DEPARTMENT OF NATIONAL DEFENCE (DND)

APPENDIX 2: TECHNICAL SPECIFICATIONS FOR

CC130H DESK TOP TRAINER

TO ANNEX A: STATEMENT OF WORK FOR THE CC130H DESK TOP TRAINER

Prepared by:

DAEPM(R&CS) 6
National Defence Headquarters
Major General George R. Pearkes Building
Ottawa, Ontario
K1A 0K2

17 June 2013

TABLE OF CONTENTS

1.0 SCOPE 4

1.1 INTRODUCTION 4
1.2 SYSTEM OVERVIEW 4
1.3 ACRONYMS 4
1.4 GOVERNMENT DOCUMENTS 6

2.0 PHYSICAL REQUIREMENTS 6

2.1 NETWORKING 6
2.2 GRAPHICAL REPLICATION 7
2.3 HUMAN ENGINEERING 7
2.4 SUPPORTABILITY 8
2.5 RELIABILITY 8
2.6 MAINTAINABILITY 8
2.7 AVAILABILITY 8
2.8 TRANSPORTABILITY 8
2.9 DESIGN AND CONSTRUCTION 9
2.10 ENVIRONMENTAL CONDITIONS 9
2.11 MATERIALS, PROCESSES AND PARTS 9
2.12 ELECTROMAGNETIC COMPATIBILITY 10
2.13 DISPLAY PERFORMANCE REQUIREMENTS 10
2.14 PERSONNEL AND TRAINING 10
2.15 INSTRUCTOR CONFIGURATION MODE 10
2.16 TRAINEE STATION 11
2.17 COMPUTING SYSTEM PERFORMANCE 13
2.18 BACKUP SYSTEM 13
2.19 UPS 14
2.20 PRINTER 14
2.21 PROJECTOR 14

3.0 AVIONIC REPLICATION REQUIREMENTS 14

3.1 SYSTEM SIMULATION 14
3.2 FLIGHT MANAGEMENT SYSTEM 15
3.3 ELECTRONIC FLIGHT INSTRUMENT SYSTEM 16
3.4 AUTOMATIC FLIGHT CONTROL & DISPLAY SYSTEM (AFCDS) 17
3.5 AIR DATA SYSTEM (ADS) 18
3.6 NAVIGATIONAL DATA DISPLAY SYSTEM (NDDS) 19
3.7 ENGINE SIMULATION 20
3.8 ATTITUDE HEADING AND REFERENCE SYSTEM (AHRS) 20
3.9 FLIGHT PROGRESS WARNING UNIT (FPWU) 21
3.10 GLOBAL POSITIONING SYSTEM (GPS) 21
3.11 INERTIAL NAVIGATION UNIT (INU) 22
3.12 VHF NAVIGATION 23
3.13 AUTOMATIC DIRECTION-FINDERS (ADF) SYSTEM 24
3.14 IDENTIFICATION FRIEND OR FOE (IFF) 24
3.15 DISTANCE MEASURING EQUIPMENT (DME) SYSTEM 24
3.16 RADAR ALTIMETER SYSTEM 25
3.17 MULTIBAND DIRECTION FINDER (MDF) SYSTEM 25
3.18 MULTI-FUNCTION DISPLAY (MFD) 25
3.19 TCAS 26
3.20 COMMUNICATIONS SYSTEMS 26

4.0 SUPPORT SYSTEMS 27

4.1 AERODYNAMIC MODEL 27
4.2 ATMOSPHERIC MODEL 27
4.3 EXTERNAL ENVIRONMENT MODEL 27
4.4 POWER PLANT MODEL 27
4.5 DTT-SPECIFIC SUPPORT SYSTEMS 28

5.0 FUNCTIONAL REQUIREMENTS 28

5.1 TRAINING MODES 28
5.2 GAMING AREAS 29
5.3 TRAINING MANAGEMENT 29
5.4 NAVIGATION DATABASE 32
5.5 INSTRUCTOR STATION FUNCTIONS 33
5.6 SELECT INSTRUCTOR MODE 33
5.7 SELECT TRAINEE MODE 33
5.8 FREE-PLAY CONTROL 33
5.9 MISSION PLAN CONTROL 34
5.10 HELP FUNCTIONS 34
5.11 TRAINEE MONITORING 35
5.12 SCENARIO RECORDING 35
5.13 REPLICATED CONTROLS 35
5.14 EDIT USER ACCOUNTS 35
5.15 EDIT MISSION PLAN 37
5.16 EDIT GAMING AREA 39
5.17 CREATE MPGS DATA 40
5.18 UPDATE NAV DATABASE 40
5.19 TRAINING CONTROL 40
5.20 ACCESS TRAINEE RECORDS 41
5.21 CONTROL TRAINEE REVIEW 41
5.22 REVIEW USER EVENTS 41
5.23 REVIEW SCENARIO RECORDS 41
5.24 SCENARIO PLAYBACK 42
5.25 CONFIGURE DTT DEVICE 42

6.0 MAINTENANCE 43

6.1 DTT SOFTWARE 43
6.2 TEST AND DIAGNOSTICS 43
6.3 CHANGE DATE/TIME 43

1.0 Scope

1.1 Introduction

1.1.1 This document is the software and hardware specification requirements defining the CC130H Desk Top Trainer (DTT) to the current aircraft configuration.

1.2 System Overview

1.2.1 The system shall consist of 15 networked DTT devices, each reconfigurable for use as pilot, ACSO, or Instructor; networkable for specific crew concept training or as stand alone individual training. . Breakdown of devices are as follows:

1.2.1.1 Pilots – 6;

1.2.1.2 ACSO – 3;

1.2.1.3 OFS – 1;

1.2.1.4 Unit training (413, 424, 435 Sqns); and

1.2.1.5 Test-bed – 1.

1.2.2 The DTT shall be designed with consideration to minimizing the number of instructional staff and maintainers required to operate and maintain the system.

1.2.3 The DTT shall be upgradeable for future considerations.

1.3 Acronyms

ACP	Autopilot Control Panel
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADS	Air Data System
AFCDS	Autopilot Flight Control and Display System
AHRS	Attitude Heading and Reference System
ALI	Barometric Altimeter
AP	Autopilot
APS	Autopilot System
ASI	Airspeed Indicator
ATCRBS	Air Traffic Control and Radar Beacon System
ATT	Attitude
AUP	Avionics Update Program
BIT	Built In Test
BSIU	Bus Subsystem Interface Unit
CDU	Control Display Unit

CDR	Critical Design Review
CD-ROM	Compact Disk Read Only Memory
CEU	Checklist Entry Unit
COTS	Commercial Off The Shelf
DFD	Data Flow Diagrams
DG	Directional Gyro
DME	Distance Measuring Equipment
DND	Department of National Defence
DPU	Display Processor Unit
DSC	Digital Scan Converter
DSP	Display Select Panel
DTT	Desk Top Trainer
EADI	Electronic Attitude Director Indicator
ECP	Emergency Control Panel
EFD	Electronic Flight Display
EFIS	Electronic Flight Instrument System
EHSI	Electronic Horizontal Situation Indicator
ELT	Emergency Locator Transponder
FCC	Flight Control Computer
FMS	Flight Management System
FPWU	Flight Progress Warning Unit
GPS	Global Positioning System
HDG	Heading
HMI	Human-Machine Interface
IFF	Identification Friend or Foe
ILS	Instrument Landing System
INU	Inertial Navigation Unit
LAN	Local Area Network
Mb	Megabit
MB	Megabyte
MDF	Multiband Direction Finder
MFD	Multifunction Display
MICD	Multiplex Interface Control Document
MOC	Military Occupational Code
MPGS	Mission Planning Ground Station
MPU	Multifunction Processor Unit
MSP	Mode Select Panel
NAVAID	Navigation Aid
NAVDB	Navigation Database
NDB	Non-Directional Beacon
NDDS	Navigational Data Display System
OEM	Original Equipment Manufacturer
PRE	Altitude Preselector/Alerter
RAM	Random Access Memory
RDP	Remote Data Programmer
RDU	Radar Display Unit

RRU	Remote Readout Unit
SAR	Search and Rescue
TAI	Temperature/True Airspeed Indicator
TSP	Trainer Specification
UTC	Universal Time Co-ordinate
VHF	Very High Frequency
VCAC	Virtualized CC-130H AUP CDU
VOR	VHF Omni-directional Radio range
VSI	Vertical Speed Indicator

1.4 Government Documents

1.4.1 The following documents are applicable to this document to the extent referenced herein:

1.4.1.1 Aircraft operating instructions (AOIs);

1.4.1.2 Sample CC130H mission profile;

1.4.1.3 Software Requirements Specification for CC130 FMS 800 document;

1.4.1.4 FMS 800 version 7.1; and

1.4.1.5 General Arrangement of Flight Deck Equipment - Level 2 Drawings of EFIS Select Panel, Auxiliary Switch Panel, and Test Panel.

2.0 Physical Requirements

2.1 Networking

2.1.1 The DTT System shall be capable of being configured into multiple logical networks.

2.1.2 Logical groups shall be formed based on each trainee's assigned instructor.

2.1.3 When a trainee is logged in, the trainee shall be automatically grouped with other trainees with the same instructor. The instructor shall have the capability to select any trainee to monitor from those trainees within his logical group.

2.1.4 For the duration of a trainee's login session, the instructor shall have the capability to temporarily assign a trainee within a logical group to another instructor.

2.1.5 The CC-130H DTT System shall consist of DTT devices in a networked configuration as follows:

2.1.5.1 It shall be possible to network any lesser number of DTT devices and still maintain the full functional capabilities of the DTT system.

2.1.5.2 Each DTT device shall be operable, even when removed from the network, as a stand alone device, having full capability for use in either DTT System configuration mode of operation;

2.1.5.3 The DTT System shall provide an automated capability for instructional staff to rapidly reconfigure the DTT System into up to three logical groups of instructor determined size, to permit concurrent instruction to be provided to up to three different groups of trainees, using up to three instructors, with no interaction or interference between the groups.

2.2 Graphical Replication

2.2.1 The interactive displays shall be emulated or simulated; with aircraft systems graphically represented on the displays.

2.2.2 Aircraft cockpit panels required for the CC130 training and control inputs for all applicable switches and controls shall be graphically replicated.

2.2.3 Unless otherwise stated and approved by DND, graphical replications shall duplicate the size, colour, and appearance of the actual aircraft equipment being replicated. Tolerances for replicated items are as follows:

2.2.3.1 The two dimensional width and height replication of individual objects shall be within 10% of the measurements of the object being replicated;

2.2.3.2 The spatial relationship of features within a replicated object shall be within 10% of the spatial placement of corresponding features on the object being replicated;

2.2.3.3 The total comparable size tolerance between adjacent graphically replicated objects shall not exceed a total of 10%. For example, if one object is 5% larger than actual aircraft object size then an adjacent object cannot be more than 5% smaller than actual aircraft object size; and

2.2.3.4 The positioning of the graphical representations shall duplicate the relative positioning of the actual aircraft instruments.

2.3 Human Engineering

2.3.1 Each DTT Device shall operate in a desktop environment.

2.3.2 A suitable desk and seat shall be provided for each position, per DTT Device.

2.3.3 Design, selection and arrangement of equipment shall ensure ease, efficiency and safety of operation in the performance of all necessary functions by instructional, maintenance, and trainee personnel in fulfilling the intended use of the DTT System.

2.4 Supportability

2.4.1 The design of the DTT shall be such that the system can be supported for a 10 year life of type.

2.5 Reliability

2.5.1 Reliability of operation and ease of maintenance shall be of prime importance in design and manufacture of the DTT trainer system.

2.5.2 Adequate design margins shall be provided to maximize equipment reliability under the expected in-service conditions.

2.5.3 The DTT shall achieve a Mean Time between Failure (MTBF) of greater than or equal to 500 hours, when subjected to daily power on/off cycles, and normal operating conditions.

2.6 Maintainability

2.6.1 The DTT shall achieve a Mean Time to Repair (MTTR) of not greater than 30 minutes at the Operational Maintenance Level when repaired by CF technical staff.

2.6.2 The DTT shall achieve a 90th percentile Maximum Corrective Maintenance Time (MAXCMT) of not greater than one hour at the Operational Maintenance Level when repaired by CF technical staff.

2.6.3 The time required for adjustment and calibration at this level of maintenance shall not exceed 20 minutes.

2.7 Availability

2.7.1 Reliability shall be integrated with maintainability efforts in order to achieve maximum availability in the most economic manner. The DTT system shall be ready for operation at least 98% of the time when a training session is called for, Monday to Friday, from 0800 to 1700 daily.

2.7.2 Once start up and daily readiness checks have been completed, no additional set up time shall be required other than training session initiation by the instructor/operator.

2.8 Transportability

2.8.1 The DDT System shall reside in a fixed facility, or facilities, and shall be transportable as component parts.

2.8.2 The DTT System shall be designed to allow for transportation to the installation site by standard commercial transportation.

2.8.3 Major components shall be designed to permit disassembly and reassembly without the use of special tools, and without unsoldering, cutting, crimping, welding or destruction of any material.

2.9 Design and Construction

2.9.1 Unless otherwise stated by specific reference herein, the DTT System shall be designed and built by the Contractor in accordance with the best commercial practices.

2.9.2 To the greatest extent possible, highly reliable commercial off-the-shelf (COTS) hardware and software products shall be used including controls, switches, keyboards, touch screen and/or pointing devices for graphical user interface input.

2.9.3 The DTT devices shall include CD/DVD/RW, USB port(s) and at least 1TB Hard Disk space.

2.9.4 Aircraft system manufacturer's data shall be used to provide direct design traceability for the avionics simulated or emulated in the DTT System. The FMS software requirements are defined in the Software Requirements Specification for CC130 FMS 800 document.

2.10 Environmental Conditions

2.10.1 The CC-130H DTT shall be designed to withstand the following climatic conditions without degradation:

2.10.1.1 Operating:

2.10.1.1.1 Temperature: 15°C to 32°C

2.10.1.1.2 Humidity: 20% to 80% non-condensing

2.10.1.1.3 Dust and lighting: standard office conditions

2.10.1.2 Non-Operating and Storage

2.10.1.2.1 Temperature: -35°C to 48°C

2.10.1.2.2 Humidity: 0% to 90% condensing (to 38°C)

2.11 Materials, Processes and Parts

2.11.1 Materials, parts, and processes used in the design and construction of the DTT System shall be chosen with due consideration given to the intended use, safety, durability, retention of appearance, and avoidance of corrosion or other chemical effects. The DTT System shall not contain, and the DTT System project shall not create, hazardous products, toxic substances or dangerous goods as defined and controlled under the following acts, latest amendments:

2.11.1.1 The Hazardous Product Act ;

2.11.1.2 The Canadian Environmental Protection Act; and

2.11.1.3 The Transportation of Dangerous Goods Act

2.12 Electromagnetic Compatibility

2.12.1 The design and manufacturing of the DTT System shall be such that the susceptibility of the assembled system to conducted and radiated interference existing within the system and at the installation site is minimized to the extent that the system's performance is not degraded.

2.12.2 Conducted or radiated interference caused by the DTT Devices shall be adequately suppressed so that the performance of other systems, in the general vicinity at the installation site, is not degraded.

2.13 Display Performance Requirements

2.13.1 Display formats shall maximize legibility and avoid subjective interpretation.

2.13.2 The average brightness and contrast shall not differ markedly from one displayed object to another.

2.13.3 Displayed data shall have no apparent flicker, positional jitter or X-Y crosstalk, and shall not drift.

2.13.4 Displays shall have appropriate operating and adjustment controls which are accessible to users and maintenance personnel.

2.13.5 Display face plates shall be designed and positioned to prevent glare and minimize user head or eye motion.

2.14 Personnel and Training

2.14.1 The training required to operate and maintain the DTT System shall be held to a minimum.

2.15 Instructor Configuration Mode

2.15.1 The instructor configuration shall provide the capability to meet the system training management requirements within this document.

2.15.2 The instructor configuration mode shall be user friendly and easy to control in order to allow the instructor to devote maximum time directly to trainees as opposed to operating the instructor configuration mode.

2.15.3 The Instructor configuration mode shall be networkable to any select trainee device or any combination of Trainee devices.

2.15.4 Prompts and aids in such form as help files, menus, and tables showing options and default values shall be provided to lead the instructor in Gaming Area and Mission Plan generation.

2.15.5 Maximum use shall be made of single function interactive switches or buttons which allow direct access to desired menus or displays.

2.15.6 The Instructor shall have the capability to extract exercise Gaming Area and Mission Plan data to be used for debriefing of trainees.

2.15.7 The DTT System shall include a networked laser printer to permit the instructor(s) to print at least the Trainee records, Gaming Area and Mission Plan data.

2.16 Trainee Station

2.16.1 The trainee shall be provided with a simple interactive method of controlling own aircraft speed, heading, altitude, and attitude.

2.16.2 Trainee stations shall include the following as a minimum:

2.16.2.1 **Pilot station:** The pilot station shall contain graphic representations of the following:

2.16.2.1.1 Autopilot Control panel (ACP);

2.16.2.1.2 Flight Progress Warning Unit (FPWU);

2.16.2.1.3 Electronic Horizontal Situation Indicator (EHSI);

2.16.2.1.4 Electronic Attitude Director Indicator (EADI);

2.16.2.1.5 Vertical Speed Indicator (VSI);

2.16.2.1.6 Barometric Altimeter (ALI);

2.16.2.1.7 Air Speed Indicator (ASI);

2.16.2.1.8 Altitude Pre-selector/Alerter (PRE);

2.16.2.1.9 Temperature/True Airspeed Indicator (TAI);

2.16.2.1.10 EFIS Select Panel;

2.16.2.1.11 Mode Select Panel (MSP);

2.16.2.1.12 Radar Switching Panel;

2.16.2.1.13 EFIS Aux Select Panel;

2.16.2.1.14 EFIS Test Panel;

2.16.2.1.15 Multi-Frequency Direction Finder (MDF-124) Control Panel;

2.16.2.1.16 Emergency Control Panel;

2.16.2.1.17 Remote Readout Unit (RRU);

2.16.2.1.18 Computer Display Unit (CDU)

2.16.2.1.19 Control Wheel Switches (go around switch, AP disconnect switch, control wheel steering switch);

2.16.2.1.20 Display Select Panel (DSP);

2.16.2.1.21 CAT II Select/Ann; and

2.16.2.1.22 RADAR BIT, STC, FTC, IAGC, Sim, Cursor, Data, and Range markers.

2.16.2.2 **ACSO Station:** The ACSO station shall contain graphic representations of the following:

2.16.2.2.1 Radar Display Unit (RDU);

2.16.2.2.2 Radar Display Unit Control Panel (RCDU);

2.16.2.2.3 Computer Display Unit (CDU)

2.16.2.2.4 Multifunction Display Unit (MFD);

2.16.2.2.5 Multifunction Display Select Panel (MDSP);

2.16.2.2.6 Display Select Panel (DSP);

2.16.2.2.7 Radar Control Panel; and

2.16.2.2.8 Barometric Altimeter.

2.16.2.3 **FE Station:** The FE training shall make use of the pilot and ACSO stations.

2.17 Computing System Performance

2.17.1 The computer(s) shall be based on a commercially available family of computers using a commercially supportable operating system.

2.17.2 The digital computer system design shall provide for computational, logical, I/O, and memory access speeds that will satisfy the real time processing requirements of all simulation and control functions.

2.17.3 The computer system configuration shall be sized, and the programs shall be designed and organized, to permit execution at speeds which eliminate perceptible stepping, jitter, oscillation, or erratic behaviour.

2.17.4 The total processing time for the measured worst case logical path during any program iteration shall not exceed 50% of the frame time, where frame time = 1/maximum iteration rate.

2.17.5 The computer system resources shall have a 50% reserve capability at the time of acceptance. For example, individual resource reserves shall be equal to or greater than the resources used.

2.17.5.1 This reserve capability shall apply to all CPUs, memories, secondary storage, I/O channels, and throughput. Secondary storage devices shall include program load and data base storage devices.

2.17.5.2 This reserve shall apply to the fitted memory at the time of delivery. In addition, expansion slots shall be available to provide the capability to expand the fitted memory by 50%.

2.17.6 The DTT System shall be expandable to permit the number of devices comprising the DTT System design baseline to be increased.

2.17.7 A self-test capability shall be provided to verify the performance and accuracy of the computer system and peripherals.

2.18 Backup System

2.18.1 A backup system shall permit all DTT System software to be backed up on a storage device; independent of the common DTT System storage devices. It shall be possible to manually initiate backup operations from the instructor station of any DTT Device in the DTT System.

2.18.2 An automated procedure shall be implemented to conduct weekly backups.

2.18.3 Backups shall be able to be scheduled.

2.18.3.1 Full backup shall only be scheduled for a single station that is specified by the maintainer. This is due to the limited space available on a tape. Mission plan data and trainee data may be backed up on a scheduled basis, but may required multiple tape volumes if the data set becomes too large for the media used.

2.18.4 Instructors and maintenance personnel shall have the ability to perform backups.

2.19 Uninterruptible Power Supply (UPS)

2.19.1 A UPS shall be provided with each DTT station.

2.19.2 In the event of a power failure or interruption, the UPS shall support operation of the DTT system for sufficient time to allow a normal shutdown of the DTT system as designed.

2.20 Printer

2.20.1 A COTS laser printer shall be provided.

2.20.2 The printer shall be capable of being networked to any of the DTT devices and be selectable from any DTT station on the network without physically connecting/disconnecting any cables.

2.21 Projector

2.21.1 A minimum of 1920 by 1200 high-definition COTS projector shall be provided.

2.21.2 The projector shall be capable of supplying the video output from any DTT device monitor.

2.21.3 There shall be a signal splitter to allow for an additional video output to be connected.

3.0 Avionic Replication Requirements

3.1 System Simulation

3.1.1 The DTT System shall emulate the functions of the Flight Management System (FMS), and simulate the Navigational Data Display System (NDDS), and the Autopilot Flight Control and Display System (AFCDS).

3.1.2 The DTT System shall provide a generic simulation of the flight dynamics of the CC130H:

3.1.2.1 With the exception of where specifically stated, the level of simulation fidelity shall be such that the trainee shall not be able to distinguish between the performance of the actual aircraft systems and that of the DTT System;

3.1.2.2 Aircraft displays and other aircraft panels shall be replicated with high resolution graphics;

3.1.2.3 With the exception of where it is desirable from a training perspective to enhance or degrade performance under instructor control, accuracy of simulated or emulated aircraft equipment shall replicate but not exceed the performance of the particular equipment under real world conditions;

3.1.2.4 All non-real-time interactions and displays shall be provided within a representative time that shall not exceed 0.5 second between user action and display update;

3.1.2.5 It shall be possible to distort the impression of real time for training benefit under instructor or Mission Plan control. Actions that typically happen over a period of time longer than five minutes shall be considered candidates for time acceleration, for example, lengthy transit periods between two geographical coordinates;

3.1.2.6 Aircraft systems not specifically required for training, such as electrical, hydraulic, and air conditioning, shall be modelled to the extent required to support the C130 avionic systems simulation or emulation; and

3.1.2.7 Where a specific function is not supported by the DTT, a simulator peculiar message shall be displayed to advise the trainee.

3.2 Flight Management System

3.2.1 Requirements

3.2.1.1 All FMS 800 operations that would be performed by the crew shall be simulated by the DTT System.

3.2.1.2 The FMS emulation shall be based on the FMS manufacturer's detailed design data to ensure that the system performs in the same manner as the aircraft system. FMS maintenance and diagnostic programs and their associated CDU display pages need not be supported by the emulation except for those indications that are necessary to support malfunctions or degraded modes.

3.2.1.3 The FMS DTT System emulation shall be capable of fully supporting degraded tasks.

3.2.1.4 The DTT System shall be capable of performing the following FMS CDU tasks:

3.2.1.4.1 CDU control of navigation systems and AHRS including the presentation of resultant CDU and AFCDS displays;

3.2.1.4.2 Control of navigation systems including AHRS, GPS 1, GPS 2, INU, ADF, Dual IFF, DME, VOR/ILS, and Radar Altimeter.

3.2.1.4.3 Operate the FMS in all normal and degraded modes and interpret associated displays and enunciations;

3.2.1.4.4 Conduct equipment pre-flight checks;

3.2.1.4.5 Select, execute, and modify flight plans;

3.2.1.4.6 Select steering sources;

3.2.1.5 Without an actual Data Loader Receptacle, simulate the loading and use of Mission Planning Ground Station (MPGS) data; and

3.2.1.6 Interpret power-up and periodic BIT.

3.2.2 Malfunctions

3.2.2.1 The following malfunctions shall be simulated by the FMS system:

3.2.2.1.1 Pilot's CDU total failure;

3.2.2.1.2 Pilot's RRU total failure;

3.2.2.1.3 ECP total failure;

3.2.2.1.4 MIL-STD-1553B bus A total failure;

3.2.2.1.5 MIL-STD-1553B bus B total failure;

3.2.2.1.6 Data Loader RT total failure;

3.2.2.1.7 DAU RT total failure;

3.2.2.1.8 Total BSIU #1 failure; and

3.2.2.1.9 Total BSIU #2 failure.

3.3 Electronic Flight Instrument System

3.3.1 Requirements

3.3.1.1 The EFIS simulation shall be designed using the CC-130H, MICD, PIDS, HIDD, SRS, and Level 2 drawings as primary data sources.

3.3.1.2 The simulation shall simulate the performance of the EFIS to the extent necessary to support training on the CC-130H aircraft.

3.3.2 Malfunctions

3.3.2.1 The EFIS model developed for the CC-130H DTT shall simulate the following malfunctions:

3.3.2.1.1 EADI display failure;

3.3.2.1.2 EHSI display failure;

3.3.2.1.3 DPU #1 total failure;

3.3.2.1.4 Erroneous heading comparator failure;

3.3.2.1.5 Erroneous pitch comparator failure;

3.3.2.1.6 Erroneous roll comparator failure;

3.3.2.1.7 MFD total failure; and

3.3.2.1.8 Cross-side data bus failure.

3.4 Automatic Flight Control & Display System (AFCDS)

3.4.1 Requirements

3.4.1.1 The AFCDS, less EFIS, shall be simulated based on the installation and AOIs, and measurement of the aircraft equipment to ensure that the system performs in the same manner as the aircraft system.

3.4.1.2 All AFCDS, less EFIS, Flight guidance modes shall he supported by the DTT System mode simulation.

3.4.1.3 The AFCDS, less EFIS, simulation shall include simulations of the interfaced input and output signals of the AFCDS, less EFIS, as defined in the PIDS paragraph 3.7.1.2, MICD, and SRS.

3.4.1.4 The simulation shall utilize simulated inputs from the GPS, INU, VOR/DME, and AHRS systems for navigation purposes.

3.4.1.5 The AFCDS, less EFIS, functionality shall be implemented through video display graphics representation and shall include the Autopilot Control Panel (ACP), the Mode Select Panel (MSP), and Control Wheel including switching. Control Wheel functions shall be controlled via an interactive video display/pointing device.

3.4.1.6 As a minimum, the capability to perform the following tasks shall be provided:

3.4.1.6.1 Power up AFCDS (less EFIS);

3.4.1.6.2 Operate the AFCDS (less EFIS) in all normal and degraded modes, and interpret associated displays and annunciations;

3.4.1.6.3 Conduct equipment pre-flight checks;

3.4.1.6.4 Operate the ACP;

3.4.1.6.5 Operate the MSP;

3.4.1.6.6 Monitor and interpret flight conditions; and

3.4.1.6.7 Interpret power-up and periodic BIT.

3.4.2 Malfunctions

3.4.2.1 The following malfunctions shall be supported:

3.4.2.1.1 Trim runaway failure;

3.4.2.1.2 FCC #1 failure; and

3.4.2.1.3 FCC CSDB bus failure.

3.5 Air Data System (ADS)

3.5.1 Requirements

3.5.1.1 The simulated ADS shall receive its sensor input from the external environment model and then process the aerodynamic data into the formats required by the aircraft interfaces.

3.5.1.2 The simulated ADS shall provide the outputs necessary to drive the graphical representations of the following ADS displays:

3.5.1.2.1 Air Speed Indicator (ASI);

3.5.1.2.2 Vertical Speed Indicator (VSI);

3.5.1.2.3 Altitude pre-selector/Alerter (PRE);

3.5.1.2.4 Barometric Altimeter (ALI); and

3.5.1.2.5 Temperature/True Air Speed Indicator (TAI).

3.5.2 Malfunctions

3.5.2.1 The ADS model developed for the CC-130H DTT shall simulate the following malfunctions:

3.6 Navigational Data Display System (NDDS)

3.6.1 Requirements

3.6.1.1 The NDDS shall be simulated.

3.6.1.2 The radar systems simulation shall completely support all radar systems cockpit interactions including the display of radar imagery on the RDU, EFIS, and Multi-Function Displays (MFD).

3.6.1.3 The actual radar simulation shall be limited to operational characteristics and control.

3.6.1.4 Displayed radar images shall be instructor selectable based on specific training Gaming Areas.

3.6.1.5 For a specific selected Gaming Area, the displayed image shall be updated representative of own aircraft position, movement, and radar control settings (range, tilt, gain, etc).

3.6.1.6 Radar set test patterns and radar system fail display conditions shall be supported.

3.6.1.7 The simulated radar returns shall include weather and ground mapping returns that are consistent with the mission.

3.6.1.8 The simulated radar returns shall include test patterns.

3.6.1.9 These radar returns shall be a static representation with a range change capability.

3.6.1.10 As a minimum, the capability shall be provided to perform the following tasks:

3.6.1.10.1 Power up NDDS; and

3.6.1.10.2 Operate NDDS system specific to the APN-59 and APS-133 radars including typical, not exact, representative ground mapping and weather radar returns and test patterns.

3.6.1.11 The Navigational Data Display System (NDDS AN/ASN-508) simulation shall be designed using the CC-130H AOIs.

3.6.1.12 The radar system (APN-59 or APS-133, as appropriate) shall be modelled as part of the NDDS system.

3.6.1.13 Must be able to display and control brightness and contrast.

3.6.2 Malfunctions

3.6.2.1 The following malfunctions shall be supported by the NDDS simulation:

3.6.2.1.1 Communications failure between Radar R/T and RDP;

3.6.2.1.2 DSC #1 failure;

3.6.2.1.3 DSC #2 Total Failure; and

3.6.2.1.4 RDP total failure.

3.7 Engine Simulation

3.7.1 The engine simulation shall be a limited model intended only to provide support to the other systems.

3.8 Attitude Heading and Reference System (AHRS)

3.8.1 Requirements

3.8.1.1 The Attitude Heading and Reference System simulation shall be designed using the CC-130H AOIs.

3.8.1.2 The AHRS shall be designed to support all operations defined as requiring DTT support.

3.8.2 Malfunctions

3.8.2.1 The Attitude Heading and Reference System model developed for the CC-130H DTT shall simulate the following malfunctions:

3.8.2.1.1 AHRC #1 total failure;

3.8.2.1.2 AHRS pitch disagree (error in AHRC #2);

3.8.2.1.3 AHRS roll disagree (error in AHRC #2);

3.8.2.1.4 AHRS heading disagree (error in AHRC #2);

3.8.2.1.5 AHRC #1 initialization failure;

3.8.2.1.6 AHRC #1 CSDB bus failure; and

3.8.2.1.7 AHRC #2 CSDB bus failure.

3.9 Flight Progress Warning Unit (FPWU)

3.9.1 Requirements

3.9.1.1 The Flight Progress Warning Unit simulation shall be designed using the FPWU System Specification and the CC-130H Aircraft Operating Instructions as primary data sources.

3.9.1.2 The FPWU shall be designed to support all operations defined as requiring DTT support.

3.9.2 Malfunctions

3.9.2.1 The Flight Progress Warning Unit model developed for the CC-130H DTT shall simulate the following malfunctions:

3.9.2.1.1 Pilot's FPWU total failure.

3.10 Global Positioning System (GPS)

3.10.1 Requirements

3.10.1.1 The GPS systems shall simulate the GPS receiver which shall provide ground position data, signal validity, and mode of operation.

3.10.1.2 Ground information shall include, as a minimum, the following: present aircraft latitude, present aircraft longitude, and the current Universal Time Coordinate (UTC).

3.10.1.3 The FMS shall be provided with the channel status number, channel status frequency and code type, tracking state, and carrier-to-noise ratio for each satellite tracked.

3.10.1.4 The modes of operation shall consist of initialization, and navigation.

3.10.1.5 While engaged in navigation mode, an estimated horizontal error, estimated vertical error, and satellites tracked shall be computed for use by other systems.

3.10.1.6 The GPS system simulation shall be designed based on the data available in the CC-130H Aircraft Operating Instructions.

3.10.2 Malfunctions

3.10.2.1 The GPS system shall support the following malfunctions:

3.10.2.1.1 GPS 1 – GPS Keys - Expire after 7 days;

3.10.2.1.2 GPS 1 – GPS Keys - No Handshake or Expired;

3.10.2.1.3 GPS 1 – GPS Keys – No Keys;

3.10.2.1.4 GPS 1 – Position Information Degraded;

3.10.2.1.5 GPS 1 – Total GPS Failure;

3.10.2.1.6 GPS 2 – Receiver Fails;

3.10.2.1.7 GPS 2 – Total Failure;

3.10.2.1.8 GPS 2 – 3 Satellites in view;

3.10.2.1.9 GPS 2 –Antenna Fails;

3.10.2.1.10 GPS 2 – Approach P-RAIM Failure;

3.10.2.1.11 GPS 2 – Degraded CEP .15;

3.10.2.1.12 GPS 2 – Degraded CEP .35;

3.10.2.1.13 GPS 2 – Inaccurate GPS Solution;

3.10.2.1.14 GPS 2 – Insufficient No Satellites in view;

3.10.2.1.15 GPS 2 – No RAIM Available; and

3.10.2.1.16 GPS 2 –RAIM Detected Satellite Fault.

3.11 Inertial Navigation Unit (INU)

3.11.1 Requirements

3.11.1.1 The INU shall be designed based on data available in the CC-130H AOI and the Specification for USAF Standard form, Fit and Function Medium Accuracy Inertial Navigation Unit.

3.11.2 Malfunctions

3.11.2.1 The following malfunctions shall be supported by the INU simulation:

3.11.2.1.1 INU 1 – MIL STD 1553 B RT Failure;

3.11.2.1.2 INU 1 - Position Information Degraded;

3.11.2.1.3 INU 1 – Total Failure;

3.11.2.1.4 INU 1 – Drift rate, High 2.2 NM/HR;

3.11.2.1.5 INU 1 – Drift rate, Low 0.6 NM/HR;

3.11.2.1.6 INU 1 – CEP 0.5;

3.11.2.1.7 INU 1 – CEP 1.6;

3.11.2.1.8 INU 1 – CEP 2.4;

3.11.2.1.9 INU 1 – CEP 3.2;

3.11.2.1.10 INU 2 – MIL STD 1553B RT Failure;

3.11.2.1.11 INU 2 – Drift rate, High 2.2 NM/HR;

3.11.2.1.12 INU 2 – Drift rate, Low 0.6 NM/HR;

3.11.2.1.13 INU 2 – CEP 0.5;

3.11.2.1.14 INU 2 – CEP 1.6;

3.11.2.1.15 INU 2 – CEP 2.4; and

3.11.2.1.16 INU 2 – CEP 3.2.

3.12 VHF Navigation

3.12.1 Requirements

3.12.1.1 The VHF navigation shall provide navigational VHF Omni-directional Radio Range (VOR), instrument landing system (ILS), Glide Slope (GS), and VOR/tactical air navigation (VORTAC) information to the FMS and EFIS based on tuned frequency.

3.12.1.2 Two VHF navigation systems shall be simulated.

3.12.1.3 The VHF Navigation system (Intermediate Radio Receiving Set AN/ARN-127) shall be designed from data provided in the CC-130H AOIs.

3.12.2 Malfunctions

3.12.2.1 The VHF Navigation system shall support the following malfunctions:

3.12.2.1.1 VOR/ILS #1 - failure of glide slope;

3.12.2.1.2 VOR/ILS #1 - failure of localizer; and

3.12.2.1.3 VOR/ILS #1 total failure.

3.13 Automatic Direction-Finders (ADF) System

3.13.1 Requirements

3.13.1.1 The ADF system shall provide the relative bearing to tuned stations to the EFIS displays through FMS CDU control.

3.13.1.2 The ADF system shall be designed from data provided in the CC-130H AOI and the ADF System Specification.

3.13.2 Malfunctions

3.13.2.1 The ADF system shall support the following malfunction:

3.13.2.1.1 ADF #2 RT total failure, and

3.13.2.1.2 ADF #1 total failure.

3.14 Identification Friend or Foe (IFF)

3.14.1 Requirements

3.14.1.1 The IFF shall provide simulation support of FMS CDU control of the AN/APX-119 transponder.

3.14.1.2 The IFF system shall be designed from data provided in the CC-130H AOI and the IFF system specification for the APX100.

3.14.2 Malfunctions

3.14.2.1 The IFF system shall support the following malfunction:

3.14.2.1.1 IFF total failure.

3.15 Distance Measuring Equipment (DME) System

3.15.1 Requirements

3.15.1.1 The DME simulation shall provide line of sight distance and station identification for any FMS tuned DME station to the FMS, EHSI, and MFD.

3.15.1.2 The model shall simulate two DME systems.

3.15.1.3 The DME system simulation shall be designed from data provided in the CC-130H AOI and the CC-130H AOIs.

3.15.2 Malfunctions

3.15.2.1 The DME system shall support the following malfunction:

3.15.2.1.1 DME #1 total failure.

3.16 Radar Altimeter System

3.16.1 Requirements

3.16.1.1 The Radar Altimeter model shall provide radar altitude to the EADI, MFD and ACSO's MPU.

3.16.1.2 The Radar Altimeter system shall be designed from data provided in the CC-130H AOIs.

3.16.2 Malfunctions

3.16.2.1 The radar altimeter system will not support any malfunctions.

3.17 Multiband Direction Finder (MDF) System

3.17.1 Requirements

3.17.1.1 The MDF system shall provide the bearing to an active search and rescue (SAR) beacon to EHSI and MFD.

3.17.1.2 The MDF system shall be designed from data provided in the CC-130H AOI.

3.17.1.3 Multiple SAR Beacons shall be selectable with varying power settings (ie range detectable) and the ability to turn them on or off during simulation.

3.17.2 Malfunctions

3.17.2.1 The MDF system shall support the following malfunctions:

3.17.2.1.1 Intermittent SAR reception, and

3.17.2.1.2 Fault internal to MDF 124 (detectable by power on BIT).

3.18 Multi-function Display (MFD)

3.18.1 Requirements

3.18.1.1 The MFD shall be designed from data provided in the CC-130H AOI and the system specification for the MFD.

3.18.1.2 The simulation shall be limited to operational characteristics and control.

3.18.2 Malfunctions

3.18.2.1 The MFD system shall support the following malfunctions:

3.18.2.1.1 MFD – Co-pilot course 000;

3.18.2.1.2 MFD – Co-pilot course 064;

3.18.2.1.3 MFD – Co-pilot course 090;

3.18.2.1.4 MFD – Co-pilot course 180;

3.18.2.1.5 MFD – Co-pilot course 244; and

3.18.2.1.6 MFD – Co-pilot course 270.

3.19 TCAS

3.19.1 Requirements

3.19.1.1 The TCAS system shall be designed from data provided in the CC-130H AOIs. Multiple aircraft can be inserted in the simulation, both during mission plans and during free-play that will demonstrate how the TCAS works and show the functionality of traffic avoidance.

3.19.2 Malfunctions

3.19.2.1 The following TCAS malfunctions shall be supported:

3.19.2.1.1 TCAS – Self-test failure; and

3.19.2.1.2 TCAS – ARINC 429 BUS Failures.

3.20 Communications Systems

3.20.1 Requirements

3.20.1.1 The CC-130H communications systems shall be supported to the extent necessary to support related FMS communications systems operations.

3.20.1.2 The Communications system simulation shall be designed from data provided in the CC-130H AOI.

3.20.2 Malfunctions

3.20.2.1 The communications systems simulation shall support the following malfunctions:

3.20.2.1.1 HF #1 total failure;

3.20.2.1.2 HF #2 RT total failure;

3.20.2.1.3 V/UHF #1 total failure; and

3.20.2.1.4 V/UHF #2 RT total failure.

4.0 Support Systems

4.1 Aerodynamic Model

4.1.1 Requirements

4.1.1.1 The CC-130H aerodynamics model shall provide steady-state flight characteristics which are representative of the class of aircraft to which the CC-130H belongs.

4.1.1.2 Transitional rates and accelerations shall be within normal limits for this class of aircraft.

4.1.1.3 The valid operational range of the aerodynamics model shall correspond to normal flight within the CC-130H flight envelope.

4.1.2 Malfunctions

4.1.2.1 The aerodynamics system will not support any malfunctions.

4.2 Atmospheric Model

4.2.1 Requirements

4.2.1.1 The atmospheric model shall provide the aircraft simulation with atmospheric conditions, for the active training scenario, such as outside air temperatures, Mach number, wind velocities, and air densities.

4.2.2 Malfunctions

4.2.2.1 The atmospheric model simulation will not support any malfunctions.

4.3 External Environment Model

4.3.1 Requirements

4.3.1.1 The external environment shall provide simulation with the ground elevation and magnetic variation of the current aircraft position as well as determine crash conditions.

4.3.2 Malfunctions

4.3.2.1 The external environment model will not support any malfunctions.

4.4 Power Plant Model

4.4.1 Requirements

4.4.1.1 The power plant simulation shall provide thrust for use by the aerodynamics model.

4.4.2 Malfunctions

4.4.2.1 The power plant model will not support any malfunctions.

4.5 DTT-Specific Support Systems

4.5.1 Requirements

4.5.1.1 CC-130H DTT-Specific Support Systems simulations shall include simple models as required in support of the remaining simulations.

4.5.1.2 They shall include, but not be limited to, the following systems: flight controls, auto-throttle, electrical, and landing gear.

4.5.2 Malfunctions

4.5.2.1 The simulation support systems will not support any malfunctions.

5.0 Functional Requirements

5.1 Training Modes

5.1.1 The DTT System shall provide the capability to train pilots, co-pilots, ACSOs, and FEs on the CC130H.

5.1.2 Simulated DTT geographical training environments shall be selectable from predefined and stored Gaming Areas.

5.1.3 A Gaming Area shall be a simulation of the real world within a predefined simulated geographical area in which the training will take place. Real world simulation may be limited to those things required by the DTT System avionic system simulation model in order to satisfy training requirements. Gaming Areas may include, but are not limited to, topographic details and the coordinates and type of key objects within the area such as the nav/com facilities.

5.1.4 Gaming Areas shall be used for both Free-Play and Mission Plan modes.

5.1.5 Each DTT device shall be configured within the network as a single-user system, operable for the pilot/co-pilot, or ACSO training in either of the modes described below:

5.1.5.1 Mission Plan Mode. In Mission Plan mode the DTT device shall be controlled and monitored by instructor selectable Mission Plans containing rule-based events preselected to occur in a given sequence, under certain conditions, or at specified times during a training exercise.

5.1.5.1.1 A Mission Plan shall consist of a trainee briefing, instructor notes, the selected gaming area, the selected MPGS data set, aircraft and environment initialization parameters, an event list and the aircraft tail number to be used for the mission plan.

5.1.5.1.2 In Mission Plan mode, the DTT shall identify and record errors in the trainee performance and provide expert guidance to the trainee. The results of the trainee's performance shall be storable.

5.1.5.2 Free-Play Mode. In Free-Play mode the DTT device shall operate independent of any Mission Plan or automated monitoring.

5.1.5.2.1 The instructor shall have the capability of monitoring the simulation of any student within the assigned logical group, from any instructor station on the DTT network via the instructor station display.

5.1.5.2.2 The DTT System simulation model shall provide sufficient Free-Play to allow the trainee to deviate from specified procedural operations with the simulation remaining in an active state and responding in a realistic manner.

5.2 Gaming Areas

5.2.1 Simulated DTT System geographical training environments shall be selectable from predefined and stored Gaming Areas.

5.2.2 Real world simulation shall be limited to those items required by the DTT System avionic systems simulation models.

5.2.3 Gaming Areas shall be used for both Free-Play mode and Mission Plan mode of operation.

5.2.4 The Gaming Area shall be defined as an area bounded by lines of latitude and longitude specified by the instructor when the Gaming Area is created.

5.2.5 During training, the Gaming Area shall contain navaids from the Navigation Aid database, weather patterns and topographical features as selected by the instructor from pre-defined databases.

5.3 Training Management

5.3.1 The instructor shall have the capability to monitor and control all appropriate aspects of the simulation to meet the required training objectives. These aspects include Gaming Area creation and control, selected environmental parameters, and mission parameters. Also included are creation and control of individual Mission Plans required to meet the aircrew (pilot, co-pilot, ACSO and flight engineer) training requirements such as tactical and

strategic airlifts, air-to-air refuelling, and search and rescue missions, including normal and degraded modes of operation.

5.3.2 In both the Mission Plan mode and Free-Play mode of operation, the instructor shall have the capability to:

5.3.2.1 Create and save entirely new Gaming Areas or to build new Gaming Areas, by modifying, copying or using previously built Gaming Areas. They shall be capable of precisely initializing the DTT System state at the start of an exercise in order to be utilized as training exercise baselines;

5.3.2.2 Store up to 500 pre-programmed Gaming Areas and 500 pre-programmed Mission Plans on each DTT Device. At any instructor station it shall be possible to select Gaming Areas and Mission Plans for use on any DTT Device. Once Gaming Areas or Mission Plans are loaded, all DTT Devices shall operate independently of each other;

5.3.2.3 Initialize systems, on the ground but not in flight(using Mission Plans, selected Gaming Area or instructor defined parameters as appropriate) with default values which are normally provided to the aircraft from the Mission Planning Ground Station (MPGS);

5.3.2.4 Record and later replay a previously recorded exercise or segment thereof, defined by Gaming Area and Mission Plan, on one or more DTT Devices (either student or instructor display) for demonstration purposes. The DTT System shall be able to supply this replay via a video output in a format compatible with the selected video projection device to be used for classroom instruction;

5.3.2.5 Select the DTT Device mode of operation as either Free-Play mode or Mission Plan mode;

5.3.2.6 Control the training exercise through the use of software tools such as freezes, jumps, and malfunctions;

5.3.2.7 Monitor and control individual or all DTT Devices within the network from any instructor station;

5.3.2.8 Initiate simulated malfunctions to aid in instruction during either ground or flight operations. Malfunctions shall be based on the non-normal procedures contained in the AOIs and on defined AUP equipment degraded modes of operation. All malfunctions shall be modelled from aircraft data, and shall affect the simulation in the same manner as they affect the design basis aircraft. The malfunctions shall cause realistic indications and effects in both primary and related supporting systems. The capability shall be provided for malfunctions to be either selectable by the instructor, or pre programmed to occur at a specific Mission Plan time or event;

5.3.2.9 Setup trainee records including the selection of lessons, Gaming Areas and Mission Plans which have been assigned to the trainee.

5.3.3 The DTT System shall automate the following:

5.3.3.1 Management of the DTT System instruction and administration with a Computer Managed Instruction (CMI) system. The capability shall be provided to:

5.3.3.1.1 Automatically record and evaluate trainee performance in Mission Plan mode, based on specific conditions, tolerances, and parameters coded into the Mission Plan. A record entry shall be generated each time a trainee logs on to the DTT System and updated in accordance with trainee results. The entry shall show date and time, names of missions run, and results such as normal termination and abnormal conditions;

5.3.3.1.2 Manually enter trainee evaluation data. Store, access, and print DTT System trainee records and reports; and

5.3.3.1.3 Administrate training including maintenance of trainee records, evaluation and tracking of trainee performance, and management of trainee progress.

5.3.3.2 Creation, storage and retrieval of Mission Plans for use in the Mission Plan mode of operation. It shall be possible to create entirely new Mission Plans or to build new Mission Plans by modifying or copying existing Mission Plans. Mission Plans shall run within, and therefore be dependent upon, specific Gaming Areas. The capability shall exist for multiple individual Mission Plans to be based on the same Gaming Area;

5.3.3.3 Identification and recording of errors in trainee performance in the Mission Plan mode of training. The results of trainee performance shall be linked to the DTT System CMI system. The Mission Plans provided with the DTT System shall contain defined tolerances, parameters and conditions which shall be used in rule based algorithms to detect trainee errors. When such an error is detected, the training exercise shall pause/freeze and the DTT System shall provide expert guidance/coaching to the trainee. The instructor shall have the capability to define tolerances, parameters, and conditions while developing new Mission Plans, and the capability to modify the same in existing Mission Plans.

5.3.3.4 Expert guidance/coaching shall consist of:

5.3.3.4.1 Advising the trainee of the error that has been made;

5.3.3.4.2 Provision of computer-based help features relating to the error subject matter; and

5.3.3.4.3 A means of establishing that the trainee is competent/ready to proceed.

5.3.3.5 The DTT System shall display at the instructor station and record for later debrief use, the following:

5.3.3.5.1 In both Free-Play mode and Mission Plan mode:

5.3.3.5.1.a The progressive geographical positions (tracks) of the simulated aircraft;

5.3.3.5.1.b information pertinent to each track such as time, current heading, altitude, and speed; and

5.3.3.5.1.c pertinent information relevant to key activities.

5.3.3.5.2 In Mission Plan mode only:

5.3.3.5.2.a Indication of the occurrence of a reaction to rule based events predefined in the Mission Plan;

5.3.3.5.2.b Relevant data relating to the occurrence of a reaction to a rule based event; and

5.3.3.5.2.c warnings, cautions, and errors in trainee performance.

5.4 Navigation Database

5.4.1 The DTT shall use the worldwide Jeppesen navigational database and be updatable from in order to provide realism of training tasks and FMS navigation regions.

5.4.2 One DTT device shall be used to load the latest Jeppesen data for the DTT System. Any other DTT devices on the network shall synchronize with the selected Device.

5.4.3 Only Maintainers and Administrators shall be able to load this data.

5.4.4 The database shall include the following information:

5.4.4.1 VHF Nav Aids;

5.4.4.2 NDB Nav Aids;

5.4.4.3 Airports;

5.4.4.4 Localizer beacons;

5.4.4.5 Glide Slope beacons; and

5.4.4.6 Land-based points (IAF, MAP, Fish Point, ..., as per current databases)

5.4.5 Only navaids located within the gaming area shall be available to the simulated navigation and communications systems during training.

5.5 Instructor Station Functions

5.5.1 The following paragraphs describe the functionality that shall be available to users at the instructor station.

5.6 Select Instructor Mode

5.6.1 Users shall be required to log in to be able to use an instructor station.

5.7 Select Trainee Mode

5.7.1 All users shall be required to log in to be able to use a trainee station.

5.7.2 Once logged in, the trainee shall be able to invoke one of the two following modes:

5.7.2.1 Free-Play Training; and

5.7.2.2 Mission Plan Training.

5.7.3 Which mode is available to the student at a given time shall be determined by the DTT Curriculum assigned to the trainee and the pre-requisites previously achieved by the trainee.

5.8 Free-Play Control

5.8.1 The trainee shall have an array of simulator controls specific to the DTT available during training beyond the simulated aircraft control panels and displays. As a minimum the following controls shall be provided:

5.8.1.1 Freeze/Unfreeze simulation;

5.8.1.2 Reset Simulation;

5.8.1.3 Accelerate simulation;

5.8.1.4 AHRS/INU Quick Align;

5.8.1.5 Aircraft Power On/Off;

5.8.1.6 Insert/Remove Data Cartridge from the Data Transfer Unit;

5.8.1.7 Select desired calibrated airspeed;

5.8.1.8 Select desired power setting; and

5.8.1.9 A simplified means of controlling aircraft attitude, used to support control wheel steering.

5.9 Mission Plan Control

5.9.1 When initializing for a Mission Plan, the DTT shall use either the pilot or ACSO station configuration as specified by the Mission Plan.

5.9.2 The trainee shall have an array of simulator controls specific to the DTT available during training beyond the simulated aircraft control panels and displays. As a minimum the following controls shall be provided:

5.9.2.1 Freeze/Unfreeze simulation;

5.9.2.2 Accelerate simulation;

5.9.2.3 Aircraft Power On/Off;

5.9.2.4 Insert/Remove Data Cartridge from the Data Transfer Unit;

5.9.2.5 Select desired calibrated airspeed;

5.9.2.6 Select desired power setting; and

5.9.2.7 A simplified means of controlling aircraft attitude, used to support control wheel steering.

5.10 Help Functions

5.10.1 The trainee shall be provided with on-line help reference to assist with aircraft subject matter covered by the DTT training intent. Help shall be selectable by the trainee, or offered when an error occurs during a Mission Plan.

5.10.2 When an error is detected during a Mission Plan, the training exercise shall pause/freeze and the DTT device shall provide guidance/coaching to the trainee. The guidance/coaching shall consist of:

5.10.2.1 Advising the trainee of the error that has been made;

5.10.2.2 Provision of computer-based help features relating to the error subject matter; and

5.10.2.3 A means of establishing that the trainee is competent/ready to proceed.

5.10.3 Access to the help functions shall be denied during performance check (PC) mission plans.

5.11 Trainee Monitoring

5.11.1 During both Mission Plan and Free-Play training modes, trainee performance shall be monitored and relevant information shall be temporarily stored in order to be recalled at the end of the mission for review of the trainee's performance.

5.11.2 Each DTT device shall have the capability of displaying at the instructor station, and recording for later debrief use, the following:

5.11.2.1 The progressive geographical positions (track) of the simulated aircraft;

5.11.2.2 Aircraft position, heading, altitude, airspeed, and vertical speed; and

5.11.2.3 Information regarding SAR/ELT, environment, and malfunction status.

5.11.3 In Mission Plan mode only, the capability of displaying at the instructor station and recording for later debrief use, the following:

5.11.3.1 Indication that the trainee has completed a rule-based event predefined in the Mission Plan;

5.11.3.2 Relevant data relating to the completion of a rule-based event; and

5.11.3.3 Indication that the trainee failed to complete a rule-based event.

5.12 Scenario Recording

5.12.1 In both the Mission Plan mode and Free-Play mode of operation, the instructor shall have the capability to record and later replay a previously recorded exercise defined by Gaming Area and Mission Plan, on one or more DTT devices (either student or instructor display) for demonstration purposes. Capability shall also be provided to supply this replay via a video output in a format compatible with the selected video projection device to be used for classroom instruction.

5.13 Replicated Controls

5.13.1 Aircraft cockpit panels and control inputs for all applicable switches and controls, shall be graphically replicated on video monitors.

5.13.2 The trainee shall interface with the aircraft simulation using the replicated controls and displays.

5.13.3 Where a specific function is not supported by the DTT, a simulator-specific message shall be displayed to advise the trainee.

5.14 Edit User Accounts

5.14.1 The following user types shall be provided:

5.14.1.1 **Trainees**: Trainees shall only be able to operate the trainee station as required to run Mission Plans and to perform Free-Play training;

5.14.1.2 **Instructors**: Instructors shall only be able to operate the Instructor Station as required to manage Mission Plans, training operations, and trainee records;

5.14.1.3 **Maintainers**: Maintainers shall only be able to operate the Instructor Station as required to perform the provided maintenance functions, including station reconfiguration. Maintainers shall have access to the operating system; and

5.14.1.4 **Administrators**: Administrators shall be able to operate the Instructor Station as required to manage the DTT system user accounts. Administrators shall also have access to all other DTT functions.

5.14.2 Administrators shall have the ability to define and store the following data for each user:

5.14.2.1 User ID;

5.14.2.2 User Account Name;

5.14.2.3 Password;

5.14.2.4 Crew Specialty;

5.14.2.5 Assigned Curriculum;

5.14.2.6 User Types (trainee, instructor, Maintainer, and/or Administrator); and

5.14.2.7 Instructor Name (chosen from a list of instructor users).

5.14.3 The User Name and User Account Name shall be required to create a user account.

5.14.4 The password shall not be echoed to the screen when typed.

5.14.5 Confirmation shall be required when changing the password.

5.14.6 The password shall be a minimum of 6 characters.

5.14.7 The Language shall default to English.

5.14.8 DTT System users shall be able to be assigned to more than one user type. For example, a user who is assigned trainee, instructor, and maintainer

user types may perform all trainer functions except for user account management.

5.14.9 The User Type shall default to trainee only.

5.14.10 The Instructor Name shall be selected from a list of users whose User Type includes instructor.

5.14.11 This field shall be optional, with the intent of identifying a trainee's instructor.

5.14.12 The option to disable an account shall be provided, allowing an account to be disabled without deleting the account information.

5.14.13 The capability to delete user accounts shall be provided. When a user account is deleted, all user records for that account shall also be deleted.

5.15 Edit Mission Plan

5.15.1 The capability shall be provided to create, store, delete, and retrieve Mission Plans for use in the Mission Plan mode of operation.

5.15.2 It shall be possible to create entirely new Mission Plans or to build new Mission Plans by modifying or copying existing Mission Plans. Mission Plans shall run within, and therefore be dependant upon, specific Gaming Areas.

5.15.3 The capability shall exist for multiple individual Mission Plans to be based on the same Gaming Area.

5.15.4 The instructor shall have the capability to define the following data for a Mission Plan:

5.15.4.1 Mission Plan Name, defining a one line description of the plan;

5.15.4.2 Trainee Crew Station, defining what crew station (Pilot or ACSO) is to be used for the mission;

5.15.4.3 Instructor Notes, describing the objective and content of the mission plan;

5.15.4.3.1 The Instructor Notes shall be a free-field text description that the instructor may fill with whatever information is desired;

5.15.4.4 Mission Plan Briefing Data, describing the mission to the level of detail that would typically be given to the aircrew;

5.15.4.5 Gaming Area to be used;

5.15.4.6 MPGS Data to be used; and

5.15.4.7 Mission Plan Event List, describing the pre-programmed events that will occur during the course of the mission.

5.15.5 The instructor shall have the capability to print the Mission Plan briefing data to allow it to be given to the trainee prior to executing a Mission Plan.

5.15.6 When creating a Mission Plan, the instructor shall have the capability to define the initialization point at which the training will commence. Initialization parameters shall include aircraft location and gross weight.

5.15.7 To allow for precise initialization, the instructor shall be able to define the initial latitude and longitude of the aircraft for an on ground mission, or the initial latitude, longitude and altitude for an airborne mission.

5.15.8 When initializing for a mission plan, the , the instructor shall have the capability to initialize systems, on the ground but not in flight, with default values which are normally provided to the aircraft from the Mission Planning Ground Station (MPGS).

5.15.9 The Event List shall be a sequence of events that shall be monitored during the training.

5.15.10 Events shall be constructed using a set of user-defined statements that will be evaluated by the software.

5.15.11 Parameters required to define statements shall be selectable from a list provided on the DTT.

5.15.12 The parameters shall include, but not be limited to, parameters necessary to support the training of all tasks defined in CDRL-124.

5.15.13 Other parameters in addition to those required for the training tasks outlined shall be included to provide more specific instruction for normal operations and malfunctions.

5.15.14 The instructor shall be prompted for values, specific to each parameter, that are required to define each statement.

5.15.15 The instructor shall have the capability to define tolerances for each parameter. The statements thus defined shall provide the conditions under which the trainee will be evaluated and shall be used to direct the expert guidance/coaching system as to what help topic(s) should be presented when an error in trainee performance is detected. These tolerances, parameters, and conditions shall also determine when the help will be presented.

5.15.16 The instructor shall have the capability to define the time or location at which to trigger each event.

5.15.17 When the trainee has completed all the steps defined in the events outlined in the Mission Plan, the DTT Sytem shall automatically end the mission.

5.15.18 The DTT System shall permit the instructor to print Mission Plan data.

5.16 Edit Gaming Area

5.16.1 The instructor shall have the capability to create, store, delete and retrieve Gaming Areas.

5.16.2 The instructor shall have the capability to build new Gaming Areas by modifying; copying or using previously built Gaming Areas.

5.16.3 The instructor shall have the capability of precisely initializing the DTT device state at the start of an exercise in order to be utilized as training exercise baselines.

5.16.4 The following data shall be defined for a Gaming Area:

5.16.4.1 Gaming Area Name;

5.16.4.2 Gaming Area Summaries;

5.16.4.3 Gaming Area boundaries;

5.16.4.4 Default Aircraft Starting Location;

5.16.4.5 Nav Database Modifications;

5.16.4.6 Weather Patterns;

5.16.4.7 Topographical Features.

5.16.5 The Game Area boundary shall be specified as the area enclosed by two latitude lines and two longitude lines.

5.16.6 In addition to the NAVAID data supplied in the Navigation Aid database, the instructor shall have the capability to add NAVAIDs to the selected gaming area.

5.16.7 The instructor shall have the capability to delete or modify any NAVAID definitions from the gaming area. Additions, deletions, or modifications to the NAVAID (s) in the gaming area shall not modify the Navigation Aid database.

5.16.8 The instructor shall have the capability to place up to four (4) weather patterns selected from a weather database into the gaming area. The weather database shall contain up to four (4) pre-determined weather patterns.

5.16.9 The instructor shall have the capability to place up to four (4) topographical features into the gaming area. The topographical feature database shall contain up to four (4) pre-determined topographical features.

5.16.10 The instructor shall have the capability to store up to 500 pre-programmed Gaming Areas on each DTT device.

5.16.11 The DTT System shall permit the instructor to print Gaming Area data.

5.17 Create MPGS Data

5.17.1 The instructor shall have the capability to load an MPGS data file for use with the FMS, and to delete an MPGS data file which resides on the DTT.

5.18 Update Nav Database

5.18.1 A mechanism for updating the DTT Nav Database with commercially available Jeppesen database updates shall be provided.

5.19 Training Control

5.19.1 The instructor shall have the capability to select the DTT device mode of operation for either Free-Play training or Mission Plan training.

5.19.2 The instructor shall have the capability to select the Gaming Area to be used for Free-Play training. The Gaming Area shall be selected from the set of previously created Gaming Areas.

5.19.3 The instructor shall have the capability to select the MPGS Data Set to be used for Free-Play training. The MPGS Data Set must be selected from the set of previously created MPGS Data Sets.

5.19.4 In both the Mission Plan and Free-Play mode of operation, the instructor shall have the capability to control the training exercise through the use of simulation controls such as freeze, accelerate, and malfunction activation.

5.19.5 In both the Mission Plan and Free-Play mode of operation, the instructor shall have the capability to monitor and control individual trainees within his/her logical network.

5.19.6 In both the Mission Plan and Free-Play mode of operation, the instructor shall have the capability to initiate simulated malfunctions to aid in instruction during either ground or flight operations.

5.19.7 Access to trainees outside the logical network shall be provided, but shall require specific instructor actions.

5.19.8 The capability shall be provided for malfunctions to be either selectable by the instructor, or pre-programmed to occur at a specific Mission Plan time or event.

5.19.9 The instructor shall have the capability to clear/delete any unwanted malfunction during a training scenario.

5.20 Access Trainee Records

5.20.1 In both the Mission Plan mode and Free-Play mode of operation, the instructor shall have the capability to set up trainee records including the selection of Gaming Areas and Mission Plans which have been assigned to the trainee.

5.20.2 The instructor shall have the capability to print the trainee records and evaluation results.

5.20.3 The instructor shall have the capability to select to review and modify trainee records as described in the following sub-paragraphs.

5.21 Control Trainee Review

5.21.1 The instructor shall have the capability to select one of the trainee record views described in the next paragraphs.

5.22 Review User Events

5.22.1 The instructor shall have the capability to review the trainee's training history.

5.22.2 The history shall indicate significant events in the training sequence including, but not limited to:

5.22.2.1 When the trainee logged in;

5.22.2.2 When the trainee stopped a training session and how it was terminated (completed, aborted, etc); and

5.22.2.3 When the trainee logged out, and manually entered evaluation data.

5.23 Review Scenario Records

5.23.1 The instructor shall have the capability to review the trainee's scenario records. The scenario record shall include the following significant events:

5.23.1.1 Start of training;

5.23.1.2 Instructor-initiated actions including simulation Freeze/Unfreeze/Reset, environment changes, malfunction changes, and acceleration changes;

5.23.1.3 Trainee-initiated actions including simulation Freeze/Unfreeze/Reset and acceleration changes;

5.23.1.4 Help requests;

5.23.1.5 Mission Plan events; and

5.23.1.6 End of training.

5.24 Scenario Playback

5.24.1 The instructor shall have the capability to playback recorded Mission Plan or Free-Play training sessions.

5.24.2 Controls required to start, stop, and accelerate through the recorded scenario shall be provided.

5.24.3 Only the last recorded Free-play training session shall be available per trainee.

5.24.3.1 The playback shall be displayed on both the trainee and instructor stations.

5.24.3.2 The instructor station shall display the progressive geographical tracks of the simulated aircraft, information pertinent to each track, and other pertinent information relevant to key activities.

5.24.3.3 The trainee station shall display the trainee's instruments and shall update those displays as if the trainee were repeating the scenario.

5.24.4 The instructor shall have the capability to start a mission from various stages of any mission in the event of a system crash or if a mission cannot be completed in the same day.

5.25 Configure DTT Device

5.25.1 Maintainers shall have the ability to add or remove stations from the trainer configuration.

5.25.2 Each station shall maintain full functional capabilities with any number of stations connected to the network.

5.25.3 As part of the initial configuration of a station, the instructor shall be required to specify a unique identifier for the station and any network information as required in order to permit communication with the rest of the network.

5.25.4 When a station is connected to the network, it shall automatically become visible to all other stations on the network.

5.25.5 By querying the network, each station shall be able to determine what other stations are available, what data exists on them, which station the laser printer is connected to, which station the tape drive is connected to, etc.

5.25.6 The network configuration shall be designed with no limit on the number of DTT stations that can be added, with the caveat that the performance shall be limited by the network traffic required.

5.25.7 The network traffic shall support, as a minimum, 20 DTT stations in order to provide flexibility for future expansion.

6.0 Maintenance

6.1 DTT Software

6.1.1 A discrete installation method for the new DTT software shall be provided along with an image of the systems.

6.1.2 Maintenance personnel shall be able to access the software.

6.2 Test and Diagnostics

6.2.1 Test and Diagnostics shall be provided for the following devices:

6.2.1.1 Computer Displays (Test Pattern, used for adjustment);

6.2.1.2 Local DTT network; and

6.2.1.3 Operating System Diagnostics.

6.2.2 The DTT computers shall only have the diagnostics supplied with the computer or available from the operating system.

6.2.3 The self-test capability shall be achieved using a combination of hardware and software tests provided by the hardware/ software OEM, along with custom software where necessary. Operation of the vendor-supplied self-tests may require access to, and use of, the Operating System.

6.3 Change Date/Time

6.3.1 One DTT device shall be used to set the date/time for the DTT System.

6.3.2 Any other DTT devices on the network shall synchronize with the selected Device.

6.3.3 Only Maintainers and Administrators shall be able to set the date and time.