

NAVY TRAINING SYSTEM PLAN
FOR THE
JET ENGINE TEST INSTRUMENTATION

N78-NTSP-A-50-0102/I

APRIL 2001

JET ENGINE TEST INSTRUMENTATION

EXECUTIVE SUMMARY

The Jet Engine Test Instrumentation (JETI) is a newly developed system that will, in time, supplant and replace the A/F32T-10A Standard Engine Test System, the A/W37T-1 Engine Test System and various A/F32T-10 Engine Test Systems throughout the Navy, both ashore and afloat. This Initial Navy Training System Plan addresses the training requirements required for proper operation and maintenance of this system.

JETI will be operated and maintained by Navy Aviation Machinist's Mates with Navy Enlisted Classification code 6422 assigned to the Aircraft Intermediate Maintenance Department Test Cell Work Center 450. JETI will provide an integrated, computer-based measurement and automation system for the purpose of intermediate level testing of aircraft gas turbine engines. It will be maintained in accordance with the actions as delineated in OPNAVINST 4790.2G. Since the equipment is operated and maintained at the intermediate level, Level 1 (on-equipment) maintenance will be performed at the intermediate level. Depot level maintenance is planned to be conducted by the manufacturer or through contractor maintenance.

Familiarization training for the Technical Evaluation personnel at the Naval Air Warfare Center, Aircraft Division, Patuxent River, Maryland, was performed by the contractor in June 2000. Training for Naval Air Technical Data and Engineering Service Command (NATEC) representatives will be at Naval Air Station Lemoore, California, in May 2001 and again, along with fleet personnel, during the first installation on an Atlantic Fleet aircraft carrier undergoing overhaul during FY01. Follow-on training will be accomplished by NATEC personnel and/or On-the-Job Training, as required. Specific training requirements have not been defined as yet. The manufacturer will establish initial material support.

The project is in the Engineering and Manufacturing Development Phase (Phase II) at the current time. Production, Deployment, and Operational Support (Phase III) will begin with the first installation, and Initial Operational Capability should be attained by fourth quarter FY01.

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JET ENGINE TEST INSTRUMENTATION

LIST OF ACRONYMS

AD	Aviation Machinist's Mate
AE	Aviation Electrician's Mate
AIMD	Aircraft Intermediate Maintenance Department
AMTCS	Aviation Maintenance Training Continuum System
BIT	Built-In Test
CBT	Computer-Based Training
CM	Corrective Maintenance
CNO	Chief of Naval Operations
COTS	Commercial Off-The-Shelf
IMA	Intermediate Maintenance Activity
JETI	Jet Engine Test Instrumentation
MTIP	Maintenance Training Improvement Program
NA	Not Applicable
NATEC	Naval Air Technical Data and Engineering Service Command
NAWCAD	Naval Air Warfare Center, Aircraft Division
NEC	Navy Enlisted Classification
NTSP	Navy Training System Plan
OJT	On-the-Job Training
OPO	OPNAV Principal Official
PC	Personal Computer
PM	Preventive Maintenance
TECHEVAL	Technical Evaluation

JET ENGINE TEST INSTRUMENTATION

PREFACE

This second iteration Initial Navy Training System Plan (NTSP) is an early look at the Jet Engine Test Instrumentation (JETI) program, updating the December 1999 version. This document explores the various employment and support alternatives currently under consideration. This NTSP is a product of the Training Planning Process Methodology, as outlined in OPNAV publication P-751-3-9-97.

PART I - TECHNICAL PROGRAM DATA

A. NOMENCLATURE-TITLE-PROGRAM

1. **Nomenclature-Title-Acronym.** A/W37T-1A, A/F32T-10B, A/E37T-36A Jet Engine Test Instrumentation (JETI)

2. **Program Element.** 020416N

B. SECURITY CLASSIFICATION

- 1. **System Characteristics** Unclassified
- 2. **Capabilities** Unclassified
- 3. **Functions**..... Unclassified

C. MANPOWER, PERSONNEL, AND TRAINING PRINCIPALS

OPNAV Principal Official (OPO) Program Sponsor..... CNO (N781C)

OPO Resource Sponsor CNO (N781C)

Developing Agency..... NAWCAD Lakehurst

Training Agency CINCLANTFLT (N721)
CINCPACFLT (N70)
CNET (ETE32)

Training Support Agency NAVAIRSYSCOM (PMA205)

Manpower and Personnel Mission Sponsor CNO (N12)
NAVPERSCOM (PERS-4, PERS-404)

Director of Naval Training..... CNO (N795)

D. SYSTEM DESCRIPTION

1. **Operational Uses.** The JETI will provide full performance test capability at the Aircraft Intermediate Maintenance Department (AIMD), both ashore and afloat, for manual and automatic testing of gas turbine engines. The system capabilities will include instrumentation, data acquisition, engine and facility control, and status display. These enhanced capabilities allow

interface and control of Full Authority Digital Electronic Control aircraft engines and are required to properly test and evaluate the performance of the F414 engine installed in the F/A-18E/F. Initially JETI will only be used by the Navy, but Marine Corps facilities may acquire it in the future.

The JETI will have a distinctive designation and part number, depending on the application. When installed aboard an aircraft carrier it will be designated the A/W37T-1A, part number 3654AS100-1. When installed in a fixed facility ashore it will be designated the A/F32T-10B, part number 3654AS100-2. In the transportable configuration it will be designated the A/E37T-36A, part number 3654AS100-3.

2. Foreign Military Sales. Not Applicable (NA)

E. DEVELOPMENTAL TEST AND OPERATIONAL TEST. Technical Evaluation (TECHEVAL) began in July 2000 at the Naval Air Warfare Center Aircraft Division (NAWCAD) Patuxent River, Maryland. Testing will be completed for the A/F32T-10B configuration in April 2001, and for the A/W37T-1A configuration in December 2001.

F. AIRCRAFT AND/OR EQUIPMENT/SYSTEM/SUBSYSTEM REPLACED. JETI is the planned replacement for the A/F32T-10A Standard Engine Test System, the A/W37T-1, and various A/F32T-10s.

G. DESCRIPTION OF NEW DEVELOPMENT

1. Functional Description. The JETI is a Commercial Off-The-Shelf (COTS) Personal Computer (PC)-based test system that interconnects two major functional elements: the engine under test and the test facility. It is designed to monitor and display all parameters of an engine being tested, and allows out-of-airframe testing and troubleshooting. The system will integrate six different functions: instrumentation, data acquisition, system processor-controller, programmable throttle system, distributed electrical power, and operator-maintenance control and display. The system will also provide a printout of the calculated engine performance data during normal testing.

The JETI contains two PCs linked via Ethernet. Each PC is a 600 MHz Pentium III with 256 MB RAM, a 13.4 GB hard drive, an Ethernet card, a keyboard, a mouse, and a 18" Liquid Crystal Display touch screen. Each system also includes a CD-ROM drive, a 250 MB Iomega Zip Drive, a 56K modem, and a laser printer.

2. Physical Description. All versions of the JETI (shipboard, shore-based, and portable) are planned to have the same number of cabinets with identical instrumentation. The difference in facility configuration will be the control room floor plan. The dimensions of the system will be eight feet high by eight feet wide by two feet deep, with a weight of 1800 pounds.

3. New Development Introduction. The JETI will be introduced as a new production system.

4. Significant Interfaces. In the original installations, JETI will interface with the existing test system utilizing common hardware such as electrical junction boxes, mechanical junction boxes, power supplies, programming harness box, ancillary equipment, busses, etc., but will have separate cabling, software, and a stand-alone computer control system.

5. New Features, Configurations, or Material. NA

H. CONCEPTS

1. Operational Concept. JETI will be operated and maintained by Navy personnel assigned to the AIMD Engine Test Cell Work Center 450. Operator-maintenance personnel will be Aviation Machinist's Mates (AD) with a Navy Enlisted Classification (NEC) code 6422. JETI requires a total of two technicians, one AD 6422 and one safety observer-maintenance man, usually an Aviation Electrician's Mate (AE).

2. Maintenance Concept

a. Organizational. There is no organizational level maintenance on the JETI. Level 1 (on-equipment maintenance) will be performed by the using Intermediate Maintenance Activity (IMA).

b. Intermediate. Intermediate level maintenance personnel will perform Level 1 maintenance tasks and systems calibration, including daily and pre-operational inspections, Preventive Maintenance (PM), and servicing, in addition to maintaining, repairing, or replacing most of the components. Built-In Test (BIT) will be the primary means of troubleshooting the system. Non-repairable components will be forwarded to the depot level for evaluation or repair.

(1) Preventive Maintenance. PM on the JETI will be conducted at specific intervals in accordance with procedures established on Maintenance Requirement Cards. PM actions include but are not limited to corrosion inspection, cleaning, lubrication, and pre- and post-operational inspections.

(2) Corrective Maintenance. Corrective Maintenance (CM) will consist of fault isolation to the failed component or subassembly, replacement of defective or failed items, functional check for proper operation, and calibration by the IMA's Calibration Lab if required.

c. Depot. Depot level maintenance consists of repair and restoration to meet specified requirements with the manufacture of parts, assemblies, or the end item as required. Repair of repairable components and assemblies will be identified in a Maintenance Plan with designated Source, Maintenance, and Recoverability codes for the specified depot level repair. The contractor or other authorized representative will perform depot level maintenance, rather than the Navy developing organic capability.

d. Interim Maintenance. There is no maintenance beyond the skill level of intermediate maintenance personnel. Additional assistance will be provided by either Naval Air Technical Data and Engineering Service Command (NATEC) personnel or the manufacturer.

e. Life-Cycle Maintenance Plan. NA

3. Manning Concept. The manning concept is based on functional operational requirements and maintenance workload. No increase in current manpower requirements is required. Existing manpower requirements for each site are adequate to operate and maintain the JETI.

a. Estimated Maintenance Man-Hours per Operating Hour. Although the data on man-hour requirements for maintenance are not yet available, maintainability design will focus on simplicity, accessibility, fault location, BIT and/or test points, component interchangeability and availability, use of common tools and support equipment, safety, fault minimization, and low frequency of CM and PM. Published, generally accepted, maintainability and human factor design guidelines and industry standards, to the extent applicable, will be used as guidance.

b. Proposed Utilization. While deployed aboard aircraft carriers, the JETI will be utilized approximately 11.4 hours per day, seven days a week for a normal six-month deployment. The shore-based usage will be approximately eight hours per day, five days per week.

c. Recommended Qualitative and Quantitative Manpower Requirements. The JETI will not cause a change in fleet manpower requirements. The manning and skill levels of personnel currently assigned are adequate to operate and maintain the system.

4. Training Concept. The training for the JETI is currently planned to be On-the-Job Training (OJT). There will not be a formal training course, but several methods of passing on the necessary skills will be examined. The contract for the training provider has not been initiated, and will not be considered until after the first installation of the system is complete.

Chief of Naval Operations (CNO) letter 1500 serial N889H3 dated September 1992 gave Naval Air Maintenance Training Group authorization to cancel other Engine Test Systems Turbine training and gave responsibility of training to NATEC and the local AIMDs. This training is conducted by selected NATEC representatives and licensed senior Test Cell Operators on an as-required basis.

The established training concept for most aviation maintenance training divides “A” School courses into two or more segments called *Core* and *Strand*. “A” School *Core* courses include general knowledge and skills training for the particular rating, while “A” School *Strand* courses focus on the more specialized training requirements for that rating and a specific aircraft or equipment, based on the student’s fleet activity destination. *Strand* training immediately follows *Core* training and is part of the “A” School. “A” School *Core* and *Strand* is the prerequisite training that will be needed to progress into JETI training.

a. Training Methods. The following training methods are under consideration and should be evaluated for the best cost-benefit usage. All are considered “Onboard Training.”

(1) Self-Study Handbook. The first option is to provide a Self-Study Handbook with each system that contains instructions on operation and maintenance. These handbooks would consist of hands-on exercises with the actual equipment, troubleshooting problems, diagrams, learning objectives, instruction sheets, assignment sheets, problem sheets, and written tests.

(2) Computer-Based Training. Computer-Based Training (CBT) is one of the easiest methods of providing information in a structured manner for self-study. This stand-alone training provider would utilize the same objectives of the handbook, but is self-contained and can provide a suitable level of simulation.

(3) Embedded Training. Enlarging on the CBT media, and since this system will be computer supported, an embedded training syllabi could be the best answer. This has all the advantages of CBT, but is installed as part of the JETI and the use of simulation is more realistic in that the actual equipment is used during the training evolution. Hands-on training of this type will provide one of the best learning tools available and will not necessitate more instructors or classrooms.

b. Initial Training

(1) Operator. Operator training was provided by the manufacturer to the NAWCAD personnel that are performing the technical evaluation. This training was hands-on, on-site, in the form of OJT. Further initial training will be provided by the manufacturer during the first installation of the system on an Atlantic Fleet aircraft carrier. This training will again be OJT and will be given to NATEC Representatives, as well as to the ship’s company personnel. At the current time there is no contractual obligation to provide further training, but this will be addressed in the production contract to be executed for follow-on systems. It is probable that in the future NATEC Instructors will provide the training at the time of installation, and thereafter the training will most likely be one of the three onboard types discussed above.

(2) Maintenance. Maintenance training will be conducted concurrently with Operator training.

c. Follow-on Training. NATEC representatives and licensed senior Test Cell Operators conduct on-site follow-on training for Operators and Maintainers of other engine test systems on an as-required basis. Training for the JETI could be accomplished in the same manner.

d. Student Profiles

SKILL IDENTIFIER	PREREQUISITE SKILL AND KNOWLEDGE REQUIREMENTS
AD 6422	<ul style="list-style-type: none"> ° C-601-2011, Aviation Machinist's Mate Common Core Class A1 <li style="text-align: center;"><i>And</i> ° C-601-2012, Aviation Machinist's Mate Helicopter Fundamentals Strand Class A1 <li style="text-align: center;"><i>Or</i> ° C-601-2013, Aviation Machinist's Mate Turboprop Fundamentals Strand Class A1 <li style="text-align: center;"><i>Or</i> ° C-601-2014, Aviation Machinist's Mate Turbojet Fundamentals Strand Class A1
AE	<ul style="list-style-type: none"> ° C-100-2020, Avionics Common Core Class A1 ° C-602-2042, Aviation Electrician's Mate Intermediate Maintenance Level Strand Class A1

e. Training Pipelines. Since the training track for the NEC 6422 has been discontinued, there is no formal training track that could be used to provide the training necessary. Currently, there is no plan to re-establish a training track to support this or other test cell systems.

I. ONBOARD (IN-SERVICE) TRAINING

1. Proficiency or Other Training Organic to the New Development

a. Maintenance Training Improvement Program. The Maintenance Training Improvement Program (MTIP) is used to establish an effective and efficient training system responsive to fleet training requirements. MTIP is a training management tool that, through diagnostic testing, identifies individual training deficiencies at the organizational and intermediate levels of maintenance. MTIP will be replaced by the Aviation Maintenance Training Continuum System (AMTCS). Current planning is for AMTCS to begin full implementation for fleet deployment in March 2001.

b. Aviation Maintenance Training Continuum System. The AMTCS will provide career path training to Sailors from their initial service entry to the end of their military career. AMTCS is planned to be an integrated system that will satisfy the training and administrative requirements of both the individual and the organization. The benefits will be manifested in the increased effectiveness of the technicians and the increased efficiencies of the management of the training business process. By capitalizing on technological advances and integrating systems and

processes where appropriate, the right amount of training can be provided at the right time, thus meeting the CNO's mandated "just-in-time" training approach.

Technology investments enable the development of several state-of-the-art training and administrative tools: Interactive Multimedia Instruction for the technicians in the Fleet in the form of Interactive Courseware with Computer Managed Instruction and Computer Aided Instruction for the schoolhouse.

Included in the AMTCS development effort is the Aviation Maintenance Training Continuum System - Software Module which provides testing (Test and Evaluation), recording (Electronic Training Jacket), and a Feedback system. The core functionality of these AMTCS tools are based and designed around the actual maintenance-related tasks the technicians perform, and the tasks are stored and maintained in a Master Task List data bank. These tools are procured and fielded with appropriate COTS hardware and software, i.e., Fleet Training Devices - Laptops, PCs, Electronic Classrooms, Learning Resource Centers, operating software, and network software and hardware.

Upon receipt of direction from OPNAV (N789H), AMTCS is to be implemented and the new tools integrated into the daily training environment of all participating aviation activities and supporting elements. AMTCS will serve as the standard training system for aviation maintenance training within the Navy and is planned to supersede the existing Maintenance Training Improvement Program. AMTCS implementation will begin with the F-14, E-2C, and all models F/A-18 aircraft. For more information on AMTCS refer to PMA205-3D3.

2. Personnel Qualification Standards. NA

3. Other Onboard or In-Service Training Packages. Other than what has already been described above, no additional onboard training has been envisioned. The required training will be acquired as outlined above or by hands-on training provided by NATEC personnel.

J. LOGISTICS SUPPORT

1. Manufacturer and Contract Numbers

CONTRACT NUMBER	MANUFACTURER	ADDRESS
N68335-00-C-0234 NS-35F-5883 N-001-8999A-770	Racal Instruments Inc.	12758 Cimmaron Path San Antonio, TX 78149
N-001-8999A-70	Support Systems Associates Inc. (SSAI)	683 Route 70 Lakehurst, NJ 08733

2. Program Documentation. The Draft Acquisition Logistics Support Plan is available for review. The system specifications are also available.

3. Technical Data Plan. The end item technical manual (AG-JETIS-MIB-000) will address the JETI system in both the T-1 and T-10 configurations. Separate work packages will provide for the distinctive installation and facility interfaces. Technical manuals for each Test Program Set used to test the F414, F404-400/402, F110, J52, and GTC36-200/201 Engines will also be developed. In-process reviews will be conducted during TECHEVAL to evaluate the development of the technical manuals with final verification being performed on an installed system.

4. Test Sets, Tools, and Test Equipment. There is no new requirement for special test sets, etc. Built-In Test will accomplish most of the troubleshooting, and no specialized equipment will be required for corrective maintenance.

5. Repair Parts. The contractor will ensure that spares and repair parts to support the JETI and any support equipment are identified, selected, ordered, delivered, and stocked as interim supply support. The contractor will provide Provisioning Technical Documentation to support supply efforts. It will include, but is not limited to Long Lead Items List, Provisioning Parts List Index, Provisioning Parts List, Warranty Provisions, and Spares Acquisition Plan. The Material Support Date is scheduled for November 2003.

6. Human Systems Integration. NA

K. SCHEDULES

1. Installation and Delivery Schedules. The following schedule covers the Technical Evaluation of the system, the installation at shore activities, and aircraft carriers as they become available in the shipyard during overhaul.

INSTALLATION SCHEDULE

ACTIVITY	FY00	FY01	FY02	FY03	FY04
NAWCAD Patuxent River	1				
Aircraft Carriers		1	2	2	7
Shore Activities		1	2	2	2

(See the note following the next table.)

2. Ready For Operational Use Schedule

READY FOR OPERATIONAL USE SCHEDULE

ACTIVITY	FY00				FY01				FY02				FY03				FY04			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Aircraft Carriers								1	1			1		2			1		1	5
Shore Activities			1				1		1		1		1		1		2			

Note. The above includes the first installation, which is a Prototype installation, in June 2000 at NAWCAD in Patuxent River. The first production installation is planned to begin in March 2001. A total of 20 systems will be procured in the first increment with all installations to be complete by 2005.

3. Time Required to Install at Operational Sites. The installation requirements are still being studied, but preliminary estimates indicate that the initial installation should take about two months from start to finish. Further refinements in the installation procedure will certainly lower the time required in the future.

4. Foreign Military Sales and Other Source Delivery Schedule. NA

5. Training Device and Technical Training Equipment Delivery Schedule. NA

L. GOVERNMENT-FURNISHED EQUIPMENT AND CONTRACTOR-FURNISHED EQUIPMENT TRAINING REQUIREMENTS. NA

M. RELATED NTSPs AND OTHER APPLICABLE DOCUMENTS

DOCUMENT OR NTSP TITLE	DOCUMENT OR NTSP NUMBER	PDA CODE	STATUS
F/A-18 Aircraft NTSP	NTSP-A-50-7703H/D	PMA265	Draft Nov 00
Gas Turbine Engine Test Systems NTSP	NTSP-A-50-8616B/A	PMA205	Approved Aug 98

APPENDIX A - POINTS OF CONTACT

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