



*U.S. DEPARTMENT OF COMMERCE
Office of Inspector General*



*National Oceanic and
Atmospheric Administration*

*NWS Weather Forecast Offices Generally
Perform Well, but Regional Oversight and
Management at Some Offices
Need to be Improved*

Final Inspection Report No. IPE-14577/September 2002

**PUBLIC
RELEASE**

Office of Inspections and Program Evaluations

SEP 30 2002



UNITED STATES DEPARTMENT OF COMMERCE
The Inspector General
Washington, D.C. 20230

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FROM: Johnnie E. Frazier

A handwritten signature in cursive script, reading "Johnnie E. Frazier".

SUBJECT: Final Inspection Report: *NWS Weather Forecast Offices Generally Perform Well, but Regional Oversight and Management at Some Offices Need to be Improved* (IPE-14577)

As a follow-up to our August 21, 2002, draft report, this is our final report on the inspection of crosscutting issues at 14 Weather Forecast Offices (WFOs) within the National Weather Service. The report includes comments from NOAA's written response. A copy of this response is included in its entirety as an attachment to the report.

Overall, we found that the 14 WFOs we reviewed provide reliable and timely weather products and services. We also found improvements were made during the time we conducted our reviews. For example, a noteworthy improvement has been made in the WFOs' management of their information technology resources. We are especially pleased to see that NWS has called for increased regional oversight of the WFOs as a result of our initial reviews. However, we still have several concerns about the administrative operations of a few WFOs and the frequency and thoroughness of oversight reviews performed by the regional offices. Included within this review is an update on the progress of the four WFOs that were the subject of earlier OIG inspection reports issued over the past two years. Based on our findings from those WFO inspections, our survey of the 10 additional WFOs focused on many of the same issues. Overall, the WFOs in this review exhibited a number of the same strengths and weaknesses that were discussed in the earlier inspection reports.

We appreciate receiving an initial action plan addressing the recommendations along with your response to the draft report. Please provide us with an updated action plan on all open recommendations within 60 calendar days.

We thank the personnel in NWS headquarters, regions, and the individual WFOs for the assistance and courtesies extended to us during our review. If you have any questions about our report or the requested action plan, please contact me on (202) 482-4661, or Jill Gross, Assistant Inspector General for Inspections and Program Evaluations, on (202) 482-2754.

Attachment

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EXECUTIVE SUMMARY

The National Weather Service, an agency of the National Oceanic and Atmospheric Administration, operates 121 weather forecast offices (WFOs) nationwide. Each WFO issues general weather forecasts and warnings of severe weather—such as tornadoes, severe thunderstorms, floods, hurricanes, and extreme winter weather—for its assigned county warning area. WFOs use both technology—radar, satellite, and automated surface observing systems—and professional staff to prepare forecasts and issue warnings and to help ensure the provision of timely and accurate weather information to the citizens in their county warning areas.

During 2000 and 2001, the Office of Inspector General conducted comprehensive inspections of 4 WFOs—Raleigh, North Carolina; San Angelo, Texas; Missoula, Montana; and Chanhassen, Minnesota—to determine how effectively the WFOs (1) delivered warnings, forecasts, and other information to their service users; (2) coordinated their activities with state and local emergency managers; (3) managed their network of volunteer observers and spotters; and (4) managed their resources and maintained adequate administrative controls to comply with Department of Commerce, NOAA, and NWS policies and procedures. We also evaluated NWS's regional oversight of its WFOs. Our overall assessment of the WFOs we evaluated was that they generally provide effective weather products and services but need to improve administrative operations and oversight. They also need regular and consistent attention from NWS regional and WFO managers to ensure adherence to Commerce and federal administrative guidelines. To determine whether the issues we identified for these 4 WFOs were applicable to other weather offices, we conducted limited reviews of 10 additional WFOs (shown in the box below) from all six NWS regions from September 2001 through March 2002.

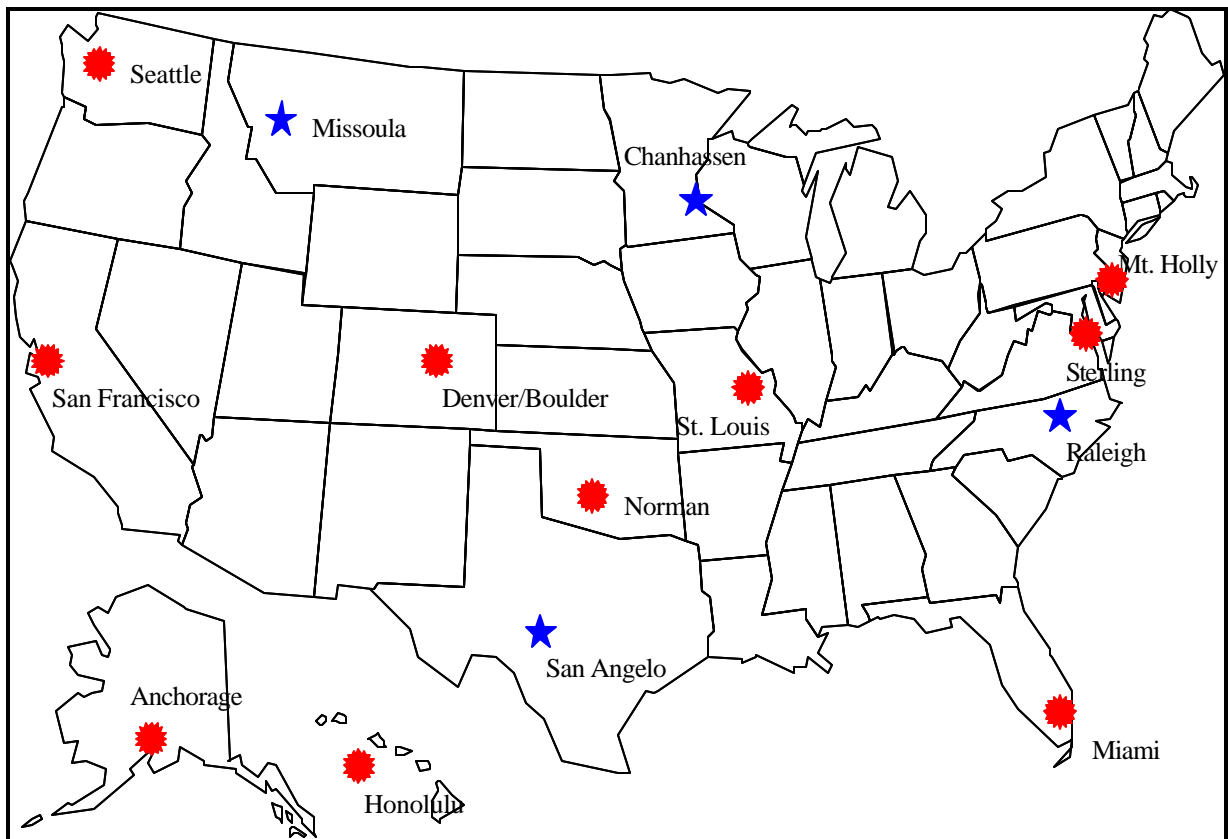
This report presents our crosscutting observations and recommendations based on our review of all 14 WFOs, including updated information on our comprehensive inspections of 4 WFOs.

The 10 Additional WFOs Reviewed		
<u>Eastern Region</u> Mt. Holly, New Jersey Sterling, Virginia	<u>Central Region</u> Denver/Boulder, Colorado St. Louis, Missouri	<u>Southern Region</u> Miami, Florida Norman, Oklahoma
<u>Western Region</u> San Francisco, California Seattle, Washington	<u>Alaska Region</u> Anchorage, Alaska	<u>Pacific Region</u> Honolulu, Hawaii

In performing the initial 4 WFO inspections, we examined pertinent weather office records and documents and interviewed WFO staff. We also interviewed four regional directors and some of their staff as well as Department of Commerce and federal, state, and local government officials, including emergency managers. In addition, we spoke with private-sector representatives involved in meteorological activities to obtain their assessment of

WFO services and to solicit any suggestions they had for improving the dissemination of their local WFO's critical information. In conducting this crosscutting review, we followed up with the first four WFOs to update information on their office's performance in the seven major program areas discussed in this report. In performing our limited review of the 10 additional WFOs, we conducted in-depth telephone interviews with the managers of six offices and conducted brief visits to four offices, in addition to follow-up telephone interviews. These reviews also included an assessment of the offices' forecasting statistics and compliance with NWS procedures, but we did not look at physical inventories of accountable property. We also did not interview local or state officials, other partners and the Skywarn or Cooperative Observer Program volunteers at the 10 additional WFOs. Shown below in Figure 1 are the locations of the first four WFO inspections, and the 10 additional WFOs at which we conducted limited reviews.

Figure 1: Locations of WFOs Included in This Review



Source: Office of Inspector General.

Legend:

- ★ WFOs at which OIG performed comprehensive inspections.
- ★ WFOs at which OIG performed brief on-site reviews in addition to an assessment of offices' forecasting statistics and compliance with NWS procedures.

Table 1: WFO Performance in Major Programs, Management and Administrative Areas

	Forecasting (based on NWS FY01 data)	Outreach	Skywarn & Cooperative Observer Programs	Training	Information Technology	Administrative Operations	Regional Oversight
Comprehensive WFO Inspections:							
Chanhassen	G	S	G	G	S	NI	P
Missoula	NI	G	S	G	S	NI	NI
Raleigh	S	S	S	S	S	NI	NI
San Angelo	S	G	G	G	S	NI	NI
Limited WFO Inspections:							
Anchorage	G	G	NI	G	S	S	NI
Denver/Boulder	NI	S	G	NI	S	NI	NI
Honolulu	S	G	G	S	S	NI	P
Miami	NI	G	S	G	S	NI	NI
Mount Holly	S	S	G	S	S	NI	S
Norman	S	S	S	S	S	NI	NI
St. Louis	G	S	G	S	S	NI	NI
San Francisco	S	G	G	G	S	NI	P
Seattle	G	S	G	G	S	NI	NI
Sterling	NI	S	S	S	S	NI	NI
<p>LEGEND: G = Good S = Satisfactory NI = Needs Improvement P = Poor</p> <p>Forecasting (severe storms, winter weather, probability of precipitation, aviation weather, hydrology, and fire weather) G – More than 80 percent of verification statistics are above or within 10 percent of the regional averages. S – From 70 to 80 percent of verification statistics are above or within 10 percent of the regional averages. NI – Less than 70 percent of verification statistics are above or within 10 percent of the regional averages.</p> <p>Outreach (public/partner liaison and feedback, technical education, constituency building, and recruitment) Skywarn & Cooperative Observer Programs (area coverage, recruitment, training, newsletters, site visits, and full spares kits) Training (training plan, IDPs, one-on-one training, WES, IFPS training, and research) Information Technology (IT oversight, documentation, controls and procedures, and maintenance) Administrative Operations (purchase cards, convenience checks, accountable property, and government vehicles) G – Office met or exceeded all requirements in each program area. S – Office met all but 1 requirement in each program area. NI – Office met all but 2 requirements in each program area. P – Office did not meet any requirements in each program area.</p> <p>Regional Oversight (includes station inspections and administrative reviews) G – Regional office performed all required and recommended station inspections and administrative reviews in the last 3 years. S – Regional office has performed at least 1 station inspection and 1 administrative review in the last 3 years. NI – Regional office has performed at least 1 station inspection or administrative review in the last 3 years. P – Regional office did not perform any station inspections or administrative reviews in the last 3 years.</p>							

Source: Office of Inspector General.

To assess the performance of all 14 offices, our review covered the seven major areas of office operations as defined by NWS: (1) forecasting, (2) outreach, (3) the Skywarn¹ and Cooperative Observer² programs, (4) staff training, (5) information technology operations,

¹ NWS's Skywarn Program is part of a nationwide effort to train volunteer spotters to provide WFOs with timely and accurate eyewitness reports of severe weather.

(6) office management and administration, and (7) regional oversight. In Table 1, we present our summary of the performance of each office in these seven areas. Our assumptions and the basis for our ratings are discussed further in each of the respective report sections.

We found the WFOs to be generally effective in carrying out their core mission of forecasting the weather and issuing weather products (such as forecasts, warnings, and advisories).

- 1. Forecasting is generally effective.** Based on our review of NWS verification statistics,³ we found that most of the 14 offices have produced generally reliable and timely forecast products. WFO personnel believe they are able to accomplish their mission because of the commitment of office staff, different approaches to forecasting, and effective use of the Console Replacement System⁴ to reach the public, local emergency managers, the media, and other users. By evaluating fiscal year 2001 statistics for severe storms, winter weather, probability of precipitation, aviation weather, hydrology, and fire weather, we found that 10 of the 14 offices had very good or satisfactory verification statistics. However, 4 offices generated some statistics lower than regional averages. This warrants attention by WFO and regional personnel. Although one-year statistics are not necessarily a true indicator of an office's long-term performance, the regional office and each WFO can determine whether its current statistics are merely an anomaly or an indication of an ongoing trend that may need correction (see page 6).
- 2. Outreach efforts are effective.** We found that all 14 WFOs effectively implement NWS outreach initiatives as well as their own individual outreach plans. The WFOs work with local officials and the media to help educate citizens and warn them of severe weather events. We interviewed public officials, including state, county, or other local emergency managers in Raleigh, San Angelo, Missoula, and Chanhassen. They all responded positively about their interaction with the WFOs and the quality of services they received. Although we did not interview local or state officials, other partners and community groups at the 10 additional WFOs, officials at those sites did report on the various activities they conduct in support of the NWS outreach initiative and their own WFO's outreach plan. We also found that the WFOs reach out to schools and community groups to increase awareness of meteorology and weather safety (see page 17).
- 3. Skywarn and Cooperative Observer Programs are well run.** The WFOs we reviewed, with the exception of Anchorage, conduct generally well-run programs for their Skywarn spotters and cooperative observers. Anchorage, however, faces formidable challenges because of the size and remoteness of its warning area and the harshness of its winters. We were told that the office lacks sufficient budgetary resources to charter

² NWS's Cooperative Observer Program uses volunteers to provide daily weather measurements, including rainfall and snowfall amounts.

³ NWS's verification process matches warnings to actual weather observations and compiles statistical results of forecasting performance.

⁴ The Console Replacement System is a relatively new personal computer-based broadcasting console installed at each WFO. It automatically translates written NWS forecasts and warnings into synthesized voice broadcasts over NOAA Weather Radio, a nationwide network of radio transmitters broadcasting continuous weather information directly from WFOs across the country.

additional aircraft to cover its area satisfactorily during the limited fair weather months. Although we did not interview local or state officials, other partners, and the Skywarn or Cooperative Observer Program volunteers at the 10 additional WFOs, we did interview the individuals responsible for these programs at each office. They reported on the scope of their programs, including their area coverage, recruitment and training of volunteers, and outreach efforts to the volunteer community (see page 19).

4. Staff training is generally good, but research efforts may need more emphasis.

Although the WFOs are conducting in-house training through their science and operations officers, progress on office-wide training plans and individual development plans (IDPs) is lagging. For example, 7 of the 14 offices did not have IDPs in place for all of their employees, and the Denver/Boulder office did not have an office-wide training plan, although its office managers reportedly do counsel employees about training and career advancement opportunities periodically. It is important to note that we have seen improvements in this area. For example, at the time of our inspection at San Angelo, the office did not have individual development plans in place, but now it does. The WFOs, for the most part, should be on track with their staff training objectives by the end of fiscal year 2002, when individual development plans for each employee are scheduled to be completed.

As far as staff research projects are concerned, we found that although the NWS encourages WFOs to conduct some form of operational or applied research, WFO research varies according to the emphasis each office places on promoting its staff's research efforts. Only 6 WFOs appeared to have particularly active research agendas (see page 26).

5. Information technology (IT) operations are improving. When we began inspecting WFOs in early 2000, none of the 121 WFOs had prepared required security documentation, and some office personnel were not aware of and not following NWS policies on IT security. Now, at all 14 WFOs we reviewed, IT security documentation has been completed, and IT oversight is performed regularly. Specifically, since 2000, office IT personnel have (1) been assigned to oversee security issues, (2) prepared almost all of the required IT security documentation, (3) implemented IT controls and procedures, and (4) adequately maintained office IT systems (see page 31).

6. Administrative and management operations need tighter internal controls. Our review of WFOs' administrative and management operations covered their use of purchase cards and convenience checks, accountable property, and government vehicles. The inspection reports of Raleigh, San Angelo, Missoula, and Chanhassen also assessed whether WFO managers were adequately overseeing administrative operations. Based on responses to our interview questions made by NWS officials at the other 10 WFOs, we found that most of these offices have weak internal controls over the use of the purchase cards, convenience checks, and vehicles and inadequate maintenance of accountable property records, potentially making the WFOs vulnerable to theft and waste of government resources. However, since our Raleigh review in February 2000, several WFOs improved their administrative operations by reducing the number of purchase

cardholders and tightening controls over accountable property and government vehicles. Regional office oversight has also been improved in many areas. NWS has created an implementation checklist to be used by regional managers to review WFOs' operational integrity, including compliance with policies, internal controls, information technology, facilities, and human and other resource management. We also attribute these positive results to the NWS Assistant Administrator's decision to disseminate our report on the Raleigh WFO, and our subsequent WFO reports, to all WFOs, and to caution WFO managers to improve their operations and procedures as necessary. We still, however, have several concerns about the administrative operations of a few WFOs (see page 37).

- 7. Regional oversight should be improved.** Although the 14 WFOs generally provide effective weather products and services, their history of infrequent regional oversight and our discovery of some administrative deficiencies at some of the WFOs call for prompt attention by NWS regional and WFO managers. NWS regional offices are responsible for providing WFOs with management support and oversight, yet NWS regional offices have failed to conduct regular reviews of their WFOs' management, program, technical, and administrative operations on a consistent basis. In addition, only eight annual station inspections have been conducted since fiscal year 2000, contrary to NWS requirements for 12-month and 18-month inspections, depending on the weather program under review. The apparent lack of oversight has contributed to the nature of the administrative and operational deficiencies within some of the 4 WFOs at which we conducted comprehensive inspections, including improper purchase card and convenience check transactions, inaccurate inventory records, and incomplete station duty manuals. For the 10 WFOs at which we conducted limited reviews, our concern about the need for increased regional oversight is not based solely on the fact that we found administrative problems, but also takes into consideration each regional office's record of station inspections and administrative reviews of their respective WFOs (see page 49).



It also should be noted that as a result of our inspection reports of Raleigh (September 2000) and San Angelo (June 2001), the NWS Assistant Administrator formed a team of eight WFO meteorologists-in-charge (MICs) to recommend techniques for improving WFO operations in five specific areas: cooperative observer network management, Skywarn training, staff training, quality control, and forecast operations. The team conducted its work from September 2000 through August 2001. It had contacts and meetings with program managers in NWS's eastern, central, southern, and western regions and identified specific suggestions and best practices for each of the five areas of review. For example, the characteristics of a successful cooperative observer program included strong support from the MIC, sharing of the workload among the WFO staff, and keeping cooperative observers involved through personal visits and newsletters. NWS provided the results of its review to all regional personnel and posted best-practices information on its web site.

Although we did not evaluate the methodology and findings of the NWS team, we did find positive results of the team's efforts in the WFOs we subsequently reviewed. For example, the Skywarn and Cooperative Observer programs, for the most part, were very well run.

Similarly, we found an increased emphasis on staff training and development throughout the WFOs. We believe that many of the improvements we noted resulted from lessons learned or best practices outlined in our first four WFO inspections as well as in the results of NWS's team review that were sent to all regional personnel, and subsequently shared with their WFOs. We applaud the National Weather Service's efforts to strengthen its management oversight of the WFOs and encourage it to ensure that station inspections, administrative reviews, and follow-up reviews of WFOs are conducted by all NWS regions on a regular basis.

On page 52, we offer a series of recommendations to the NWS Assistant Administrator to address concerns raised in this report.

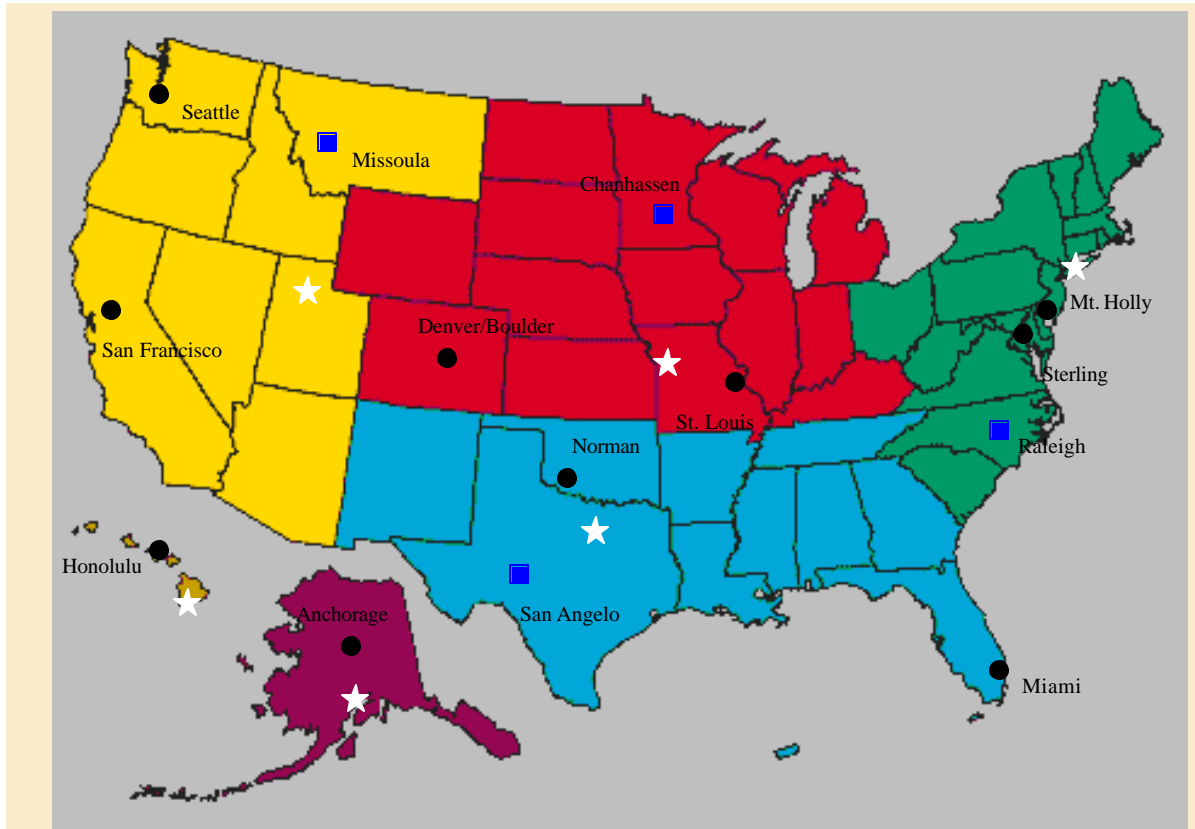


In response to our draft report, NWS fully concurred with 11 recommendations and partially concurred with 2 recommendations. NWS officials stated that they have developed an implementation schedule for all 13 recommendations.

INTRODUCTION

Pursuant to the authority of the Inspector General Act of 1978, as amended, the Office of Inspector General conducted inspections of 14 National Weather Service (NWS) weather forecast offices (WFOs). Originally, we conducted full inspections of four WFOs, one in each of the four NWS regions in the lower 48 states (see Figure 2 map).

Figure 2: National Weather Service Field Offices



For administrative purposes, the NWS divides the United States and its territories into regions. Each region has a headquarters office that oversees the NWS field offices within that region:

- WFOs at which OIG performed completed inspections.
- WFOs at which OIG telephoned and/or conducted brief on-site reviews.
- ★ Regional Offices

Pacific Region: Hawaii and Guam; Independent Island Countries in free association with the U.S.

Central Region: Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Wisconsin, Wyoming

Western Region: Arizona, California, Idaho, Montana, Nevada, Oregon, Utah, Washington

Alaska Region: Alaska

Eastern Region: Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, West Virginia

Southern Region: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, New Mexico, Oklahoma, Puerto Rico, Tennessee, Texas

Source: NWS Website and Office of Inspector General.

From February 2000 through November 2001, we performed one-week inspections at Raleigh, North Carolina; San Angelo, Texas; Missoula, Montana; and Chanhassen, Minnesota (see Figure 2 photos).¹ Subsequently, we selected 10 additional offices from all six NWS regions for a more limited review to determine the prevalence of similar issues in other WFOs. This report outlines crosscutting issues that we identified based on data and observations from all 14 offices, with updated information on the original 4 inspections.

Inspections are special reviews that OIG undertakes to provide agency managers with timely information about operations including current and foreseeable problems. By highlighting problems, the OIG hopes to help managers move quickly to address them and to avoid similar problems in the future. The inspections are also conducted to identify and prevent fraud, waste, and abuse in federal government programs and encourage effective, efficient and economical operations. Inspections may also highlight effective programs or operations, particularly if their success may be useful or adaptable for agency managers or program operations elsewhere.

The inspections that constitute this review were conducted in accordance with the *Quality Standards for Inspections* issued by the President's Council on Integrity and Efficiency. During our reviews and at their conclusion, we discussed our findings with applicable WFO meteorologists-in-charge (MICs); the directors of NWS's eastern, southern, central, and western regions; other NOAA senior managers; and the assistant administrator for NWS.

OBJECTIVES, SCOPE, AND METHODOLOGY

The objectives of our inspections and limited reviews were to determine how effectively the WFOs (1) deliver warnings, forecasts, and other information to their service users including the general public; (2) coordinate their activities with state and local emergency managers; (3) manage their network of observers and volunteer spotters; and (4) handle their management and administrative operations in compliance with Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), and NWS policies and procedures. We also assessed the effectiveness of NWS's regional oversight of WFO operations and programs.

In addition to the 4 WFOs named above, we conducted limited reviews of 10 more WFOs: San Francisco, California; Seattle, Washington; Sterling, Virginia; Mt. Holly, New Jersey; St. Louis, Missouri; Denver/Boulder, Colorado; Anchorage, Alaska; Miami, Florida; Norman, Oklahoma; and Honolulu, Hawaii.

For our review of all 14 WFOs, we focused on seven performance areas: weather forecasting, office outreach, the Skywarn and Cooperative Observer programs, staff training and applied research, information technology operations, administrative and management operations, and regional oversight. From September 2001 through March 2002, we visited or telephoned the 10

¹ (1) *Raleigh Weather Forecast Office Provides Valuable Services but Needs Improved Management and Internal Controls*, Final Inspection Report No. IPE-12661, Office of Inspector General, September 2000, (2) *San Angelo Weather Forecast Office Performs Its Core Responsibilities Well, but Office Management and Regional Oversight Need Improvement*, Final Inspection Report No. IPE-13531, Office of Inspector General, June 2001, (3) *Missoula Weather Forecast Office Generally Provides Quality Service to Its County Warning Area*, Final Inspection Report No. IPE-14225, Office of Inspector General, September 2001, and (4) *Chanhassen Weather Forecast Office Generally Provides Effective Forecasts, but Office Management and Regional Oversight Need Improvement*, Final Inspection Report No. IPE-14423, Office of Inspector General, March 2002.

additional WFOs, assessing each using a checklist of issues compiled from our first four inspections. These limited reviews included an assessment of the offices' forecasting statistics and compliance with NWS procedures, but we did not look at physical inventories of accountable property. We also did not interview local or state officials, other partners and the Skywarn or Cooperative Observer Program volunteers at the 10 additional WFOs.

Figure 3: The 4 WFOs where comprehensive inspections were conducted (clockwise from top left): Raleigh, San Angelo, Missoula, and Chanhassen.



Source: Office of Inspector General.

In performing our reviews of the first four WFOs, we examined pertinent records and documents and interviewed available staff. We also interviewed the eastern, southern, central, and western regional directors and other regional staff, and interviewed many representatives from the Department of Commerce and other federal, state, and local government agencies. In addition, we spoke with individuals outside of government who are involved in meteorological activities and work closely with WFO staffs, to obtain their assessment of the services provided by the WFOs as well as to elicit any suggestions they had for improving WFOs' dissemination of critical weather information.

BACKGROUND

NWS, an agency of NOAA, operates 121 WFOs nationwide. Each office issues local weather forecasts and warnings of severe weather—such as tornadoes, severe thunderstorms, floods, hurricanes, and extreme winter weather—for its assigned county warning area. These offices, where applicable, also support NWS’s marine, aviation, and climatic data collection and prepare guidance for the fire weather program, which supports federal lands management and wildfire control. Each office has various personnel with specific responsibilities to help the WFO fulfill its mission, as outlined in Table 2.

Table 2: WFO Personnel and Responsibilities

Office Personnel	Responsibilities
Meteorologist-In-Charge	Oversees all aspects of office operations in accordance with NWS policies and procedures.
Warning Coordination Meteorologist	Serves as the liaison between offices and users of office products and services in an office’s county warning area; conducts outreach activities to educate users on all office products and services; manages the preparedness programs for their local areas, including preparing users for all local hazards; and provides direction, instructions, and assistance to office staff in conducting office operations.
Science and Operations Officer	Serves as the technical director and principal scientific advisor to the MIC and office staff; and ensures that any scientific advances are incorporated into office operations and they also plan and implement office training programs.
Data Acquisition Program Manager	Manages office data network activities including collecting, quality controlling, and disseminating data.
Electronic Systems Analyst	Manages office computer systems including hardware and software and sets priorities for equipment repair for all office-owned equipment.
Lead Forecaster	Performs as shift leader and is responsible for all products issued by offices during his or her operational shift.
Journeyman Forecaster	Produces all operational office products including routine and non-routine forecasts, warnings, and statements.
Electronic Technician	Supports the day-to-day maintenance of WFO equipment.
Hydrometeorological Technician	Aids meteorologists on duty, typically handling public service requests and performing data collection and quality control.
Administrative Support Assistant	Oversees office administrative operations and responds to user inquiries.
Meteorologist Intern	Assists office forecasters with office programs and operational products.

Source: NWS Office Position Descriptions.

WFOs use a variety of technologies, products, and programs to help warn the citizens in their county warning areas of potentially threatening weather conditions. WFO staff use radar, satellite, and automated surface observation systems to prepare forecasts and issue warnings for all types of severe weather. The Advanced Weather Interactive Processing System (AWIPS) at WFOs integrates NWS meteorological and hydrological data with NWS satellite and radar data, enabling forecasters to prepare and issue more accurate and timely forecasts and warnings. Some WFOs also have an active Upper-Air Observation Program,² using radiosonde technology.

² NWS’s Upper-Air Observation Program involves the operation of 92 radiosonde stations in North America and the Pacific Islands and support for 10 stations in the Caribbean. Radiosondes provide upper-air data useful for weather forecasts and research.

NWS is in the process of implementing a new component of AWIPS, the Interactive Forecast Preparation System (IFPS). IFPS is a sophisticated software program providing interactive tools to forecasters for interpreting and editing grids of weather elements and generating products in various formats from a digital database.

To effectively provide early warnings and collect important climatological data, WFOs also must rely in part on their many partners. For example, state and local emergency managers are vital components of WFO efforts to disseminate critical weather information to the public, and the WFO plays an important role in state and local officials' efforts to keep abreast of severe weather events. Other partners include media representatives and Skywarn and Cooperative Observer volunteers.

Skywarn, part of a nationwide effort involving more than 16,000 volunteers, trains volunteer spotters to provide WFOs with timely and accurate severe weather reports. Cooperative Observer volunteers, numbering more than 1,600, provide daily weather measurements of temperature, wind, and precipitation amounts. The meteorological community considers both of these programs critical to verifying and collecting data, which helps improve forecast models and the recording of accurate climatic data. After developing weather forecasts and obtaining critical information from its partners, each WFO disseminates that information to the general public through NOAA Weather Radio, Internet sites, local media, and other means.

NWS's Identification of Successful Characteristics of WFO Operations

Based on our inspection report on Raleigh, NWS established a team of MICs to evaluate specific areas of WFO operations. From September 2000 through August 2001, in NWS's eastern, central, southern and western regions, the NWS team evaluated Cooperative Observer network management, Skywarn training, staff training, quality control, and forecast operations. They developed a management methodology for operating a successful WFO based on their findings of best practices. The methodology addresses the overall structure of office operations: (1) visible support and involvement of the MIC, (2) use of a team approach, (3) use of training and development plans, (4) verification and quality control with timely feedback, and (5) innovation and flexibility. NWS has provided the results of its review to all regional personnel and posted best-practices information on its web site. We commend NWS for its effort to improve office operations.

Although we did not evaluate the methodology and findings of the NWS team in this review, we did find evidence of the positive results of the team's efforts in the WFOs we visited and interviewed. For example, the Skywarn and Cooperative Observer programs, for the most part, are very well run and exhibited many of those characteristics that the NWS team identified in its report. Similarly, since we conducted our earlier WFO inspections, we found an increased emphasis on staff training and development throughout the WFOs. NWS officials stated that many of these improvements resulted from lessons learned or best practices identified in our first four WFO inspections as well as in NWS's review that was sent to all regional personnel.

FINDINGS AND CONCLUSIONS

I. WFOs' Weather Forecasting Is Generally Effective

We examined the weather forecasting programs of 14 WFOs to determine whether each has been issuing timely, high-quality products to the public. Each WFO issues general or zone³ forecasts, severe weather and flood warnings, advisories, and specific forecasts for each of its weather programs. Specifically, we reviewed office performance statistics, the quality control process, weather products, and radar operations. While we found that some weather areas need improvement, we believe that the 14 WFOs are issuing timely and reliable products, quality control is adequate, most products are useful to the community, and radar operations are effective. Overall, office personnel believe that they have been able to accomplish their mission because of the commitment of office staff, different approaches to forecasting, and effective use of the Console Replacement System to reach office users.

A. *Most programs have yielded reliable forecasts*

For each of the 14 WFOs we reviewed, we summarized their verification statistics for fiscal year 2001 by weather area including severe storms, winter weather, probability of precipitation, aviation weather, hydrology, and fire weather. While the 14 WFOs performed well in the six major weather programs (such as severe storms and winter weather) during fiscal year 2001, we identified weather programs that need to be addressed. The accuracy of a WFO's forecast within each weather program is determined by three statistical elements: False Alarm Ratio (FAR),⁴ Probability of Detection (POD),⁵ and Lead-Time.⁶ An additional measure, the Critical Success Index (CSI), is a function of the POD and FAR.

While one-year statistics are not indicative of each office's long-term performance, each office can determine whether current statistics are an anomaly or an ongoing trend. Table 3 indicates each WFO's recent forecast accuracy for each of the six main weather programs. Based on the verification statistics, each WFO's weather program is scored as follows: (1) more than 80 percent of the WFO's verification statistics (FAR, POD, lead-time, and CSI) are above or within 10 percent of the regional average; (2) from 70 to 80 percent of the WFO's verification statistics are above or within 10 percent of the regional average; or (3) less than 70 percent of the WFO's verification statistics are above or within 10 percent of the regional average.

³ Each WFO has a county warning area that is divided into zones comprising either one or more counties that are often large and/or topologically diverse in mountainous and coastal areas. For each zone, an office issues zone forecasts that include temperature (max/min), probability of precipitation (POP), precipitation type, cloud type, cloud amount, snow amount, and wind direction and speed. Each office issues two seven-day extended zone packages every day.

⁴ The False Alarm Ratio is the fraction of all warnings that are unverified by office personnel, Skywarn volunteers, or other authorized personnel. A high ratio indicates that an office is issuing warnings of events that do not occur.

⁵ The Probability of Detection shows the fraction of all severe events (*i.e.*, severe thunderstorms and tornadoes) for which warnings were issued. Attempting to achieve a high Probability of Detection by issuing more warnings would tend to have the undesirable effect of increasing the False Alarm Ratio.

⁶ Lead-time is the interval between when a warning is issued and when an event reportedly occurs.

Table 3: WFO Verification Statistics Compared to Regional Averages for FY 2001

	Severe Storms	Winter Weather	Probability of Precipitation	Aviation Weather	Hydrology	Fire Weather
Eastern Region						
Mt. Holly	S	G	S	G	S	N/A
Raleigh	G	S	S	S	S	N/A
Sterling	G	P	G	P	S	N/A
Central Region						
Chanhassen	G	G	G	G	S	N/A
Denver/Boulder	P	P	G	G	S	N/E
St. Louis	G	G	G	G	G	N/A
Southern Region						
Miami	P	N/A	G	N/E	P	N/A
Norman	G	S	S	G	S	N/A
San Angelo	S	P	S	G	G	N/A
Western Region						
Missoula	P	P	G	S	G	P
San Francisco	N/E	S	S	G	N/E	N/A
Seattle	P	G	G	G	N/E	N/E
Alaska Region						
Anchorage	N/A ⁷	S	N/A	G	N/A	N/A
Pacific Region						
Honolulu	P	N/A	G	G	S	N/E
<p>LEGEND: G = Good S = Satisfactory P = Poor N/A = Not Applicable N/E = No Events G More than 80 percent of verification statistics are above or within 10 percent of the regional average. S From 70 to 80 percent of verification statistics are above or within 10 percent of the regional average. P Less than 70 percent of verification statistics are above or within 10 percent of the regional average. N/A Not Applicable. N/E No or minimal weather events for statistical purposes.</p>						

Source: OIG Compilation based on NWS Verification Statistics for fiscal year 2001.

Severe Storms Program

Each WFO has severe storm products that include thunderstorms and tornado warnings. For severe storm weather products, the lead-time, FAR, the POD, and the CSI performance measures are very important.

⁷ WFO stated that winter weather is their severe storm program.

Based on fiscal year 2001 statistics, the severe storms program had the most offices with overall statistics below their regional averages. In this category, we found five offices with severe storms statistics above their regional averages, two offices that had one element (FAR or lead-time) that was below the regional averages, and five offices with two or more elements (POD, FAR, lead-time, or CSI) below the regional averages. San Francisco did not have enough severe statistics to compile while Anchorage used its winter weather program as its severe weather program. For the five offices that had less than 70 percent of their verification statistics above or within 10 percent of the regional average, the POD appears to be the most problematic element, followed by FAR and lead-time.

Winter Weather Program

Table 3 indicates a winter weather program with mixed results similar to the severe storms program. During fiscal year 2001, four offices had winter weather statistics that were above their regional averages, four had statistics with one element below the regional averages, and four offices had two or more elements that were below their regional averages. For the four offices with statistics below their regional averages, the FAR and lead-time were the elements most frequently below the regional averages. Two offices, Miami and Honolulu, for obvious reasons, did not compile winter weather statistics.

While we found the winter weather programs for Raleigh, Norman, San Francisco, and Anchorage were mostly above their regional averages, Raleigh's FAR and the lead-times for the other three offices were below regional averages. Nevertheless, WFO users we spoke with expressed satisfaction with winter weather warnings and forecasts. Office personnel cited an extensive knowledge of the area climatology, research on winter weather, and an active spotter network as reasons for successful winter weather programs.

Probability of Precipitation Program

While the POP statistics for WFOs involve many factors, two sound indicators of POP success are an office's (1) improvement of its forecasts over its model guidance data, and (2) percentage of correct POP forecasts compared to the model guidance. For this program during fiscal year 2001, 13 offices performed well (Anchorage does not compile probability statistics). Eight offices had statistics above their regional averages and five offices had one element of their statistics that was below their regional averages. For the five offices with the one sub-par element, four offices had not improved their forecasts over the model guidance that each office received.

During our review of the San Angelo and Missoula WFOs, we found issues pertaining to POP forecasts. We found that San Angelo was the only Southern Region office during much of 2000 that had fewer POP forecasts correct than its model forecasts.⁸ NWS officials told us that each office should have more POP forecasts correct than the model forecasts, therefore improving each model forecast. They were also concerned that San Angelo forecasters had not consistently outperformed the model forecasts. In following up on San Angelo's 2001 statistics, we found that San Angelo did improve its statistics over the southern region model guidance. However, its 2.4

⁸ The average southern region office improved its forecasts (based on model guidance) by 5 percent compared to San Angelo, which had a -5.5 percent for April through September 2000.

percent improvement was still less than the 7.3 percent average for the other southern region WFOs. We recommend, therefore, that NWS Southern Region officials work with San Angelo managers to address this problem.

We also found that Missoula's improvement over model guidance only equaled the 2000 model guidance percentage. Office personnel cited various reasons for not exceeding the model guidance percentage of correct forecasts. Mostly, they believe that the office had a slight "dry" bias⁹ during April through September 2000; or in other words, they under-forecast the actual precipitation that occurred. Office personnel stated that a dry bias is not uncommon at forecast offices, and happens because staff may be inexperienced, or poorly trained, or simply do not fully understand the local climatology. Forecasters also cited the terrain of Missoula's county warning area, the radar angle, and the difficulty in predicting such storms as reasons for the WFO not exceeding its model guidance percentage of correct forecasts. Missoula's 2001 statistics indicate an improvement above the model guidance. Nevertheless, we recommend the WFO address the continuing discrepancy between San Angelo's POP improvement over the model guidance and the southern region's 2001 average (see page 8).



In response to our draft report, NWS officials concurred with our recommendation to address the discrepancy between WFO San Angelo's POP improvement over the model guidance and the Southern Region's 2001 average. NWS officials stated that San Angelo had improved its POP forecasts during the first 6 months of 2002 beyond its 2001 performance. According to NWS, the MIC is undertaking additional steps to further improve San Angelo's precipitation forecasting through use of the Weather Event Simulator and an emphasis on professional development activities to enhance the staff's precipitation forecasting skills. NWS will review the WFO's final calendar year 2002 precipitation verification statistics when they become available.

Aviation Weather Program

The 14 WFOs also did very well in this weather area during fiscal year 2001. Ten of the 14 WFOs had statistics that were above their applicable regional averages, while two WFOs only had one element of their statistics that was lower than their regional averages. The remaining two WFOs (Sterling and Miami) had statistics that were below their 2001 regional averages. For aviation weather, we compiled four statistics to judge performance: FAR and POD for ceiling height at less than 1,000 feet, and FAR and POD for visibility less than three miles. We found that Sterling and Miami were below average in the aviation statistics, although the Miami statistics were derived from so few events as to render them statistically insignificant.

Hydrology Program

Thirteen WFOs have hydrology programs. Two of the 13 offices did not have any hydrology events in FY 2001. Three of the remaining 11 offices had statistics that were above their regional averages, seven offices had only one element of their statistics that was below their regional averages, and one office had two elements of its statistics that were below its regional average. For the seven offices with one negative statistic, five offices (Mt. Holly, Raleigh, Sterling,

⁹ An office could have a "wet" bias where they over-forecast the amount of precipitation.

Chanhassen, and Denver/Boulder) had lead-times less than their regional averages. For the other two offices (Norman and Honolulu), Norman had a lower POD than its regional average, and Honolulu had a higher FAR than its regional average. Miami was the only office that had two elements of its statistics (FAR and lead-time) that were below the regional average—it had a lead-time of 18 minutes compared to a southern region average of 49 minutes.

During our Chanhassen review, we found a similar discrepancy between the office's and the central region's flash-flood lead-times. Chanhassen provided a significantly shorter lead-time for flash floods. According to NWS officials, there was a difference of opinion as to when a flash flood was determined to be occurring; the range of opinion varied between the time when rainfall begins to the time roads are flooded. NWS has no clear, objective criteria that WFOs can use to document the beginning of a flash flood and leaves that determination to the WFOs.

In our discussions with Chanhassen, NWS Central Region, and NWS headquarters officials, they acknowledged the lack of specific criteria and none could further clarify when a forecaster should determine that a flash flood warning should be issued. We urged NWS officials to provide the Chanhassen forecast staff with more meaningful criteria to use in determining what conditions must be present to issue flash-flood warnings for their specific terrain. We also recommended that Chanhassen's MIC work with the Central Region to improve the office's short lead-time record. In their response, NWS officials stated that they had made changes, with which we concur, to the Weather Service Operations Manual regarding the issuance of warning products for heavy rains occurring during existing river flooding. However, we recommend that NWS officials work with WFO Miami to improve its flash-flood lead-time compared with the southern region's average.



In response to our draft report, NWS officials concurred with our recommendation to improve WFO Miami's flash-flood lead-time over the Southern Region average. NWS officials state that WFO Miami will use the Weather Event Simulator to help improve its staff's skills in forecasting heavy rain events. Furthermore, WFO managers and Southern Region officials will monitor Miami's flash flood warning performance to assess the success of the training and to make adjustments, as necessary.

Fire Weather Program

While four of the 14 WFOs had fire weather programs, Missoula is the only office during fiscal year 2001 that had been regularly compiling yearly fire weather statistics or had meaningful fire weather statistics to compile. The three other offices, Denver/Boulder, Honolulu, and Seattle, had fire weather programs that either began late in the fiscal year or had minimal fire weather events to report. During our review, we found that Missoula provides critical services to firefighters and emergency managers for wildfire suppression and public safety. The office's fire weather statistics, its training record, and comments from the users indicate that this program has been successful.

While Missoula's fiscal year 2001 fire weather statistics were below the western region average, the office's 2000 statistics were mostly above the regional average. During our on-site review of Missoula, we found that the 2000 fire weather FAR and lead-time statistics were above the

western region average. Although the office's POD was below the 2000 regional average, users stated that the forecasters in Missoula provide timely and accurate fire weather watches, warnings, and forecasts and that the WFO's incident meteorologists (IMETs)¹⁰ provide valuable on-site weather support to firefighters.

Missoula personnel suggested conducting post-season analyses of the 2000 and future fire weather seasons similar to an analysis conducted by the Great Falls WFO. The analyses would involve meeting with the office's fire weather customers to ensure that its products meet customer needs. NWS's fire service assessment team cited the Great Falls post-season customer analysis as one of eight best practices of the 2000 fire season.¹¹ In our inspection report, we suggested that Missoula's MIC consider performing such an analysis after its future fire weather seasons. We have learned subsequently from the MIC that Missoula chose to evaluate the office's fire weather performance at the end of each fire event, thereby providing a more rapid assessment of its performance instead of waiting until the end of the fire season. We believe this action satisfies the intent of our earlier suggestion.

B. Quality control of forecast products has improved

During our prior visits to Raleigh, San Angelo, and Missoula, we found that the three staffs were not performing systematic quality control reviews of office products before and after they were issued. Office personnel stated that they only occasionally asked other personnel to proofread daily products. Consequently, some office products were issued with misspellings and with improper information such as coding, and weather terminology. Office personnel assumed that because the offices have experienced forecasters, the offices would produce quality products. While office personnel believe that the overall quality of office products has been adequate, they emphasized that the accuracy and completeness of products can be improved with a more consistently applied quality control program. Overall, we believe that quality control of forecast products has improved through better office oversight and procedures.

During our Chanhassen review, we found that the office had adequate quality control of office products. More importantly, personnel at the other 10 WFOs reported that quality control had vastly improved. Since our reviews began in early 2000, WFO management have taken steps to improve office quality control. Regional offices in the last two years have emphasized quality control, and two WFOs (Raleigh and San Angelo) have prepared operating plans to implement a quality control program specifically aimed at improving forecast accuracy. Implementation of such plans should improve quality control over the offices' products by requiring individuals assigned to quality control to regularly review products and services and provide feedback to staff and management.

As stated earlier, NWS is currently implementing its new Interactive Forecast Preparation System. Office personnel stated that IFPS should improve quality control because it will allow forecasters to generate products in various formats from each office's digital database. As a result, quality control of weather products will be easier and therefore less time consuming. Although quality control of forecast products has improved, we recommend that WFO and

¹⁰ IMETs are meteorologists who are dispatched to fires. NWS had over 60 IMETs at the end of the 2000 fire weather season.

¹¹ *Northern Idaho and Western Montana Summer 2000 Wildfires*, National Weather Service, February 2001.

regional management ensure that such progress continues. Specifically, they need to emphasize to all forecasters and hydrometeorological technicians that products must be reviewed, and an ongoing quality control system should be implemented.



In response to our draft report, agency officials concurred with our recommendation to emphasize quality control of forecast products. The Director of the Office of Climate, Water, and Weather Services holds monthly conference calls with the Regional Headquarters Meteorological Services Division Chiefs to stress the importance of quality control. NWS officials believe that these conference calls have been an effective means to emphasize quality control. To support this point, they cite feedback from an external customer that indicated a drop in error rates for severe thunderstorm warning and tornado warning products. However we believe that further oversight to verify improvements in quality control is warranted, and suggest that the WFO inspections conducted by the regional staff should explicitly look at progress in this area.

C. *Some state and local weather forecast products may be unnecessary*

We found that state and local forecasts for many WFOs may be duplicative or unnecessary. NWS officials at some WFOs agreed that the state and local forecast products were redundant. Both Chanhassen and Missoula believe that the summary state forecast information could be obtained through their local zone forecast products. Other WFO office managers and forecasters also thought that the state forecast product was duplicative and burdensome to prepare. In addition, we found that six offices had stopped preparing their local forecasts because the same information is available to users in other office forecast products.

Most offices issue forecasts only for their county warning area. However, in each state, one office serves as the state liaison office, whose responsibility is coordinating statewide weather issues and providing a unified NWS voice to state officials on weather-related topics. Because Chanhassen is the NWS liaison office for the State of Minnesota, it issues a forecast for the state, comprised of forecasts from the state's other WFOs. The statewide forecast product is very general, by necessity, because it covers varied climatology. However, there remain a small segment of users, such as media wire services or public radio stations that have a statewide broadcast responsibility, who prefer this forecast product.

While WFO personnel stated that some local users of weather products find the statewide information useful when making weekend travel plans, the specific information these users seek is readily available through a variety of sources. For example, users may access the websites of Chanhassen and the other WFOs, the Chanhassen WFO ring-through telephone line, NOAA Weather Radio, or the local television media to get statewide weather reports. Missoula office personnel contribute to the production of Montana's state forecast product. However, several of them expressed concern that the product duplicated zone forecasts and consumes time that they could better use doing other work, such as quality control. We spoke to the MIC in the Great Falls WFO, whose office prepares the Montana state forecast product, to get more information on the product. He has had users emphasize the importance of the product's data and ease of use. However, while he believes that the product is valuable and that it should be retained, he agreed that the usefulness of the product is questionable because of the state's varied climatology and

because it does not provide specific, detailed information from each office's extended zone forecast.

WFO officials told us that the Central Region is conducting a pilot test in Kentucky on the use of a digitized state forecast product, which may satisfy the needs of local users while also reducing the resources needed to produce a state forecast product. We recommend that NWS evaluate the costs and benefits of producing the state forecast product and make a decision as to whether WFOs should continue to issue it in its current format, issue it in a revised format, or eliminate the product entirely.

WFO personnel also stated that preparing their local forecasts was duplicative. We found that six out of the 14 offices no longer prepared their local forecasts. For example, a local forecast would be for downtown Minneapolis or St. Paul. However, users could obtain comparable information through their applicable WFO's zone forecast product. While the WFOs anticipated some resistance from users upon eliminating these products, office personnel explained to media and emergency management personnel how the same information could be obtained through the zone forecast products. We recommend that NWS determine whether WFOs can eliminate their local forecast products.



In response to our draft report, agency officials concurred with our recommendation to determine if any state and/or local forecast products are no longer necessary. NWS officials report that they are performing an analysis of the NWS's public weather product suite, through interaction with their customers, to determine the NWS product baseline, including the continued need for state and/or local forecast products.

D. Radar coverage issues need to be addressed

We found two WFOs during our reviews whose forecasting performances were partially degraded because of radar angle and availability. Specifically, at Missoula, the radar's angle and location on a mountaintop at 8,000 feet elevation (see photo in Figure 4) was cited as the key factor in the office's low severe weather statistics from 1997 to 2000. In addition, at San Angelo, the availability of a U.S. Air Force radar used by the office was below NWS, Department of Defense, and Department of Transportation standards. These issues had impacted the forecasting capability of both offices.

At Missoula from 1997 to 2000, the office's FAR, POD, and lead times for severe storms had steadily declined. Office personnel greatly attributed this decline to the radar's location and the positive 0.5-degree angle, which prevents Missoula personnel from detecting lower atmospheric conditions in the population centers. Although all NWS radars are set at a positive 0.5-degree angle, only a few—those located at elevated sites surrounded by mountainous terrain—have this problem in detecting lower atmospheric conditions. It is worth noting that the radar in Missoula was once positioned at a negative angle but office personnel stated that NWS changed all radars to the same angle.

NOAA has conducted several research studies on the radar angle and has determined that the elevated radar locations would generally obtain better forecast data if the angles were lowered slightly. These prior NOAA studies recommended that an engineering study and an

environmental impact study¹² be conducted by WFOs contemplating a radar angle change, as well as the issuance of a public information paper¹³ on radiation from the radar. Studies indicate that NWS should consider lowering the angle of selected radars after completing the recommended actions. In its fiscal year 2001 operating plan, the Missoula office has included plans to evaluate its radar angle. We recommended that these actions be completed as soon as possible.

Figure 4: Missoula WFO Radar at the top of Point Six



Source: Office of Inspector General.

NWS officials agreed with our recommendation and noted that Missoula, in conjunction with the National Severe Storms Laboratory, has completed an evaluation of the elevation of the radar and concluded that using negative elevation angles for the radar shows the potential for improved detection of low-altitude weather conditions in the surrounding valleys and improved estimates of

¹² National Weather Service, *Management Services Division/Scientific Services Division White Paper—Lowering Lowest Elevation Scan to 0.0 or Neg. 0.5*, Fall 2000.

¹³ NEXRAD Operational Support Facility, *WSR-88D Radiation and Biological System Considerations*, October 1994.

precipitation amounts throughout the coverage area. NWS also stated that the Western Region would pursue with NWS Headquarters during 2002, the feasibility of conducting environmental and engineering studies in support of lowering the radar angle and its potential effect on improving detection capability. We recommend that NWS officials conduct the environmental and engineering studies of the Missoula radar's angle and make the appropriate adjustments to the radar angle.

At San Angelo, we found the reduced availability of the Air Force radar at Dyess Air Force Base restricted San Angelo's radar coverage of its county warning area. San Angelo personnel use both the Air Force's and their own radar for coverage of its county warning area. When the Dyess radar is not operational, San Angelo staff use other NWS radars for backup. However, because these radars are at different locations, the WFO radar coverage is less than that provided when the Dyess radar is operating. According to Dyess officials, in calendar year 2000, the Air Force radar was available 92.2 percent of the time, which is below the 96.0 percent minimum operating standard for all NEXRAD¹⁴ radars.

Knowledgeable Department of Defense personnel cited two problems for the decreased radar operational availability. First, they emphasized that getting Defense requisitions for radar repairs reviewed and approved for system input has been an ongoing problem because the turnover and inexperience of military base personnel have sometimes delayed the requisition process. Also, some bases lack on-site operations personnel, commercial delivery carriers have restrictive pick-up and delivery times for necessary replacement parts, and the Defense acquisition approval system has operational limitations. Defense personnel stated that all of the above problems were recently reviewed.

Second, Defense officials stated that problems with the Dyess radar, including ongoing problems with the radar's air conditioning, ductwork, and power supply, have reduced the radar's operational availability. They stated that NWS's Radar Operations Center (ROC) in Norman, Oklahoma, had sent specifications to Air Force officials at Dyess to replace the air conditioning system and install new interior ducts. They emphasized that these improvements needed to be performed so this radar can effectively assist the San Angelo office with its radar coverage. We recommended that NWS should continue to work with Defense officials to complete the timely repair of radar equipment and to help maintain its continued availability. NWS officials agreed with our recommendation.



In response to our draft report, NWS officials partially concurred with our recommendation to conduct the environmental and engineering studies of the WFO Missoula radar angle, and to make appropriate adjustment to the radar, if necessary. NWS officials state that conducting the environmental and engineering studies will be costly and involve risk. They state that NWS is first conducting a "paper" study of the costs, impacts, and expected benefits from potentially lowering the radar angle at Missoula. The results of the "paper" study will be used to determine if NWS should commit to the full environmental and engineering studies. We are pleased that

¹⁴ The National Weather Service, the Department of Defense, and the Department of Transportation operate 158 Next-Generation Weather Radars as part of a tri-agency network providing nationwide weather support.

NWS is proceeding with its review and analysis of the Missoula WFO's radar angle. As noted in our Missoula inspection report, the angle of the radar has prevented the WFO from detecting lower atmospheric conditions and has adversely affected the WFO's severe storm statistics. We look forward to NWS completing its "paper" study of the Missoula radar in December 2002, and its January 2003 decision on whether to go ahead with the full environmental and engineering studies.

II. Forecast Office's Outreach Efforts Are Effective

While outreach is the responsibility of all NWS employees, field offices are responsible for developing outreach programs unique to their local area, and soliciting customer and partner feedback to improve NWS products and services. According to the *NWS Fiscal Year 2001 Outreach Action Plan*, outreach consists of (1) public awareness and preparedness; (2) constituency building; (3) partner technical education; (4) expanded public knowledge of weather, water and climate for recruitment; and (5) public and partner feedback.

In our inspection reports of four WFOs and reviews of 10 additional WFOs, we found that most of the offices have been effectively implementing NWS outreach goals by (1) interacting with their user communities and building relationships with various community groups and educating them on local weather, and (2) obtaining feedback on the products and services they offer.

WFOs' interaction with user communities

WFO staff nationwide work with state and local emergency managers to help citizens in their communities be aware of and prepare for potential natural disasters, such as floods, hurricanes, tornadoes, blizzards, hail, and other emergencies that may affect public safety. These efforts (1) help increase public responsiveness to warnings and critical weather, (2) better prepare users for extreme weather events, (3) develop and strengthen partnerships to respond more effectively to weather events, and (4) increase user feedback to enhance NWS services.

During our reviews of the Raleigh, San Angelo, Missoula, and Chanhassen WFOs, we met with several state and local emergency managers who spoke highly of the cooperation and service they received from these offices. In addition to being generally pleased with the timeliness and quality of the forecasts and warnings, emergency managers commended these WFOs on their outreach programs. Generally, officials commented that WFO employees are available to discuss weather forecasts, conduct demonstrations, and provide general assistance.

Although we did not interview local or state officials, other partners, and community groups at the 10 additional WFOs, officials at those sites did report on the various activities they conduct in support of the NWS outreach initiative and their own WFO's outreach plan. Our review of various documents showed that the additional 10 WFOs undertook varied activities to implement their outreach plans. For example, most office staff members participate in a multitude of school-related events to increase students' awareness of meteorology and weather safety. According to their plans, in addition to other events, they also participate in high school Career Days, provide office tours,¹⁵ and host career development workshops. The staff members also present safety talks before various social clubs and community groups, and teach Skywarn classes. Furthermore, some offices provide tours to minority groups and participate in other minority-sponsored activities to increase awareness of possible careers in meteorology with hopes of diversifying NWS.

¹⁵ Many WFOs nationwide have temporarily discontinued office tours until further notice due to the events of September 11, 2001. These tours have contributed to good community relations and improved public understanding of the WFO's mission and operations.

Media representatives with whom we spoke during the 4 comprehensive WFO inspections also thought highly of the WFOs and their services and responsiveness. Maintaining good relations with the media is important because the media is a key element in WFO outreach and information dissemination efforts. Although many of the media representatives we spoke with are meteorologists themselves, they said they value the insight and professional opinions of the NWS staff. Other interactions with the media include various WFO staff giving interviews to television, radio, and print representatives on subjects ranging from snow measurements to the Winter Storm Severity Index to Severe Weather Awareness Week, and other general weather services and products.

Collecting feedback from users

WFOs are required to solicit feedback from local emergency managers, media, marine and aviation users, and volunteers. We found that all of the offices we reviewed used various mechanisms to gather feedback from their respective user groups. For example, many offices conduct post-season partnership workshops at which users are given presentations on what is new in NWS and the WFO. In turn, users provide feedback to the WFO staff about the efficiency and effectiveness of their forecast information. The offices also conduct surveys on their products, ranging from aviation and marine weather data to the Cooperative Observer Program, as a method of collecting information. For example, some offices hand out surveys at various public events (*i.e.*, boat shows and county fairs), while others conduct surveys on-line at their web sites, allowing their users to submit their responses electronically while accessing information. For example, we were told that the Denver/Boulder WFO conducted an online survey on the NOAA Weather Radio voice to get feedback from its users.

A few WFOs have innovative outreach practices to bring awareness to and receive feedback from their local communities and user groups. For example, as noted in an earlier report, the Missoula WFO invites the users in its county warning area to the office for a customer workshop. At these workshops, WFO customers are given a presentation on what is new in NWS and the WFO. Other WFOs, such as Anchorage and Honolulu, use other approaches to inform people of weather events. We were told that Anchorage has a television program that is aired on public TV stations, and Honolulu holds press conferences to inform its communities of weather events.

Generally, the 14 offices we reviewed have effectively implemented NWS's overall outreach initiative by improving citizens' awareness of weather terminology, severe weather risks and precautions, and NWS products and services in their respective County Warning Areas (CWAs). Moreover, the WFOs have formed strong relationships with emergency officials, the media, and schools in order to enhance the public's awareness of NWS activities and improve local communities' knowledge of weather conditions and weather emergency preparedness.

III. Skywarn and Cooperative Observer Programs Are Well Run

The Skywarn and Cooperative Observer programs at the 14 WFOs are both effective and well managed. The programs are comprised of volunteers who receive training and equipment from their local WFOs, report to their WFO on severe weather conditions, and help record weather observations for their respective county warning areas. These volunteers help WFOs by providing early warning of severe weather conditions, verification of severe storms, and timely observations of weather conditions.

A. Most WFOs have effective Skywarn programs

Skywarn is an NWS program that, in collaboration with emergency management agencies, trains private citizens to become volunteer weather spotters. Skywarn spotters provide forecast offices with timely, accurate severe weather reports. Table 4 includes the four elements (shaded rows) of Skywarn programs we used to determine whether WFOs were managing these programs satisfactorily. The elements we chose and the questions we asked about them were: did the WFO have adequate spotter coverage of its county warning area; did the WFO have an active spotter recruitment program; did the WFO conduct spotter training classes; and did the WFO issue a newsletter for its spotter network?

Table 4: Elements of WFO Skywarn Programs

Elements	Raleigh	San Angelo	Missoula	Chanhassen	San Francisco	Seattle	St. Louis	Denver/Boulder	Anchorage	Miami	Norman	Sterling	Honolulu	Mount Holly
Number of spotters	1,500	800	439	1,416	340	686	2,000	1,200	68	547	2,000	2,300	290	3,200
Number of counties or zones	31	24	44	51	12	13	45	22	16*	7	56	44	8*	39
Number of spotters per county or zone	48	33	10	28	28	53	44	54	4	78	36	52	36	82
Full area coverage	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
Spotter recruiting	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Spotter training	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Spotter newsletter	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y
LEGEND: Y = Yes N = No Y = WFO fulfilled the element. N = WFO did not fulfill the element. *Zones in county warning area.														

Source: Office of Inspector General and WFO officials.

Although we did not interview local or state officials, other partners, and the Skywarn or Cooperative Observer Program volunteers at the 10 additional WFOs, we did interview the individuals responsible for these programs at each office. They reported on the scope of their

programs, including their area coverage, recruitment and training of volunteers, and outreach efforts to the volunteer community.

In general, WFOs have an adequate number of Skywarn spotters

All 14 offices we reviewed had recruited their own networks of volunteers, ranging from nearly 70 to 3,200 spotters. The range is largely the result of population density or sparseness in the regions surrounding the WFOs. Anchorage, Alaska, has the smallest number and Mount Holly, New Jersey, the largest. Spotters also range widely in terms of age and professional background; among other things, they may be emergency management and law enforcement officials, students, or amateur radio operators.

Although the number of spotters varies widely among WFOs, and most WFO officials stated that they felt their office had good coverage for their warning area, a few reported that they did not have adequate coverage in specific locales. For example, Seattle reported good coverage in strategic locations, except for mountainous areas, and Anchorage reported gaps in its coverage, although it is striving to fill them. If a WFO has significant gaps in its coverage, that location may be unable to receive early detection and verification of approaching severe storm conditions. San Francisco and Honolulu, although they have relatively low numbers of spotters as compared with other WFOs, did not report any concerns with area coverage. We did not attempt to verify their reported lack of concern with area coverage.

Recruitment of spotters in local areas is effective

Part of a WFO's overall outreach efforts to the community includes recruiting volunteers to help with essential early detection of weather events, and all the WFOs we reviewed have programs to recruit new spotters. WFO officials recruit new spotters at periodic meetings they arrange with local emergency management groups. WFOs have also used spotter training sessions to encourage trainees to recruit new spotters. Some WFOs use their Internet web sites not only to advertise the Skywarn program, but also to post recruitment bulletins for additional spotters. The MIC at San Francisco stated that his office focuses its recruitment efforts on amateur radio groups because they are organized, reliable, and have communications capability during severe weather conditions and because they encourage their members to participate in Skywarn. The Seattle MIC stated that his office screens prospective volunteers to ensure that they are serious and committed to the program.

WFOs use innovative techniques to train spotters

All the 14 WFOs we reviewed conducted periodic training for their spotters. It is critical that WFOs keep their volunteer spotters proficient in detecting and reporting severe weather. The WFO officials we interviewed said they hold pre-season meetings with their spotter networks to orient the spotters to the upcoming severe weather and winter weather seasons and ensure that they are prepared. Following the severe weather seasons, the WFOs hold post-season meetings to learn of ways to improve their efforts.

While most WFOs conduct the training directly with the spotters in their area, the Chanhasen WFO conducts "train the trainer" classes, which allows the WFO to leverage its resources by enlisting the aid of highly motivated and trained spotters to conduct training classes on their own.

A few WFOs have innovative training practices to sharpen the skills of their spotter network. For example, in its training sessions, the Chanhassen WFO uses videos of recent severe storms in their area to more precisely acquaint their spotters with storm conditions they may actually encounter, given the topography of their area. Chanhassen updates its video every 2 years, including footage of new storms. Other WFOs, such as St. Louis, reported that they use multimedia in their spotter training sessions, incorporating, for example, laptop computers with slides and photos. Denver/Boulder stated that it trained local law enforcement dispatchers in weather terminology, so if dispatchers must provide information about a severe weather event, the training will help to minimize confusion over the specific nature of the severe weather being reported.

Most WFOs publish newsletters for their spotter networks

Most of the WFOs we reviewed publish newsletters to keep their spotter networks in touch with developments in the Skywarn program. Although newsletters are not an NWS requirement, we believe that they do further the objectives of the agency's outreach program to keep their community partners current with NWS program activities. NWS officials stated that spotters find the newsletter both helpful, in instructing them on maintaining their gages and anticipating seasonal weather changes, informative, and supportive, in recognizing veteran spotters who receive length-of-service awards from NWS officials. Anchorage and Norman do not publish newsletters for their spotters. Norman's Internet web site, however, has a description of its Skywarn program, with links to its storm spotter guide and local amateur radio groups involved in Skywarn, and instructions on how volunteers and public officials can get started in storm spotting. Other WFOs also use their web page to keep their spotters abreast of developments in the Skywarn program.

Although the Honolulu WFO is developing its own newsletter, WFO officials stated that amateur radio clubs on the islands, in partnership with the WFO, incorporate the office's Skywarn news in their clubs' newsletters, and on many islands, most of the amateur radio operators are also Skywarn spotters. One slightly different method of disseminating news is used by the St. Louis WFO; officials stated that they issue a newsletter occasionally, but also contribute articles to the newsletters of local emergency management agencies and amateur radio groups.

B. Cooperative Observer Programs are generally well maintained, but future staffing raises questions

The Cooperative Observer Program is a nationwide weather and climate-monitoring network of volunteers. Each volunteer observer regularly reports temperature, wind, and rainfall amounts to the local WFO so that forecasts and warnings can be issued and the climate of the United States can be recorded to help improve the accuracy of the agency's forecasts. Whereas the Skywarn program relies on spotters to identify and report severe weather conditions, cooperative observers are expected to take daily weather observations of temperature and precipitation at specific times each day and report the information directly to the WFO. Other cooperative observers record daily weather observations that are reported on a monthly basis for use by climatologists. This data consists of 24-hour minimum and maximum temperatures, liquid content of precipitation, snowfall, and snow depth.

The vast majority of WFOs conduct regular visits to observer sites to establish a personal relationship with observers and monitor WFO equipment; only Anchorage indicated difficulty in doing so because of the extreme winter weather conditions in that region and a reported lack of funding. A more important issue that is discussed later in this report, however, is the availability of future WFO staff to carry out the program.

Table 5 lists four elements (shaded rows) of the Cooperative Observer Program we used to determine whether WFOs were operating satisfactorily. The elements we chose and the questions we asked about them were: did the WFO have adequate observer coverage of its county warning area; did the WFO regularly visit the observer sites; did the WFO issue a newsletter for its observer network; and did the WFO maintain a full spares kit for the Fischer & Porter gages (a mechanical rain gage used at many observer sites)?

Table 5: Elements of WFO Cooperative Observer Programs

Element	Raleigh	San Angelo	Missoula	Chanhausen	San Francisco	Seattle	St. Louis	Denver/Boulder	Anchorage	Miami	Norman	Sterling	Honolulu	Mount Holly
Number of observers	76	65	91	102	91	118	127	97	100	32	204	130	274	123
Number of counties or zones*	31	24	44	51	12	13	45	22	16*	7	56	44	8*	39
Number of observers per county or zone**	2	3	2	2	8	9	3	4	6	5	4	3	34	3
Full area coverage	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Regular site visits	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Observer newsletter	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of Fischer & Porter gages	13	14	34	26	21	39	40	35	14	10	15	29	68	19
Full spares kit or replacement gage	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
LEGEND: Y = Yes N = No Y = WFO fulfilled the element. N = WFO did not fulfill the element. * Zones in county warning area. ** Rounded to nearest whole number.														

Source: Office of Inspector General and WFO officials .

Cooperative observer coverage of CWAs is generally good

Of the WFOs we reviewed, only Anchorage reported a significant gap in its network of cooperative observer coverage, a gap resulting from the sheer size and remoteness of Anchorage’s county warning area.

NWS's criterion for placing cooperative observers is that they be approximately 25 miles apart. Most offices reported that they were able to meet that criterion. Lack of sufficient observer coverage makes the jobs of forecasters and climatologists more difficult. Many WFO officials reported the need to recruit replacement observers and the difficulty of doing so with the gradual aging of the population; observers tend to be older citizens and there seems to be less interest in observing among younger people. Although many MICs acknowledged that recruitment of volunteers is an ever-present challenge, none indicated that they are faced with growing gaps in their observer site coverage.

All but one WFO maintain a schedule of semiannual site visits

WFO officials stated that there are two reasons why it is important to conduct regular visits to volunteer observer sites. First, the WFO staff member meets with the observer to review operating procedures, answer any questions he or she may have, and check the gages to ensure that they are working properly. Second, the WFO staff member provides valuable feedback to the observer on the WFO's operations. Many WFO officials cited this personal contact as key to the continued success of the program and the reason that many observers continue to volunteer their services, despite the fact that the majority of observers receive no compensation.

All the WFOs in our review, except Anchorage, conduct site visits to their cooperative observers twice a year. Anchorage is often unable to visit its observer sites twice yearly because of the vastness of its warning area, the lack of roads, and the harshness of Alaska's winters. The Anchorage staff conducts most of their site visits by ski planes or float planes in the third and fourth quarters of the fiscal year. Unfortunately, the latter part of the fiscal year is also when NWS directs its field units to constrain their spending. As a result, Anchorage personnel stated that they are unable to complete all of their required visits each year, given the limited season of fair weather and limited resources with which to conduct their visits.

NWS plans to reduce Cooperative Observer Program resources

During our inspection of the Chanhassen WFO, we were told that NWS plans to reduce the number of WFO employees who generally support the Cooperative Observer Program. Specifically, NWS headquarters expects that as attrition occurs among data acquisition program managers (DAPMs), they will not be replaced. Furthermore, NWS officials expect the number of hydrometeorological technicians (HMTs) to shrink to three at each WFO. NWS has determined that the observer program would be adequately supported if WFOs' data acquisition units maintain a minimum of four employees—three HMTs and one meteorologist intern. However, this number would represent a reduction in current WFO staffing. For example, each of the four WFOs that were the subject of our complete inspection reports had six employees in their data acquisition units, including DAPMs, HMTs, and interns. Nevertheless, NWS officials stated that they will support the program by ensuring that at least four employees, as described above, will comprise the data acquisition unit, and should turnover occur, new staff will receive Cooperative Observer Program training at the NWS Training Center.

The potential effect of losing a member of the WFO's cooperative observer team is that the efforts of WFO staff to develop a rapport with their observer network may be diminished. One MIC stated that interns may not be as successful at supporting observers because experience and continuity on the part of WFO staff are important to running an effective observer program.

Another concern voiced by several MICs was that the most expeditious career path for NWS meteorologist interns is not in maintaining an outside network of observers but serving, instead, with the WFO's forecast team, honing their meteorological skills in preparation to become a forecaster. This resource scenario poses a challenge for WFOs trying to retain experienced staff to maintain their volunteer observer networks. We recommend NWS officials determine whether the proposed staffing changes are sufficient for WFOs to manage their Cooperative Observer Programs or, if they are not, what alternative means, such as contracting for such services, should be considered. We also recommend that new staff assigned to this program receive proper training.



In response to our draft report, NWS officials concurred with our recommendation to ensure that new employees assigned to this program receive Cooperative Observer Program training. They stated that NWS establishes all class schedules and the number of training slots with input from all regional and field offices through the National Strategic Training and Education planning process, which results in an annual training plan.

All but one WFO issue a Cooperative Observer newsletter

Of the 14 WFOs in this review, only Raleigh does not issue a newsletter to its network of observers. Raleigh officials stated that although they do not issue their own newsletter, they do communicate with their observers through mailings, telephone calls, and personal visits, and all their observers receive the *National Cooperative Observer* newsletter issued quarterly by the National Climatic Data Center.

Figure 5: Fischer & Porter Rain Gage



Source: NWS Internet web page.

Newsletters allow WFOs to communicate information to their observers during the year, keeping them interested and involved in the program. Newsletters we obtained featured articles that (1) remind observers of procedures they must use to take and report their observations, and of the

value of accurate and timely observations; (2) keep observers alert to climate trends, such as the flash-flood season, and to signs of severe storm activity; (3) honor observers with newsletter articles announcing their length-of-service awards; and (4) welcome new, and thank departing, observers for their service. One WFO reported that 90 percent of its observers have computers with Internet connections and so it provides an electronic newsletter monthly, but also sends one in the mail quarterly to reach those observers without Internet access.

Most WFOs maintain a full spares kit for Fischer & Porter gages

Part of the responsibility of each WFO is to maintain and replace, as necessary, the Fischer & Porter rain gages (see Figure 5 photo) in their county warning area. We found that most WFOs maintain several gages within their county areas, some of which are collocated with observers, whereas other, more remote gages are queried by telephone modem. Having a full spares kit on hand avoids significant downtime should a gage fail. Although three WFOs reported not having a full spares kit, they did report having a partial spares kit or a replacement gage and, therefore, did not feel that a full spares kit was necessary. They said that they did not experience significant downtime as a result of the lack of a full spares kit. Most of the WFOs reported no problems maintaining their gages, except for Anchorage, where the harsh winter weather and the high cost of traveling to the sites limited its ability to visit observer sites for about half of the year. Thus, during the fair weather months, Anchorage staff must spend several days on a ski plane or floatplane, attempting to visit multiple sites in one day, although they are still unable to cover the network.

IV. WFOs' Training Is Generally Good, But Research Efforts May Need More Emphasis

In our review of WFO training and research activities, we found that most of the 14 WFOs were meeting the training needs of their employees, incorporating new training tools to sharpen the proficiency of forecast staff members. Some of them were encouraging their staff to improve their forecast skills through operational or applied research. The elements we chose and the questions we asked about them were: did the WFO (1) have an office-wide training plan; (2) have individual development plans (IDPs) in place for all employees; (3) conduct one-on-one training sessions between the science and operations officer (SOO) and the forecast staff; (4) have an operational Weather Event Simulator (WES); (5) conduct training sessions on the new Integrated Forecast Preparation System (IFPS); and (6) conduct operational or applied research projects, and post summaries of such research on their Internet website?

Table 6: Elements of WFO Training and Research

Element	Raleigh	San Angelo	Missoula	Chanhasen	San Francisco	Seattle	St. Louis	Denver/Boulder	Anchorage	Miami	Norman	Sterling	Honolulu	Mount Holly
Office-wide training plan	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
IDPs for employees	N	Y	Y	Y	Y	Y	N	N	Y	Y	N	N	N	N
One-on-one training	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
WES is operational	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
IFPS training	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Conducts research	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Research on website	Y	N	N	Y	Y	N	Y	N	N	Y	N	N	N	Y
Active research program	Y				Y		Y			Y	Y			Y
LEGEND: Y = Yes N = No Y = WFO fulfilled the element. N = WFO did not completely fulfill the element.														

Source: Office of Inspector General and WFO officials.

A. WFO training programs generally meet employees' needs

The science and operations officer, under the supervision of the MIC, is responsible for the training program at each WFO. Since February 2000 when we began our WFO inspections, these officials, in the 14 offices we reviewed, have taken significant steps to improve their offices' training regimens. For example, during our inspection visits with the first four WFOs, each of the offices lacked either an office-wide training plan or IDPs, or both. We are pleased to note that, as a result of our reviews, all of the first four WFOs are now in compliance, with the exception of

Raleigh, which should have its IDPs completed by the end of the fiscal year. As Table 6 shows, 7 of the 14 WFOs had all of the targeted training program elements in place. Six WFOs were missing only one element, the same element—IDPs for all employees. Denver/Boulder was the only office lacking more than one element. All of the WFOs in our review incorporate WES into forecaster training as well as conduct training sessions on IFPS.

Office training plans are, essentially, complete and in place

We found during our review and inspection update that 13 of the 14 WFOs have office-wide training plans in place; the 10 WFOs where we conducted limited reviews have had partial success in developing their own training programs. For example, Denver/Boulder did not have an office-wide training plan in place, but it did survey staff to determine their training needs and discussed those needs during performance reviews. We wish to note that during our November 2000 inspection of San Angelo, it did not have a structured training program in place, but has since succeeded in doing so. As for IDPs, despite the fact that 7 WFOs reported they did not have IDPs in place for all of their employees, these offices at least had completed them for their first-line supervisors and intended to have the remaining employees' plans in place by the end of fiscal year 2002. We recommend that NWS regional officials work with their respective WFOs to ensure that they develop an office training plan and have completed IDPs in place for all staff as soon as possible.



In response to our draft report, NWS officials concurred with our recommendation to ensure that office training plans and individual development plans are in place as soon as possible.

Most training programs use WES as an effective training tool

The science and operations officer has various tools, such as the newly operational Weather Event Simulator, to help increase the proficiency of the forecast staff. During our review, the 14 WFOs reported that their SOOs actively conduct one-on-one training sessions with their forecast staff, which is the traditional training method. These sessions help the forecast staff increase their forecasting proficiency.

All of the 14 WFOs had their WES workstations (shown in Figure 6) operational. WES is a training tool designed to place a forecaster in a realistic operational situation to sharpen his or her forecasting skills by simulating actual weather events. The WES, similar in concept to flight simulators used for pilot training, is a new high-technology training program that is now installed at all WFOs. According to the NWS Assistant Administrator, studies from the Departments of Defense and Transportation, and the private sector, have shown that 25 hours of quality simulation training can achieve about two years of experience.

The Honolulu WFO staff noted that although their WES is operational, they have not done much with it yet because the “canned” program is not as applicable for their weather events. Several WFOs believe that WES will become a more valuable training tool as more archived weather events become available. Therefore, we recommend that NWS ensure that each WFO has an operational WES that is equipped with archived weather events that are representative of a variety of relevant climates for use in training programs to improve forecaster proficiency.

Figure 6: WES workstation at the Sterling WFO



Source: Office of Inspector General.



In response to our draft report, NWS officials concurred with our recommendation to ensure that WFOs have appropriate archival software to conduct training simulations with the WES. They stated that each office now has the means and the responsibility to produce its own training cases according to its needs. Although NWS officials stated that NWS headquarters will continue to produce national WES cases to satisfy the diverse training needs of WFOs nationwide, they noted that there is not yet a national simulation case for the Pacific Region. NWS officials further noted that there have been successful examples of WFOs adopting simulation cases developed from other WFOs located several hundred miles away, and suggest that WFO Honolulu may benefit by seeking tropical weather event cases developed by other WFOs.

WFOs anticipate IFPS will require increased investment of training resources

The Integrated Forecast Preparation System (IFPS) uses a digital database, containing forecasts of weather elements (i.e., maximum and minimum temperatures, wind speed and direction, and amount of cloud cover), so that forecasters can edit the values in this database and then use product generation tools to automatically compose and format their products, such as written forecasts and weather advisories. This will allow NWS forecasters to concentrate on making important forecast and warning decisions, rather than on preparing products. This digital database also makes it easier for forecasters to keep their products consistent over time and among products. IFPS was operational at the WFOs we reviewed, and officials expect that IFPS will allow forecasters to more easily prepare their forecasts.

NWS officials stated that the introduction of IFPS into a WFO's forecast operations requires a significant investment of training resources. Although all WFOs reported their IFPS was operational and they were conducting training sessions for the staff, many had concerns about the amount of time needed to fully implement it into their forecast operations. We recommend that NWS officials ensure that sufficient training resources are provided to implement this new system.



In response to our draft report, NWS officials concurred with our recommendation, and stated that IFPS training plans are in development and will be issued in the fall of 2002.

B. Scope of WFOs' research efforts varies by location

Based on our discussions with WFO officials, and our review of WFO web sites, we found the level of applied research carried out by the WFOs varies widely. Offices collocated at or in close proximity to universities or government laboratories with research facilities, such as the WFOs in Raleigh, St. Louis, Norman, and San Francisco, have a strong emphasis on applied research and benefit from joint research efforts. Several other offices have good programs, while a few offices place less emphasis on applied research.

Most WFO MICs and SOOs encourage their forecast staffs to perform operational or applied research. These managers suggest research topics to improve forecasters' knowledge in various areas and incorporate the research into the offices' training plans. Results of the research are shared with other WFOs in the region, when applicable. Such research can improve forecast accuracy and create a better understanding of certain meteorological phenomena.

For example, Norman officials responded to our request with several examples of recent research projects, which are completed or in progress. One example is a study of atypical tornadic storms, which identified previously undocumented portions of the tornadic supercell spectrum and provided guidance to forecasters to show how such storms are characterized by radar. Norman officials expect that this study will improve their ability to recognize tornado threats. The results will be presented at the upcoming 2002 American Meteorological Society Severe Storms Conference. They also hope to complete a training case study for distribution on WES. A second example is a study of tornado damage survey assessment techniques. Norman, in conjunction with the National Severe Storms Laboratory and the University of Oklahoma, conducted a study to document the techniques and issues associated with conducting scientific surveys of damage following a major tornado outbreak. The tornado outbreak of May 3, 1999, provided the focus for the study, which then provided a template for surveys of future events. Preliminary results were shared at a May 2000 symposium, and the results were published in June 2002.

Unfortunately, some WFO officials reported that their forecast staffs, with the demands placed on them to use WES for training sessions or other operational demands, do not have enough non-operational shifts that they can use for training, applied research, and other purposes. In fact, as noted in our Missoula inspection report, the SOO there believed that more research was needed to correct a problem the WFO's radar had in predicting severe storms. Since our inspection visit, we were advised that the WFO, in conjunction with the National Severe Storms Laboratory, had completed an evaluation that found a solution to the radar problem.

Although we believe that WFOs benefit from their research efforts, the emphasis placed on conducting such research varies by WFO. Some WFO managers are ardent proponents of conducting local research projects. Not only does such applied research benefit the WFO in particular and NWS in general, but they believe that forecasters seeking to advance their NWS careers can do so by undertaking research projects. On the contrary, other WFO managers and

forecasters are adamant in their belief that WFOs serve primarily an operational role—developing forecasts and issuing weather warnings and advisories—and that research should not be a significant part of WFO operations.

We found that at least 7 of the 14 offices we interviewed are situated near either a university or college with a meteorology or atmospheric sciences department, or a government laboratory, thus enabling them to develop mutually beneficial relationships with the faculty. In those offices near a university, the SOO participates in the university's curriculum while also arranging for faculty members to make presentations to the WFO's forecast staff. We also note that a few WFOs undertook joint research projects with local institutions.

While many of the offices may be conducting valuable applied research, we searched the Internet web sites of all 14 WFOs and found only 6 with links to their research program. We found that the web sites for the Raleigh, San Francisco, St. Louis, Miami, and Mt. Holly WFOs, in particular, stand out as having very active research programs—based on the number of research projects identified. Although the Norman WFO does not have an Internet link to its research program, it furnished us, upon request, several examples of local research projects. The remaining WFO sites may have their own examples of local research projects, but none were requested. We recommend that all WFOs continue to encourage their staffs to conduct applied research projects, and also establish links on their Internet web pages as a means to disseminate their research results and to provide access to that research to other WFOs and the public.



In response to our draft report, NWS officials concurred with our recommendation to encourage operational and applied research throughout all levels of NWS. NWS officials further stated that the Office of Science and Technology is developing NWS policy directives on science review and technology infusion which, when in final form, will define the processes a field organization will use to perform, approve, and provide operational and applied research within NWS and provide access to the public through Internet links to websites.

V. Information Technology Operations Are Improving

When we began our review, none of the 121 WFOs had prepared security documentation required by NOAA and NWS, and we found that some office personnel were neither aware of nor following NWS policies on IT security. At one office, we found that no one was being held accountable for managing the office's IT systems and equipment, while at another office, the staff had just begun to implement NWS's IT security policies. By the end of our review of 14 offices, WFO personnel had greatly improved their information technology (IT) operations by completing security documentation and performing regular IT oversight. While we only reviewed the IT operations of 14 offices over the last two years, we believe that the WFOs have made the most improvement in the IT area. We found that the 14 offices we reviewed have established a comprehensive IT program.

We reviewed four major areas to analyze the quality of office IT operations. In Table 7, we document the improvements in office IT operations specifically in the areas of IT oversight, security documentation, controls and procedures, and maintenance. At the beginning of our reviews, WFOs did not understand the requirements of a complete IT program. The elements we chose and the questions we asked about them were: did the WFO (1) have office IT personnel assigned to oversee security issues; (2) have all of the required IT security documentation prepared; (3) implement all IT controls and procedures; and (4) adequately maintain the office's IT systems?

A. *IT personnel are being assigned to oversee security issues*

Our major IT issue during the last two years was to determine whether each WFO had adequate IT security and oversight. Without adequate office oversight, we were concerned that NWS information systems would not be fully operational and secure. From our review of the Raleigh WFO in February 2000 to our visit to the Mt. Holly WFO in February 2002, we found that some WFOs had progressed from having no designated IT official to an on-site Information Technology Officer (ITO), a new position created by NWS in 2001. After reviewing 14 offices, all of them had designated IT responsibility to one or more individuals including the new ITOs at seven of those WFOs. The ITOs are solely responsible for IT operations, whereas current individuals assigned to the IT area have other duties to perform. ITOs will be assigned to all WFOs when positions at those offices are available. As of April 2002, NWS had designated ITOs at 82 of the 121 WFOs.

While NWS has emphasized IT oversight, we found the oversight of the offices we visited could be improved. As stated earlier, during our Raleigh review, no one had been officially designated the primary IT representative. While the office's ESA stated that he had been the office's *de facto* systems security officer, he stated that he did not know what security guidelines had been issued and what security tasks needed to be implemented. The ESA emphasized that the office's MIC never officially designated anyone in the office as the IT security officer. After our review, the MIC appointed one of the office's electronic technicians as the new IT security officer. Since the issuance of our final report in September 2000, the Raleigh MIC has selected an ITO who assumed the new post in June 2002.

Table 7: Information Technology Issues Found at WFOs

Issue	Raleigh	San Angelo	Missoula	Chanhassen	San Francisco	Seattle	St. Louis	Denver/Boulder	Anchorage	Miami	Norman	Sterling	Honolulu	Mount Holly
IT Oversight														
• ITO on staff*	Y	N	N	N	Y	Y	Y	N	Y	N	Y	N	Y	N
• IT designated individual**		Y	Y	Y								Y		Y
• IT duties among staff**								Y		Y				
IT Security Documentation														
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
IT Controls and Procedures														
• Passwords changed regularly	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
• Software licenses reviewed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
• System backups performed	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
• Security software updated	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
IT Maintenance														
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<p>LEGEND: Y = Yes N = No Y Completed or performed. N Not completed or performed.</p> <p>* Some WFOs have hired an Information Technology Officer (Y) while others plan to hire an ITO (N). ** If an office has an ITO, they do not need an IT-designated individual, nor do they need to spread IT duties among staff.</p>														

Source: Office of Inspector General and WFO officials.

At San Angelo, the office’s IT security officer had been designated in September 2000 just prior to our November 2000 review, and he had just prepared the office’s security plan,¹⁶ risk analysis,¹⁷ and disaster recovery plan¹⁸ in October 2000. Office personnel told us that the required NWS documents were completed only in preparation for our review and that the office’s security officer was designated after the staff read the OIG inspection report on the Raleigh WFO. Before the security officer’s designation at both Raleigh and San Angelo, no one had been periodically re-evaluating security levels and ensuring that only approved hardware and software were installed.

At Missoula, an IT security officer had not been designated until November 2000. The office’s electronic systems analyst, who had been unofficially performing these duties in response to the

¹⁶ The security plan contains detailed technical information about the office’s systems, its security requirements, and the controls implemented to provide protection against vulnerabilities.

¹⁷ The risk analysis measures the relative vulnerabilities and threats to an office’s information technology systems in order that resources can be used to strengthen security and minimize potential losses.

¹⁸ The disaster recovery plan provides continuity in data processing services should catastrophic events occur, causing interference with normal system operations.

new NWS security guidelines and our inspection of the Raleigh WFO, accomplished important IT tasks, such as regularly changing system passwords, completing a full hardware and software inventory, and implementing virus protection software. At Chanhassen, the ESA oversees IT resources and security by supervising two electronic technicians, and working with the technicians to maintain and upgrade the office's computer hardware and software and maintain the radar. As shown in Table 7, 6 of the remaining 10 WFOs have ITOs in place, and they are fully supporting the IT program for their respective WFO.

B. IT documentation has been prepared

Since 1990, NWS has issued several policies for maintaining the security of each WFO's hardware and software systems.¹⁹ In August and December 1999, NWS issued a new AWIPS security policy and an overall NWS IT security plan.²⁰ The new security plan greatly expanded office security requirements, including requiring an office-level security plan, risk analysis, and disaster recovery plan. At the completion of this crosscutting review, we found only two of the 14 offices had not completed all of their required IT documentation (see Table 7).

At the time of our Raleigh review, NWS had just mandated these security requirements, so we considered it too soon to evaluate the Raleigh WFO's compliance with them. However, subsequent to our visit, Raleigh completed its required documentation. At San Angelo, as noted above, staff members signed the office's IT Security Plan just before our November 2000 inspection. As a result, office security had not been officially documented and properly implemented at the time of our visit. We also found no documentation that the office's IT Security Plan, Risk Analysis, and Disaster Recovery Plan had been approved by the MIC and reviewed by the NWS Information Technology Security Officer, who must approve all three documents.²¹ As an update to our prior San Angelo report, San Angelo now reports that its security documentation is complete.

During our Missoula inspection, NWS's Information Technology Security Officer approved the office's security plan, risk analysis, and contingency plan. However, because the MIC and the SOO were relatively new to the office and their jobs, they were not involved in preparing these documents, and they did not completely understand the office's IT security program. It is important that the SOO is aware of the office's IT security program so that he or she can ensure that everyone has proper training in IT security. The office IT security officer confirmed that he had not seen the office's three documents and, more importantly, was unsure what his specific duties and responsibilities were as the WFO's IT security officer. We recommended that the MIC needed to clarify the responsibility of the IT security officer, which the MIC has subsequently done.

In our review of the Chanhassen WFO, we determined that the IT program was well managed. The ESA serves as the designated IT person for the WFO. We found the office had an approved IT security plan, risk analysis, and contingency plan in place. Every staff member is required to

¹⁹ The three key policies are (1) *IT Security Management*, NOAA Administrative Order, August 1990, (2) *National Weather Service Office Automation Policy and Guidelines*, Weather Service Operations Manual, Chapter A-50, May 1991, and (3) *Final Advanced Interactive Processing System Security Policy*, December 1996.

²⁰ *Advanced Weather Interactive Processing System (AWIPS) Information Technology Security Policy*, August 1999, and *National Weather Service Information Technology (IT) Security Plan*, December 1999.

²¹ *National Weather Service Information Technology (IT) Security Plan*, December 1999.

review the plan with the MIC once a year and initial all updates to the plan to attest that they have reviewed it. As shown in Table 7, all of the remaining 10 WFOs have their IT documentation in place.

C. IT controls and procedures are being implemented

NWS has made systems security policies more stringent to increase the protection of its IT resources. Each NWS IT systems owner has specific guidance for operating all systems and ongoing security tasks including (1) maintaining the appropriate level of security for IT resources, (2) periodically reevaluating security levels, (3) ensuring that only approved hardware and software are installed, and (4) designating an office IT security officer. NWS's new policies reaffirm the importance of periodically reevaluating IT security and designating an IT security officer. We found that the 14 WFOs have instituted and begun addressing prescribed NWS controls and procedures. As a result, the 14 WFOs have enhanced the security levels of their IT programs beyond what they were when we started our reviews in February 2000. Table 8 outlines the general recommendations we made during our inspections of Raleigh, San Angelo, Missoula, and Chanhassen to NWS regional, WFO, and Headquarters personnel.

Table 8: Previous OIG Recommendations to Improve IT Controls and Procedures

<p>The WFO should:</p> <ul style="list-style-type: none">➤ periodically revise system passwords;➤ prepare an updated software inventory;➤ test the office's backup and contingency procedures as soon as possible;➤ send the IT Security Plan, Risk Analysis, and Disaster Recovery Plan to the NWS Security Officer, NOAA Security Officer, and the Department of Commerce Security Manager for approval; and➤ revise the risk analysis to document all appropriate risks, including that of outside intrusion.
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Source: Office of Inspector General.

We issued the above recommendations because the first four offices we reviewed had not been adequately addressing security issues. For example, we found that Raleigh had not designated a systems security officer, performed periodic security reviews, periodically changed system passwords, or updated its virus software. We recommended that Raleigh's new office IT liaison implement the new AWIPS policy and NWS security plan and correct the office's deficiencies as soon as possible. Without adequate IT security measures in place, a WFO is at greater risk and may face numerous vulnerabilities, including employees downloading unapproved software, having unlicensed software installed, and not having adequate protection against computer viruses.

At Missoula, we found that the office recently had assigned an individual to take over the IT duties from the office's electronic systems analyst. We recommended that the new IT security liaison determine what IT security tasks still needed to be performed and ensure that they are completed. For example, the electronic systems analyst stated that some new computer security updates had not been implemented and that some IT contingency and/or evacuation procedures had not been tested. The Missoula MIC now reports that the office has updated the security software, and the contingency plans have been tested.

At Chanhassen, we believe that the ESA has been able to effectively manage the IT security resources and environment. However, he stated that at times it is difficult to keep abreast of ongoing maintenance of electronic systems and IT security issues for the office. He attributed the difficulty to minor emergencies that arise. To remedy the situation, the ESA developed trouble guides to help the forecasters trouble-shoot minor software or systems problems that they would normally call on the ESA to fix. He acknowledged that with the growing emphasis on IT issues in general and the emphasis on IT security in particular, it would be helpful to have a full-time ITO in place in the near future. Central Region officials have told us that when the next DAPM, HMT, or meteorologist intern leaves, Chanhassen will hire an ITO.

D. IT maintenance is being performed

Overall, we found that the 14 WFOs were performing adequate IT maintenance. However, we identified some problems during the last two years that WFO managers needed to address. Table 9 identifies those problems that WFO staff have experienced and corrected.

Table 9: IT Maintenance Issues at Weather Forecast Offices

Issue Identified by OIG	Status
ESA not overseeing system repairs. (Raleigh)	ESA began overseeing repairs.
Office lacked a systems maintenance schedule. (Raleigh)	Office prepared maintenance schedule.
Electronic technicians had not performed regular maintenance on some office equipment. (Raleigh)	Office personnel now perform regular maintenance.
Electronic technicians had not recorded their time spent on repairs in the repair system. (Raleigh)	Electronic technicians began recording all of their time.
Office lacked an inventory of system hardware and software including software license information. (Raleigh and San Angelo)	Offices prepared an inventory.
Some office equipment was not promptly repaired. (Raleigh)	All office equipment is now promptly repaired.
Some automation hardware and software had not been implemented. (Raleigh and Missoula)	All automation hardware and software was implemented.
Office personnel did not know how to use the repair system. (Raleigh)	Office personnel were instructed on how to use the repair system.
Office lacked a full spares kit, which hindered repair of equipment. (Missoula)	Office obtained additional parts needed for repair of equipment
Office personnel felt systems maintenance was overwhelming. (Chanhassen)	ESA prepared trouble guides to help forecasters trouble-shoot minor software or systems problems. Office personnel must wait for office to hire an ITO.

Source: Office of Inspector General and WFO officials.

E. Regional oversight should address ongoing IT operations

As a result of NWS’s development of IT policies and procedures and increased departmental emphasis on IT security, it is important for the NWS regional offices to effectively oversee IT operations at all WFOs. During our reviews and discussions with the 14 offices, office personnel

stated that it is difficult to manage IT security issues as well as ongoing maintenance of office electronic systems. While all WFOs will eventually have an ITO to oversee IT activities, there is no guarantee that the issues described in Table 9 will not recur. Continuous oversight of all IT operations is also necessary to help ensure that all IT requirements are addressed and progress made in this area is maintained. As a result, we recommend that NWS follow up on the IT maintenance issues identified in Table 9 as well as other issues related to IT personnel, documentation, and procedures during future office and regional oversight reviews.



In response to our draft report, NWS officials concurred with our recommendation that information technology issues (such as IT security controls and procedures, documentation, and maintenance) be added to their checklists for regional oversight reviews of WFOs.

VI. WFO Administrative Operations Need Tighter Internal Controls

Our review of administrative operations at the 14 WFOs included the handling of purchase cards, convenience checks, accountable property, and government vehicles. We found numerous administrative deficiencies at several WFOs. Specifically, we found that (1) some WFO purchase card holders did not follow federal and Commerce policies and regulations on proper use of purchase cards, (2) convenience checks were improperly used in some WFOs, (3) controls over accountable property were weak, and (4) internal controls over the use of government vehicles were lacking.

A. WFOs failed to follow Commerce and NOAA regulations for purchase cards

We noted that all WFOs that we reviewed failed to (1) follow purchase card regulations, (2) use required sources of supply for purchases, (3) demonstrate a need for the current number of purchase cardholders, (4) provide adequate supervisory oversight over purchase card usage, or (5) obtain refresher training for cardholders and approving officials.

Offices did not follow purchase card regulations

In our review of purchase card usage at the 14 WFOs, we found that several WFOs did not comply with departmental guidelines in maintaining purchase order logs, attaching supporting documentation to the statements, and providing detailed descriptions of their purchases. Rather, they omitted supporting documentation, and used vague descriptions, such as “office supplies,” “building supplies,” or “training,” or in some instances they did not maintain logs at all. Some cardholders stated that they did not know they were required to submit logs.

In addition, we identified purchases by multiple cardholders, other than the administrative support assistant (ASA), for the same items—compact disks and other general office supplies (*e.g.*, pens, pencils, folders)—that could easily and more efficiently have been purchased by the administrative support assistant for the entire office. Centralizing purchases of general office supplies could save money and increase internal controls. In another example, we found purchases made by the electronic technicians for computer equipment that should have been purchased by the electronic systems analyst (ESA), who is the electronic technicians’ supervisor. To save money and improve controls, we also recommend that WFOs centralize all computer-related purchases with the ESA.

Some MICs did not ensure that there were adequate internal controls over purchase cards, nor did they provide adequate oversight or refresher training to ensure that the cardholders adhere to regulations and procedures related to purchase card use. The lack of adequate controls provides the opportunity for theft and waste of government resources.

The Commerce Acquisition Manual²² requires that cardholders maintain a purchase card ordering log for all transactions and attach applicable mandatory approvals and receipts. The log should include a clear, detailed description of the itemized purchases, payments, returns, and credits;

²² Commerce Acquisition Manual, April 2000, Part 1313.301, “Department of Commerce Purchase Card Procedures.”

appropriate supporting documentation, including sales receipts; and the cardholder statements with the MIC's approval signature.

We recommend that the MICs centralize the responsibility for ordering general office supplies and computer or electronic equipment with their ASA and ESA, respectively, to ensure adequate control of purchases and to minimize the number of purchase card statements to be reviewed. This would also enable them to more easily track their offices' budgets and their procurement actions, allow for better inventory reconciliation, and, in turn, help save money. Lastly, we recommend that all office cardholders and approving officials, including the MICs, review purchase card rules and regulations, and receive refresher training on proper usage of purchase cards.

Purchase cardholders failed to use required sources of supply

The *Federal Acquisition Regulation* (FAR) and Commerce regulations state that purchase cardholders must acquire supplies and services from specific sources, if they are capable of providing them. In our sample of purchase card statements, we found examples of WFO cardholders purchasing office supplies from commercial sources such as Franklin Covey, Office Max, and Office Depot retail stores. We identified two examples, in the Miami and St. Louis offices, in which purchases were made of pens, notepads, and batteries from Office Max. Although it is not inherently improper to purchase such items from commercial sources, officials must follow certain steps to make such purchases. Although it is not a requirement, an example of documenting purchases from commercial sources of supply was identified at the San Angelo WFO, where an employee purchased a flashlight from Wal-Mart and submitted documentation stating the reason why she did not use a required source of supply. The San Angelo WFO uses a standard form to record and justify all purchases that are not from a required source of supply. We recommend that NWS evaluate this procurement process and consider using it in all WFOs.

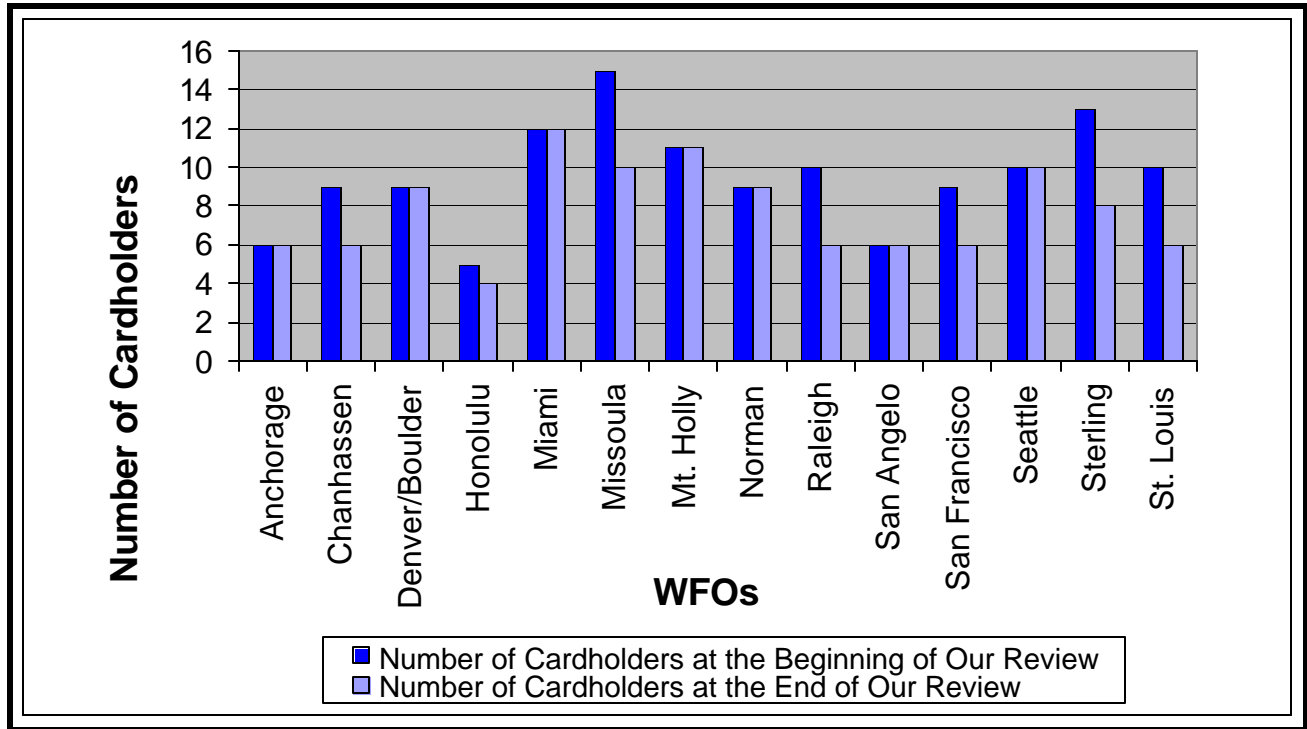
According to the FAR, Subpart 8.001, agencies are required, in priority order, to purchase supplies from (1) Federal Prison Industries, Inc. (FPI), (2) products available from the Committee for Purchase From People Who Are Blind or Severely Disabled (NIB/NISH), (3) wholesale supply sources, such as the General Services Administration (GSA), (4) mandatory Federal Supply Schedules, (5) optional use Federal Supply Schedules (such as an Office Depot schedule), and (6) commercial sources (such as Office Max). Agencies may only use commercial sources after having determined that the needed items are not available from higher priority sources.

Unfortunately, we found no evidence that the above-mentioned required sources of supply were considered before items were bought using purchase cards, except in the example noted for San Angelo. The supplies listed on all the documents we reviewed were purchased from commercial sources and could have been ordered through GSA or another required source of supply. Therefore, we recommend that the WFOs comply with the FAR requirements regarding use of required sources of supply and implement the appropriate procedures when they do not use required sources of supply, as is done in San Angelo.

WFOs have an excessive number of government purchase cardholders

In our review, we found that 11 WFOs had nine cardholders or more. However, since our inquiry into the number of government purchase cardholders, 7 of the 14 WFOs have reduced or are in the process of reducing the total number of cardholders in their offices (see Chart 1).

Chart 1: Number of Purchase Cardholders at Each WFO



Source: WFO officials.

Based on our analysis, we believe that there are an excessive number of purchase cardholders in the WFOs we reviewed. We found that the number of cardholders makes it more time-consuming for MICs to thoroughly review and approve each cardholder’s monthly statement. Additionally, the large number of cardholders makes it difficult to ensure that proper procedures are followed. In accordance with NWS guidance, we recommend that the MIC in each WFO determine the minimum number of cardholders necessary and eliminate those with little or no activity for the past year. We were told that as a result of our Raleigh inspection report, several MICs have reduced the number of purchase cardholders in their offices. For example, the MIC in Missoula told us that one of the first improvements she made was to reduce the number of cardholders in her office from 15 to 10, and she plans to reduce them further. Furthermore, we were told that as a result of our Chanhassen inspection report, the Central Region Administrative Chief has reduced the number of purchase cardholders and the monthly purchase limits of cardholders in all WFOs region-wide.



In response to our draft report, NWS officials concurred with our recommendations on the use of purchase cards. NWS said that it is currently conducting an administrative review of all field offices. The review covers, in part, the appropriate number of purchase card and convenience

check accounts at each office, employee knowledge of and compliance with FAR requirements, and clarification of instances of inappropriate use, if any.

NWS officials also stated that they would examine centralizing the purchasing of office supplies and computer equipment with the ASAs and ESAs; they will comply with the Department's June 2002 requirement that all new and existing cardholders and approving officials must complete purchase card training (or refresher training, if applicable) by September 30, 2002. Furthermore, NWS officials stated that they will (1) examine the San Angelo form identified in the report for possible adoption NWS-wide to ensure compliance with FAR requirements before using commercial sources of supply; (2) cancel all unnecessary purchase cards; (3) as part of their administrative reviews, determine if there are instances of inappropriate use of the purchase cards; and, (4) add monitoring of WFO compliance with purchase card rules and regulations to the checklist for the regional administrative reviews.

B. Internal controls over convenience checks need to be strengthened at some WFOs

While we found that most WFOs were using convenience checks properly, two WFOs were using convenience checks inappropriately. We also found three WFOs that appear to have more authorized convenience check users than needed.

WFOs should follow guidelines for convenience checks

We found that most WFOs are following NWS guidance for convenience checks. In our inspections of Raleigh, San Angelo, Missoula, and Chanhasen, we only found one example of personal misuse of a convenience check. In addition, based on interviews with staff and a small sample of convenience check statements, we did not find, in our limited inspections, any examples of misused convenience checks at the 10 additional WFOs. Nevertheless, improvements could be made in the management of these accounts. For example, St. Louis stated that they have used convenience checks to reimburse employees for official expenses, such as parking fees. As noted in the Chanhasen inspection report, the departmental guidance does not allow convenience checks to be used to reimburse NWS employees.

According to departmental regulations, convenience checks are to be used only for official, authorized purposes, including payments to vendors that do not accept government purchase cards or purchase orders. NWS guidance provides that convenience checks cannot be used for the following: (1) travel advances; (2) pay vendors that accept the government purchase card, purchase orders, blanket purchase agreements, Purchase Order-Invoice-Voucher Forms (SF 44s), or for items offered through the General Services Administration; (3) interim receipts prior to the purchase being made; (4) Cash-In-Your-Account (a Commerce Department employee awards program); or (5) reimburse employees, individuals or vendors.

We recommend that the St. Louis WFO stop using convenience checks to reimburse employees. Overall, we recommend that NWS regional offices review their WFOs' convenience check accounts to determine if there are any instances of inappropriate use and ensure that all future convenience check transactions are in accordance with departmental guidelines.

The number of WFO convenience check account holders should be minimized

We found three WFOs that have more authorized convenience check users than what appears to be operationally necessary. The Denver/Boulder and San Angelo WFOs have two authorized convenience check users, and Missoula has three. Because we found very little use by users at the three WFOs, we believe the number should be reduced. For example, the Denver/Boulder ASA and MIC have individual convenience check accounts, yet the MIC reportedly has never used his checks and the ASA uses hers infrequently. At San Angelo, the DAPM and the ESA are the check users, although the ESA has seldom used his, and the DAPM is frequently away from the WFO. At Missoula, the three convenience check users are the former ASA (who is now an HMT in the office), the current ASA, and the ESA. According to office staff, the former ASA no longer uses her convenience checks, but the office has yet to process the necessary paperwork to cancel her account. Furthermore, officials stated that the ESA has only used one check in the past six months.

As a practical matter, we recommend that the number of authorized convenience check users be kept at a minimum and, if unused, an account should be cancelled to limit vulnerability. Some WFOs have little or no need for convenience checks. For example, the Sterling and Anchorage WFOs do not have any convenience check users. We believe that convenience checks should only be issued when operationally necessary. In the example noted above for Denver/Boulder, we believe the MIC should cancel his account, based on lack of need. In San Angelo, it would likely be more convenient for the ASA to be the authorized convenience check user for the office, rather than the DAPM and ESA—because they both are frequently out of the office. For Missoula, we recommend that the MIC should not only immediately cancel the former ASA's convenience checks, given that she no longer uses them, but also determine if it is operationally justifiable to have the both ASA and the ESA retain their convenience checks.



In response to our draft report, NWS officials concurred with our recommendations on the use of convenience checks. As noted above, NWS's administrative review of field offices will focus on convenience checks (and purchase cards) to eliminate unnecessary convenience check accounts, and re-emphasize mandatory rules and regulations governing the use of convenience checks. NWS will also conduct refresher training, and add a requirement to monitor WFO convenience check use to the regional administrative review checklist.

In response to our draft report, NWS officials partially concurred with our recommendation to cancel convenience check accounts at the Denver/Boulder, San Angelo, and Missoula WFOs. NWS officials stated that they would await the outcome of their administrative review of all WFOs to determine the appropriate number of convenience check accounts at each field office. NWS officials did concur, however, with our recommendation to cancel the former Missoula ASA's convenience check account. We agree with the approach NWS is undertaking and appreciate their efforts to conduct a thorough review of all WFOs, in addition to the three locations we identified, to determine the appropriate number of convenience check accounts at each office.

C. Controls over accountable property could be stronger

As part of our review of administrative operations, we found that overall controls over accountable property were generally good, with the exception of two offices. Specifically, for Raleigh and Chanhassen, we found that the inventory records were not accurate or up-to-date, resulting in both missing equipment and accountable property not being included on the official inventory. We also found that eight WFOs maintain excess computer equipment in on- and off-site storage facilities. In Table 10 are the elements we chose and the questions we asked of WFOs: (1) do they conduct annual inventory; (2) do they secure sensitive property; (3) do they use a sign-out log for sensitive property; (4) do they dispose of excess equipment; and (5) if they have not disposed of excess equipment, are they in the process of doing so?

Table 10: Accountable Property Practices of 14 WFOs

Elements	Raleigh	San Angelo	Missoula	Chanhassen	San Francisco	Seattle	St. Louis	Denver/Boulder	Anchorage	Miami	Norman	Sterling	Honolulu	Mount Holly
Found all items in sample*	N	Y	Y	N										
Conducts annual inventory	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Secures sensitive property	N	Y	Y	N	Y	Y	Y	N	Y	N	Y	Y	Y	N
Uses a sign-out log for sensitive property	N	N	Y	N	Y	Y	Y	N	N	N	N	Y	N	Y
Disposes of excess equipment	Y	N	Y	N	N	Y	Y	N	Y	N	N	N	N	Y
In the process of disposing of excess equipment		N	Y	N	N			N		N	N	Y	Y	
LEGEND: Y = Yes N = No Y WFO fulfilled the element. N WFO did not fulfill the element. * OIG did not check inventory items during brief reviews at 10 WFOs.														

Two WFOs cannot account for personal property inventory

In conducting our inspections of the four WFOs, we sampled items on their property lists and recent purchase records to determine whether the items were included on the office's official NOAA inventory record. For Raleigh and Chanhassen, we could not locate all items selected from their inventory lists; however, we were able to locate all inventoried items for San Angelo and Missoula. In addition, at the Raleigh and Chanhassen WFOs some purchases did not appear

on any inventory record. In our review of the additional 10 offices, officials at all of the WFOs reported that they conduct annual inventory reviews of all accountable property.²³

At 5 of the 14 WFOs, the designated property custodians (usually the MICs) told us that they do not secure sensitive property²⁴ in a locked cabinet, safe, or office in accordance with departmental and NWS guidelines. On the other hand, 6 of the remaining 9 WFOs have implemented added security measures in that they either require employees to obtain permission to use sensitive items or they use a sign-out log. The other 3 of the remaining 9 WFOs secure sensitive items according to departmental and NWS guidelines.

According to departmental regulations and NWS guidelines, the property custodian is responsible for maintaining inventory, which includes ensuring that (1) administration and maintenance are effective and based on a system of control and accountability for personal property; (2) physical inventories are taken, records are reconciled, and discrepancies are investigated and resolved; and (3) property is fully utilized and safeguarded from misuse or theft.²⁵

In an example of inadequate internal controls, we found missing property in the Raleigh WFO that should have been on the inventory list. Specifically, an employee purchased a digital camera with his purchase card, however there was no inventory entry made to reflect the purchase. When another employee inquired about the digital could not be located in the office.

In another example, we found that the Raleigh camera, the first employee reportedly denied the purchase. While we found evidence that the purchase was made and the item was received, there was no record of it on the inventory list, and the WFO did not have an adequate system of control and accountability for personal property. Although the MIC sent us an inventory report dated March 8, 2001, certifying, “that all personal property items are listed on the Personal Property Inventory Report, and that the items as indicated on the report were on hand,” we were able to identify sensitive items that were on hand but were not listed on any property record, as well as three laptop computers that were on the inventory record but could not be found in the office. Eventually, the ESA was able to locate the missing laptops—one used by the fire weather meteorologist and two used by the electronic technicians.

Furthermore, while trying to verify whether property items were properly maintained, we observed that some sensitive items were not secured. Specifically, we found a handheld film scanner on a desk in the back room work area of the WFO where it could easily have been stolen or misplaced. Chapter 4 of the Department’s *Personal Property Management Manual* defines sensitive items as “non-expendable items that may be converted to private use or have a high potential for theft.” It requires supervisors to be responsible for the security of personal property and to use a responsible method to ensure its accountability.

According to departmental regulations, as the property custodian, the MIC is responsible for all of the office’s accountable property. He or she should have knowledge of the governing regulations

²³ It should be noted that we are not able to verify whether all of an office’s accountable property is listed on their inventory records without conducting an on-site review.

²⁴ Sensitive property, as defined by Chapter 4 of the Department’s *Personal Property Management Manual*, is any “non-expendable items that may be converted to private used or have a high potential for theft” that are under \$2,500.

²⁵ U.S. Department of Commerce. *Personal Property Management Manual*, section 1.204.

and ensure that the people selected to track and maintain property do so in accordance with those regulations.

We recommend that WFO property custodians secure all sensitive property, such as laptop computers, digital cameras, handheld scanners, and other items that could easily be misplaced or stolen and ensure that they are adequately inventoried and controlled. As an added security measure, we recommend that sensitive property be stored in a centralized location and a sign-out log be used to track usage and assign accountability, as is done in the Missoula and San Francisco WFOs. In addition, NWS should ensure that the MICs and appropriate staff are trained on maintenance and oversight of accountable property. Overall, we recommend that regional officials review their WFOs' maintenance of personal property inventories.

Removing excess equipment at WFOs could result in savings

We found that 10 of the 14 WFOs have maintained excess computer equipment for extended periods of time in on- and off-site storage facilities. The offices have been slow in declaring laptop computers, external disk drives, and other equipment as surplus and disposing of them.

We should note that six of the 14 WFOs reported that they have disposed of their excess property. Of the remaining eight offices, three (San Francisco, Sterling and Honolulu) have identified and declared their excess property as surplus and are awaiting final approval to dispose of excess property. The remaining five offices with excess equipment continue to store it in spaces that could be used to either store other items or eliminated altogether. At the time of our visit, the Raleigh WFO maintained a storage facility nearby; however, they have since terminated the lease and surplused and disposed of the excess equipment, saving NWS \$13,701 annually.

Disposing of excess property could yield benefits to individual WFOs. For example, according to its records, the Norman WFO pays rent for storage space in three separate off-site storage facilities that may not be needed. We were told by the staff that the three units are used to store supplies for the Cooperative Observer Program, various parts needed to repair the radar and other surface observation equipment, administrative records that are too voluminous to be maintained in the office, and old computers and printers. Officials stated that Norman did not have office space available in which to store the contents of these storage facilities. The office does not maintain inventory records for these storage facilities; however, the staff told us that they "know what is in them." The rental contract for the three storage facilities totals \$2,580 per year.

According to the Department's *Personal Property Management Manual*:

"all property (whether accountable or not) that is no longer needed in an office should be turned in to the property custodian, together with Form CD-50, 'Personal Property Control' or CD-509, 'Property Transactions Request' for redistribution or disposal. Such forms shall be used to make changes to the records and accounts for accountable property, and should also be used to establish records of property stored for subsequent redistribution or disposal."

We recommend that NWS direct all WFOs to declare as surplus, dispose of, or return to the regional office, all excess equipment, according to the procedures set forth in the Department's manual and NWS policy. In addition, we recommend that all NWS Regions determine whether

off-site storage facilities are still needed, or whether additional funds could be saved by excessing additional property and terminating leases. Furthermore, the Southern Region Headquarters should review the Norman WFO's storage contract and determine whether there is a need for all three storage units. At a minimum, we recommend that the WFO consolidate the two units that contain equipment, inventory the property, and dispose of or surplus the items that are no longer needed. We also recommend that the WFO store the administrative files at NOAA's central storage facility in Kansas City. Although it does not represent a significant amount of money, the WFO could realize a savings of approximately \$1,500 by eliminating two of its storage units.

Funds to Be Put to Better Use

We determined that the Norman WFO could save approximately \$1,500 per year in storage facility rental costs by eliminating excess equipment and consolidating the contents of the two storage units for equipment into one unit and transferring the administrative files occupying the remaining storage unit to Kansas City. We believe that more savings may be possible if NWS takes similar action to eliminate the need for off-site storage facilities at other WFOs.



In response to our draft report, NWS officials concurred with our recommendations to ensure that WFO managers and staff comply with accountable property regulations and guidelines. NWS officials stated that during regional administrative reviews, they will ensure that sensitive property is secured in a centralized location and that appropriate staff are trained on maintaining accountable property records. During these administrative reviews, surplus equipment will be identified and disposed of in accordance with applicable regulations and NWS policy. Furthermore, regional officials will be directed to work with WFO managers to consolidate stored items, dispose of surplus property, and determine if leases to off-site storage facilities can be terminated.

D. The number and usage of government vehicles need to be reviewed

After reviewing a sampling of vehicle logs and the number of official vehicles at the 14 WFOs, we found that all the vehicle logs are now reportedly adequate, but 2 WFOs appeared to have an excessive number of official government vehicles. The 14 WFOs have an average of four vehicles per office, although the number varies from two to seven vehicles. However, 12 of the 14 WFOs have 5 or fewer vehicles and 8 of the 14 WFOs have 4 or fewer vehicles. Miami and Seattle have six and seven vehicles, respectively. We believe that their operational needs could be met with fewer vehicles. Chart 2 shows the number of government-owned vehicles at each WFO.

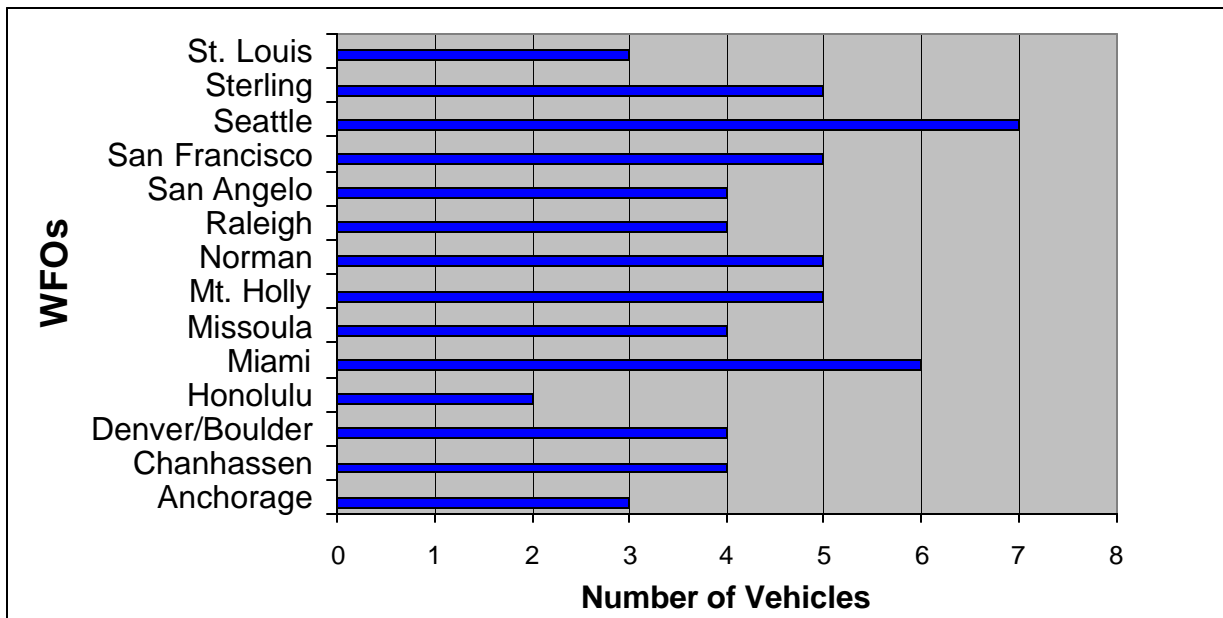
During our review, we determined that WFO employees use government vehicles at each office as follows:

- Electronic systems analysts and electronic technicians maintain surface observation equipment;
- Cooperative Observer Program Managers (CPM) conduct field visits for maintenance and repair of equipment; and
- Office management staff, including the MIC, DAPM, WCM, ASA, and SOO, conduct outreach activities and recruiting, meetings with emergency managers, and other official government business.

Number of Vehicles at Miami and Seattle WFOs should be reviewed

The Miami MIC stated that his office has one vehicle for each specific program or entity: the radar, the ASOS sites, the Cooperative Observer Program, administrative functions, outreach, and general office uses. While he believes that the office could manage with fewer vehicles, the MIC maintains that the current number is necessary because the Tropical Prediction Center (TPC) often borrows the office’s vehicles during the hurricane season (the WFO and the TPC are collocated on the Florida International University campus).

Chart 2: Number of Government Vehicles at Each WFO



Source: NWS officials.

After reviewing Miami’s vehicle logs, it does not appear that the office needs six government vehicles. For example, the 2001 Dodge Caravan, which Miami officials stated was to be used by the electronics technicians for radar maintenance, was only used approximately 40 times from June 2001 to February 2002, with an average of 3 hours per trip. Many of the recorded purposes and destinations of travel for this vehicle appear to be for general office uses, such as a trip to the Florida International University bookstore and an airport pickup. Similarly, the 1996 Ford

Aerostar and the 2001 Dodge Ram, which are also intended for use by the electronics staff, were only used approximately 20 times during the same time period as above, with an average of 2 hours per trip. We found other examples where these vehicles were used for general destinations like Office Depot, as indicated by the vehicle logs.

We believe that the Miami WFO could realize cost savings, without adversely affecting its operations, by eliminating at least one vehicle. By turning in one of the vehicles with the least amount of usage—the Dodge Ram—we believe the WFO could save money.

The Seattle MIC stated that they need seven vehicles because the office has 30 employees, 5 of whom are electronic technicians who are constantly in the field maintaining the office's many ASOS and river gage installations. The MIC also said that the WFO has vehicles that are funded for specific purposes, such as maintaining ASOS sites, the radar, and the Cooperative Observer Program, and that the Fire Weather Program needs a dedicated vehicle during the fire season. According to the MIC, another factor affecting vehicle usage at the Seattle WFO is that the staff must often travel for extended periods to visit some of the gage sites located on the Olympic Peninsula and the Pacific Coast. To do this, he said it is necessary for them to transport the vehicle on a ferry across Puget Sound to access the gage sites.

However, we believe the Seattle WFO should consider using one of the vehicles in its "off season" for other purposes, thus eliminating the need for a seventh vehicle. For example, the vehicle identified for the fire weather program could be used for outreach and Skywarn spotter training during the winter months in addition to the other WFO vehicles that would be available. When no WFO vehicles are available, WFO staff could use their personal vehicles (and claim reimbursement for mileage) for these purposes. According to departmental travel officials, government employees may be reimbursed if they use their personal vehicles to travel for official business. We recognize that the Seattle WFO needs vehicles to support the fieldwork and outreach programs of its staff. Nevertheless, we believe that the potential exists for Seattle to realize cost savings by carefully reviewing the priorities of its program needs and the availability of vehicles.

WFO vehicle logs are adequate

NWS officials told us that the 14 WFOs now use General Services Administration motor vehicle logs, which are required by most regions, to record each trip taken. The vehicle log information includes travel dates, times, and destinations; purpose of travel; and trip mileage when on official government business. However, we should note that at the time of our visit in February 2000, the Raleigh WFO did not maintain vehicle logs. Shortly thereafter, the MIC implemented a system to track the use of official government vehicles. The MIC told us that as a result of our recommendation, his office maintains vehicle logs for each vehicle that include the beginning and ending mileage so he can check if the appropriate mileage is recorded for the recorded destination. He also said that the logs and keys are kept on the forecast floor and are controlled by the shift supervisor. He further stated that the new tracking system is very helpful in determining the amount of usage on each vehicle and ensuring accountability for each vehicle. In addition to the basic information contained in their vehicle logs, six WFOs maintain sign-in and sign-out logs to keep track of when the vehicles are away from the office and to enable staff members to reserve them in advance to avoid usage conflicts.

Based on our analysis of the information provided to us, we recommend that the Miami and Seattle MICs review all vehicle logs and conduct an analysis to ensure that their vehicles are being used in an appropriate manner and to justify the need for six or seven vehicles, respectively. To achieve budgetary savings for NWS, we recommend NWS regional officials instruct all MICs to periodically review their vehicle logs, including beginning and ending mileage as is now reportedly done in Raleigh, and to cancel the lease on any vehicle for which there is insufficient demonstrated need.



In response to our draft report, NWS officials concurred with our recommendations to MICs that they periodically review their vehicle logs, verify that vehicles are being used appropriately, and return any vehicle for which there is not a demonstrated need. Furthermore, NWS officials stated that they would monitor WFO compliance with the OIG recommendations on vehicles during the regional administrative inspections.

VII. Regional Oversight Should Be Improved

In conjunction with this review, we found that although most NWS regional offices had performed some station inspections, they had mostly failed to conduct administrative reviews for the 14 WFOs discussed in this report. NWS regional officials claimed to offer management support and oversight to their WFOs through annual regional management conferences, monthly teleconferences, e-mail updates, monthly administrative updates, or Regional Administrative Guides. For the 4 WFOs at which we conducted comprehensive inspections, our concern is that the absence of adequate regional oversight allowed administrative problems to go undetected. For the 10 additional WFOs at which we conducted limited reviews, our concern regarding regional oversight is not based on finding administrative problems, but rather on the record of station inspections and administrative reviews conducted by each regional office for their respective WFOs. If regional offices only infrequently, or never, conduct administrative reviews, the likelihood of problems occurring with purchase cards, convenience checks, etc., increases.

Station inspections are internal NWS reviews that, among other things, evaluate an office's adherence to NWS policies and procedures in various areas, including systems and equipment, the Upper Air Program, and surface observations. According to the *Weather Service Operations Manual*, Chapter B-66, regional personnel are required to conduct routine comprehensive visits of WFOs at least once every 12 months for observation programs and radar stations, and at least once every 18 months for Upper Air stations. In addition, administrative reviews are useful tools for regional officials to verify or confirm that WFOs are properly implementing NWS administrative procedures or to identify the need for remedial action or training, as needed.

According to NWS officials (see Table 11), NWS regional personnel have conducted station inspections for 11 of the 14 WFOs and administrative reviews for 4 of the 14 WFOs during the last nine years. One office had a gap of six years or more between station inspections or administrative reviews, and nine had no administrative reviews. We should note, as shown in the table, that the last administrative reviews conducted for the Miami, Norman, and San Angelo WFOs were in April 1993, May 1996, and June 1996, respectively

In our recent inspection report on the Chanhassen WFO, we found there were three internal reviews performed by the WFO's weather service evaluation officer. However, these reviews were reportedly performed in-house and not by the Central Region which has oversight responsibility.

Regional office managers told us that one of the reasons why they have not conducted consistent formal reviews of their WFOs' program and administrative operations is because of their close working relationships with the WFOs and familiarity with their operations. Specifically, Pacific Region staff told us that there have been extensive informal reviews while visiting the office on other matters, because the Honolulu WFO and the regional office are in close proximity. However, they plan to implement routine reviews. On the other hand, many of the employees we talked with stated that a lack of resources prevented the regional management staff from conducting periodic formal reviews.

We observed several conditions in WFO operations that might have been corrected earlier if there had been adequate regional oversight. For example, from the records we reviewed and the conversations we had with office staff, we found that some offices had equipment for the Upper

Air Program that frequently broke down because the equipment was antiquated. Some offices also had outdated service back-up instructions (for equipment failures), station information, and station duty manuals. We also found several administrative deficiencies that we discuss on pages 37 through 48.

Table 11: Frequency of Regional Station Inspections and Administrative Reviews

WFO	Station Inspections		Administrative Reviews	
	Performed	Dates of Last 2 Inspections	Performed	Dates
EASTERN REGION				
Raleigh	Yes	Jan 2000, Nov 2001	No	
Sterling	Yes	Aug 1998, Jul 2001	No	
Mount Holly	Yes	Sep 2001	Yes	Sep 2001
WESTERN REGION				
Missoula	Yes	Jun 1999, Sept 2000	No	
San Francisco	Coop only	Mar 2002	No	
Seattle	Yes	Jan 2002	No	
CENTRAL REGION				
Chanhasen	No		No	
St. Louis	Yes	Oct 1999	No	
Denver/Boulder	Yes	Apr 1998, Apr 1999	No	
SOUTHERN REGION				
San Angelo	Yes	Oct 2001	Yes	Jun 1996
Miami	Yes	Jan 2000, Jun 2001	Yes	Apr 1993
Norman	Yes	Jul 1993, Oct 2000	Yes	May 1996
PACIFIC REGION				
Honolulu ²⁶	No		No	
ALASKA REGION				
Anchorage	Yes	Mar 1999, Feb 2001	No	

Source: NWS officials.

Given the number and the nature of the problems documented at the 14 WFOs, we recommend that regional managers and their staff develop schedules and perform periodic on-site visits to each office in their region to review management, program, technical, and administrative operations as part of comprehensive WFO reviews. We also recommend that the respective regional office should maintain records of those reviews that highlight the problems identified and offer recommendations to correct the deficiencies. They should also conduct follow-up reviews, as necessary.

In response to our earlier inspection reports and NWS management concerns, NWS implemented the NWS *Field Office Evaluation Checklist* on January 18, 2002, to help WFOs and regional offices evaluate a WFO's operational integrity, including compliance with policies, internal controls, information technology, facilities, and human and other resource management. The NWS Assistant Administrator directed the four CONUS regional directors to develop a station

²⁶ We were told that the Pacific Region Headquarters (PRH) has never conducted station inspections or administrative reviews of the Honolulu WFO. However, we were told that PRH has conducted station inspections of the surface and Upper Air observational programs at the Lihue (October 2000 and December 2001) and Hilo (December 2000 and March 2002) area data collection centers.

inspection checklist to bring consistency to office reviews. Additionally, NWS regional office managers will now conduct routine office visits to review technical, management, and administrative functions of WFOs in their region. The Central Region staff reports that since our inspection of the Chanhassen WFO, they have developed a schedule to review every WFO in their region, as well as conduct follow-up reviews. We applaud this effort, and recommend that NWS headquarters ensure that the WFO station inspections and follow-up reviews are, in fact, conducted by all NWS regions on a regular basis.



In response to our draft report, NWS officials concurred with our recommendations to strengthen regional reviews of WFOs. NWS officials stated that they would provide guidance to regional officials for their periodic reviews of management, program, technical, and administrative operations at the field offices. The NWS headquarters guidance will include an office evaluation checklist, which can be used to track corrective actions and schedules for completion. Furthermore, NWS officials reported that each region has developed an office visitation schedule.

RECOMMENDATIONS

I. Crosscutting Recommendations

We recommend that the Assistant Administrator for NWS instruct the NWS regional directors to take appropriate action in the six following areas of concern:

Forecast Quality and Products:

1. Work with WFOs to emphasize quality control and determine if any state and/or local forecast products are no longer necessary (see pages 11 and 12).

Cooperative Observer Program:

2. If turnover occurs among staff supporting the program, ensure that new employees receive Cooperative Observer Program training so that adequate resources are available to manage the program (see page 23).

Training and Research:

3. Direct their respective WFOs to ensure that they develop an office training plan and have individual development plans in place for all staff as soon as possible (see page 27).
4. Ensure that WFOs have appropriate archival software to conduct training simulations with the Weather Event Simulator and schedule sufficient staff training time for implementing the Interactive Forecast Preparation System (see pages 27 and 28).
5. As appropriate, all WFOs should be asked to encourage their staff to conduct applied research, and to establish links on their Internet web pages to help disseminate their research results and to provide access by other WFOs and the public (see page 29).

Information Technology Resources:

6. Add information technology issues (such as IT security controls and procedures, documentation, and maintenance) to their checklists for regional office oversight reviews of WFOs (see page 35).

Administrative Operations:

7. Ensure that WFO managers and staff comply with appropriate regulations and guidelines for purchase cards and convenience checks, specifically:
 - a. Centralize WFO responsibility for ordering general office supplies and computer or electronic equipment with the Administrative Support Assistant (ASA) and the Electronic Systems Analyst (ESA) (see page 37).

- b. Ensure that all purchase cardholders and approving officials, including the Meteorologist-In-Charge, review and follow purchase card rules and regulations and receive refresher training on the proper use of purchase cards (page 37).
 - c. Ensure that all purchase cardholders comply with FAR requirements in determining whether required sources of supply meet their requirements before purchasing items from commercial sources. NWS should consider standardizing the documentation developed by the San Angelo WFO, or another simplified documentation process (see page 38).
 - d. Direct all MICs to determine the minimum number of purchase cardholders and convenience check accounts that are necessary, and cancel accounts that are not necessary (see pages 39 and 41).
 - e. Review their WFOs' convenience check account to determine if there are any instances of inappropriate use, and ensure that all future transactions are in accordance with departmental guidelines (see page 40).
 - f. Monitor compliance with purchase card and convenience check recommendations in conjunction with regional administrative reviews (see page 49).
8. Ensure that WFO managers and staff comply with appropriate regulations and guidelines for managing accountable property, specifically:
- a. Ensure that WFO property custodians secure sensitive property in a centralized location, and that appropriate staff members are trained on maintaining accountable property records (see page 42).
 - b. Direct WFO managers to declare as surplus, dispose of, or return to the regional office, all excess equipment, according to the procedures set forth in the Department's manual and NWS policy (see page 44).
 - c. Direct all NWS Regions to determine whether off-site storage facilities are still needed, or whether additional funds could be saved by excessing additional unneeded property and terminating leases (see page 44).
9. Instruct all MICs to periodically review their vehicle logs, verify that their vehicles are being used in an appropriate manner, and return any vehicle for which there is no demonstrated need (see page 47).

Regional Office Oversight:

10. Ensure that regional headquarters managers and their staff develop inspection schedules, periodically visit each WFO in their region to review management, program, technical, and administrative operations as part of comprehensive WFO reviews using the NWS *Field Office Evaluation Checklist*, maintain records of each review, and ensure that corrective actions are taken (see page 49).

II. Recommendations for Specific WFOs Covered in This Report

We recommend that the Assistant Administrator for NWS instruct the MICs of these specific WFOs or officials at the appropriate Regional Headquarters Office to take appropriate actions in the following areas:

Forecast Accuracy and Radars:

11. Improve their forecast accuracy and address radar problems. Specifically:
 - a. Address the continuing discrepancy between San Angelo's POP improvement over the model guidance and the southern region's 2001 average (see page 8).
 - b. Improve WFO Miami's flash-flood lead-time as compared with the southern region's average (see page 9).
 - c. Conduct the environmental and engineering studies of the Missoula radar's angle and, if necessary, make appropriate adjustments to the radar (see page 13).

Administrative Operations:

12. Cancel the Denver/Boulder convenience check account, based on lack of need; establish an account for the San Angelo ASA and cancel the accounts held by the DAPM and ESA; and immediately cancel the former Missoula ASA's account, and determine if it is operationally justified to have the both ASA and the ESA retain their convenience check accounts (see page 41).
13. Southern Region Headquarters should review the Norman WFO's storage contract and determine whether there is a need for all three storage units. At a minimum, the WFO should consolidate the two units that contain equipment, inventory the property, and dispose of or surplus the items that are no longer needed, and store its administrative files in Kansas City (see page 44).

APPENDIX I

Acronyms for the National Weather Service

ASA	administrative support assistant
AWIPS	Advanced Weather Interactive Processing System
CWA	county warning area
DAPM	data acquisition program manager
ESA	electronic systems analyst
FAR	false alarm rate
HMT	hydrometeorological technician
IDP	individual development plan
IFPS	Interactive Forecast Preparation System
ITO	information technology officer
MIC	meteorologist-in-charge
POD	probability of detection
POP	probability of precipitation
SOO	science and operations officer
TPC	Tropical Prediction Center
WCM	warning coordination meteorologist
WES	Weather Event Simulator
WFO	weather forecast office

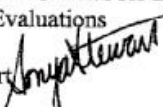
AGENCY RESPONSE



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
CHIEF FINANCIAL OFFICER/CHIEF ADMINISTRATIVE OFFICER

SEP 25 2002

MEMORANDUM FOR: Jill Gross
Assistant Inspector General for Inspections
and Program Evaluations

FROM: Sonya G. Stewart 

SUBJECT: Response to the Office of Inspector General (OIG) Draft Inspection
Report: NWS Weather Forecast Offices Generally Perform Well, but
Regional Oversight and Management at Some Offices Need to Be
Improved. Report No. IPE-1477

The National Oceanic and Atmospheric Administration appreciates the opportunity to respond to your draft inspection report. We fully concur with 11 of the recommendations and partially concur with two, and have provided an action plan for each.

Attachment



Printed on Recycled Paper



**National Weather Service
Response to
Office of the Inspector General Draft Report**

NWS Weather Forecast Offices Generally Perform Well,
but Regional Oversight and Management at Some Offices
Need to be Improved, Report No. IPE-14577/August 2002

Recommended Changes for Factual Information

Page 42, paragraph 1:

Replace "Furthermore, the Central Region Headquarters should . . ." with "Furthermore the Southern Region Headquarters should . . ." since the discussion is about WFO Norman in the Southern Region.

Page 50, Number 13:

Replace "Central Region Headquarters should review . . ." with "Southern Region Headquarters should review . . ." since the discussion is about WFO Norman in the Southern Region.

NWS Response to OIG Recommendations

Crosscutting Recommendations

The OIG states "We recommend that the Assistant Administrator for NWS instruct the NWS regional directors to take appropriate action in the six following areas of concern:"

Forecast Quality and Products:

- 1. Recommendation:** Work with the WFOs to emphasize quality control and determine if any state and/or local forecast products are no longer necessary.

NWS Response: NWS concurs. During monthly Office of Services/Regional Headquarters Meteorological Services Division Chief's conference calls, the importance of quality control in WFOs has been a frequent topic of discussion. The result, as reported by one of our external customers, error rates in our Severe Thunderstorm Warning and Tornado Warning products have dropped from 3.6% in May 2002 to 1.3% in August 2002. Based on customer feedback, using the conference call forum has shown to be an effective means to emphasize quality control and recommend closing this portion of the action.

The NWS is performing an analysis on the NWS' public weather product suite, through interaction

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with our customers to help determine our public product baselines.

Target Date for Completion: Quality Control Emphasis: Completed August 31, 2002

Product Analysis: January 31, 2003

Cooperative Observer Program:

2. Recommendation: If turnover occurs among staff supporting the program, ensure that new employees receive Cooperative Observer Program training so that adequate resources are available to manage the program.

NWS Response: NWS concurs. The NWS establishes all class schedules with input from all regional and field offices through the National Strategic Training and Education Plan (NSTEP) planning process which results in an annual training plan each June. Further, the NSTEP process determines the number of training slots available annually.

Target Date for Completion: June 30, 2003

Training and Research

3. Recommendation: Direct their respective WFOs to ensure that they develop an office training plan and have individual development plans in place for all staff as soon as possible.

NWS Response: NWS concurs. A memo directive will be issued, while an instruction on WFO training plans is being developed. The office training plan will include a component to address individual development plans.

Target Date for Completion: October 1, 2002 - Memo directive issued.

July 03, 2003 - Instruction issued

4. Recommendation: Ensure that WFOs have appropriate archival software to conduct training simulations with the

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Weather Event Simulator and schedule sufficient staff training time for implementing the Interactive Forecast Preparation System.

NWS Response: NWS concurs. An archival software capability was delivered to all WFOs, which allows them to conduct training simulations with the Weather Event Simulator (WES). This means each office has the facility and responsibility to produce their own training cases according to need. In addition, production of national WES cases will steadily continue with the goal of addressing as many diverse training needs as possible. While there is not yet a national case for Pacific Region, occurrences have already been noted where a case created for one location has been of use at another hundreds of miles away. Thus, Pacific Region may benefit from tropical weather event cases developed for the contiguous 48 states. The Interactive Forecast Preparation System (IFPS) training plans are in development and will be issued in the fall of 2002.

Target Date for Completion: WES archival software field distribution with the capability to develop "local" simulations was completed on February 4, 2002. NWS will continue to develop "national" WES simulations based on prioritization via the National Strategic Training and Education Plan (NSTEP) planning process.

IFPS training plan: October 30, 2002.

5. Recommendation: As appropriate, all WFOs should be asked to encourage their staff to conduct applied research, and to establish links on their Internet web pages to help disseminate their research results and to provide access by other WFOs and the public.

NWS Response: NWS concurs. We recognize the need to encourage operational and applied research through all levels of the scientific organization. To accomplish this, the Office of Science and Technology is developing NWS policy directives on science review and technology infusion. This policy, currently in draft, will define the processes a field organization will use to perform, approve and provide operational and applied research within the NWS and provide access to the public through internet links to

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websites. Implementation instructions will detail the processes to clearly show how a good science idea or technology concept can become part of the overall corporate capability.

**Target Date for
Completion:** December 31, 2002

Information Technology Resources:

- 6. Recommendation:** Add information technology issues (such as IT security controls and procedures, documentation, and maintenance) to their checklists for regional office oversight reviews of WFOs.

NWS Response: NWS concurs. We will revise our "NWS Instruction 10-1502 - Office Evaluation" to cover the IT issues.

**Target Date for
Completion:** December 1, 2002

Administrative Operations:

- 7. Recommendation:** Ensure that WFO managers and staff comply with appropriate regulations and guidelines for purchase cards and convenience checks, specifically:
- a. Centralize WFO responsibility for ordering general office supplies and computer or electronic equipment with Administrative Support Assistant (ASA) and the Electronic Systems Analyst (ESA).
 - b. Ensure that all purchase cardholders and approving officials, including the Meteorologist-in-Charge, review and follow purchase card rules and regulations and receive refresher training on the proper use of purchase cards.
 - c. Ensure that all purchase cardholders comply with FAR requirements in determining whether required sources of supply meet their requirements before purchasing items from commercial sources.

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- d. Direct all MICs to determine the minimum number of purchase cardholders and convenience check accounts that are necessary, and cancel accounts that are not necessary.
- e. Review their WFOs' convenience check accounts to determine if there are any instances of inappropriate use, and ensure that all future transactions are in accordance with departmental guidelines.
- f. Monitor compliance with purchase card and convenience check recommendations in conjunction with regional administrative reviews.

NWS Response:

NWS concurs. The National Weather Service is in the process of conducting an administrative review of all field offices. As part of the review, NWS is focusing on purchase card and convenience check accounts in terms of the appropriate number at each field office, ensuring holders know the purchase card/convenience check regulations and comply with FAR requirements, and determining if there are instances of inappropriate use.

NWS will examine centralizing WFO responsibility for ordering office supplies and computer or electronic equipment with Administrative Support Assistants (ASAs) and the Electronic Systems Analysts (ESAs) and will cancel all unnecessary purchase card and convenience check accounts. In June 2002, the Department established a requirement for all new and existing cardholders and approving officials to complete purchase card training by September 30, 2002. Mandatory rules and regulations will be reemphasized and refresher training (available on-line) will be provided to all those with convenience check accounts. We are examining the form used by WFO San Angelo for adoption NWS-wide to ensure compliance with FAR requirements on purchasing from commercial sources.

An additional item(s) will be added to the checklist contained in "NWS Instruction 10-1502 - Office Evaluation" to improve coverage in monitoring compliance with purchase card and convenience check use.

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**Target Date for
Completion:**

September 30, 2002 - Purchase card refresher training completed.

October 31, 2002 - Memo directing examination of centralization of purchase cards; convenience check on-line refresher training; and implementation of NWS-wide form for use of commercial vendors.

December 1, 2002 - "NWS Instruction 10-1502 - Office Evaluation" (see response to recommendation #6) revised to include additional checklist item(s) on monitoring compliance with purchase cards and convenience check use.

December 15, 2002 - Cancellation of unneeded purchase cards and convenience check accounts.

January 31, 2003 - Complete refresher training for convenience check accounts.

8. Recommendation:

Ensure that WFO managers and staff comply with appropriate regulations and guidelines for managing accountable property, specifically:

- a. Ensure that WFO property custodians secure sensitive property in a centralized location and that appropriate staff members are trained on maintaining accountable property records.
- b. Direct WFO managers to declare as surplus, dispose of, or return to the regional office, all excess equipment, according to the procedures set forth in the Department's manual and NWS policy.
- c. Direct all NWS Regions to determine whether off-site storage facilities are still needed, or whether additional funds could be saved by excessing additional unneeded property and terminating leases.

NWS Response:

NWS concurs. NWS will add two items to the checklist contained in "NWS Instruction 10-1502 - Office Evaluation" that will ensure WFO property custodians secure sensitive property in a centralized location and appropriate staff members are trained on maintaining accountable property records.

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During our administrative review, surplus equipment is being identified and disposed of in accordance with Department regulations and NWS policy.

Regional Headquarters managers will be directed to work with WFO managers to consolidate stored items, dispose of surplus property, and assess if leases to off-site storage facilities can be terminated.

Target Date for Completion:

October 31, 2002 - Memo will direct review of off-site storage (see recommendation #7).

December 1, 2002 - Revised "NWS Instruction 10-1502 - Office Evaluation" and complete administrative review.

9. **Recommendation:** Instruct all MICs to periodically review their vehicle logs, verify that their vehicles are being used in an appropriate manner, and return any vehicle for which there is no demonstrated need.

NWS Response:

NWS concurs. During our administrative review, items on the checklist address whether vehicle logs are being kept, vehicles are being used in an appropriate manner and there is a demonstrated need for the current number of official vehicles. We will add to the checklist an item to ensure that unneeded vehicles are returned.

Target Date for Completion:

December 1, 2002 - "NWS Instruction 10-1502 - Office Evaluation" revised to cover unneeded vehicle return.

Regional Office Oversight:

10. **Recommendation:** Ensure that regional headquarters managers and their staff develop inspection schedules, periodically visit each WFO in their region to review management, program, technical, and administrative operations as part of comprehensive WFO reviews using the NWS Field Office Evaluation Checklist, maintain records of each review, and ensure that corrective actions are taken.

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NWS Response: NWS concurs. NWS is developing "NWS Instruction 10-1502 - Office Evaluation" to provide guidance to regional headquarters in the periodic visit to all field offices to review management, program, technical and administration operations. This instruction will include the office evaluation checklist, which also tracks corrective actions and schedules for completion. Each region has developed an office visitation schedule.

Target Date for Completion: July 31, 2002 - Completed Office Visitation Schedules.
October 1, 2002 - "NWS Instruction 10-1502 - Office Evaluation" issued.
September 30, 2006 - Last field office visited in first visit cycle.

Recommendations for Specific WFOs Covered in This Report

The OIG states "We recommend that the Assistant Administrator for NWS instruct the MICs of these specific WFOs or officials at the appropriate Regional Headquarters Office to take appropriate action in the following areas:

Forecast Accuracy and Radars:

- 11. Recommendation:** Improve their forecast accuracy and address radar problems. Specifically:
- a. Address the continuing discrepancy between San Angelo's POP improvement over the model guidance and the Southern Region's 2001 average.

NWS Response: NWS concurs. Final statistics for 2001 for the two offices for which WFO San Angelo verifies precipitation forecasts show the office improving POP forecasts by 3.1% over model guidance, and as of June 2002 (latest data available) the statistics show the offices improving POP forecasts by 11.9% over model guidance. The trend is in the right direction. The MIC is undertaking additional steps to further improve the office's precipitation forecasting skill including use of the new Weather Event Simulator and emphasis on professional development activities directed toward improving

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precipitation forecasting skills. NWS will further assess progress by evaluating the office's final calendar year 2002 precipitation verification statistics when they are available in March 2003.

**Target Date for
Completion:**

March 30, 2003

- b. Improve WFO Miami's flash-flood lead-time as compared with the Southern Region's average.

NWS Response:

NWS concurs. To improve lead time on flash flood warnings, the office will use the new Weather Event Simulator to train the staff in improving their skills in forecasting heavy rain events. WFO managers along with Southern Region Headquarters will monitor flash flood warning performance to assess the success of the training and make adjustments as necessary. Through June 2002 (latest data available), only one flash flood event has been recorded in the 2002 statistics. Final verification statistics will be available in March 2003.

**Target Date for
Completion:**

March 30, 2003

- c. Conduct the environmental and engineering studies of the Missoula radar's angle and, if necessary, make appropriate adjustments to the radar.

NWS Response:

NWS partially concurs. Conducting the environmental and engineering studies of the Missoula radar's angle will be costly and involve risk. NWS is first conducting a "paper" study of the costs, impacts and expected benefits from potentially lowering the radar angle at Missoula. A former forecaster at the Missoula Weather Forecast Office collaborated with two individuals at the National Severe Storms Laboratory, on a scientific paper about improved detection of weather events using negative elevation angles for mountaintop radars. Expected benefits are being derived from the

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scientific paper¹ published earlier this year. Costs and impacts are being estimated by the NWS's Radar Operations Center, in consultation with the NWS Western Region and the National Severe Storms Laboratory. The results of the "paper" study will be used to determine if NWS should commit to the full environmental and engineering studies recommended by the OIG.

**Target Date for
Completion:**

December 1, 2002 for "paper" study.

January 1, 2003 for decision on whether to conduct the full environmental and engineering studies recommended by the OIG.

Administrative Operations:

12. Recommendation: Cancel the Denver/Boulder convenience check account, based on lack of need; establish an account for the San Angelo ASA and cancel the accounts held by the DAPM and ESA; and immediately cancel the former Missoula ASA's account, and determine if it is operationally justified to have both the ASA and the ESA retain their convenience check accounts.

NWS Resonse: NWS partially concurs. As stated in our response to recommendation #7, NWS will examine the centralization of purchasing office supplies and equipment. If the results of the examination warrant, we will cancel the Denver/Boulder convenience check account; establish an account for the San Angelo ASA and cancel their DAPM and ESA accounts; and determine if both the ASA and ESA from Missoula should retain their accounts. The former Missoula ASA's account has been cancelled.

**Target Date for
Completion:**

Completed - Missoula former ASA's account cancelled on May 9, 2002.

¹ Brown, Rodger A., Vincent T. Wood, Timothy W. Barker, 2002: **Improved Detection Using Negative Elevation Angles for Mountaintop WSR-88Ds: Simulation of KMSX near Missoula, Montana.** *Weather and Forecasting*. Vol. 17, No. 2, pp. 223-237.

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October 31, 2002 - Memo directing examination of centralization of purchasing office supplies and equipment.

December 15 - cancel unneeded check accounts.

13. Recommendation: Central Regional Headquarters should review the Norman WFO's storage contract and determine whether there is a need for all three storage units. At a minimum, the WFO should consolidate the two units that contain equipment, inventory the property, and dispose of or surplus the items that are no longer needed, and store its administrative files in Kansas City.

NWS Response: NWS concurs. Southern Region Headquarters will work with the Norman WFO management to consolidate storage, inventory the property, and dispose of surplus items. Unneeded on-site administrative files will be disposed in accordance with DOC and NOAA file disposition regulations.

Target Date for Completion: December 1, 2002.