ACQUISITION OF THE WEATHER AND RADAR PROCESSOR

Federal Aviation Administration

Report Number: AV-2002-084
Date Issued: February 28, 2002

Memorandum

U.S. Department of Transportation
Office of the Secretary
of Transportation
Office of Inspector General

Subject: ACTION: Report on Federal Aviation Administration's Acquisition of the Weather and Radar Processor
AV-2002-084

Date: February 28, 2002

From: Alexis M. Stefani
Assistant Inspector General for Auditing

Reply to Attn. of: JA-10:x60500

To: Federal Aviation Administrator

This report on the Federal Aviation Administration's (FAA) acquisition of aviation weather systems examines progress to date with the Weather and Radar Processor (WARP) program. WARP is a new weather system for en route centers that is intended to provide air traffic controllers (controllers), traffic managers, and meteorologists with accurate and reliable weather information. We met with FAA program officials during the week of January 28, 2002, and obtained oral comments to the report. FAA officials generally agreed with our results, and we have taken their comments into consideration in preparing this report.

Fielding new weather systems is important to increase capacity and enhance the margin of safety by providing controllers and pilots with more accurate and timely weather information. Today, controllers receive weather data from long range radars in the form of alphanumeric characters that are not always accurate—occasionally missing significant weather events and erroneously indicating weather that does not exist.

In June 1996, FAA awarded a contract to Harris Corporation for the development and implementation of WARP. FAA plans to invest $276.8 million[1] to acquire, field, and maintain WARP. Thus far, Congress provided $139.4 million for the program, which includes $24.2 million in fiscal year (FY) 2002. The initial stages of the program provided new weather systems for meteorologists and en route

[1] This funding includes $155.4 million from the Facilities and Equipment account and $121.4 million from the Operations account.

traffic managers. *The primary stage, installing WARP weather products on controller displays, remains to be completed.*

OBJECTIVE AND SCOPE

Our objective was to evaluate FAA's management of the WARP program with respect to cost, schedule, and performance. As part of our review, we assessed WARP program management areas that included system requirements; contracts and contractor performance; financial management; test and evaluation; software development; human factors; and logistic support. We also met with Department of Commerce's National Weather Service (NWS) and Department of Defense (DoD) officials to discuss their roles in coordinating and providing weather services to FAA.

We performed our work from July 2000 through December 2001 in accordance with Government Auditing Standards as prescribed by the Comptroller General of the United States. Exhibit A provides a detailed discussion of our audit scope and methodology. Exhibit B lists the offices we visited or contacted during the audit.

RESULTS IN BRIEF

WARP is expected to significantly improve the weather information on controller displays by providing accurate color graphics of weather on the same displays that controllers use to track aircraft, a capability that does not exist today. This could help reduce accidents and delays caused by uncertainty over the location and intensity of weather hazards.

FAA has experienced significant problems managing the development and deployment of WARP on *controller displays*—mostly due to human factors and technical problems. The current plan is to begin using WARP on controller displays at the first site, the Dallas/Ft. Worth en route center, in July 2002, over a 3-year delay. FAA plans to have WARP operational at all 21 en route centers by September 2002. Since 1995, the estimated cost of the program has increased from $227.8 million to $276.8 million, or 22 percent. *However, the current cost baseline is not realistic and the schedule is at risk.* We are recommending that, before additional funding is provided for WARP, FAA provide the Secretary and appropriate congressional committees with a credible cost and schedule baseline that reflects the effort to resolve controller human factors and technical problems, fix high priority trouble reports, and provide more timely weather updates to controllers.

One outcome of the September 11th terrorist attacks was FAA's decision to maintain long range radar. These radars are primarily surveillance radars for tracking aircraft, but they also collect limited weather information. If not for FAA's decision to maintain the long range radar, we believe that the WARP program would be in jeopardy. The decision to keep long range radar was made to ensure that FAA could locate aircraft with and without transponders. However, FAA's decision will also help mitigate some controller concerns with WARP by enhancing radar coverage and providing a back-up source for weather information. Further, FAA neither planned nor budgeted for the costs to sustain long range radar—these costs are significant and outside of the WARP program. Many of these radars have exceeded their useful life by 20 years, and FAA has begun to develop cost estimates to upgrade or replace the long range radar.

Despite the decision to maintain long range radar, FAA still faces significant challenges in installing WARP on controller displays without further material cost increases and schedule delays. These challenges include the following.

- ***Resolving National Air Traffic Controllers Association (NATCA) human factors and technical problems, especially those with safety implications.*** In September 2000, controllers identified a wide range of human factors and technical issues that have safety implications, such as improving the graphic presentation of weather information on controller displays. In the past 8 months, FAA has made progress on these human factors and technical problems. For example, a donut-shaped ring, called a "bull's-eye," unexpectedly appeared on controller displays after maintenance was performed on the weather radar. This ring could distract controllers, block their view of aircraft, or impede their ability to safely track the movement of aircraft. FAA is installing a software modification to keep the "bull's-eye" from appearing on controller displays.

  FAA still needs to complete actions to resolve eight human factors and technical problems. For example, controllers stated that they do not receive adequate indications on their display, such as a "system outage notification," when Next Generation Radars[2] (NEXRAD) are out of service. This leads to safety concerns that, in some instances, controllers could conclude there is clear weather, when in fact weather is not showing on their displays because a NEXRAD is out of service. An interim procedural solution is being put in place for traffic managers to verbally notify controllers when NEXRADs are out of service. However, FAA still needs to identify cost and schedule estimates to implement a long-term solution to this problem.

[2] NEXRAD is a tri-agency (NWS, DoD, and FAA) Doppler weather radar system that provides weather information for WARP on the location, intensity, and movement of hazardous weather activity. NEXRAD has historically been used to provide weather information for public safety, but FAA now intends to use weather data from these radars on the same displays that controllers use to manage air traffic.

- ***Identifying and fixing FAA high priority trouble reports.*** Trouble reports are generated primarily when software problems are found during testing of the system.[3] High priority trouble reports must be fixed by the contractor in order to meet system performance requirements. As of December 1, 2001, 354 of 703 trouble reports identified during testing since 1999 were not fixed. We found that the number of trouble reports has remained fairly constant with each test, with new problems appearing as quickly as others are corrected. Of the 354 open trouble reports, 56 are high priority. For example, one high priority trouble report addresses the fact that WARP is not able to restore a specified weather event from the archived files to support accident investigations. We note that FAA still needs to review and prioritize 259 trouble reports. Consequently, the true scope of the remaining software effort, in terms of time and cost, to fix high priority trouble reports is not known.

- ***Providing more timely weather updates to controllers.*** While NEXRAD will provide better weather information than controllers previously had with long range radar, it takes longer to get the data. FAA national airspace requirements state that weather information must be provided to controllers within 2 minutes once hazardous weather has been identified and must be maintained current to within 2 minutes. Currently, weather information from long range radar is provided to controllers approximately every 2 to 3 minutes.

  Weather information from NEXRAD is typically provided every 6 minutes, and tests conducted mainly at the Dallas/Ft. Worth en route center found that weather updates were as much as 14 minutes old. FAA officials point out that in the time-critical nature of air traffic control, these differences could have a safety impact. Further, since NEXRAD is a tri-agency radar, providing more timely weather updates will require coordination with NWS and DoD. FAA will likely need additional funding to provide more timely weather updates on controller displays.

RECOMMENDATIONS

The WARP program has merit because it will provide much-improved weather information on controller displays to enhance the flow of air traffic and improve safety. Our recommendations include that, before additional funding is provided for WARP, FAA develop a credible new cost and schedule baseline that is reflective of the effort to resolve the remaining NATCA human factors and technical problems, fix high priority FAA trouble reports, and provide more timely weather updates to en route controllers.

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[3] The WARP program also uses trouble reports as a method for system users to provide comments on WARP that could result in new requirements or procedural changes.

FAA's recent decision to keep long range radars has an important impact on the WARP program. However, many of these radars have exceeded their useful life by 20 years and must be upgraded or replaced. It is important to note that FAA has begun to develop cost estimates to upgrade or replace the long range radar. These costs could be substantial and will be funded outside of the WARP program. We have initiated a review of the long range radar program that will evaluate FAA's efforts to clearly define funding requirements and coordinate aircraft surveillance requirements with DoD and other Government agencies.

AGENCY COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

On January 22, 2002, we provided the draft report to the offices of the Associate Administrator for Research and Acquisitions, Associate Administrator for Air Traffic Services, and the Weather Integrated Product Team. We discussed the report with FAA officials from those offices, and they generally agreed with our finding. Further, FAA officials commented that corrective actions are already underway to address our concerns. FAA officials did not address our recommendation that future funding for WARP should be contingent on developing a credible new cost and schedule baseline that addresses the issues discussed in this report. We are requesting that FAA provide written comments to the final report that address all of our recommendations.

FINDING AND RECOMMENDATIONS

WARP is expected to significantly improve the weather information on controller displays by providing accurate color graphics of weather on the same displays that controllers use to track aircraft, a capability that does not exist today. This could help reduce accidents and delays caused by uncertainty over the location and intensity of weather hazards. These improvements are also being used to provide better weather information for new Free Flight technologies, such as the User Request Evaluation Tool.

FAA has experienced significant problems managing the development and deployment of WARP on controller displays. The current plan is to begin using WARP on controller displays at the first site, the Dallas/Ft. Worth en route center, in July 2002, over a 3-year delay. All 21 en route centers are planned to be operational by September 2002. Since 1995, the estimated cost of the program has increased from $227.8 million to $276.8 million, or 22 percent. However, FAA still faces challenges in installing WARP on controller displays without further material cost increases, and the schedule is at risk. Key challenges that must be met include:

(1) Resolving long-standing human factors and technical problems,

(2) Addressing the safety impacts of incorporating NEXRAD data on controller displays, and

(3) Clearly defining funding requirements to implement a cost-effective maintenance strategy.

FAA Must Address Long-Standing Human Factors and Technical Problems

In September 2000, controllers identified a wide range of human factors and technical issues that have safety implications, such as improving the graphic presentation of weather information on controller displays. In the past 8 months, FAA has made progress on these human factors and technical problems. For example, a donut-shaped ring, called a “bull’s-eye,” unexpectedly appeared on controller displays after maintenance was performed on the weather radar. This ring could distract controllers, block their view of aircraft, or impede their ability to safely track the movement of aircraft. FAA is installing a software modification that will keep the “bull’s-eye” from appearing on controller displays.

Examples of other NATCA human factors and technical problems include the need for an additional color intensity button on controller displays to better

distinguish weather products from aircraft, revised the terminology for weather intensity to be consistent with other FAA weather systems, and additional weather sensors—including sensors on the Canadian border—to improve the quality and reliability of the weather display. These concerns also have safety implications.

NATCA requested that FAA resolve six human factors and technical problems before installing WARP on any controller displays and that six problems be fully evaluated within 180 days after the first WARP weather products are operational on controller displays. Of the six problems that FAA needed to fix before WARP is installed on any controller displays, four problems are resolved, and interim solutions are being put in place for two concerns, including the NEXRAD outage notification described below.

WARP does not provide controllers adequate indications on their displays when a NEXRAD is out of service. This leads to safety concerns that, in some instances, a controller could conclude that there is clear weather, when in fact weather is not showing on a display because a NEXRAD is out of service. An interim procedural solution is being put in place for traffic managers to verbally notify controllers when NEXRADs are out of service. FAA still needs to identify cost and schedule estimates to implement a long-term solution to fix this problem.

FAA has not identified solutions to fix any of the six problems that were to be fully evaluated within 180 days after the first WARP weather products are operational on controller displays. Some of these problems have important safety implications, and FAA should not delay evaluating and identifying solutions to these problems. For example, controllers expressed concern that the NWS was filtering out NEXRAD weather data that were not considered useful to meteorologists. As a result, complete weather information might not be available to controllers in some areas, such as major arrival routes, where weather information is considered critical to air traffic operations. FAA needs to identify the cost and schedule estimates to implement solutions for the six problems that were to be fully evaluated within 180 days after the first WARP weather products are operational on controller displays.

Table 1 summarizes the status of the key human factors and technical problems raised by NATCA.

Table 1. Status of NATCA Concerns With WARP

Concern	Explanation of Concern	Status
Resolution Required Prior to Placing WARP on Controller Displays (Items 1-6)		
1. Bull's-Eye	A "donut-shaped" ring appears on controller displays when NEXRAD technicians perform certain maintenance tasks. If the bull's-eye is not removed, it can impede a controller's view of aircraft on the display.	Resolved
2. NEXRAD Status Banner (Outage Notification)	Controllers have no way of knowing when NEXRADs are out of service. Adding a NEXRAD status banner on controller displays could prevent a controller from concluding that there is clear weather, when in fact weather is not showing on the display because a NEXRAD is out of service.	Interim Solution
3. Coverage Maps	Some WARP coverage maps on controller displays show a 248 nautical mile coverage map, while other maps display a 124 nautical mile coverage map. Making all the coverage maps consistent would reduce misunderstandings by controllers in interpreting weather coverage areas.	Interim Solution
4. Graphic Intensity Setting	Adding an additional graphic intensity button would help controllers better distinguish the view of weather and aircraft on controller displays.	Resolved
5. Common Phraseology	WARP weather intensity is identified as three levels, which is inconsistent with the six levels of intensity provided by terminal and flight service station weather systems.	Resolved
6. Long Range Radar Data to Supplement NEXRAD Data	Keeping long range radar would provide additional coverage areas as well as a backup weather service for NEXRAD.	Resolved
Evaluation Required 180 Days After Placing WARP on Controller Displays (Items 7-12)		
7. Reduce 6-minute NEXRAD Scan	NEXRAD typically provides weather updates every 6 minutes. This update rate is too slow for air traffic operations.	Unresolved
8. Develop a Product for 24,000 Feet and Above	The 0 to 60,000 foot composite weather product includes too much ground clutter. Adding a 24,000 to 60,000 foot weather product would eliminate ground clutter on controller displays.	Unresolved
9. Integrate All Sensors Into WARP	Integrating additional weather sensors into WARP—including sensors on the Canadian border—would improve the quality and reliability of the weather display.	Unresolved
10. Incorporate WARP in the Host Computer Backup System	WARP is not considered a critical system and therefore not a redundant system. Incorporating WARP on the existing Host computer backup system would ensure that weather services are available if the Host computer fails.	Unresolved
11. Record WARP Data From Controller Displays	Recording WARP data from controller displays would make these data available during accident investigations.	Unresolved
12. Eliminate Product Filters by NWS	Individual NEXRAD sites determine what weather products to filter from the weather data collected. Controllers do not want the products filtered and are requesting that the NEXRAD sites deliver all aviation products.	Unresolved

Even if the 12 human factors and technical problems are resolved, it is likely that new problems will emerge—primarily due to limited operational testing of WARP weather products on controller displays. Since August 1999, there have been no

site tests of WARP weather products on controller displays other than a controller demonstration, which highlighted many of the 12 human factors and technical problems. Further, there have been 10 new software versions and each new version has had performance problems. Most recently, in October 2001, FAA shut down a software test at the Dallas/Ft. Worth en route center because there were so many performance problems with the software that testing could not be completed.

In addition, while FAA was effective in identifying system performance problems, 354 of 703 test trouble reports identified during testing were not fixed as of December 1, 2001. We found that the number of trouble reports has remained fairly constant, with each test resulting in new problems appearing as quickly as others are corrected.

Of the 354 open trouble reports, 56 are high priority. High priority trouble reports must be fixed by the contractor in order to meet system performance requirements. For example, WARP is not able to restore a specified weather event from the archived files to support accident investigations. Further, FAA still needs to review and prioritize 259 trouble reports. Consequently, the true scope of the remaining software effort, in terms of time and cost, to fix high priority trouble reports is not known.

Before any additional funding is provided for WARP, FAA should rebaseline the program to include the cost and schedule estimates to fix the unresolved NATCA human factors and technical problems and to close all FAA high priority trouble reports.

FAA Faces Challenges Incorporating NWS and DoD Weather Radars Into the National Airspace System

Today, en route controllers receive weather data on their displays from FAA-owned long range radars. These radars are primarily surveillance radars that are also used to collect limited weather intensity information. However, the weather data delivered by these radars are limited to two levels of intensity, show only coarse storm cells, and are not always accurate (that is, the radars often miss significant weather and erroneously indicate weather that does not exist). Figures 1 and 2 compare weather data from long range radars and NEXRADs.

Comparison of Long Range Radar and NEXRAD Weather Presentations [4]

Figure 1. Long Range Radar

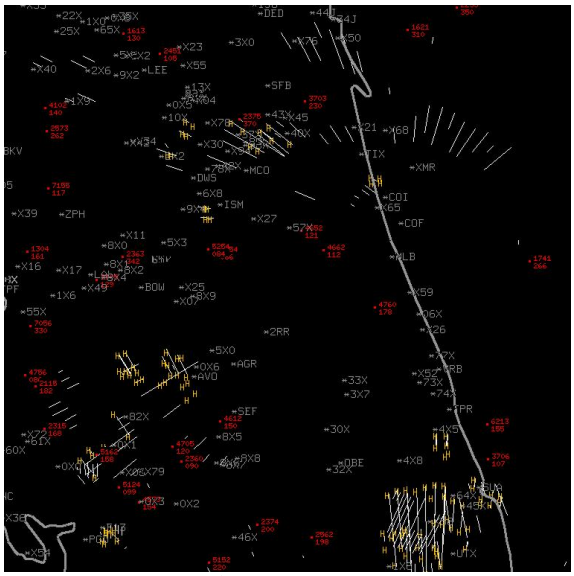
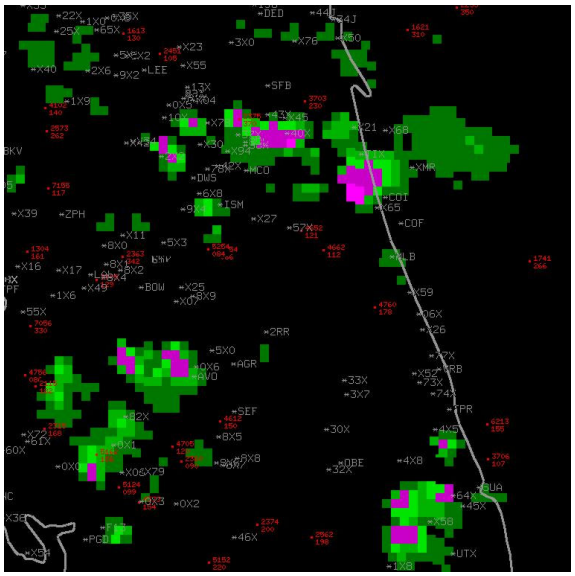


Figure 2. NEXRAD



Source: MITRE Corporation

WARP's performance, and overall acceptance by the controller workforce, is linked to using NEXRAD for detecting adverse weather. When FAA installs WARP weather products on controller displays, it now intends to rely primarily on NEXRADs to display weather products on the same screen controllers use to safely separate aircraft. NEXRAD is a tri-agency (NWS, DoD, and FAA) Doppler weather radar that will provide a better graphic representation of the location, intensity, and movement of hazardous weather. In relying on NEXRADs, FAA needs to address two key operational concerns:

- NEXRADs do not meet en route air traffic control requirements to provide current weather information within 2 minutes of when hazardous weather has been identified.

- Relying on NEXRAD to support air traffic control requires close coordination with the NWS and DoD to address limitations in the radars' reliability and coverage area.

Following September 11, FAA decided to maintain long range radar, which will provide an alternative source of weather information on controller displays. If not for FAA's decision to maintain the long range radar, we believe that the WARP

[4] These pictures are for comparison purposes only and may not accurately represent the controller's view. These pictures were prepared by MITRE Corporation to compare NEXRAD and long range radar data along the east coast of Florida.

program would be in jeopardy. FAA's decision has implications for the WARP program because it will help alleviate some controller concerns—which include using long range radar to enhance radar coverage and provide a backup source of weather information. While FAA's decision to maintain long range radar has mitigated some of the NEXRAD limitations, additional actions are needed to provide controllers more useful weather information.

NEXRADs do not meet National Airspace System requirements to provide current weather information within 2 minutes of when hazardous weather has been identified. While NEXRAD will provide better weather information than a controller previously had with long range radar, it takes longer to get the data. FAA National Airspace System requirements state that weather information must be provided to controllers within 2 minutes once hazardous weather has been identified and must be maintained current to within 2 minutes. Currently, long range radars provide weather information to controllers approximately every 2 to 3 minutes, which in some cases does not meet the National Airspace System requirement but is accepted by controllers. *When WARP weather products are used on controller displays, NEXRAD will typically provide weather updates every 6 minutes, and, in some cases, weather updates could be up to 14 minutes old.* FAA officials note that this issue is not unique to the WARP program and will affect other systems that rely on NEXRAD such as the Integrated Terminal Weather System.

During a test at the Seattle en route center, controllers reported that during fast moving weather fronts, the weather appeared to "jump" across their displays as the weather information was updated. Not only were the data old, but the weather "jumps" distracted controllers. FAA officials point out that in the time-critical nature of air traffic control, these differences are not trivial. Moreover, *the utility and operational aspects of providing weather information on controller displays are on a much tighter time constraint than for other Government users.* FAA will need to identify the additional funding it needs to provide more timely weather updates on controller displays.

The product team needs to coordinate with the NWS and DoD to address limitations in the radars' reliability and coverage area. NWS and DoD maintain 141 of 148 NEXRADs[5] that will provide weather information to support en route air traffic operations. NWS and DoD control how and when scheduled and unscheduled maintenance activities are performed. This is significant because *when WARP is deployed on controller displays, FAA will essentially place its trust in a weather radar over which it has little or no control.*

[5] FAA maintains seven NEXRADs that provide weather information for WARP.

The most significant safety risk to FAA of relying on NEXRAD is the potential loss of weather services, in which case controllers would be unable to relay important hazardous weather information to pilots. This condition is most significant in geographic areas that have a single, non-redundant NEXRAD coverage. Controllers have raised several important questions about the extent they could be held liable during weather related accidents.

At our request, the NWS provided a map that identified geographic areas that have only a single NEXRAD providing weather services, mostly west of the Mississippi River (see Exhibit C). We used the map provided by the NWS to identify radar units that could result in loss of weather services to FAA if there was a NEXRAD outage. We identified over 50 NEXRADs that provide weather services in a single, non-redundant coverage area.

We also analyzed NEXRAD availability data[6] from November 1997 through March 2001 and found 22 instances where single coverage NWS or DoD radar units did not meet the NEXRAD availability standard of 96 percent for over 2 consecutive months. This analysis identified radars where FAA is more vulnerable to losing NEXRAD weather data. Some of these radars impact large air routes around Dallas/Ft. Worth, Houston, and Washington, D.C. Table 2 provides examples of four sites that had low NEXRAD availability rates for 2 consecutive months or more.

Table 2. Examples of NEXRAD Sites With Low Availability

Site	Month/Year	Availability
Houston/Galveston, TX	June 1998	40.3%
	July 1998	83.0%
Cannon Air Force Base, NM	April 1999	72.5%
	May 1999	89.1%
	June 1999	69.1%
	July 1999	53.1%
Charleston, WV	February 2000	86.3%
	March 2000	89.9%
	September 2000	91.9%
	October 2000	88.7%
Glasgow, MT	September 2000	54.0%
	October 2000	69.4%

As controllers become more dependent on NEXRAD weather products to provide weather information to pilots, it is important to minimize disruptions to weather information that supports air traffic operations. Before FAA widely installs

[6] Availability is defined as the percentage of hours that the system was available for operations compared to the total facility operating hours.

WARP weather products on controller displays, it needs to coordinate with NWS and DoD to ensure that adequate resources and procedures are in place for using NEXRAD to support air traffic operations.

FAA Has Not Clearly Defined Funding Requirements to Implement a Cost-Effective Maintenance Strategy

FAA initially planned to use a combination of FAA technicians and contractor support to provide WARP system maintenance. Under the initial maintenance concept, FAA site technicians were responsible for on-site hardware maintenance, the FAA Logistics Center was responsible for depot maintenance, and the Harris Corporation was responsible for all software maintenance. However, questions have been raised about the cost-effectiveness of the WARP maintenance approach.

In August 1998, FAA conducted an operations and maintenance cost comparison to assess FAA maintenance support versus contractor maintenance support for WARP. The assessment concluded that FAA maintenance support was more cost-effective over the life of the WARP program. In August 1999, the WARP product team notified the Joint Resources Council (JRC) of its plans to implement an in-house maintenance strategy based on the operations and maintenance cost comparison and that additional funding would be needed. The JRC directed the product team to complete an A-76 study,[7] since it was proposing a change to the existing maintenance strategy—which was for contractor maintenance. When the study was completed, the product team was to return to the JRC for additional funding, if necessary. We found no evidence that the product team performed this review.

In October 2000, a WARP report showed that the product team still had not reached consensus on a maintenance strategy. In addition, the report found that the WARP program (1) lacked an operational remote maintenance capability by the contractor, (2) had unsatisfactory contract requirements to repair some WARP components, and (3) provided incomplete maintenance handbooks. FAA still needs to complete the A-76 study requested by the JRC and identify funding requirements to support the maintenance concept.

[7] Office of Management and Budget Circular A-76, "Performance of Commercial Activities," August 1983 (Revised 1999) states that the Government shall not start or carry on any activities (including maintenance) if the services can be procured more economically by a commercial source. A special review is required to compare the cost of in-house and contract services to determine who will do the work.

FAA Needs to Update the WARP Program Cost and Schedule Estimates

FAA has experienced significant problems managing the development and deployment of WARP on controller displays—mostly due to controller human factors and technical problems (which include software problems encountered during testing and system integration problems). WARP has also been impacted by moving the key testing site from Seattle to Dallas/Ft. Worth.

Since 1995, program costs have increased by $49 million, or 22 percent, and FAA has delayed fielding WARP on controller displays by over 3 years. Table 3 summarizes the cost and schedule changes for WARP.

Table 3. Cost and Schedule Changes for WARP

COST: (Funding in Millions)	**APB* 03/95**	**APB 12/96**	**APB 08/99**	**Program Estimate** 10/01**
Facilities and Equipment	$126.4	$126.4	$143.6	$155.4
Operations	$101.4	$101.4	$121.4	$121.4
Total	**$227.8**	**$227.8**	**$265.0**	**$276.8**
SCHEDULE:				
First Operational Readiness Date	06/99	09/99	10/00	07/02
Last Operational Readiness Date	02/00	02/00	02/01	9/02

* APB = Acquisition Program Baseline

** The JRC still needs to approve the latest program cost and schedule estimates.

FAA has not updated the WARP program baseline since August 1999 and has materially breached both the cost and schedule baselines. Currently, FAA intends to begin using WARP on controller displays in July 2002. However, FAA faces challenges that could result in additional cost increases or schedule delays before WARP weather products are installed on controller displays. These challenges include fixing human factors and technical problems, providing more timely weather updates to controllers, and identifying funding requirements to implement a cost-effective maintenance strategy. Consequently, the October 2001 estimates need to be revised.

RECOMMENDATIONS

The WARP program has merit because it will provide much-improved weather information on controller displays to enhance the flow of air traffic and improve safety. We recommend that FAA:

1. Develop a credible new cost and schedule baseline *before* additional funding is provided for WARP that reflects the effort to:

   - Resolve the remaining NATCA human factors and technical problems,
   - Identify and fix all FAA high priority trouble reports,
   - Provide more timely weather updates to en route controllers, and
   - Clearly define funding requirements to implement a cost-effective maintenance strategy.

   This information should be provided to the Secretary and appropriate congressional committees.

2. Implement procedures with NWS and DoD to coordinate NEXRAD maintenance activities.

AGENCY COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

On January 22, 2002, we provided a draft of this report to the offices of the Associate Administrator for Research and Acquisitions, Associate Administrator for Air Traffic Services, and the Weather Integrated Product Team. We discussed the report with FAA officials from those offices, and they generally agreed with the finding.

FAA officials stated that corrective actions are underway to address our concerns. Specifically, FAA and NATCA have established a working group to resolve the remaining controller issues, and the first meeting is scheduled for March 2002. FAA also signed a tri-agency memorandum of understanding to improve coordination of maintenance activities with NWS and DoD. Lastly, by March 2002, FAA plans to complete a cost comparison of maintaining WARP through contractor versus FAA maintenance.

FAA officials agree that keeping long range radar may help mitigate some of the unresolved controller concerns. However, FAA officials also cautioned that new issues could emerge as controllers begin using the new weather information on their displays. This is because controllers have little hands-on experience using accurate color graphics of weather on the same displays that they use to manage traffic.

Agency officials also stated that since NEXRAD is a tri-agency radar, FAA has a limited ability to dictate changes to the system. FAA officials stated that they have initiated some actions, in coordination with the NWS and DoD, to identify ways to reduce the time it takes to provide controllers weather information.

The actions promised by FAA officials are a step in the right direction. However, FAA officials did not address our recommendation that future funding for WARP should be contingent on developing a credible new cost and schedule baseline that addresses the issues discussed in this report.

ACTION REQUIRED

In accordance with Department of Transportation Order 8000.1C, we would appreciate receiving your written comments within 30 days. If you concur with our finding and recommendations, please indicate for each recommendation the specific action taken or planned and the target dates for completion. If you do not concur, please provide your rationale. Furthermore, you may provide alternative courses of action that you believe would resolve the problems presented in this report.

We appreciate the cooperation and assistance provided by your staff during the review. If you have any questions or need further assistance, please contact me at (202) 366-1992, or David A. Dobbs, Deputy Assistant Inspector General for Aviation, at (202) 366-0500.

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EXHIBIT A. AUDIT SCOPE AND METHODOLOGY

We performed audit work from July 2000 through December 2001 and reviewed documentation dated from November 1990 through December 2001 covering all aspects of the WARP program. We revised our original objectives and are not reporting on the Integrated Terminal Weather System at this time. This review was performed in accordance with Government Auditing Standards as prescribed by the Comptroller General of the United States.

Since WARP is in the solution implementation phase of FAA's acquisition process, we concentrated our review on whether FAA was effectively and efficiently preparing the system to support a decision to deploy WARP at all en route centers. To evaluate whether FAA was effectively managing the WARP program, we assessed program management areas that included system requirements; contracts and contractor performance; financial management; test and evaluation; software development; human factors; and logistic support.

Key program documents we examined included the mission need statement, operational requirements document, acquisition plan, acquisition program baseline, test and evaluation master plan, test reports, logistic support plans, the prime contract, and all contract modifications. We interviewed the key personnel responsible for developing and implementing these plans.

We also evaluated key program status report documents that included monthly program status reports, team meeting minutes, JRC decisions, and acquisition reviews. These reports were used to identify, track, and evaluate program cost, schedule, and performance risks.

To assess the key risks associated with using NEXRAD for air traffic, we analyzed monthly system performance data for 141 NEXRADs for the period November 1997 through March 2001.

EXHIBIT B. OFFICES VISITED OR CONTACTED

In conducting our review, we visited or contacted the following offices:

FAA Offices

FAA Headquarters, Washington, DC
FAA Southwest Region, Ft. Worth, TX
FAA William J. Hughes Technical Center, Atlantic City, NJ
Air Traffic Control System Command Center, Herndon, VA
Dallas/Ft. Worth Air Route Traffic Control Center, Ft. Worth, TX
Seattle Air Route Traffic Control Center, Seattle, WA

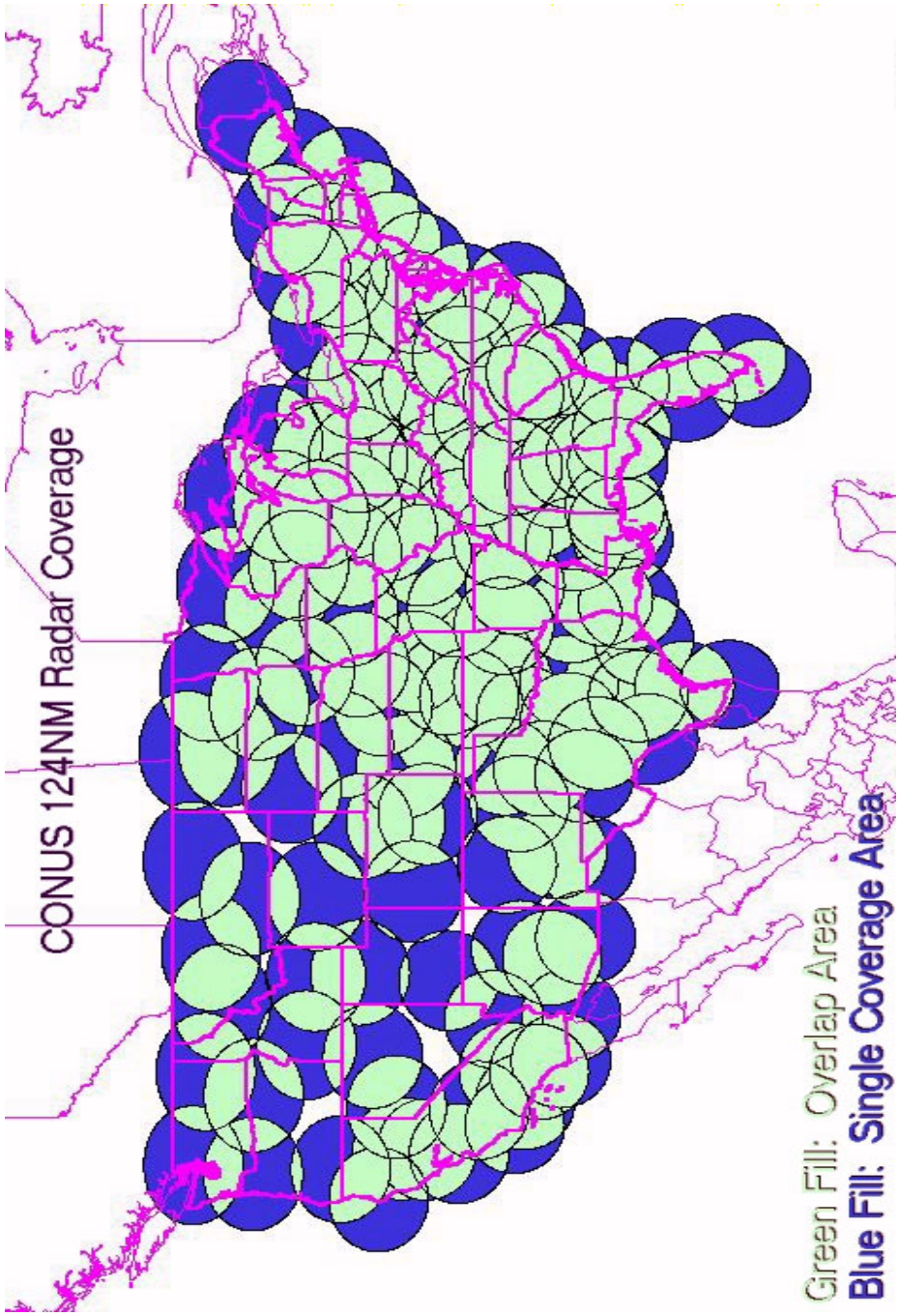
Non-FAA Offices

National Center for Atmospheric Research, Boulder, CO
National Weather Service Radar Operations Center, Oklahoma City, OK
National Weather Service Office of Climate, Water, and Weather Services, Kansas City, MO
Scott Air Force Base, U.S Air Force, Belleville, IL
Harris Corporation, Melbourne, FL
Massachusetts Institute of Technology, Lincoln Laboratory, Boston, MA
MITRE Corporation, Mclean, VA
TRW, Washington, DC

Unions and Associations

Air Line Pilots Association, Herndon, VA
National Air Traffic Controllers Association, Washington, DC
Professional Airways Systems Specialists, Washington, DC

EXHIBIT C. NEXRAD COVERAGE MAP



Source: National Weather Service (Coverage map at 12,000 ft.)
CONUS – Continental United States
NM – Nautical Miles

Exhibit C. NEXRAD Coverage Map

EXHIBIT D. MAJOR CONTRIBUTORS TO THIS REPORT

THE FOLLOWING OFFICE OF INSPECTOR GENERAL STAFF CONTRIBUTED TO THIS REPORT.

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Sam Vass	Senior Auditor
Richard Payne	Program Analyst
Catherine Aubrey	Program Analyst
Shirley Murphy	Editor