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Next Generation Weather Radar (NEXRAD) Principal User Processor (PUP) Operational Test and Evaluation (OT&E) Operational Test Plan

Baxter R. Stretcher

June 1993

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16. Abstract The purpose of this plan is to describe and detail the procedural approach, method, and responsibilities to be employed in conducting the Operational Test and Evaluation (OT&E) on the Next Generation Weather Radar (NEXRAD) Principal User Processor (PUP) system. The testing of the NEXRAD PUP will determine the operational suitability and effectiveness of the NEXRAD PUP aviation weather products used by the Center Weather Service Unit (CWSU) meteorologists for air traffic control (ATC).			
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INTRODUCTION

PURPOSE.

The purpose of this plan is to describe the procedural approach, methods, and responsibilities to be employed in conducting Operational Test and Evaluation (OT&E) Operational Testing on the Next Generation Weather Radar (NEXRAD) Principal User Processor (PUP). This OT&E Operational Testing will be performed by the Federal Aviation Administration (FAA) Technical Center, ACW-200D, at the Washington, DC, and Houston, TX, Air Route Traffic Control Centers (ARTCCs) during the month of March 1993. The plan outlines the method for evaluating the operational suitability and effectiveness of the NEXRAD PUP and aviation weather products provided to the Center Weather Service Unit (CWSU) meteorologists.

The OT&E Operational Testing of the NEXRAD PUP will determine the operational suitability and effectiveness of the NEXRAD PUP aviation weather products used by CWSU meteorologists for air traffic control (ATC). The primary focus will be to assess the usefulness of the PUP's products as aids to detecting and forecasting aviation hazardous weather.

The NEXRAD system is an "S"-band doppler weather radar system developed by the Paramax Corporation. This system is designed to detect wind shear and other hazardous weather phenomena for the Department of Transportation (DOT)/FAA, and also to perform other functions for the Department of Defense (DOD) and the Department of Commerce (DOC).

BACKGROUND

In October of 1983, the NEXRAD Program Council (NPC) requested that the Air Force Operational Test and Evaluation Center (AFOTEC) conduct the NEXRAD Initial Operational Test and Evaluation (IOT&E). In order to accomplish this, an integrated tridepartmental test team under the management of AFOTEC signed a Memorandum of Agreement (MOA) in April of 1984. The test team consisted of the DOC, the DOD, and the DOT. The NEXRAD Test and Evaluation Master Plan (TEMP) was coordinated and approved by all participating agencies in March of 1985. The TEMP detailed the responsibilities of the participants and the general IOT&E scenario. A second MOA was signed by the NPC members and the AFOTEC commander on November 1988, and focused on the IOT&E(2).

Two independent test teams under the overall management of the AFOTEC conducted IOT&E of the competing contractors' (Raytheon and Unisys, formerly Sperry) NEXRAD units. Unisys was selected as the production contractor and preparations for IOT&E(2) began. A 160-member integrated tridepartmental test team under the management of AFOTEC conducted an IOT&E(2) on the Unisys (Paramax) preproduction NEXRAD system. The IOT&E(2) was divided into two parts (A and B). Part A combined Development Test and Evaluation (DT&E) with OT&E and contractor activities from March 1989, to May 1989. Part B was a dedicated OT&E from May 1989, to August 1989. The DOC conducted their part of the test at the Weather Service Forecast Office in Norman, Oklahoma. The DOD conducted their testing at Tinker Air Force Base, Oklahoma, at the Base Weather Station. The DOT (FAA) did their OT&E Operational Testing at the FAA Academy in Oklahoma City, Oklahoma.

REFERENCE DOCUMENTS

This section lists the applicable documents and reference materials which relate to the contents of this plan.

R400-SP401A NOV 1, 1991	NEXRAD Technical Requirements (NTR)
FAA-STD-024a	Preparation of Test and Evaluation Documentation.
NAS-SS-1000 VOL III	NAS System Specification
NAS ORDER 1810.4B	FAA NAS Test and Evaluation Policy
AFOTEC PROJECT 86-0167	NEXRAD IOT&E PHASE II{IOT&E(2) FINAL REPORT DECEMBER, 1989

EVALUATION PHILOSOPHY

The OT&E Operational Testing of the NEXRAD by the CWSU meteorologists is designed to give them an opportunity to have input to the operational suitability and effectiveness of the NEXRAD PUP in an aviation environment. This input may be used for future system modifications.

Some of the features that the OT&E Operational Testing will pay particular attention to are in the following areas:

- * timeliness of requested products,
- * effectiveness of providing products at maximum load,
- * effectiveness of NEXRAD as an aid in briefing, consulting, and coordinating aviation weather problems,
- * effectiveness of NEXRAD's automatic alert features as an aide,
- * effectiveness of NEXRAD as an aide for the meteorologist in preparing and presenting briefings when using Overlays, Automated Alerts, Time-lapse, Dial-up, Multiple Screens and Background Maps,
- * effectiveness of NEXRAD's automatic mode deselection feature.

The results from this OT&E Operational Testing will be utilized by the FAA NEXRAD Program Office to recommend changes to the NEXRAD, if necessary, or as input for future systems.

EVALUATION APPROACH

The OT&E Operational Testing approach is to utilize questionnaires to be given to the CWSU meteorologist. The operational evaluation will be conducted at two sites: Washington, DC, ARTCC and Houston, TX, ARTCC.

The meteorologists will be trained for the PUP operations by the National Weather Service (NWS) at Norman, OK. CWSU operators are adapting NWS training of PUP functionality to an ARTCC application without benefit of an FAA course. They will receive 4 weeks of training on the PUP operational activities and the interpretation and dissemination of NEXRAD's hazardous weather information. Additional on-the-job training will be conducted at the existing PUP site. The FAA Technical Center, ACW-200D representative will brief the meteorologists on the purpose, scope, and procedures of the evaluation and distribute the questionnaires.

The meteorologist will complete the questionnaire. The questionnaire will be organized to address the effectiveness of NEXRAD as an aid in performing specific aspects of the meteorologist's job in the CWSU. Following the evaluation, the completed questionnaires will be analyzed by ACW-200D personnel. The data collected will form the basis for a draft report, which will be forwarded to the principal organizations supporting the NEXRAD PUP OT&E Operational Testing. A final report will follow the draft report.

EQUIPMENT

The PUP receives NEXRAD products from the Radar Product Generator (RPG) upon request from the operational personnel. The PUP contains the display unit for product control, status monitoring, local annotation, and product archiving. The PUP has three major components: the data processor, the system console, and the workstation.

The data processor is a two-bay cabinet containing the necessary hardware/software for all data processing activities. The cabinet also contains the narrow-band links used between the PUP and its associated Radar Product Generator (RPG) for internal product request and distribution, and for external requests and distribution from nonassociated RPGs. The NEXRAD PUP has one dedicated port to its associated RPG and four dial-up ports for access to four additional RPGs at any location in the radar network. Each RPG has two dedicated ports and two dial-up ports assigned for an FAA product request.

The system console holds an alphanumeric terminal consisting of a keyboard and a 14-inch cathode ray tube (CRT) screen. The console is an interactive peripheral device connected to the display processor port on the data processor cabinet. The functions provided by the console include system initialization and startup, control of the disk/tape operations, loading and execution of processor diagnostic programs, and start/stop of the systems application software.

The workstation is the primary operational position for the PUP. It provides the operator with the capability to request, display, and manipulate weather products generated by the RPG. The workstation consists of a table structure with operator work space and support provisions for an application terminal, two color monitors, a graphic tablet, and an audio alarm. A hard copy device is also provided on a separate table that may be positioned up to 50 feet from the workstation.

The PUP is connected to the NEXRAD's RPG unit by narrow-band links within the communication group of the NEXRAD Communication Group. This connection is used for internal product request and distribution, for interunit product request and distribution, and for distribution of products to other users. The links are interconnected for transmission over one direct line and other dial-up commercial telephone lines for external data requests.

ORGANIZATION ROLES AND RESPONSIBILITIES

The principal organizations participating in the OT&E of the PUP include FAA NEXRAD Program Office (ANR-500), FAA Technical Center (ACW-200D), and Washington and Houston ARTCCs.

RESPONSIBILITIES.

ANR-500. ANR-500 has the overall responsibility for the NEXRAD PUP Acquisition and Deployment.

FAA Technical Center/ACW-200D. The FAA Technical Center, ACW-200D, has been designated to provide the Associate Program Manager for Test (APMT). The APMT is responsible for the overall management and direction for the NEXRAD PUP OT&E Operational Testing. ACW-200D will complete and publish an operational evaluation Test Plan and associated questionnaires, make initial site visits, and coordinate with the CWSU to ensure that the PUP site will have CWSU meteorologists available to successfully complete the OT&E Operational Testing. ACW-200D will also administer the questionnaires to the CWSU meteorologist. An analysis will be based on data collected from the responses to the questionnaire. This analysis will be used in the preparation of a draft report and a final report from ACW-200D.

Washington and Houston ARTCC CWSUs. The CWSUs will provide the ACW-200D Evaluator with access to the CWSU meteorologists that will participate in the OT&E Operational Testing.

ROLES.

The roles for conducting the NEXRAD PUP OT&E Operational Testing are as follows:

AMPT. The AMPT is responsible for the overall management and direction for the NEXRAD PUP OT&E Operational Testing as detailed in FAA Order 1810.4B.

EVALUATOR. The Evaluator is the ACW-200D representative who will administer and conduct the on-site evaluation of the NEXRAD PUP at the Washington and Houston ARTCCs. The Evaluator will participate in all site visits, reviews, and briefings. The Evaluator will perform data analysis and prepare the reports.

EVALUATION PARTICIPANTS. Three Houston and four Washington CWSU meteorologists will evaluate the NEXRAD PUP by completing the associated questionnaire.

DOCUMENT REQUIREMENTS AND CONTROL

The documents required to conduct, describe, and report the results of the OT&E Operational Testing of the NEXRAD PUP are listed below.

EVALUATION PLAN.

This plan describes the requirements, methods, and responsibilities for conducting the OT&E Operational Testing of the NEXRAD PUPs located at the Washington and Houston ARTCCs. It provides a plan that will allow for an evaluation by the CWSU meteorologist in a live operational environment.

EVALUATION QUESTIONNAIRE.

A questionnaire will be developed by ACW-200D in order to obtain feedback from the PUP CWSU meteorologists. The questionnaire will focus on the overall suitability and effectiveness of the PUP as an aid for the CWSU meteorologists in preparing accurate and timely aviation weather warnings. The questionnaire will be structured to obtain the evaluation by rating a statement about each feature/function on a five-point scale ranging from Very Good to Very Poor. Comments will also be encouraged.

TEST REPORT SUMMARY.

A Test Report Summary will be submitted to ANR-500 within 15 days from completion of the test.

FINAL REPORT.

ACW-200D will prepare the final report and will include conclusions, problems/issues, and recommendations resulting from the evaluation. This report will be sent to ANR-500, and the participants, by May 15, 1993.

TRAINING

Detailed training of the ARTCC CWSU's meteorologists participants will be conducted by the NWS through the Operational Support Facility (OSF) at Norman, OK, in coordination with the Houston and Washington ARTCC CWSUs.

EVALUATION SUPPORT REQUIREMENTS

This section describes the instrumentation required for the evaluation, the types of data analysis to be performed, and the evaluation configuration.

INSTRUMENTATION.

No special instrumentation is required for the evaluation. The PUP is presently installed at the Washington ARTCC CWSU with all of the necessary equipment. The PUP will be installed at the Houston ARTCC starting the week of January 11, 1993. The two PUPs will be similar in their configuration.

DATA ANALYSIS.

Numerical values will be assigned to the questionnaire response, and then statistically analyzed. The intent of the analysis is to find the degree of satisfaction or dissatisfaction the CWSU meteorologists have with the NEXRAD PUP. The suggestions and open comments will be analyzed using content analysis. These comments will have higher weight in the analysis due to the small amount of respondents. The responses will be grouped so as to provide maximum meteorologist feedback. The evaluation of the responses to the questionnaires will help to answer questions regarding CWSU operational usage of the NEXRAD PUP.

EVALUATION CONFIGURATION.

The evaluation is taking place at the Washington and Houston ARTCC CWSUs. Each of the NEXRAD PUP installations is expected to include one dedicated port to the associated RPG, one dial-out port to the RPG, one dedicated port to the PUP external system, and one dial-in port from other users. The installations will also contain the hardware/software required for graphics processing, local control, status monitoring, local annotation, product archiving, and communication narrow-band links. A system console supports an alphanumeric terminal consisting of a keyboard and a 14-inch CRT screen. The system console provides for the initialization and startup, control of the disk/tape operations, loading and execution of the processor diagnostic programs, and start/stop of the system application software. The workstation is the primary operational position for the NEXRAD PUP Unit. It contains two graphic displays, an alphanumeric display, a hard copy device, and video interface connections.

The Washington ARTCC PUP has been installed with the above configuration. The associated NEXRAD site for the Washington PUP is located in Sterling, VA. The Houston ARTCC PUP is to begin installation the week of January 11, 1993. The associated NEXRAD site for the Houston ARTCC PUP is located in League City, TX.

REVIEWS AND MEETINGS

The visits, briefings, and reviews described below are necessary to successfully conduct the OT&E Operations evaluation of the NEXRAD PUP.

INITIAL SITE VISIT.

An initial visit to the Washington ARTCC CWSU was needed to obtain specific information necessary to conduct the evaluation. Information that was obtained included the number of meteorologists that will be participants, layout of the PUP area, display equipment being used, duty schedule of participants, etc. The information from this initial visit to the Washington ARTCC CWSU will suffice for both the Washington and the Houston ARTCC CWSUs since both sites are similar.

EVALUATION BRIEFING.

Briefings will be held at the CWSU to insure that the intent of the evaluation is conveyed, the logistics are understood, and the questionnaires are thoroughly explained. The FAA Technical Center ACW-200D, who will be conducting the briefing, will insure that each participant has been briefed and that all questions and concerns are addressed. The briefing will be held on an as needed basis so that all duty shifts are covered.

SCHEDULE

Initial visit Washington ARTCC/CWSU	November 19, 1992
Develop Evaluation Plan	December 1992, through January 1993
Prepare Evaluation Questionnaires	January 1993, through February 1993
Operational Evaluation Complete	March 1993
Test Summary	15 days after the evaluation
Final Report	May 15, 1993

NEXRAD PUP EVALUATION REQUIREMENTS MATRIX.

THE NEXRAD PUP requirements are contained in the NEXRAD Technical Requirements (NTR) and in the National Air Space (NAS) SS-1000. These requirements will be utilized to insure traceability from the NEXRAD OT&E Operational Test questionnaires to the NAS-SS-1000. A NEXRAD PUP OT&E Operational Test matrix has been developed to contain the specification references, requirements, and the evaluation questionnaire category under which it will be evaluated (appendix A).

ACRONYMS AND ABBREVIATIONS

AFOTEC	Air Force Operational Test and Evaluation Center
APMT	Associate Program Manager for Testing
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
CRT	Cathode Ray Tube
CWSU	Center Weather Service Unit
DOC	Department of Commerce
DOD	Department of Defense
DOT	Department of Transportation
DT&E	Development Test and Evaluation
FAA	Federal Aviation Administration
IOT&E	Initial Operational Test and Evaluation
MOA	Memorandum of Agreement
NAS	National Airspace System
NEXRAD	Next Generation Weather Radar
NPC	NEXRAD Program Council
NTR	NEXRAD Technical Requirements
NWS	National Weather Service
OSF	Operational Support Facility
OT&E	Operational Test and Evaluation
PUP	Principal Users Processor
RPG	Radar Product Generator
TEMP	Test and Evaluation Master Plan

APPENDIX A
NEXRAD ARTCC CWSU METEOROLOGIST
OT&E OPERATIONAL MATRIX

NEXRAD ARTCC CWSU METEOROLOGIST
OT&E OPERATIONAL MATRIX

NAS-SS-1000 VOLUME III	REQUIREMENT DESCRIPTION	QUESTIONNAIRE SECTION	REMARKS
3.2.1.2.4.1.5	Distribution of WX products.	section I	
3.2.1.2.4.1.7	Accept and process operational control.	section I	
3.2.1.2.4.1.8	Accept and process remote maintenance control.	section I	
NEXRAD TECHNICAL REQUIREMENTS (NTR)			
3.6	Training	section III	
3.7.3	PUP functional area requirements.	section II	
3.7.3.1	PUP display and data entry.	section II	
3.7.3.2	Product request.	section I	
3.7.3.3	Product display.	section I	
3.7.3.4	Local product storage.	section I	
3.7.3.5	FAA Product annotation and distribution.	section I	
3.7.3.6	PUP control.	section II	
3.7.3.7	Status monitoring	section III	
3.7.3.8	Archiving	section III	