U.S. DEPARTMENT OF COMMERCE
Office of Inspector General

National Oceanic and Atmospheric Administration

Missoula Weather Forecast Office Generally Provides Quality Service to Is County Warning Area

Final Inspection Report No. IPE-14225/September 2001

PUBLIC RELEASE

Office of Inspections and Program Evaluation

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

September 28, 2001

MEMORANDUM FOR: Scott B. Gudes
Acting Under Secretary for Oceans and Atmosphere

John J. Kelly, Jr.
Assistant Administrator
National Weather Service
National Oceanic and Atmospheric Administration

FROM: Johnnie E. Frazier

SUBJECT: Final Inspection Report: *Missoula Weather Forecast Office Generally Provides Quality Service to Its County Warning Area* (IPE-14225)

As a follow-up to our August 17, 2001, draft report, this is our final report on our inspection of the Missoula, Montana, Weather Forecast Office. 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.

The WFO staff in Missoula is providing what its partners and service users described as valuable products and services. Indeed, most of the office's key verification statistics indicate that the office is providing timely, accurate winter and fire weather forecasts, considered the two most important forecasting products in Missoula's county warning area. However, we have some concerns about the office's ability to forecast and verify severe weather events, due primarily to the location and angle of the office's WSR-88D radar and the scarcity of observation stations and spotters.

Please provide your action plan addressing the recommendations in our report within 60 calendar days.

We thank the personnel in NWS headquarters, the Western Region, and the Missoula WFO 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

Pursuant to the authority of the Inspector General Act of 1978, as amended, the Office of Inspector General conducted an inspection of the National Weather Service's (NWS) Weather Forecast Office (WFO) in Missoula, Montana. Our fieldwork was conducted from March 26 through March 30, 2001. We also conducted interviews and reviewed files and other pertinent information at NWS headquarters from March 8 through June 15, 2001. The objective of this inspection was to determine how effectively the Missoula WFO (1) delivers warnings, forecasts, and other information to its service users; (2) coordinates its activities with state and local emergency managers; and (3) manages its network of observers and volunteer spotters. We also assessed the adequacy of the office's management and its internal controls; its compliance with Department, National Oceanic and Atmospheric Administration (NOAA), and NWS policies and procedures; and the effectiveness of NWS's regional oversight. This is the third in a series of OIG inspections of WFOs.

NWS, an agency within NOAA, has 121 WFOs nationwide. Each WFO issues local weather forecasts and warnings of severe weather—such as tornadoes, severe thunderstorms, floods, hurricanes, and extreme winter weather—for its assigned counties. In April 2000, the Missoula office was converted from a Weather Service Office to a Weather Forecast Office, which resulted in its assuming additional responsibilities. The office currently has a staff of 25 and services a warning area covering 14 counties (11 in Montana and 3 in Idaho).

The WFO uses various technologies and programs to help protect the citizens in its county warning area. Radar, satellite, and automated surface observing systems are used to prepare forecasts and issue warnings for all types of severe weather. NWS commissioned the Advanced Weather Interactive Processing System in Missoula on February 15, 2000. This system, which integrates NWS meteorological and hydrological data with NWS satellite and radar data, is designed to enable forecasters to prepare and issue more accurate and timely forecasts and warnings.

The office's fire weather program, considered its most critical activity, provides meteorological support to wildland fire management agencies for the protection of life and property. This support includes providing warnings, forecasts, on-site services during wildfires, and meteorological training for fire management officials.

In performing our review, we examined pertinent records and documents and interviewed all of the available staff at the Missoula WFO. We also interviewed the regional director in Salt Lake City, as well as many representatives from the Department and other federal, state, and local government agencies. In addition, we spoke with individuals outside of the federal government who are involved in meteorological activities to obtain their assessment of the services provided by the Missoula WFO, as well as to elicit any suggestions they had for improving the office's provision of critical weather information.

We found that the office was effectively providing most services to the public and was generally well managed. For example:

- **The WFO has done a good job of issuing most weather forecast and warning products.** The office's fire weather, winter weather, hydrology, and aviation programs have been generally good since it assumed the additional weather program responsibilities associated with being a WFO. Office personnel believe that they have been able to accomplish their mission through the commitment of WFO staff and the addition of two forecasters. While the Missoula office has some consistently strong programs, the severe storm program requires management's attention. In addition, to further strengthen its fire weather program, the WFO should consider conducting a post-season analysis of the 2000 and future fire weather seasons. The NWS's fire assessment team considers this to be a "best practice" in place at the Great Falls WFO (see page 6).

- **Office outreach efforts to emergency managers and other users are effective.** We spoke with numerous public officials and emergency managers from several counties concerning their interaction with the Missoula WFO and elicited their views on the quality of services the WFO provides. Although several officials provided suggestions for improving the WFO's service, all of them had favorable comments about their interaction with WFO staff and the quality of services they received (see page 14).

- **Regional oversight appears adequate.** As part of our review, we examined certain aspects of the Western Region's management and oversight of the Missoula WFO. Specifically, we looked at the frequency of station inspections and general visits by regional management to address questions and provide regional oversight of WFO operations, management, and administrative support. We also assessed how well the regional office supported the transition of three new employees into the Missoula office to fill key positions. We found that regional oversight appears to be adequate (see page 20).

- **Actions are being taken to improve the office's training program.** The Missoula office has a structured training program with biannual training plans for the office as a whole and for each staff member. The science operations officer, who is responsible for the WFO's training and research, also plans to use research studies as a training tool to enhance the staff's knowledge in key areas. However, the officer agreed that individual development plans need to be completed for each staff member and training checklists should be reviewed and updated (see page 22).

We also found a number of managerial, administrative, and operational deficiencies that require prompt attention by NWS and WFO managers.

- **Although the Cooperative Observer and Skywarn programs are generally well maintained, some improvements are possible.** Although the WFO's Cooperative Observer and Skywarn programs, which rely primarily on volunteer observers to report on weather events, are well maintained, staff were concerned about the future of these

programs for two reasons. Specifically, office personnel emphasized that (1) maintaining observers for both programs could get more difficult as observers lose interest and retire from the program and (2) it is difficult to find or replace observers in isolated locations. In addition, office personnel are also concerned about not receiving more NWS direction and support regarding the Cooperative Observer Program. While personnel believe that NWS officials are planning to update the program, they are uncertain of the direction the program is going. More importantly, they did not know whether individual observers are to be replaced by automated gages (see page 16).

- **Several resource allocation issues need to be addressed.** Although the Missoula WFO generally runs efficiently, a few areas require management's attention. Specifically, the office runs the risk of losing incident meteorologists[1] to the Geographic Area Coordination Centers,[2] many WFO personnel consider several forecast products to be redundant or unnecessary, and electronic technicians spend too much of their time traveling to repair distant weather observation equipment (see page 23).

- **Internal controls are generally adequate, but there are several high cost items that are not adequately controlled.** Although we found most administrative functions in the Missoula WFO were adequately performed due to recently improved administrative controls, we identified a couple of areas that require management's attention. Specifically, we found that there are sensitive, high-cost items that are not included on the office inventory, for example, All-Terrain Vehicles (ATVs), snowmobiles, and enclosed trailers, because they are under the $5,000 threshold. The office also maintains excess automated data processing equipment (see page 27).

- **Quality control needs to be more systematic.** The Missoula staff was not consistently performing quality control reviews of office products before and after they were issued. As a result, a few office products have been issued with improper information. While the overall quality of office products we reviewed appeared adequate, staff emphasized that the accuracy and completeness of products can be improved. WFO management needs to emphasize to all forecasters and hydrometeorological technicians that products must be reviewed, and a sound quality control system should be consistently applied (see page 32).

On page 34, we offer a series of recommendations to the Under Secretary for Oceans and Atmosphere and the NWS Assistant Administrator to address our concerns.

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[1] Incident meteorologists provide on-site meteorological support to firefighters.

[2] Geographic Area Coordination Centers locate and dispatch needed firefighters and support personnel throughout the 11 geographical areas covered by the GACCs. The GACCs often work with local member agencies at the National Interagency Fire Center, which includes the Agriculture Department's Forest Service; the Interior Department's Fish and Wildlife Service, National Park Service, Bureau of Land Management, Bureau of Indian Affairs, and Office of Aircraft Services; and NWS.

In its written response to our draft report, NWS generally agreed with and outlined steps it has taken to address the intent of all but one of our recommendations. NWS officials noted that the NOAA Personal Property Office advises against adopting the recommendation to place snowmobiles and All-Terrain Vehicles on its inventory list because these vehicles do not exceed the accountability threshold of $5,000 and there have been no instances of lost, stolen, or misplaced vehicles.

The intent of our recommendation was to ensure that high-cost items below the accountability threshold that have high potential for theft or misuse would be adequately accounted for. As noted in NOAA's response, "individual Property Custodians within the Line/Staff/Program Offices have the flexibility to include items, e.g., snowmobiles/All-Terrain Vehicles, in their inventory…." This is a reasonable way to address our concerns. Therefore, we are now recommending that NWS direct all relevant WFO Property Custodians to put all sensitive property, including snowmobiles, All-Terrain Vehicles (ATVs), and enclosed trailers, on their inventory list and track and control them accordingly.

Where appropriate, we adjusted the language in our report in response to NOAA's comments. We also commend NWS for its aggressive plan of remedial actions to address our findings.

INTRODUCTION

Pursuant to the authority of the Inspector General Act of 1978, as amended, the Office of Inspector General conducted an inspection of the National Weather Service's (NWS) Weather Forecast Office (WFO) in Missoula, Montana.

Inspections are special reviews that the OIG undertakes to provide agency managers with timely information about operational issues. One of the main goals of an inspection is to eliminate waste in federal government programs by encouraging effective and efficient operations. By asking questions, identifying problems, and suggesting solutions, the OIG hopes to help managers move quickly to address problems identified during the inspection. Inspections may also highlight effective programs or operations, particularly if they may be useful or adaptable for agency managers or program operations elsewhere.

This inspection was conducted in accordance with the *Quality Standards for Inspections* issued by the President's Council on Integrity and Efficiency. Our fieldwork was conducted from March 26 through March 30, 2001. We also conducted interviews and reviewed files and other pertinent information at NWS headquarters from March 8 through June 15, 2001. During the review and at its conclusion, we discussed our findings with the meteorologist-in-charge (MIC) of the Missoula WFO, the director of NWS's Western Region, the Assistant Administrator for NWS, and other NOAA senior managers.

OBJECTIVES, SCOPE, AND METHODOLOGY

The objective of this inspection was to determine how effectively the Missoula WFO (1) delivers forecasts, warnings, and other information to its service users, which includes the general public; (2) coordinates its activities with state and local emergency managers; and (3) manages its network of observers and volunteer spotters. We also assessed the adequacy of the office's management and its internal controls; its compliance with Department, NOAA, and NWS policies and procedures; and the effectiveness of regional oversight. This is the third in a series of OIG inspections of WFOs.

In performing our review, we examined pertinent records and documents and interviewed all of the available staff at the Missoula WFO. We also interviewed the regional director in Salt Lake City, as well as many representatives from the Department and other federal, state, and local government agencies. In addition, we spoke with individuals outside of the federal government who are involved in meteorological activities to obtain their assessment of the services provided by the Missoula WFO, as well as to elicit any suggestions they had for improving the WFO's provision of critical weather information.

BACKGROUND

NWS, an agency within NOAA, has 121 WFOs nationwide. Each office issues local forecasts, such as periodic zone forecasts, and warnings of severe weather, such as tornadoes, severe thunderstorms, floods, hurricanes, and extreme winter weather, for its assigned counties. The offices, where applicable, also support NWS's marine, aviation, and climatic data collection programs and prepare guidance for the fire weather program, supporting federal lands management and wildfire control. Each U.S. county is assigned to a specific WFO for warning purposes. The offices are responsible for effectively using advanced meteorological technology to issue weather predictions and continuing to improve the timeliness and accuracy of forecasts and severe weather and flood warnings to the public.

In April 2000, the Missoula office converted from a Weather Service Office[3] to a Weather Forecast Office. As shown in Figure 1, the Missoula WFO is located adjacent to the U.S. Forest Service's Northern Rockies Coordinating Center, which is responsible for locating and dispatching firefighters and support personnel from the Northern Rockies geographical area to wildland fires that grow to the point where local personnel and equipment are not sufficient to contain them.

Figure 1: Missoula WFO

[3] Weather Service Offices generally had fewer staff and covered a smaller warning area than WFOs.

The WFO currently has a staff of 25, including a management team consisting of the MIC, a warning coordination meteorologist, a science operations officer (SOO), a data acquisition program manager, an electronics system analyst, and an administrative assistant. The remainder of the staff consists of five lead forecasters, six journeyman forecasters, five hydrometeorological technicians, two electronic technicians, and one service hydrologist. The WFO's fiscal year 2001 operating budget, including its annual lease but excluding salaries, is $271,699.

The Missoula WFO's county warning area includes 14 counties, 11 in western Montana and 3 in north central Idaho (as shown in Figure 2). The WFO is located in NWS's Western Region. The regional office, located in Salt Lake City, is responsible for 24 WFOs.

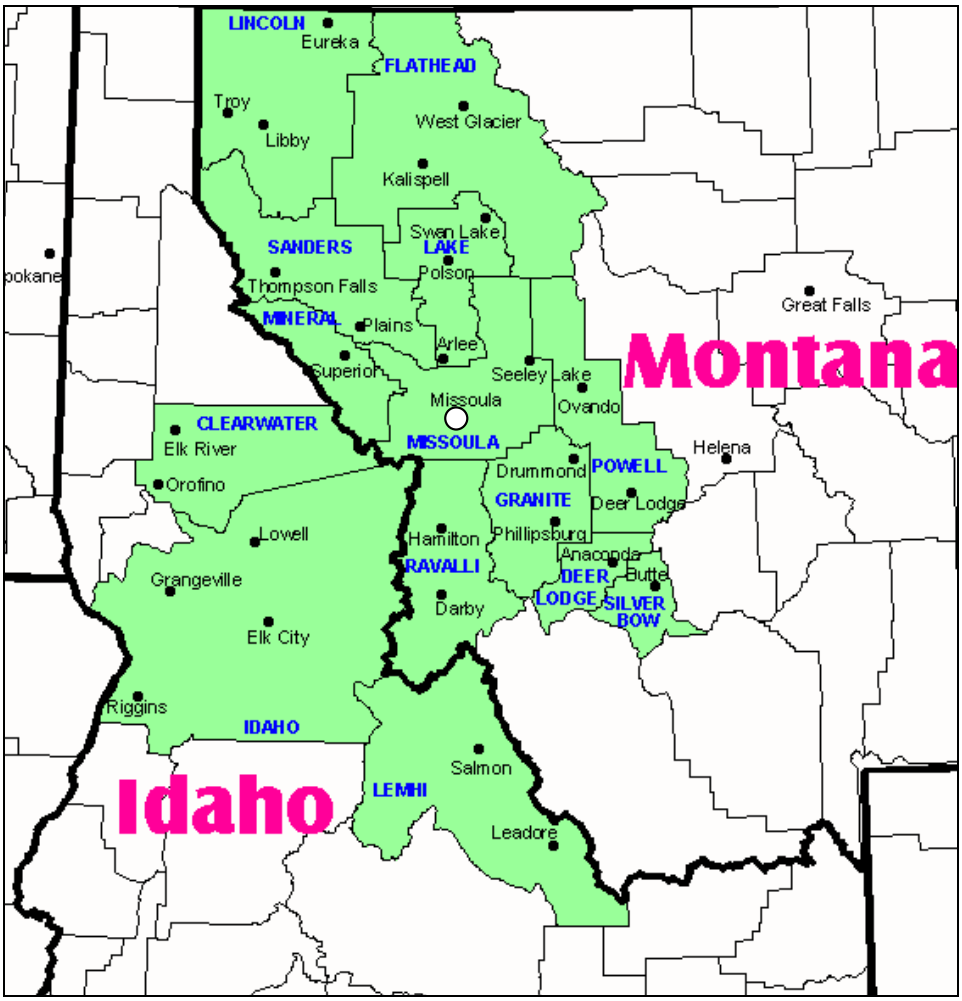

Figure 2: Missoula WFO County Warning Area

Source: National Weather Service

The WFO uses various technologies and programs to help protect the citizens in its county warning area. Radar, satellite, and automated surface observation systems are used to prepare

forecasts and issue warnings for all types of severe weather. The NWS commissioned the Advanced Weather Interactive Processing System (AWIPS) in Missoula on February 15, 2000. AWIPS, an interactive computer system that integrates NWS meteorological and hydrological data with NWS satellite and radar data, is designed to enable forecasters to prepare and issue more accurate and timely forecasts and warnings. The WFO's radar, shown in Figure 3, is located at the top of Point Six, a mountain about five miles from the WFO that peaks at about 8,000 feet above sea level.

Figure 3: Missoula WFO Radar at the top of Point Six

The office's fire weather program, considered its most critical activity, provides meteorological support to wildland fire management agencies for the protection of life and property. This support includes providing warnings, forecasts, on-site services during wildfires, and meteorological training for fire management officials.

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

The office's Skywarn program, part of a nationwide effort, trains volunteer spotters to provide the office and the Missoula county warning area with timely, accurate eyewitness severe weather reports. The Cooperative Observer program uses volunteers to provide daily weather measurements, including rainfall and snowfall amounts. The meteorological community considers both programs critical in verifying and collecting data to improve forecast models and in recording accurate climatic data. After developing weather forecasts and obtaining critical information from its partners, the office disseminates that information to the public through its partners, NOAA weather radio, the Internet, and other means.

FINDINGS AND CONCLUSIONS

I. WFO's Weather Forecasting Is Generally Effective

We examined the Missoula WFO's performance statistics to determine whether it has been issuing timely, high-quality products to the public. Each WFO issues general or zone[4] forecasts, severe weather and flood warnings, advisories, and specific forecasts for each of its weather programs. As shown in Table 1 on page 7, the office's fire weather, winter weather, and aviation programs have been timely and accurate, while the severe storms program needs attention. The probability of precipitation program showed some improvement over the model guidance and its statistics were generally comparable to the Western Region average.[5] Lastly, the WFO has also taken steps to improve its hydrology program.

To determine the WFO's overall effectiveness, we interviewed all WFO personnel and numerous public officials who work closely with the office. Both groups stated that the office provides valuable weather services but offered suggestions on how to improve its six main programs.

A. Most programs have yielded reliable forecasts

The office's fire weather, winter weather, hydrology, and aviation programs have generally been effective. Office personnel believe that they have been able to accomplish their mission because of the commitment of WFO staff and the addition of two forecasters.

Fire Weather Program

The Missoula office 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 of the users we interviewed indicate that this program has been successful.

[4] Each WFO has a county warning area that is divided into zones comprising either single or multiple counties that are often large and/or topologically diverse in mountainous and coastal areas. For each zone, the Missoula 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. The Missoula office issues two seven-day extended zone packages every day.

[5] POP forecasts document the likelihood, expressed as a percentage, that measurable precipitation (0.01 inch or more) will occur at any point within a specified forecast area (usually a county or group of counties) over a specific period of time (typically 12 hours). POP forecasts are compared to model forecasts to determine to what extent WFO-issued forecasts were more accurate than model forecasts. POP forecasts, which range between 0 and 100 percent, are verified on a point basis over a period of time using rain gages assigned to each WFO. Although gages will not measure every precipitation event, they will measure the percentage of time that measurable precipitation hit the rain gage when each POP level is forecast. If the percentage of times measurable precipitation occurs is significantly above or below that POP level, forecasters are either under or over forecasting and providing less reliable information to individuals and entities that depend upon the WFO for meteorological information.

Table 1: Missoula Verification Statistics for 2000

	Western Region Average	Missoula WFO	Better[6]	Worse/Equal[7]
Fire Weather Program:				
False alarm ratio	.26	.08	X	
Probability of detection	.88	.75		X
Lead time	10.30 hours	14.60 hours	X	
Winter Weather Program:				
False alarm ratio	.28	.10	X	
Probability of detection	.73	.90	X	
Lead time	8.59 hours	9.00 hours	X	
***Hydrology Program:**				
Aviation Program:				
False alarm ratio	(nat'l average) .53	0.00	X	
Probability of detection	(nat'l average) .15	.24	X	
Severe Storms Program:				
False alarm ratio	.59	.90		X
Probability of detection	.77	.18		X
Lead time	18.5 minutes	2.3 minutes		X
POP Program:				
Forecasts improved over model guidance	6.7%	6.3%		X
Percent of correct forecasts	87.3%	87.3%		X

* No flooding or flash flooding in 2000.

As shown in Table 1, the fire weather false alarm ratio[8] and lead time[9] statistics have been better than the average for Western Region offices. Although probability of detection[10] statistics are below the regional average, users stated that the forecasters in Missoula provide timely and

[6] This column shows the statistics that are better than the regional (or national) average.

[7] This column shows the statistics that are worse than or equal to the regional average.

[8] The false alarm ratio is the fraction of all warnings that are unverified by office personnel. A high ratio indicates either that an office is issuing warnings of events that do not occur or that its efforts to verify forecasts are lacking.

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

[10] The probability of detection shows the fraction of all severe events (i.e., tornadoes and severe thunderstorms) 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.

accurate fire weather watches, warnings, and forecasts and that the WFO's incident meteorologists (IMETs)[11] provide valuable onsite weather support to firefighters.

The WFO has five certified IMETs—two that regularly attend fires and three that act as backups. We found that the office's forecasters who are not dispatched to fires provide valuable fire weather forecasts while the IMETs attend fires. In fact, after the 2000 fire season, Montana's governor praised the Missoula office for its consistently reliable weather information. NWS also determined that the Missoula office was key to the success of fire weather activities in Montana and northern Idaho in a study of wildfires during the summer of 2000.[12]

While users are satisfied with the office's overall fire weather services, they are concerned about NWS losing some of its key IMETs just before the upcoming fire weather season. We discuss this issue in greater detail on page 23.

To improve its fire weather program, the Western Region has begun requiring all of its forecasters to integrate fire weather responsibilities into their normal duties. As part of this effort, some of the region's WFOs were provided additional personnel. The Missoula office was given two additional forecasters for local and regional fire weather activities, including training and other IMET responsibilities. These forecasters also supplement the number of qualified fire weather forecasters in order to maintain the office's fire weather shifts. Users are hopeful that the office's efforts to integrate fire weather forecasting will not dilute personnel, but instead maintain the office's reliable and timely fire weather products.

Office personnel offered two suggestions for improving the WFO's performance during the next fire weather season. First, they suggested conducting a post-season analysis of the 2000 and future fire weather seasons similar to an analysis conducted by the Great Falls office, which consisted of a meeting with its 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.[13] The MIC should consider performing such an analysis after future fire weather seasons.

Second, office personnel stated that there was no national policy outlining the shifts and number of hours that IMETs should work during the fire weather season. Currently, IMETs could conceivably be deployed for up to 14 days working 16 hours per day, and then return to their offices and work a midnight shift. Personnel also stated that they would like some flexibility on the shifts they will work during fire weather season, such as possible relief from midnight shifts, a day off between fire duty and returning to the office rotation, and administrative leave for

[11] IMETs are Meteorologists who are dispatched to fires. NWS had over 60 IMETs at the end of the 2000 fire weather season.

[12] *Service Assessment, Northern Idaho and Western Montana Summer 2000 Wildfires,* National Weather Service, February 2001.

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

travel to and from fires. According to NWS officials, national guidelines for IMET shifts are being developed.

In the area of training, the WFO's records indicate that nearly all required fire weather training has been completed by staff who work forecast shifts in the office, as shown in Table 2. While most *required* training has been received, most of the *recommended* training for the non-IMETs has not. The MIC should determine whether the recommended training for non-IMETs would improve the office's efforts to integrate fire weather responsibilities into all forecasters' normal responsibilities. If so, the MIC should ensure that the recommended training is provided to all forecasters.

Table 2: Completed Fire Weather Training for Missoula WFO

Fire Weather Training Activity	IMETS	Fire Weather Manager	MIC	Warning Coord. Meteor.	SOO	2 Senior Forecasters	Journeymen Forecasters
Baseline: Fire Weather / Wildland Fire Behavior	X	X	X	X	X	X	X
Local Needs: Terrain, Forecasting, RAWS	X	X	X	X		X	X
Red Flag Program	X	X	X	X		X	X
Narrative Forecasts	X	X	X	X		X	X
Spot Forecasts	X	X	X	X		X	X
National Fire Danger Rating System	X	X	X	X		X	X
Advanced Fire Weather / Fire Behavior	X	X		X		X	X
Complex Terrain Meteorology	X	X		X		X	X
Intermediate Fire Danger Rating System	X	X		X			X
I-100 Incident Command System	X	X		X			X
Advanced Fire Weather (IMET) Training	X	X		X			
Incident Training	X	X		X			
S-490 Fire Behavior	X	X		X			
First Responder							
S-590 Fire Behavior							
I-200 Incident Command System							

Pink = required (basic activities all meteorologist have to complete in order to issue fire weather products).
Yellow = recommended (strongly suggested activities because they cover basic fire weather activities in more detail).
Blue = optional (suggested activities because they have been identified as resources to further training and understanding of fire weather).
White = N/A (activity does not apply to people in corresponding categories).

Winter Weather Program

The WFO has also done a good job on its winter weather program. As shown in Table 1 on page 7, the office's false alarm ratio, probability of detection, and lead time have been better than the average for Western Region offices. Moreover, 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 the successful winter weather program.

Office personnel emphasized that winter storms are larger and therefore easier to track with satellite and surface observations. While satellite and surface observations provide more predictable results, forecaster knowledge of how winter storms interact with the topography also helps increase the predictability of these storms. The office relies heavily on its spotter network for current conditions. It is easier to verify winter events because winter storms are more likely to be seen by spotters or detected by the office's auto-remote observation network, and snow is longer lasting than other forms of precipitation. Recent office research on winter weather storms has also helped to improve forecasters' ability to predict winter weather storms and issue forecasts.

Hydrology Program

The Missoula office also has hydrologic responsibility for its county warning area. As a result, the office has had an on-site service hydrologist[14] since 1994 to oversee hydrology operations, train office personnel on flash flood and flood warnings, maintain flood forecast points, and issue other hydrology products.

During the last two years, the office's hydrologist and other staff members have made improvements to the hydrology program. Personnel have created seven new flood forecast points at river gages in the office's county warning area, providing local communities affected by flooding with timely and reliable information to help them determine the best course of action during floods, including whether to use sandbags or evacuate people. They have also changed flood stage heights at six flood forecast points, in coordination with county, state, and federal officials.

WFO personnel also have suggested improvements to the hydrology program. They emphasized that WFOs need a hydrology model for smaller streams to forecast flooding and subsequently issue flood warnings for smaller streams. While NWS's River Forecast Centers provide forecast offices with forecasts for larger rivers, and spotters provide valuable flood stage information during and after floods, a model for forecasting rapidly occurring flood events at site-specific areas is needed at the Missoula WFO.

Office personnel also cite a need for additional river and precipitation gages. Currently, there are sites in the Missoula county warning area that are susceptible to flooding but do not have any

[14] Only selected WFOs have on-site service hydrologists.

such gages. However, because the high cost of river gages limits the number of additional gages NWS will purchase, the NWS has successfully worked with the U.S. Geological Survey on a national basis to share the cost of additional gages. In some cases NWS has purchased telemetry and phone lines to get data from existing USGS sites.

Aviation Program

The Missoula WFO began submitting official aviation statistics into NWS's national verification database in 2000. Previously, it maintained only limited aviation statistics. The office's current aviation responsibilities include issuing Terminal Area Forecasts, which outline clouds and weather conditions over the airports in Butte, Kalispell, and Missoula, Montana. As shown in Table 1, verification statistics for the aviation program indicate that the office has better probability of detection and false alarm ratios than the national average.

According to the office staff and users we interviewed, the aviation program at the Missoula WFO has provided valuable services. From January 2000 through March 2001, the office's forecasts have been correct an average of 93 percent of the time, and its improvement over model guidance was 9.4 percent.

Probability of Precipitation Program

The office's recent probability of precipitation forecasts were accurate 87.3 percent of the time, but improvements were possible. 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. While the office had a 6.3 percent improvement over the guidance for April through September 2000, the office's percentage of correct forecasts only equaled the model guidance percentage. The percentage of correct forecasts for all Western Region offices was slightly above the model guidance.

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" bias[15] 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 they simply do not fully understand the local climatology. Forecasters also cited the terrain of Missoula's county warning area, the radar angle (see page 12), and the difficulty in predicting such storms as reasons for the WFO not exceeding its model guidance percentage of correct forecasts. Both office managers and staff realized that when they under- or over-forecast, they are not providing optimal service to the public.

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

B. The severe weather program needs improvement

While the Missoula office has some consistently strong programs, problems with the severe weather program require management's attention. From 1997 to 2000, the office's false alarm ratio, probability of detection, and lead times for severe storms have steadily declined. Office personnel attributed this decline to the radar location and the lack of spotters to provide verification in certain isolated areas of the office's large county warning area. In addition, office managers believe that forecasters need additional training and should conduct some research projects on severe storm forecasting to increase their knowledge and, thereby, provide better forecasts.

The radar's location is cited as the key factor for the office's low severe weather statistics. The radar is located on a mountaintop at 8,000 feet above sea level, and is pointed slightly up at a positive 0.5-degree angle. The radar's positive angle prevents the Missoula WFO 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.

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 and the effects from lowering the radar angle should not affect the public's health and welfare, as argued in the past by opponents of lowering the angle. These prior NOAA studies have recommended that an engineering study and an environmental impact study[16] be conducted by WFOs contemplating a radar angle change, as well as the issuance of a public information paper[17] 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. These actions should be completed as soon as possible.

Another factor that contributes to the office's low severe storm forecasting statistics is the size and scarce population of the county warning area, which makes it difficult to find a sufficient number of individuals to verify weather events.[18] Office personnel stated that recruiting spotters in populated sections in their county warning area is challenging and recruiting them in isolated locations is even more difficult (see page 16). This is because much of Missoula's county warning area is public forest or mountainous terrain that is either not occupied or occupied by individuals, some of who have little desire to be involved in a government activity.

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[16] *MSD/SSD White Paper – Lowering Lowest Elevation Scan to 0.0 or Neg 0.5,* Fall 2000.
[17] *WSR-88D Radiation and Biological System Considerations,* October 1994.
[18] NWS determines how well it handles its forecasting and severe storm warnings through its verification process, which essentially matches warnings to actual weather observations and compiles statistical results of forecasting performance.

Also with few severe weather events, there are few opportunities for the forecasters to gain experience in identifying such events. This suggests that office personnel need to receive additional training and to conduct additional research on severe events.

In their written response to our report, NWS officials agreed with our recommendation and noted that the WFO, in conjunction with the National Severe Storms Laboratory, has completed an evaluation of the elevation of the radar. The evaluation concluded that "using negative elevation angles" for the radar shows "the potential for improved detections of low-altitude weather conditions in surrounding valleys and improved estimates of precipitation amounts throughout the coverage area." The paper was submitted for publication in May 2001, but has yet to be published. NWS also stated that the Western Region would build on the paper by pursuing with NWS Headquarters the feasibility of conducting environmental and engineering studies in support of lowering the radar angle and its potential effect on improving detection capability.

II. Office Outreach Efforts Have Helped Improve WFO's Effectiveness

State and local emergency managers in Montana help citizens in their communities prepare for potential natural and man-made disasters, such as floods, wildfires, and other emergencies, that may affect public safety. WFO staff are responsible for working with these managers to help increase public responsiveness to warnings and critical weather, better prepare customers and partners for potentially dangerous weather events, develop and strengthen partnerships, and increase customer feedback to enhance NWS services.

The state and local officials spoke highly of the cooperation and service received from the Missoula WFO. According to the officials we interviewed, Missoula WFO personnel make themselves available to discuss their forecasts and provide assistance above and beyond the call of duty. In addition to being generally pleased with the timeliness and quality of the office's forecasts and warnings, the officials praised the WFO's outreach efforts.

In November 1999, the NWS published its *Fiscal Year 2000 Outreach Action Plan*, which outlines steps various agency components, including the WFOs, should consider in accomplishing their outreach goals. The Missoula WFO and its partners work well together in pursuing these goals.

Our review of the various documented activities during fiscal year 2000 showed that the office is implementing most of the action items in its plan. For example, after each weather season, the WFO invites the users in its county warning area to the office for a customer workshop. At these workshops, WFO customers, such as media representatives and emergency managers, are given a presentation on what is new in NWS and the WFO. In a workshop conducted during the week of our visit, customers were able to ask questions on numerous topics, ranging from NWS terminology to the logistics of efficiently getting forecast information from the WFO.

In addition, in fiscal year 2000, the office trained 109 spotters, 23 of whom were new. WFO staff also presented 20 public safety presentations before various clubs, groups, and committees with 419 attendees. Staff took time to visit schools to increase students' awareness of meteorology and weather safety. Lastly, tours of the WFO were provided to school groups, emergency managers, and media representatives.

The office also has good relationships with media representatives. Such relationships are important because the media is a key element in the WFO's outreach and information dissemination efforts. The media representatives with whom we spoke thought very highly of the WFO's services and responsiveness. Although some were meteorologists themselves, they valued the insight and professional opinions of the WFO staff. During fiscal year 2000, the staff in Missoula gave 32 interviews to representatives of television, radio, and print media on various subjects, including the Skywarn and Cooperative Observer programs, Severe Weather Awareness Week, and the WFO's general services and operations.

The office's outreach efforts have been effective in improving citizens' awareness of weather terminology, severe weather risks and precautions, and NWS products and services in the

Missoula county warning area. In addition, the efforts have allowed the WFO to form excellent relationships with emergency officials, the media, and schools as a means of enhancing the office's public awareness activities.

III. Although the Cooperative Observer and Skywarn Programs Are Generally Well-Maintained, Improvements Can Be Made

Although the WFO's Cooperative Observer and Skywarn programs are well maintained, staff were concerned about the programs' future. The Cooperative Observer Program is a nationwide weather and climate monitoring network of almost 12,000 volunteer citizens and institutions. Each observer regularly reports temperature 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 in order to, among other things, help improve the accuracy of the agency's forecasts. The SKYWARN program trains private citizens to provide forecast offices with timely, accurate severe weather reports. Having worked hard to establish strong programs at the WFO, office personnel emphasized that maintaining observers for both programs could become more difficult as it is difficult to recruit spotters in isolated locations. In addition, staff are unsure of the future direction of the Cooperative Observer Program.

A. Staff is concerned about losing key Cooperative Observer sites

Missoula personnel have a well-organized Cooperative Observer Program but are concerned about sustaining it. WFO personnel visit each of the office's 90 sites at least annually to maintain observer equipment. In addition, observers stated that they are happy with the training and service that they have received. However, both office personnel and users had some concerns that need to be addressed.

Concerns about attracting and retaining observers

Office personnel are concerned about losing cooperative observers and not being able to replace them. The office's county warning area encompasses numerous mountainous and forested areas. Office personnel stated that because recruiting observers for these areas is difficult, it is important to retain the current observers as long as possible. Unfortunately, we were told four of the 90 current observers have decided to no longer be observers for various reasons. While this is not an alarming number, office personnel emphasized that many of the office's observers may need to be replaced during the next 5 years. The departure of even a few observers hurts the office's data collection of public information and verification of office forecasts and warnings.

The office has reportedly lost observers because of their advancing age, relocation to other areas, and their belief that the system for inputting daily observations is cumbersome. Every day, observers use the telephone to input their observation data. Some observers who find this system cumbersome have stopped inputting their daily observations in favor of just sending the monthly report. Such actions reduce the number of observations used daily by forecasters. Office personnel believe that a more simplified user interface that does not require too much data entry or that is voice-activated may be needed to maintain observers' interest and input.

We attempted to determine what improvements to this program are necessary and reasonable. For example, we questioned whether the office could step up observer recruitment efforts, pay

more observers,[19] or issue a cooperative observers newsletter. It appears that enough personnel are involved with site visits. The office has a primary and secondary person for site visits, and one of the office's forecasters is being trained to visit observer sites and provide training.

Office personnel emphasized that few people are willing to assume the responsibility of taking weather observations every day, year after year. They emphasized that in parts of their county warning area, some people are suspicious of government activities and not likely to be interested in becoming observers. However, office personnel stated that some people may be recruited if paid, or if currently paid, an increase in pay might entice them to remain observers. The office currently has only three paid observers.

Some office personnel thought that an observers newsletter was a good idea. While the office issues a SKYWARN newsletter, one does not exist for observers. Office personnel stated that such a newsletter could maintain or increase interest in the program and perhaps attract new observers.

Concerns about NWS support for the program

In 1998, the National Research Council found that the nationwide Cooperative Observer Program was struggling because of insufficient funding, aging equipment, insufficient resources, and poor management oversight.[20] The council found that the program had been hampered by technological, organizational, and budgetary factors, and that modernization would require substantial funding for equipment, ongoing operations, and maintenance.

The Missoula WFO staff is also concerned about not receiving more NWS direction and support regarding the Cooperative Observer Program. While they believe that NWS officials are planning to update the program, they are uninformed about where the program is heading. For example, they did not know whether NWS plans to replace individual observers with automated gages. We believe that NWS needs to communicate its plans for the program to field personnel.

Office personnel also cited two examples of needed changes to the national program. First, as noted previously, they believe that NWS should develop a more user-friendly system for inputting daily information from observers because users have made numerous complaints about the complexity of the current input system. Office personnel stated that some NWS personnel developed various computer programs to input daily observations, but that users found these programs complicated to use. The personnel suggested that users need a simple interface, such as telephone or e-mail, which allows them to send data to the office. Western Region officials stated that the Central Region is evaluating a web-based approach for daily entry of weather data.

Second, office personnel raised several concerns with the NWS's new system for tracking a cooperative observer's station history and maintenance record. Office personnel stated that there

[19] A few observers in the Missoula county warning area, as well as in other areas, are paid a nominal fee to cover incidental costs associated with collecting and reporting observations.

[20] *Future of the National Weather Service Cooperative Observer Network,* National Research Council, 1998.

are not enough examples in the manual to show them how to properly input information to add to the station's history and maintenance record.

B. Office faces difficulties in locating Skywarn spotters in remote areas

The *Weather Service Operations Manual* states that forecast offices must emphasize the development and maintenance of local severe storm spotter networks.[21] Skywarn spotters observe and detect changing weather conditions, report significant weather events to the WFOs, and serve as contact points in their areas. Although office forecasters receive automated data from radars, surface instruments, and satellites, forecasters often must infer actual surface conditions. As a result, reports from Skywarn spotters help provide office personnel with the complete weather picture for forecasts and warnings.[22] The Skywarn program in Missoula is well-organized and has provided valuable information to office personnel. Moreover, over the last six years, office personnel have increased the number of spotters from 65 to 436. Despite this growth in the number of spotters, office personnel stated that certain remote or scarcely populated locations continue to lack spotters.

The warning coordination meteorologist at each WFO is primarily responsible for recruiting, training, and maintaining the office's spotter network. Staff in Missoula confirmed that recruiting spotters for isolated areas presents a constant challenge in a county warning area with numerous mountain and forested areas.

Historically, spotters reported significant weather such as tornadoes, large hail, and heavy snow, and the reports would be used to prepare forecasts and warnings. Lacking spotters in certain locations prevents office personnel from verifying such events. Office personnel believe that a lack of spotters in certain locations is one factor for their declining severe weather statistics over the last four years. (See page 12 for a further discussion of the office's severe weather statistics.)

While Missoula personnel have expanded and improved the office's spotter network, a constant effort is needed to recruit spotters in remote areas. The MIC should consider employing other methods to recruit spotters in remote areas, including issuing public service announcements on the importance of the spotter network and arranging for promotions on television and radio stations.

In their written response, agency officials agreed with our recommendation and stated that the WFO has an active outreach committee to brainstorm ideas for recruiting and retaining Skywarn Spotters. A new proposal has been introduced to include day trips to more remote areas to recruit spotters. In addition, the local Skywarn newsletter will be revamped, to include news on observers' activities, and will also be sent to all observers. NOAA also noted that the Western

[21] *Severe Storm Reporting Networks,* WSOM Chapter B-21, March 9, 1982.

[22] *Integrating the Spotter Program into the Modernized National Weather Service,* Mark H. Strobin, John Livingston, and Kenneth Holmes, NWS, April 22, 1997.

Region is in the process of tailoring an existing Central Region web-based application that will provide a more user-friendly method of data entry for cooperative observers at Internet-ready locations in the Western Region. The Missoula WFO will be used as a test site for the new application.

IV. Regional Oversight Appears Adequate

As part of our review, we examined certain aspects of the Western Region's management and oversight of the Missoula WFO. Specifically, we looked at the frequency of station inspections and general visits by regional management to address questions and provide oversight of WFO operations, management, and administrative support. We also assessed how well the regional office supported the transition of three new employees—the MIC, the SOO, and the administrative assistant.

Regional oversight appeared to be adequate. Regional division chiefs have conducted three station inspections[23] of the Missoula WFO within the last three years on various WFO operations. In 1998 the Meteorological Services Division Chief and the Hydrological Services Division Chief conducted a review of the WFO's entire operations and reported their findings to the Western Region Deputy Director. During their review, they interviewed office staff and external users, such as the Missoula County Sheriff and local media. They examined the Fire Weather, Cooperative Observer, Skywarn, and Hydrology programs, as well as administrative services and information technology (IT) systems. Although they highlighted some concerns of the office staff and customers, like the ability to maintain the Cooperative Observer Program with fewer people working on it, they reported that they were highly impressed with the WFO's efforts and that there were "no major problems."[24]

In 1999 and 2000, the region's Systems Operations Division chief conducted similar, yet less comprehensive, reviews of specific operations of the WFO. During his 1999 review, he examined several programs, including Automated Surface Observing Systems, the Cooperative Observer Program, and equipment maintenance. He also reviewed some office files and the station duty manual. He concluded in his report that overall the programs at the Missoula WFO were very well managed. The chief's 2000 review focused only on the Cooperative Observer Program. He reviewed station records, the Cooperative Observer Program vehicles, and the pre- and post-procedures for station visits, and made recommendations to improve the program. We were told that there were also four other visits made by regional staff between 1998 and 2001 that were not station inspections, but rather general office visits. No formal reports were written on these visits. By making regular office visits, the regional office has helped maintain effective office operations.

Recently, the office was assigned a new MIC, SOO, and administrative assistant. The regional office facilitated their transition by providing them with the needed support through periodic conference calls and other forms of communication. Before our visit, the regional office provided the WFO with an administrative guide as a reference that contains a list of points of contact and other support documents. Office personnel also receive assistance from the regional office with other office functions. For example, the electronic systems analyst receives periodic

[23] Station inspections are internal NWS reviews that, among other things, evaluate a WFO's adherence to NWS policies in various areas, including reviews of systems and equipment, the Cooperative Observer program, and surface observations.

[24] August 25, 1998, "Trip Report" of the Missoula WFO.

memos on updates for maintenance of vehicles and information technology systems; the newly appointed administrative assistant receives frequent guidance on the office's administrative operations. It is apparent that the Western Region is closely involved with the operations of the Missoula WFO, and that this involvement has helped the Missoula office maintain effective programs.

V. Actions Are Being Taken to Improve the Office's Training Program

In January 2001, the Missoula office hired a new science and operations officer, who is responsible for office training and research, including evaluating each staff member's operational strengths and weaknesses, and monitoring their training received and needed. The Missoula office has a structured training program with biannual training plans for each staff member. However, the SOO stated that current individual development plans need to be completed for each staff member and that training checklists should be reviewed and updated.

The office's biannual training plans outline the generic training activities proposed for the ensuing six-month period. The plans list specific training modules that are needed by all staff members and specific drills and modules by training area. Although the plan for April through September 2000 listed training activities for each staff member, the last two plans have not done so because this information is to be provided by the new individual training plans that are being developed. Instead, the SOO has listed training activities by specific area.

We believe that the SOO's proposed training agenda will enhance the office's training program. He has determined that office personnel need additional training for issuing severe storm forecasts and has also suggested various research projects to improve forecasters' knowledge in this area. He has incorporated necessary requirements and suggestions into the office's current biannual training plan. The latest plan requires that all forecasters be trained to work the hydro-meteorological desk and schedules all staff members to receive the training courses required for their particular positions. The plan also encourages all staff members to take some computer training classes and participate in local research projects.

For the staff's individual development plans, each employee will document specific training and elective activities that they believe will enhance their job performance. Each elective activity will be assigned a point total, and each employee will establish his or her point goal for the upcoming year.

In their response to our report, agency officials agreed with our recommendation and reported that Individual Development Plans (IDPs) have been completed for all but two Missoula WFO employees. IDPs for the remaining two employees are in the process of being completed. They also noted that after completing the plans, employees were informed that IDPs are flexible documents that provide a guide to training and will be reviewed periodically and revised as necessary.

VI. Several Resource Allocation Issues Need to be Addressed

Although the Missoula WFO generally runs efficiently, a few areas require management's attention to maintain or increase the efficiency and effectiveness of its operation. Specifically, the office runs the risk of losing incident meteorologists to the interagency Geographic Area Coordination Centers (GACC),[25] many office personnel consider several forecast products to be redundant or unnecessary, and electronic technicians spend too much time traveling to repair distant ASOS equipment.

A. The possibility of losing incident meteorologists to the Geographic Area Coordination Centers is a serious NWS concern

As stated earlier, incident meteorologists play a key role in the WFO's efforts to assist fire officials prevent and control wildland fires. In fiscal year 2000, the NWS had 65 IMETs who were certified or in training. IMETs provide on-site meteorological support to firefighters, who need up-to-the-second forecasts of wind direction and speed, precipitation, and other weather information. The majority of IMETs in NWS are at the GS-12 level. To reach the GS-13 level, they typically must become lead forecasters and relinquish most of their IMET responsibilities.

Various GACCs recently issued vacancy announcements for fire weather meteorologist positions at the GS-12 and GS-13 levels. Incumbents in these positions serve as geographic area fire weather managers for the federal wildland fire agencies in the GACC. According to meeting notes of the Northern Rockies Coordinating Center,[26] there may be as many as two fire meteorologists hired at each of the 11 GACCs. Coordinating center officials expressed concern that WFOs may experience a degradation of fire weather services if a number of IMETs move to GACCs to receive a promotion. NWS officials stated that the GACCs have already attracted a number of NWS IMETs.

In an area such as Missoula, where fire weather forecasting is vital to the protection of life and property, losing IMETs to the GACCs could have a serious impact on the office's ability to provide adequate fire weather forecasting services. According to NWS officials, since our inspection, one Missoula IMET has accepted a position with a GACC as a fire weather meteorologist. In an effort to deal with this potential problem, NWS has reportedly begun both recruiting forecasters interested in becoming IMETs and training new IMETs. NWS should continue to develop and implement, if necessary, a contingency plan to address this potential problem.

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[25] Geographic Area Coordination Centers locate and dispatch needed firefighters and support personnel throughout the 11 geographical areas covered by the GACCs. The GACCs often work with local member agencies at the National Interagency Fire Center, which includes the Agriculture Department's Forest Service; the Interior Department's Fish and Wildlife Service, National Park Service, Bureau of Land Management, Bureau of Indian Affairs, and Office of Aircraft Services; and NWS.

[26] The Northern Rockies Coordinating Center is the GACC that encompasses the Missoula WFO county warning area.

B. The state forecast product may be unnecessary or duplicative

In each state, one WFO serves as the state liaison office. In Montana, that office is in Great Falls. The state liaison office is responsible for coordinating statewide weather issues and providing a unified weather service voice to state officials on weather-related topics. In Montana, as in other states, the Great Falls office issues a state forecast product, which is generally used by the media and individuals traveling within the state. The state forecast product for Montana, issued twice daily, provides a five-day extended forecast for three regions: East of the Continental Divide, South West Montana, and West of the Continental Divide.

Missoula WFO personnel contribute to the production of the 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 Great Falls to get more information on the product. Although he considered the state forecast product valuable and believed that it should be retained, he agreed that the product was vague because of the state's varied climatology. Specifically, Missoula prepares localized forecast information twice daily for the area in Montana west of the continental divide. The MIC in Great Falls emphasized that the state forecast product does not provide specific detailed information from each office's extended zone forecast.

The information provided in the state forecast product is vague, often forecasting temperatures within a 20-degree range. The benefits of the state forecast product do not appear to justify the duplication of effort and time taken by the Missoula staff to contribute to the product, especially considering the detailed forecasts available in the WFO's zone forecasts. NWS officials should conduct an evaluation to determine whether it continues to be a beneficial product to offer NWS users in Montana.

C. Electronic technicians can reduce travel time required for ASOS repairs

Part of the electronic technicians' job is to "perform corrective maintenance in a timely manner when notified of an equipment failure." Among the equipment that the technicians are responsible for repairing is the office's five Automated Surface Observing Systems (ASOS). One of the ASOS sites is located at the WFO, but each of the other four is located about 120 miles away, as shown in Figure 4.

Only a few WFOs currently have a full spare parts kit; the Missoula WFO has only a partial spare parts kit. Because the electronics technicians often do not have spare parts readily available to repair the equipment after traveling to the site to determine the cause of the failure, they often must return to the office to order the parts, and then return to the site to repair the equipment. Consequently, the electronic technicians in Missoula spend a significant amount of time traveling to and from the office's ASOS sites, as shown in the Table 3 on page 25.

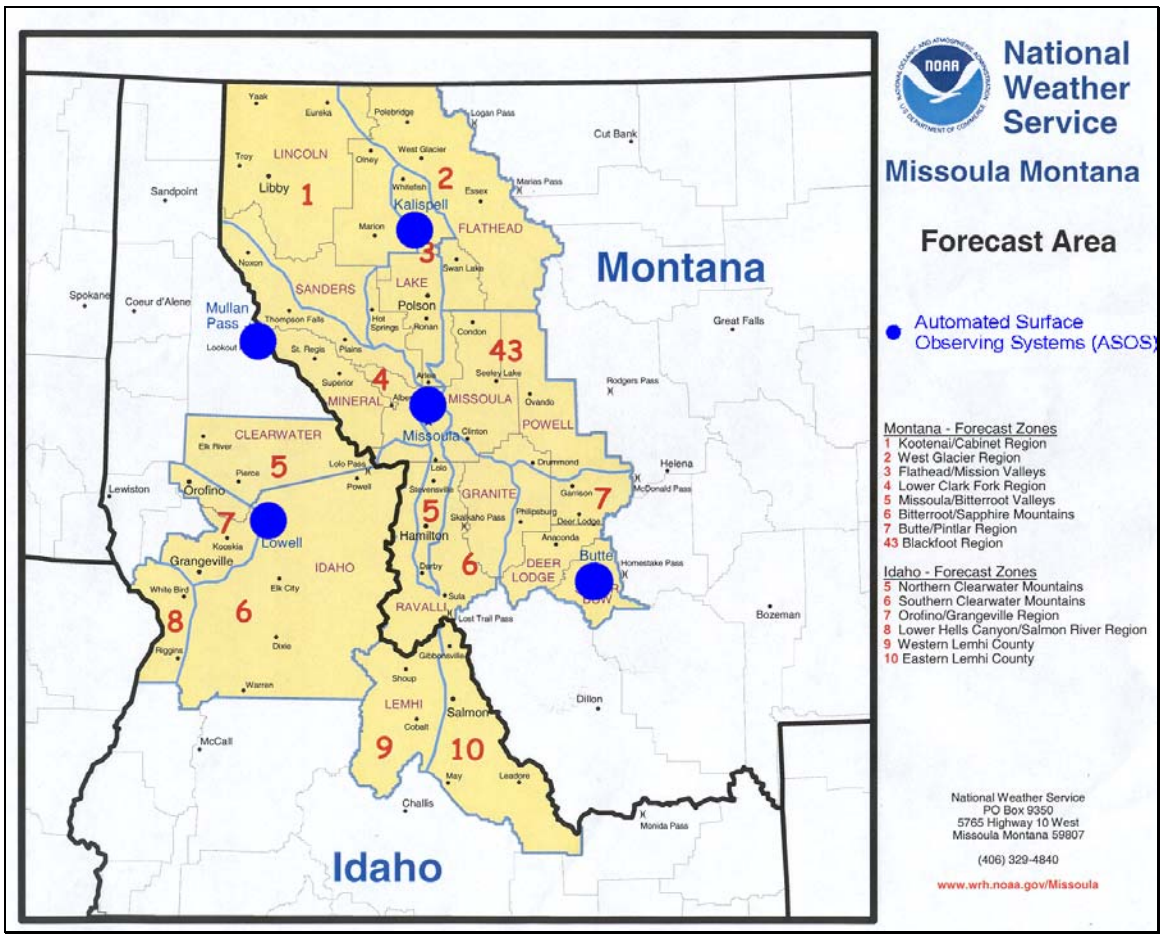

Figure 4: ASOS Sites

Source: NWS Missoula WFO

Table 3: Electronic Technicians' Travel Time (Hours)

	NWS Average	Western Region Average	Missoula WFO
Fiscal Year 1999	670	913	**1170**
Fiscal Year 2000	602	849	**999**

When we discussed this issue with the Western Region director, she agreed with our suggestion that her office perform an analysis to determine which ASOS parts are more prone to failure and therefore need replacement. The regional office will then provide a spare parts kit to the Missoula office based on that analysis, putting the electronics technicians in a better position to repair equipment on their first visit to a site and reduce the amount of unproductive travel time. The regional office should ensure that the WFO is provided a spare parts kit that better meets its needs.

In their written response, agency officials agreed with our recommendations in this section and have taken appropriate action. They determined that the State Forecast Product is still a valuable product for the Missoula WFO to issue. They commented that there are customers within Missoula's area of responsibility who need to know the overall weather forecast for a larger area.

In addition, NWS officials noted that they performed an analysis of ASOS equipment to determine which parts need to be replaced most often and should, therefore, be included in a spare parts kit. As a result of the analysis, all WFO limited spare parts kits will gradually be brought up to full complement. The WFO received a ground-to-air radio, and six of the 37 parts needed to complete its kit are under procurement and will be delivered by the end of the fiscal year. The final 31 spare parts will be provided by the end of FY2002, contingent upon funding availability.

VII. Internal Controls Are Generally Adequate, but Improvements Are Needed in Some Areas

Although we found most administrative functions in the Missoula WFO to be performed adequately due to recently improved administrative controls, we identified several areas that require management's attention. Specifically, we found that some sensitive and high cost items are not included on the office inventory, the office maintains excess computer equipment, and quality control over forecast products is not consistent and systematic.

A. MIC has recently implemented improved administrative controls

Our review of the WFO's administrative operations showed that the management of supplies, bankcards, procurement, time and attendance, vehicles, travel, and security were generally good. Although we have a few concerns with the inventory system, internal controls in that area were generally adequate. The MIC recently tightened controls over these areas as a result of findings and recommendations from our inspection report on the Raleigh WFO.[27] For example, the MIC reduced the number of holders of bankcards, established logs for recording the use of official government vehicles, and took steps to better secure sensitive property.

Number of bankcard holders reduced

One of the first improvements the MIC made after arriving at the Missoula WFO was to reduce the number of bankcard holders from 15 to 10. According to the Commerce Acquisition Manual, the MIC, as the purchase card approving official, is responsible for ensuring that cardholders complete and reconcile Purchase Card Ordering Logs and Statements of Account[28]. She is also responsible for reviewing object class codes and accounting codes. After reviewing the purchase history of each cardholder, the MIC found that many accounts in the office had little or no activity and saw no reason for 15 of the office's 25 personnel to have purchase cards. Thus, the administrative assistant now orders most needed supplies.

As a result of the MIC's actions, the remaining 10 bankcard holders are the administrative assistant, one hydrometeorological technician (the former administrative assistant), the warning and coordination meteorologist, the electronics systems analyst, two electronics technicians, the data acquisitions program manager, two forecasters who work on the cooperative program, and the service hydrologist. During our visit to Missoula, the MIC told us that she plans to further reduce the number of cardholders. We agree with her plans.

[27] *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.

[28] *Commerce Acquisition Manual*, Part 13, Section 301, "Purchase Card Procedures: Roles and Responsibilities." April 5, 2000.

Vehicle log recently established

The Missoula WFO has four government vehicles[29] that are used by the management staff and electronic technicians. The MIC improved controls by requiring the use of General Services Administration (GSA) motor vehicle logs for each vehicle to record travel times, dates, and destinations; purpose of travel; and mileage used when on official government business. The NWS *Western Region Administrative Guide* states, "each office will maintain a GSA motor vehicle log for each GSA vehicle assigned to the office."

Because the vehicle log was implemented in accordance with regional guidance issued only about 2 weeks before our visit[30], we were unable to assess whether the vehicles were being used appropriately and whether the WFO actually needs four vehicles. However, now that the MIC can account for the use of all vehicles, she should periodically review the log to ensure that the vehicles are being used in an appropriate manner and to determine whether there is a demonstrated need for four vehicles.

B. Office inventory system needs some management attention

As a part of our review of the WFO's administrative controls, we examined a sample of items on the office's inventory list and were able to identify all items selected. In fact, the MIC took steps to ensure that sensitive property was secured in a locked cabinet. We also examined a sample of equipment in the office to determine whether the items were included on the office's official inventory list. We found that certain non-expendable and high-cost items, like snowmobiles, are not included. We also found that the office maintains excess computer equipment that is no longer in use.

Sensitive property is now secured in a locked cabinet

The MIC instructed the staff to secure all of the office's portable sensitive property, such as digital cameras, laptops, camcorders, printers, and disk drives. All items that could be easily misplaced or stolen are locked in a cabinet that only she and two other staff members have access to. She also created a log in which employees are asked to record when items are taken and returned. 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 states, "supervisors are responsible for the security of personal property below $2,500 and should use a responsible method to ensure its accountability." As a result of securing and tracking items that could be stolen, the MIC can now better account for sensitive property and there are tighter controls over such inventory.

[29] The Missoula WFO leases three of the vehicles from GSA, and the fourth is owned by NWS.

[30] *Western Region Administrative Guide*, ROML W-03-01 issued and effective March 15, 2001.

Certain non-expendable, high-cost items are not included on WFO inventory list

Several non-expendable, high-cost items maintained at the WFO, such as snowmobiles, 4-wheel All-Terrain Vehicles (ATVs), and enclosed trailers, are not included on its inventory list.

According to the electronics systems analyst who is the designated property custodian, snowmobiles, ATVs, and the enclosed trailer were on the office's inventory list last year but were removed in accordance with an April 26, 2000, memo issued by Western Administrative Support Center that stated, "Property items to be included in the inventory are all nonexpendable items (items with a life expectancy exceeding one year; that have a continuing use as self-contained units…) that are either sensitive or cost $5,000 or more." Attached to the memo was a list of sensitive items that should be included on the office's inventory, such as laptops, digital cameras, and printers. Snowmobiles, ATVs, and trailers were not listed. In addition, because items in question cost slightly less than $5,000, NOAA does not consider them accountable property.

As a result, the WFO does not have a complete and accurate inventory of "non-expendable items that may be converted to private use, or have high potential for theft." According to NOAA's inventory instructions, individual Property Custodians within line, staff, or program offices have the flexibility to include additional items in their inventory if accountability is a problem. Thus, we recommend that NWS officials direct all Property Custodians at WFOs that have snowmobiles, ATVs, and enclosed trailers, to include these items on their office's inventory list and track and control them accordingly.

Office has excess computer equipment

The office maintains excess laptops, printers, external disk drives, and other computers and IT equipment in a storage facility adjacent to the office. The office has been slow in surplusing such equipment. In addition, the office cannot account for all of the equipment because, according to the property custodian, some of it is no longer on the inventory list or was never added to it.

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."

Currently, the office is storing equipment in storage space that could be used to store other items. The office should 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 their written response, agency officials agreed with all but one of our recommendations in this area. NOAA officials disagreed with our recommendation to revise NOAA's inventory instructions regarding sensitive items, to include property such as snowmobiles, ATVs, and enclosed trailers. They did not believe that these items should be added to the sensitive list because they do not exceed the accountability threshold, and there have been no known instances of lost, stolen or misplaced vehicles. However, they noted that the Line/Staff/Program Offices have the flexibility to include these items as accountable property.

NWS officials concurred with our recommendation to add all sensitive items to the office's inventory list, and stated that they will request NOAA Headquarters to revise its guidance. NWS said that it would add the items 60 days after receiving the revised regulatory guidance from NOAA. Based on NOAA's response, which provides a reasonable alternative to address our concern, we are now recommending that NWS direct all relevant WFO Property Custodians to add sensitive items, including snowmobiles, ATVs, and enclosed trailers, to their office's inventory list and track and control them accordingly. This action will meet the intent of our recommendation, which is to adequately account for sensitive federal property.

NWS officials also agreed with our recommendations that the MIC should periodically review the vehicle log to evaluate whether there is a need for four vehicles, and surplus, dispose of, or return all excess equipment to the regional office. They reported that the MIC periodically reviews the vehicle log and has determined that there is a demonstrated need for all four vehicles. NWS also reported that all excess equipment at the WFO has been surplused, disposed of, or returned to the regional office.

C. Information technology controls are improving

The office recently appointed one of the office's electronic technicians as the new IT security officer. Before this appointment, the office's electronics systems analyst had been the de facto IT security officer, implementing and maintaining much of the office's IT controls and procedures, and ensuring that IT security issues were being addressed. We believe that the electronics systems analyst initiated a meaningful IT security program. However, the new IT security officer needs to formalize a comprehensive and ongoing IT security program.

In August and December 1999, NWS issued a new AWIPS security policy and an overall NWS IT security plan.[31] Both documents require the MIC to maintain an adequate security program, including maintaining the appropriate level of security for IT resources, periodically reevaluating security levels, ensuring that only approved hardware and software are installed, and designating an office IT security officer. The new security plan greatly expands system security

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

requirements for each NWS site, including requiring an office-level security plan,[32] risk analysis,[33] and disaster recovery plan.[34]

An IT security officer was not designated at Missoula until November 2000. The office's electronics systems analyst, who had been unofficially performing these duties in response to the new NWS security guidelines and our inspection of the Raleigh WFO,[35] accomplished important IT tasks, such as regularly changing system passwords, completing a full hardware and software inventory, and implementing virus protection software.

During the week of our inspection, NWS headquarters' Information Technology Security Officer approved the Missoula office's security plan, risk analysis, and contingency plan. The three documents demonstrate the office's ability to address its IT roles and responsibilities. However, because the MIC and the SOO are relatively new to the office and their jobs, they were not involved in preparing these documents, and they do 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 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 office IT security officer. While the three basically boilerplate documents provide valuable information, office personnel must now become familiar with and customize these documents to reflect Missoula's specific office environment. In addition, the MIC needs to clarify the responsibility of the IT security officer.

We identified two issues that the new IT security officer must address. [redacted]

Second, we believe that the office's risk analysis needs some revision. [redacted]

[32] Security plans contain detailed technical information about the office's system, its security requirements, and the controls implemented to provide protection against vulnerabilities.

[33] Risk analyses measure the relative vulnerabilities and threats to an office's IT systems in order that resources can be used to strengthen security and minimize potential losses.

[34] Disaster recovery plans provide continuity in data processing services should catastrophic events cause interference with normal system operations.

[35] IPE-12661, September 2000.

D. Quality control needs to be more systematic

Some Missoula personnel have not been reviewing products before and after they are issued. For example, office personnel stated that they do not consistently ask each other to review products before they are sent to the Console Replacement System for distribution.[36] As a result, some office products contained misspelled and missing words and some content inaccuracies, such as incorrect dates, that the shift supervisor should have corrected before issuance. Office managers stated that quality control of office products is not as consistent as it could be.

The *Weather Service Operations Manual* provides WFOs with general requirements for the quality control of products. The manual states that each office should establish quality controls, including training on the operational use of update criteria, proper coding, and clear wording of products. However, the following problems were noted with the office's quality control efforts: office products are not consistently read by other staff members, inconsistencies sometimes occur between public and aviation forecasts, zone products often go directly to the Console Replacement System for distribution, and the hydro-meteorological technicians do not consistently listen to products from that system to detect errors or mistakes.

Office personnel stated that without a consistent quality control process, words are misspelled, and inadvertently added or removed. During our review of a sample of products issued by the WFO, we found two examples of errors that probably would have been detected by consistently applied quality control procedures. First, in January 2001, the office issued a product that mentioned Christmas as if it were forthcoming. Someone in the office caught the error after the product was issued. Second, in March, a zone forecast was issued without the extended forecast. Again, this error was caught and corrected after the product was issued.

Office personnel emphasized that the Console Replacement System requires significant oversight to ensure that accurate products are issued to the public. The system reads and issues text exactly as office personnel write it. While the overall quality of office products has been adequate, quality control procedures should be more consistently applied. The office has two people whose focal point duties include quality control of zone and aviation products. To maintain quality control, both forecasters and hydro-meteorological technicians need to spend more time reviewing products before they are issued.

In its written response, NWS agreed with our recommendation and reported that it has taken action. NWS officials noted that the Missoula WFO's risk assessment has been revised to adequately reflect local conditions, and penetration tests have been performed by the NWS Western Region Headquarters. They also reported that all unneeded services have been disabled, and the WFO is in conformance with NWS IT security guidelines and policies.

[36] The Console Replacement System is a relatively new personal computer-based broadcasting console installed at each NWS office that 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.

In addition, NWS agreed with our recommendation to conduct ongoing quality control over weather forecast products. Officials stated that the WFO has updated its Station Duty Manual to formally require that all products be reviewed by another staff member prior to issuance. All WFO staff are aware of the new guidance and have read and initialed the updated section in the Station Duty Manual.

RECOMMENDATIONS

We recommend that the Assistant Administrator for NWS instruct the Regional Director to take the following actions:

1. Ascertain why certain statistics for the office's Severe Storm program appear to be below the regional average and determine what corrective actions, if any, are necessary. One possibility is conducting appropriate environmental impact and engineering studies on radar radiation and the feasibility of lowering the angle of the Missoula radar. Based on the results of those studies and outreach, determine whether the angle of the Missoula radar should be adjusted (see page 12).

2. Evaluate the benefits of the state forecast product and determine whether the Missoula WFO should continue to assist in its production (see page 24).

3. Perform an analysis to determine which ASOS parts are more prone to failure and therefore need replacement. Provide the WFO with an appropriate spare parts kit based on that analysis (see page 24).

We recommend that the Assistant Administrator for NWS instruct the MIC to take the following actions:

1. Explore other ways to maintain and expand the pool of observers and Skywarn volunteers. For example, consider conducting public service announcements and simplifying the process for cooperative observers to report the data they gather (see page 16).

2. Clarify to all staff members how the new individual development plans will be used and interpreted and ensure that staff members receive appropriate training, based on their plans (see page 22).

3. Periodically review the vehicle log to ensure that the vehicles are being used in an appropriate manner and to determine whether there is a demonstrated need for the current number of vehicles (see page 28).

4. Ensure that all sensitive items are added to the office's inventory list, including snowmobiles, 4-wheel ATVs, and trailers, and are tracked and controlled accordingly. Other MICs at WFOs that have similar sensitive property should also be instructed to revise their inventory lists accordingly (see page 28).

5. Surplus, dispose of, or return all excess equipment to the regional office, according to the procedures set forth in the Department's *Personal Property Management Manual* and NWS policy (see page 29).

6. Revise the office's IT risk analysis to clearly show the risk of outside intrusion and to determine whether the office needs to take additional steps to detect and prevent outside intrusion (see page 30).

7. Conduct ongoing quality control over weather forecast products and emphasize to all forecasters and hydrometeorological technicians that products must be reviewed for quality before being issued (see page 32).

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

SEP 25 2001

MEMORANDUM FOR: Johnnie E. Frazier
Inspector General

FROM: Sonya G. Stewart

SUBJECT: Response to the Office of the Inspector General (OIG) Draft Inspection Report: Missoula Weather Forecast Office (WFO) Generally Provides Quality Service to Its County Warning Area, Report No. IPE-14225

The National Oceanic and Atmospheric Administration appreciates the opportunity to respond to your draft subject inspection report. We have taken corrective action for five of the eleven recommendations and developed an implementation schedule for five remaining recommendations. NOAA does not concur with one recommendation and our rational is attached.

Attachment

Printed on Recycled Paper

NOAA Response to OIG Recommendation

The IG states, "We recommend that the Administrative Officer for NOAA:"

Recommendation 1: Revise NOAA's inventory instructions regarding what constitutes a sensitive item, to include property such as snowmobiles and All-Terrain Vehicles.

NOAA Response: We do not concur. The NOAA Personal Property Office advises against adopting the recommendation at this time based on the following rationale:

1) The current personal property sensitive list was revised by the Department of Commerce (DOC) on October 1, 1999, after being reviewed by all Property Management Officers. The accountability threshold was increased from $2,500 to $5,000, and snowmobiles/all-terrain vehicles were not warranted to be considered for this;

2) The Department's Sensitive property list reflects items considered to be non expendable, that may be converted to private use, or have a high theft potential and are to be recorded and controlled as accountable equipment. NOAA does not feel these vehicles should be added to the sensitive list at this time because they do not exceed the accountability threshold list. In addition, there have been no instances of lost, stolen, or misplaced vehicles of this type reported to a NOAA Property Office; and

3) The NOAA Property Management Officer, with input from the Administrative Support Center's Regional Property Managers, determined that DOC's Sensitive property list meets NOAA's requirement for inventory and property control. In addition, individual Property Custodians within the Line/Staff/Program Offices have the flexibility to include items, e.g., snowmobiles/all-terrain vehicles, in their inventory if accountability is a problem in specific geographic areas.

If the OIG determines these items should be added to the sensitive list, per our conversation with our DOC counterparts, NOAA will suggest they be added to the DOC's Sensitive property list for their consideration.

Target Date of Completion: Not Applicable.

1

National Weather Service (NWS) Response to OIG Recommendations

The IG states: "We recommend that the Assistant Administrator for NWS instruct the Regional Director to take the following actions:"

Recommendation 1: Ascertain why certain statistics for the office's severe storm program appear to be below the regional average and determine what corrective actions, if any, are necessary. One possibility is conducting appropriate environmental impact and engineering studies on radar radiation and the feasibility of lowering the angle of the Missoula radar. Based on the results of those studies and outreach, determine whether the angle of the Missoula radar should be adjusted.

NOAA Response: We concur. The most important factor affecting severe weather statistics is having a sufficient number of spotters to report the occurrence of severe weather events. Spotter reports are needed to verify warnings. WFO Missoula's County Warning Area includes large amounts of public land and mountainous terrain, where few people reside permanently. The lack of spotters in certain areas makes it virtually impossible to verify severe weather warnings for those areas. As a corrective action, WFO Missoula will continue efforts to increase the number of spotters (see action plan for recommendation #1 in the third group).

NWS examined severe weather verification statistics between 1996 and 2000 for Missoula and Flathead Counties and compared them to Western Region averages (see table below). Missoula and Flathead Counties are in WFO Missoula's area of responsibility, are relatively populated, and have a sufficient number of spotters to support verification. The comparison showed WFO Missoula's verification statistics for the two counties were equal to or better than Western Region averages for 1996, 1997 and 1998 in all cases but one (lead-time for 1998). In 1999 and 2000, there were an insufficient number of severe weather events, 14 and 17 respectively, to produce meaningful verification statistics for Missoula and Flathead Counties.

	1996		1997		1998	
	Missoula & Flathead Counties	Regional Average	Missoula & Flathead Counties	Regional Average	Missoula & Flathead Counties	Regional Average
Probability of Detection	.88	.69	.88	.67	.60	.60
False Alarm Rate*	.63	.74	.68	.75	.52	.71
Lead-time (minutes)	17.3	16.4	22.8	18.1	9.8	17.7

* lower is better

2

Another contributing factor is the elevation of the radar which limits the ability of WFO Missoula to interrogate storms and detect downbursts beyond 200 kilometers because the radar beam overshoots storms beyond that distance. WFO Missoula has completed an evaluation of this factor as recommended on page 12 of the OIG draft report. The evaluation was in the form of a paper co-authored by WFO Missoula and the National Severe Storms Laboratory. The paper was submitted for publication to *Weather and Forecasting Journal* in May 2001. The paper has not yet been published. The paper concluded "using negative elevation angles" for the radar "show the potential for improved detections of low-altitude weather conditions in the surrounding valleys and improved estimates of precipitation amounts throughout the coverage area." Western Region will build on this paper by pursuing with appropriate NWS Headquarters offices, the feasibility of conducting environmental and engineering studies in support of lowering the radar angle and its potential effect on improving detection capability.

In summary, WFO Missoula does a good job of issuing warnings for their County Warning Area. Local customers are satisfied with the performance of WFO Missoula and have an understanding of the difficulties involved with issuing warnings in remote areas.

Target date of Completion: Completed August 2001 - explanation of verification statistics provided and corrective actions identified.

Recommendation 2: Evaluate the benefits of the state forecast product and determine whether the Missoula WFO should continue to assist in its production.

NOAA Response: We concur. Across Montana and nationwide, there are customers, including the Associated Press which disseminates the State Forecast Product (SFP), who need to know the overall weather forecast for a larger area. WFO Missoula should continue to prepare the section of the Montana SFP located within WFO Missoula's area of responsibility.

Target Date of Completion: Completed August 2001.

Recommendation 3: Perform an analysis to determine which ASOS parts are more prone to failure and therefore need replacement. Provide the WFO with an appropriate spare parts kit based on that analysis.

NOAA Response: We concur. An analysis was performed. As a result of the analysis, a ground-to-air radio was provided to WFO Missoula. All WFO limited spares kits will gradually be brought up to a full complement of spare parts. WFO Missoula has 94 of the 131 total parts in a full spares kit. Six of the remaining spare parts are under procurement and will be delivered to WFO Missoula by the end of the calendar year. The final 31 spare parts will be obtained by the end of FY02, contingent upon availability of funding.

Target Date of Completion: September 30, 2002.

3

The IG states "We recommend that the Assistant Administrator for NWS instruct the MIC to take the following actions:"

Recommendation 1: Explore other ways to maintain and expand the pool of observers and Skywarn volunteers. For example, consider conducting public service announcements and simplifying the process for cooperative observers to report the data they gather.

NOAA Response: We concur. WFO Missoula continues to expand its Skywarn and Cooperative Observer Program (COOP) network. WFO Missoula has an active outreach committee which works together to brainstorm ideas for recruiting and retaining Skywarn Spotters. A new proposal has been introduced to include day trips to more remote areas to recruit new spotters. In addition, the local Skywarn newsletter will be revamped to include COOP observer highlights and to add the COOP observers to the mailing list.

Western Region is in the process of tailoring a Central Region-developed web-based application for data entry to be used in Western Region. We expect the application to be ready for field testing by October 2001. WFO Missoula will be used as a test site. This application will provide a simpler, more user friendly method for cooperative observers to input daily observations at locations that have Internet connectivity.

Target Date of Completion: The proposed plan to expand the spotter network was completed in August 2001. The web-based data entry application will be operational by December 31, 2001.

Recommendation 2: Clarify to all staff members how the new individual development plans will be used and interpreted and ensure that staff members receive appropriate training, based on their plans.

NOAA Response: We concur. As of September 1, 2001, Individual Development Plans (IDPs) have been completed for all but two employees at Missoula. IDPs for the remaining two employees will be completed by September 30, 2001. During the creation of the plans, employees were interviewed to determine their individual short and long term professional goals. Based upon the interview, objectives were designed to meet the individual goals taking into account office resources, available time, and the individuals' abilities. Reasonable deadlines for the completion of these objectives were determined based upon this information. These IDPs help the MIC determine individual training needs, goals, and progress of each employee.

Once drafted, the IDPs were reviewed and signed by the employees and supervisor. The individuals were informed the IDP provides a guide to training and is a flexible document. Individuals were told that periodic reviews of the IDP will be conducted to ensure employees received training, and to allow for changes to goals, objectives, and deadlines according to individual needs.

Target Date of Completion: September 30, 2001.

4

Recommendation 3: Periodically review the vehicle log to ensure that the vehicles are being used in an appropriate manner and to determine whether there is demonstrated need for the current number of vehicles.

NOAA Response: We concur. The Meteorologist-in-Charge periodically reviews the vehicle log. There is a demonstrated need for all four station vehicles.

Target Date of Completion: Completed. Procedure in place as of March 2001.

Recommendation 4: Add any sensitive items to the office's inventory list, including snowmobiles, 4-wheel ATVs, trailers, and any other accountable property, per the revised regional instructions.

NOAA Response: We concur and will request NOAA Headquarters to revise its guidance. NWS will add all sensitive items to the office inventory lists within 60 days after receipt of revised regulatory guidance from NOAA Headquarters.

Target Date of Completion: Action will be implemented within 60 days after revised NOAA guidance is received.

Recommendation 5: Surplus, dispose of, or return all excess equipment to the regional office, according to the procedures set forth in the Department's Personal Property Management Manual and NWS policy.

NOAA Response: We concur. In January 2001, CD-52s were completed to excess six computers and four printers from the Missoula Weather Forecast Office property inventory. The computers and printers were no longer needed since WFO Missoula received five computers and two printers from the Census Bureau excess. The computers that were replaced were offered to the regional office and also listed on an Excess Bulletin by the Western Administrative Support Center. The Excess Bulletin expired on April 30, 2001. The computers and printers were then donated to a local school according to the "NOAA Computers for Education" program on May 8, 2001. At the time of the IG visit, these computers were being stored in the WFO Missoula storage area, awaiting a decision on disposal.

On May 14, 2001, the property custodian at Missoula submitted CD-52s to dispose of four obsolete laptops and one obsolete printer. The approved CD-52s were returned to Missoula on May 25, 2001, at which time the laptops were cannibalized for parts and disposed.

All excess equipment has been surplused, disposed, or returned to the regional office in accordance with the Department's Personal Property Management Manual and NWS policy.

Target Date of Completion: Completed May 25, 2001.

5

Recommendation 6: Revise the office's IT risk analysis to clearly show the risk of outside intrusion and to determine whether the office needs to take additional steps to detect and prevent outside intrusion.

NOAA Response: We concur. The WFO Missoula risk assessment has been revised to adequately reflect local conditions. The NWS Western Region Headquarters (WRH) performed penetration testing on WFO Missoula systems twice in recent months. On May 10 and July 7, 2001, WFO Missoula's IP address space was scanned by WRH IT security personnel. All IP addresses were found to be successfully patched. No high risk vulnerabilities exist. All unneeded services have been disabled. WFO Missoula staff routinely review log files to determine if/when systems are being targeted from the outside. WFO Missoula is in conformance with NWS IT security guidelines and policies.

Target Date of Completion: Completed July 2001. Penetration testing will continue on a periodic basis. Results will be analyzed and used as a basis for installing patches and disabling unneeded services as appropriate.

Recommendation 7: Conduct ongoing quality control over weather forecast products and emphasize to all forecasters and hydrometeorological technicians that products must be reviewed for quality before being issued.

NOAA Response: We concur. WFO Missoula has updated its Station Duty Manual (SDM) to formally require all products be reviewed by another staff member prior to issuance. All WFO staff have read and initialed the updated section of the SDM. The requirement for proactive quality control will be emphasized during future staff meetings, as well as individually to all lead forecasters (shift supervisors) by the MIC.

Target Date of Completion: Completed August 2001.

6