listed in Table 1-1 are designated with responsibility for specific documents.

2. Designation is defined as a process to identify positively the threat object and calculate intercept vectors.

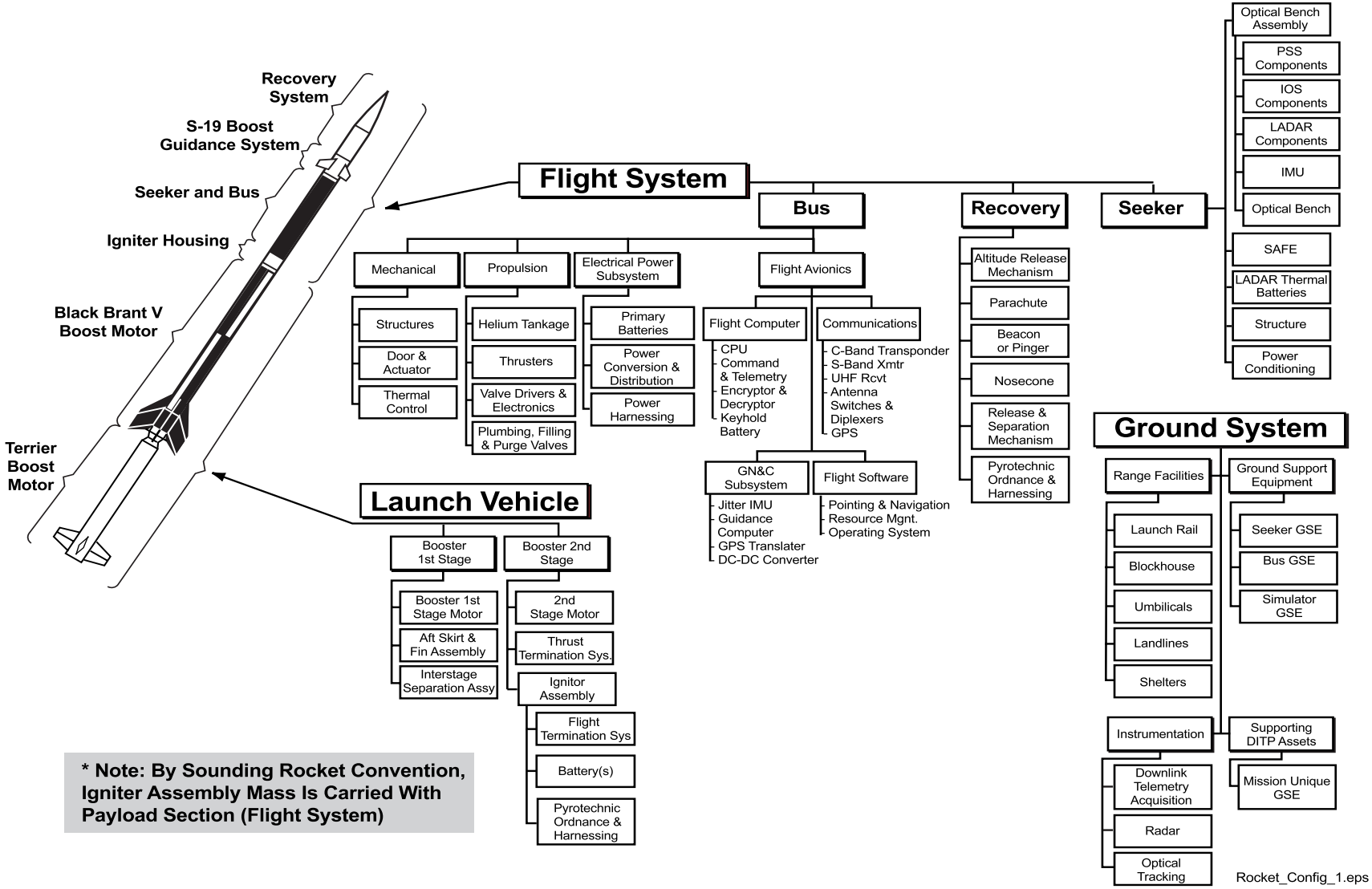

Figure 1-3. DITP Flight Demonstration Configuration

Table 1-1. Points of Contact

Item	Name	E-mail	Phone	Fax
EMI	Mike Obara	obara@ssdd.nrl.navy.mil	(202) 404-4390	
Environments	Ron Mader	rmader@space.nrl.navy.mil	(202) 404-3470	(202) 767-6429
Mechanical Systems	Ron Mader	rmader@space.nrl.navy.mil	(202) 404-3470	(202) 767-6429
LADAR	Bill Scharpf	scharpfwj@navair.navy.mil	(301) 342-0110	(301) 342-0129
PSS	Jim Waterman	waterman@estd.nrl.navy.mil	(202) 404-7945	(202) 404-7194
SAFE	Tim Meehan	meehan@ccf.nrl.navy.mil	(202) 767-0258	(202) 767-6611
IOS	Amey Peltzer	peltzer@ccf.nrl.navy.mil	(202) 767-3982	(202) 767-6611
Launch Systems	Chris Butkiewicz	cbutkiewicz@space.nrl.navy.mil	(202) 404-7409	(202) 767-9339
Target Systems	Ron Mader	rmader@space.nrl.navy.mil	(202) 404-3470	(202) 767-6429
ICD Coordination and Liaison	Joann Corey	coreyj@pxi.com	(703) 461-6700	(703) 461-3369

2.0 APPLICABLE DOCUMENTS

2.1 Government Documents. The following documents of the exact issue shown form a part of this document to the extent specified in herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

2.1.1 Specifications, Standards, and Handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

2.1.1.1 Specifications.

Number	Title	Tailoring Guidelines	Internet URL	Para Reference

2.1.1.2 Standards.

Number	Title	Tailoring Guidelines	Internet URL	Para Reference
MIL-STD-1246	Product Cleanliness Levels and Contamination Control Program	Guidelines Only	http://ditp.pxi.com	3.9.1
MIL-STD-1522	Standard General Requirements for Safe Design and Operation of Pressurized Missile and Space Systems	Mandatory	http://ditp.pxi.com	3.3.2
MIL-STD-461	Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility	As Specified	http://ditp.pxi.com	3.1.1
EWRR127-1	Eastern/Western Range Requirements	Mandatory	http://ditp.pxi.com	3.3.2

2.1.2 Other Government Publications. Documents beginning with the control number “NCST” are DITP documents controlled by the NRL TBI. Documents beginning with “NRP” are controlled by the National Aeronautics and Space Administration (NASA) and may be obtained via the Internet Uniform Resource Locator (URL) or as directed by the DITP PMO.

Number	Title	Tailoring Guidelines	Internet URL	Para Reference
NCST-D-DT014	DITP Design and Analysis Plan	As Specified	http://ditp.pxi.com	3.1.1
ER 97613/A	Environmental Specifications for 17” Black Brant Payloads and Instrumentation	Reference Only	http://ditp.pxi.com	—
NRP-1124	Outgassing Data for Selecting Spacecraft Materials	As Specified	http://misspiggy.gs-fc.nasa.gov/og	3.9.3

2.1.3 Other Government Documents, Drawings, and Publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

Number	Title	Tailoring Guidelines	Internet URL	Para Reference
DoD Cataloging Handbook H4/H8	Commercial and Government Entity (CAGE) Cataloging Handbook	For Guidance Only	http:// www.dodssp.daps.mil	—
DoDISS	Department of Defense Index of Specifications and Standards	For Guidance Only	http:// www.dodssp.daps.mil	—
DoD Directive 5230.24	Distribution Statements on Technical Documents	For Guidance Only	http:// www.dodssp.daps.mil	—

(Copies of Cataloging Handbooks H4/H8 are available form the Commander, Defense Logistics Center, Battle Creek, MI 49017-3084. Copies of the DoDISS are available on a yearly subscription basis either from the Government Printing Office for hard copy, or 1/2 inch magnetic tape is available from the DoD Single Stock Point, Standardization Documents Order Desk, Bldg. 4D, 700 Robins Avenue, Philadelphia, PA 19111-5094. Applications for copies of the DoD Directive 5230.24 should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402-0001.)

2.2 Non-Government Documents. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation.

2.2.1 American Society of Mechanical Engineers (ASME).

Number	Title	Tailoring Guidelines	Internet URL	Para Reference

2.2.2 Institute of Electrical and Electronic Engineers (IEEE).

Number	Title	Tailoring Guidelines	Internet URL	Para Reference

2.2.3 Institute of Interconnecting and Packaging Electronic Circuits (IPC).

Number	Title	Tailoring Guidelines	Internet URL	Para Reference

Copies of DoD adopted non-Government Standards are available to Military activities through the DoD Single Stock Point, Standardization Documents Order Desk, Bldg. 4D, 700 Robins Avenue, Philadelphia, PA 19111-5094. Military activities may obtain copies of non-DoD adopted documents from the sponsoring Industry Association. Non-military activities may obtain copies of non-Government standards and publications from the sponsoring Industry organization as follows:

Organization	Address	Internet URL
American National Standards Institute (ANSI)	1430 Broadway New York, NY 10018	http://www.ANSI.org/
American Society of Mechanical Engineering (ASME)	22 Law Drive Fairfield, NJ07007-2300	http://www.ASME.com/
The Institute of Electrical and Electronics Engineers, Inc. (IEEE)	345 East 47th Street New York, NY 10017	http://stdsbbs.ieee.org
Institute for Interconnecting and Packaging Electronic Circuits	7380 North Lincoln Avenue Lincolnwood, IL 60646	http://www.ipc.org/

2.3 Order of Precedence. In the event of a conflict between the text of this specification and the reference cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3.0 REQUIREMENTS

3.1 Electrical Environment.

3.1.1 EMI/EMC. DITP systems, subsystems, and components will be subjected to the applicable electromagnetic environments defined in MIL-STD-461, *Electromagnetic Emissions and Susceptibility Requirements for Control of Electromagnetic Emissions*, during prelaunch, launch and ascent, and sub-orbital operation. The requirements for space systems (including launch vehicles) are summarized in Table 3-1. Additionally, DITP systems,DT014, DITP Design and Analysis Plan.

Table 3-1. EMI/EMC Requirements for Space Systems

MIL-STD-461D Requirement	Description
CE102	Conducted Emissions, Power Leads, 10 kHz to 10 MHz
CE106	Conducted Emissions, Antenna Terminal, 10 kHz to 40 GHz
CS101	Conducted Susceptibility, Power Leads, 30 Hz to 50 kHz
CS103	Conducted Susceptibility, Antenna Port, Intermodulation, 15 kHz to 10 GHz
CS104	Conducted Susceptibility, Antenna Port, Rejection of Undesired Signals, 30 Hz to 20 GHz
CS105	Conducted Susceptibility, Antenna Port, Cross-Modulation, 30 Hz to 20 GHz
CS114	Conducted Susceptibility, Bulk Cable Injection, 10 kHz to 400 MHz
CS115	Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation
CS116	Conducted Susceptibility, Damped Sinusoidal Transients, Cables and Power Leads, 10 kHz to 100 MHz
RE102	Radiated Emissions, Electric Field, 10 kHz to 18 GHz
RE103	Radiated Emissions, Antenna Spurious and Harmonic Outputs, 10 kHz to 40 GHz
RS103	Radiated Susceptibility, Electric Field, 10 kHz to 18 GHz

3.1.2 Particle Radiation. The short duration and low altitude of the DITP flight demonstration trajectory limit the incident radiation to levels that require no design accommodations for Single Event Effects (SEU) or total dosage.

3.2 Thermal Environment. DITP systems, subsystems, and components shall meet the operational and non-operational temperature requirements provided in Table 3-2 through Table 3-5. These temperatures envelope the prelaunch, launch and ascent, and sub-orbital thermal environments.

Table 3-2. Bus Mounted Components

Item	Operational Temperature Range (°C)	Non-Operational Temperature Range (°C)
Data Processor	0 - 50	-10 - 70
Data Recorder	0 - 50	-10 - 70
WFF93	0 - 50	-10 - 70
Bus PCDU	0 - 50	-10 - 70
Bus Battery	0 - 50	-10 - 70
UHF Receiver	0 - 50	-10 - 70
C-Band Transponder	0 - 50	-10 - 70
GPS Pre-Amplifier	0 - 50	-10 - 70
S-Band Transmitter	0 - 50	-10 - 70
OBA Battery	0 - 50	-10 - 70
SAFE Battery	0 - 50	-10 - 70
SAFE PCDU	0 - 50	-10 - 70
Target Replicas	0 - 50	-10 - 70
Decoy	0 - 50	-10 - 70

Table 3-3. Seeker Module Mounted Components

Item	Operational Temperature Range (°C)	Non-Operational Temperature Range (°C)
Optical Bench Assembly		
IOS Subsystem		
• Telescope	0 - 50	-10 - 70
• FSM	0 - 50	-10 - 70
• BSM	0 - 50	-10 - 70
• Optical Bench	0 - 50	-10 - 70
PSS	0 - 50	-10 - 70
LADAR	23 +/- 2	TBD
Jitter IMU Assembly	0 - 50	-10 - 70
LADAR Thermal Battery	0 - 250	-10 - 70
SAFE	0 - 50	-10 - 70
LADAR PCDU	0 - 50	-10 - 70
OBA PCDU	0 - 50	-10 - 70
LADAR Battery	0 - 50	-10 - 70
PSS Cryostat	0 - 50	-10 - 70
Servo Controller	0 - 50	-10 - 70

Table 3-4. Flight Bus System

Item	Operational Temperature Range (°C)	Non-Operational Temperature Range (°C)
Contamination Door Assembly	0 - 50	-10 - 70
S-19 Subsystem	0 - 50	-10 - 70
SPARKS Subsystem	0 - 50	-10 - 70
ORSA Subsystem	0 - 50	-10 - 70

Table 3-5. Target Bus System

Item	Operational Temperature Range (°C)	Non-Operational Temperature Range (°C)
S-19 Subsystem	0 - 50	-10 - 70
ORSA Subsystem	0 - 50	-10 - 70

3.3 Pressure Design Environment. The operational and non-operational prelaunch, launch and ascent, sub-orbital, and recovery pressure environments are defined in Table 3-6. DITP systems, subsystems, and components shall be operational at the following altitudes: TBD. Inflatable targets will be inflated and deployed at TBD km.

Table 3-6. Pressure and Vacuum Environments

Environment	Pressure Range
Prelaunch	• Atmospheric (sea level to 6,000 ft)
Launch and Ascent	• Figure 3-1 (Pressure vs. Altitude) • Refer to Table 3-7 for pressure decay rate
Sub-Orbital	• Figure 3-1 (Pressure vs. Altitude)
Recovery	• Figure 3-1(Pressure vs. Altitude) • Refer to Table 3-7 for repressurization rate

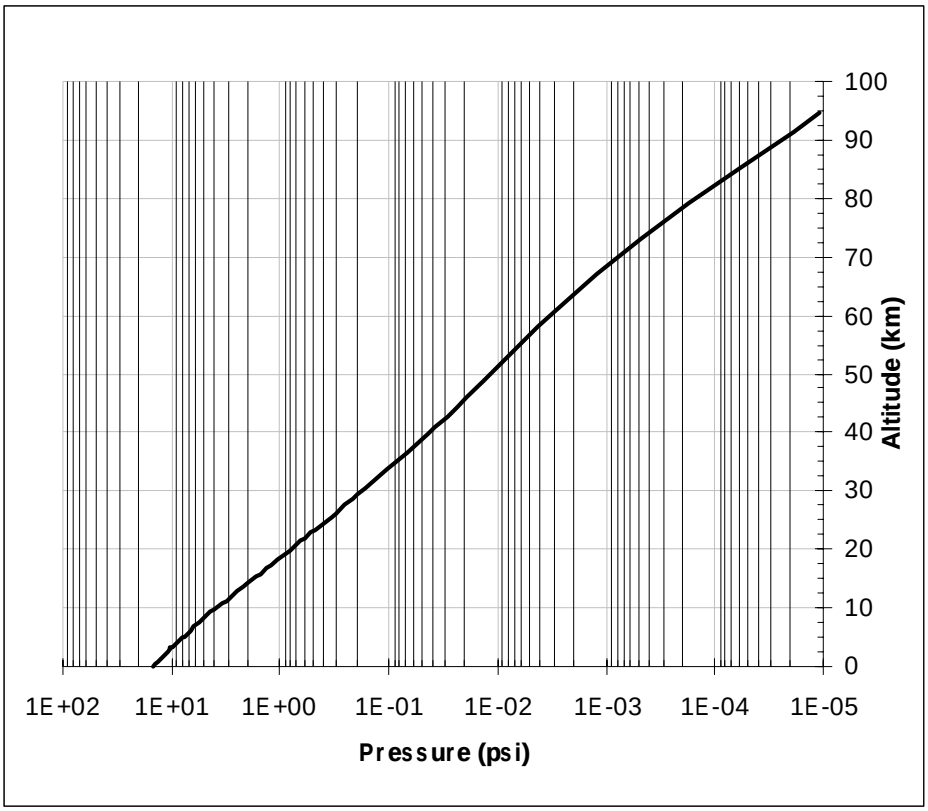

Figure 3-1. Pressure vs. Altitude (TBR)

3.3.1 Venting. The maximum pressure decay and entry repressurization rates are provided in Table 3-7. All enclosures on the DITP Flight System shall be designed to survive these conditions without undergoing degradation or presenting a hazard.

Table 3-7. Pressure Decay and Repressurization Rates

Pressure Decay Rate	[0.5 psi/sec]
Entry Repressurization Rate	TBD

3.3.2 Design, Proof, and Burst Pressure. Pressurized components shall be designed to be compatible with the requirements listed in MIL-STD-1522 and the safety requirements listed in EWRR127-1. Design, proof, and burst pressures for various DITP components are shown in Table 3-8. Proof pressure is 1.5 times the maximum operating pressure of the component or system.

Table 3-8. Design, Proof, and Burst Pressures

Item	Design Pressure	Proof Pressure	Burst Pressure
ACS Propellant Tank	TBD	TBD	TBD
ACS Propellant Valve	TBD	TBD	TBD
ACS Thrusters	TBD	TBD	TBD
Inflatable Targets	TBD	TBD	TBD

3.4 Acceleration Environment.

3.4.1 Non-Operational.

3.4.1.1 Component Static Accelerations. DITP components shall be subjected to a combination of static and low frequency "quasi-static" acceleration loads during the prelaunch, launch and ascent, and sub-orbital phases. The non-operational component mass acceleration curve is provided in Figure 3-2. These accelerations are worst case and envelope all phases of the mission with the exception of recovery.

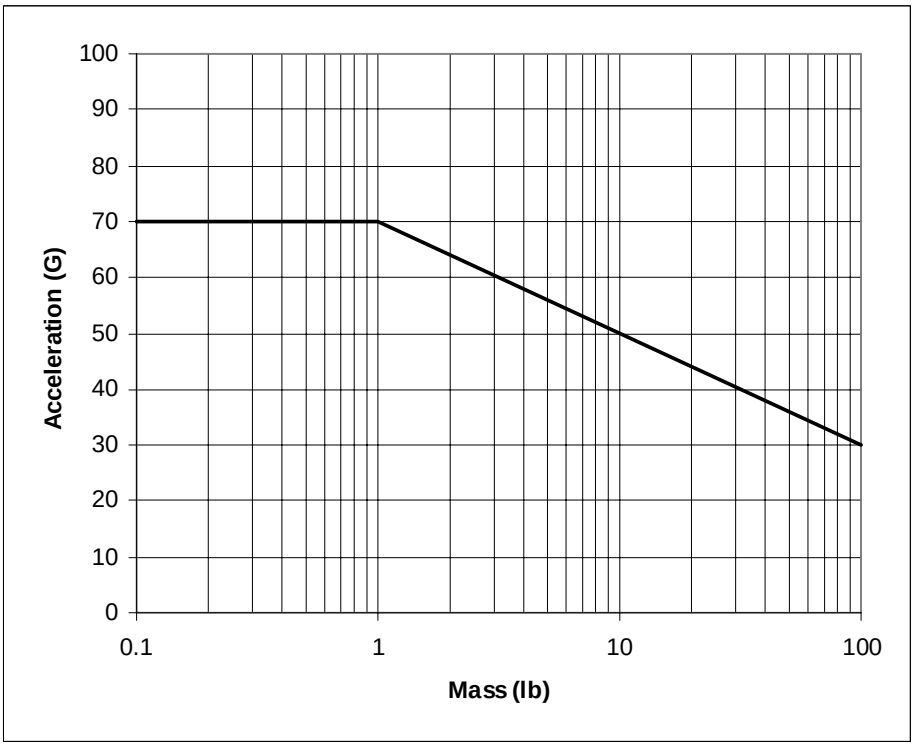

Figure 3-2. Non-Operational Component Mass Acceleration Curve

3.4.1.2 System and Subsystem Static Accelerations. DITP systems and subsysems shall be subjected to the non-operational static acceleration loads provided in Table 3-9. These loads are a combination of static and low frequency "quasi-static" accelerations for the optical bench assembly (OBA) and static accelerations for the Flight and Target Systems. These accelerations are worst case and envelope all phases of the mission with the exception of recovery.

Table 3-9. Non-Operational System and Subsystem Static Acceleration

System/Subsystem	Static Accelerations
OBA Subsystem	16.0 G's axial, 6.0 G's lateral, and 26.0 rad/sec radial centrifugal accelerations acting simultaneously
Flight System	14.0 G's axial, 6.0 G's lateral, and 26.0 rad/sec radial centrifugal accelerations acting simultaneously
Target System	18.3 G's axial, 6.0 G's lateral, and 26.0 rad/sec radial centrifugal accelerations acting simultaneously

3.4.2 Operational. TBD

3.5 Acoustic Environment. Acoustic environmental requirements are not applicable to the DITP flight system demonstration. This type of loading is generally applied to components with a large surface area to volume ratio (i.e., solar arrays) and is not considered critical for the design and testing of compact components.

3.6 Random Vibration Environment.

3.6.1 Non-Operational. DITP systems, subsystems, and components shall be subjected to random vibration loads as a result of structureborne vibration and acoustic sound pressure impingement during launch and ascent. Figure 3-3 provides the non-operational random vibration environments. The system and subsystem random vibration levels will be notched to limit the first mode response to a 3 sigma static design limit load. These accelerations are worst case and envelope all phases of the mission with the exception of recovery.

During environmental testing, DITP hardware shall be subjected to the random vibration environment for a duration of 20 seconds. This test duration is shorter than the actual flight duration. All components less than 50 lb shall be designed to the component level random vibration specification.

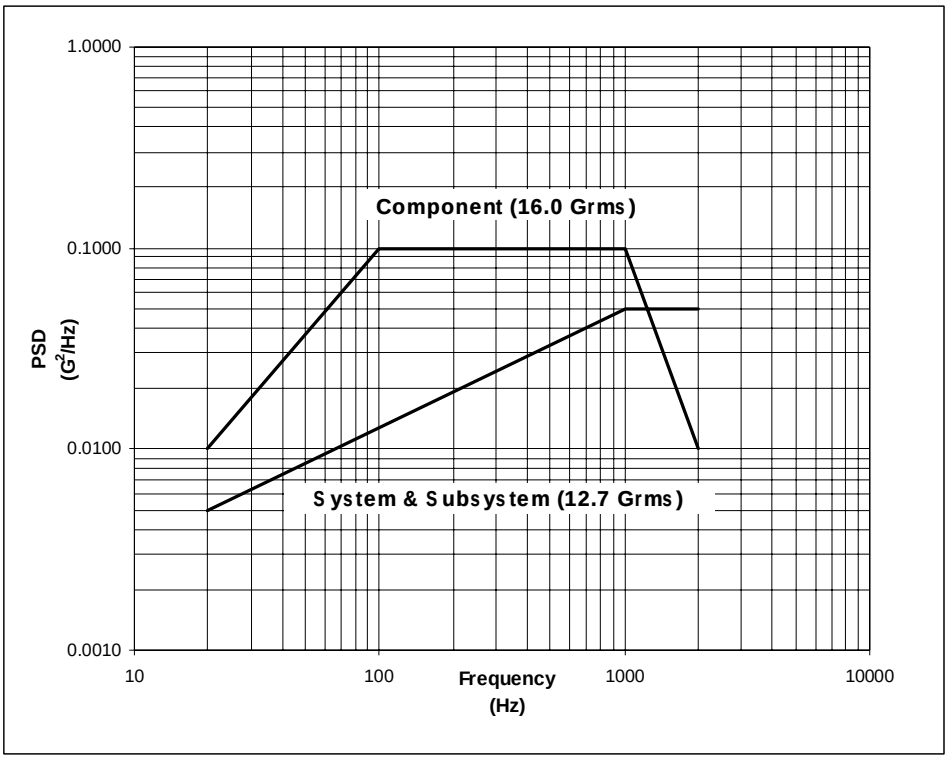

Figure 3-3. Non-Operational Random Vibration Spectrum

3.6.2 Operational. TBD

3.7 Shock Environment. DITP subsystems and components shall be subjected to ordnance induced (pyrotechnic) shock as the result of spacecraft and mechanism deployments. Table 3-10 provides the maximum expected shock criteria.

Table 3-10. Shock Levels

Item	Square Shock Wave Input
Flight Bus Components	100 G, 11 ms
Target Bus Components	100 G, 11 ms
Optical Bench Assembly	
IOS Subsystem	100 G, 11 ms
PSS Subsystem	100 G, 11 ms
LADAR Subsystem	100 G, 11 ms
Optical Bench	100 G, 11 ms
SAFE Subsystem	100 G, 11 ms

3.8 Humidity Environment. Humidity will be controlled to levels such that no condensation of moisture or frost occurs on the hardware.

3.9 Cleanliness Environment.

3.9.1 Flight System (TBR). Appropriate combinations of cleanroom levels and duration of exposure are generally sufficient to meet end-use cleanliness requirements. The time integrated total exposure of a cleanroom class which will result in a Level 750 particulate specification per MIL-STD-1246 is defined in Table 3-11. Specific cleanliness requirements for DITP subsystems and components are summarized in Table 3-12. It should be noted that the launch environment will be uncontrolled.

Table 3-11. Contamination Exposure Duration

Cleanroom Class	Exposure Duration
100	12 years
1000	2 years
10000	150 days
100000	20 days

3.9.2 Flight Target System (TBR). Not applicable.

3.9.3 Outgassing. All materials in the proximity of the DITP flight system optical bench shall be selected to exhibit a Total Mass Loss (TML) of 1.0% or less and a maximum Volatile Condensable Material (VCM) content of 0.1% per NASA Reference Publication 1124 (NRP-1124). Any use of silicone shall be identified for review by the NRL TBI.

3.10 Dormant State Environment (TBR). The handling, transportation, and storage environments must meet the non-operational environments defined in this document. Handling and storage environments must meet the cleanliness requirements specified in Section 3.9 of this document.

3.11 Recovery Environment.

3.11.1 Flight System. Recovery environments are enveloped by the launch vehicle specifications identified in this document (TBR).

3.11.2 Flight Target System. TBD

Table 3-12. Cleanliness Requirements

Item	Requirement
Flight Bus Components	
Target Bus Components	
Optical Bench Assembly	
IOS Subsystem	
PSS Subsystem	
LADAR Subsystem	Localized Class 100 cleanroom conditions or a clean dry air purge
Optical Bench	
SAFE Subsystem	
Flight Bus System	
Target Bus System	

4.0 ACRYONYMS AND ABBREVIATIONS

Acronym	Definition
ACS	Attitude Control System
ASD	Acceleration Spectral Density
BMDO	Ballistic Missile Defense Organization
BSM	Beam Steering Mirror
°C	Degrees Centigrade
CT&DH	Command, Telemetry, and Data Handling
dB	Decibel(s)
DITP	Discriminating Intercepter Technology Program
EA	Executing Agents
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ERD	Environmental Requirements Document
FCA	Flight Cryostat Assembly
FP&A	Fusion Processor and Algorithms
FPA	Focal Plane Array
FS	Flight System
FSM	Fast Steering Mirror
FTS	Flight Target System
G	Acceleration
GN&C	Guidance, Navigation, and Control
GPS	Global Positioning Sensor
Hz	Hertz
IMU	Intertial Measurement Unit
IOS	Integrated Optics Subsystem
LADAR	Light Amplification for Detection and Ranging
MSP	Malleable Signal Processor
N/A	Not Applicable
NCST	Naval Center for Space Technology
NMD	National Missile Defense
NRL	Naval Research Laboratory
PCDU	Power Control and Distribution Unit
PSS	Passive Sensor Subsystem
rms	Root Mean Square
SAFE	Sensor and Fusion Engine
sec	Second(s)
TBD	To Be Determined
TBI	Test Bed Integrator
TBR	To Be Reviewed
TMD	Theater Missile Defense
TML	Total Mass Loss
VCM	Volatile Condensable Material