NATIONAL WEATHER SERVICE'S ONSITE WEATHER SUPPORT TO WILDFIRES: PAST, PRESENT, FUTURE

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1. INTRODUCTION

The National Weather Service (NWS) has provided onsite weather support to wildland fire organization for over 85 years. During that time, the NWS Fire Weather Program has evolved along side the fire fighting agencies it has served. To meet the changing needs of those agencies, NWS has periodically adjusted its program and incorporated the latest technologies of its day into its operations.

The latest trend of increasing numbers of large and dangerous fires on wildlands across the United States has been reflected in the increasing demand for onsite weather support. Six of the busiest seasons for the NWS's Fire Weather Program have occurred since 1994.

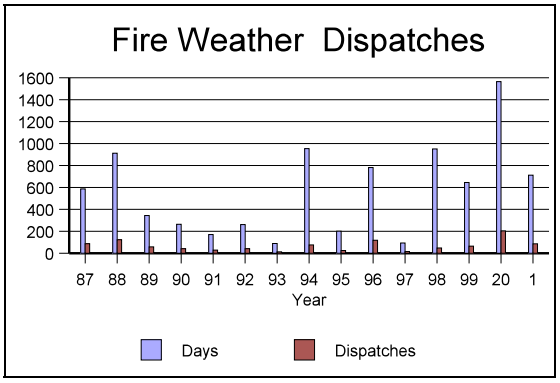

Figure 1 NWS dispatches and number of forecaster days out in the field supporting wildfires by year.

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The NWS has had to adjust to this increasing demand on its program by:1) training more meteorologists for onsite duty, 2) expand the equipment infrastructure to support those increasing number of fires, and 3) migrated to an air portable and computer based system for greater flexibility and faster response times to dispatches.

The current structure and technologies used in the NWS's onsite weather services are the result of a long evolutionary process started back during the earliest years of the U.S. Weather Bureau. The following is a chronology of those technologies and services that have lead up to the current structure and the latest round of technology infusion into the program.

2. WEATHER VANS: 1910-1930s

In response to the devastating fires and loss of life from the 1910 fires, the U.S. Weather Bureau started to provided "special fire weather forecasts" in 1914. The Weather Bureau expanded its tailored services to fire agencies and officially established a "fire weather service in 1916. Soon after, the Bureau began providing limited onsite support to ongoing fires by deploying "fire weather mobile units". Mobile unit was a loosely applied term since many fires at the turn of the century were not accessible by roads and required packing weather observing equipment on horses or mules to remote locations.

By the late 1930s, the forest road net work had expanded and the Weather Bureau began supporting major wildfires by using a "van" equipped with specially adapted meteorological equipment. L. G. Gray of the San Francisco Office has been credited for

designing the weather “van”, referred to as a miniature weather bureau on wheels. The first known dispatch took place in August 1936 on the Brandon Fire which lasted six weeks. The van incorporated both weather observing equipment and short wave radio to obtain the latest forecasts twice a day. Three additional units were built. They were located at Portland, Seattle, Shasta City, and Missoula.

Figure 2 Vintage late 30s and 40s Weather Van. NWS historical photograph, photographer unknown

3.FIRE WEATHER CAMPERS: 1940s AND 1950s

Post war America, saw an influx of new technologies either surplused from World War II military inventories or were specially designed to meet the stepped up campaign against wildfires. The Bureau took advantage of this renewed emphasis on fighting fire and updated its equipment. This resulted in the acquisition and expansion of an assortment of specially equipped camper trucks in the late 1940s and middle 1950s. The use of radio communication back to the local Weather Office gained more importance during this period as the need for and the amount of forecasting data grew. The campers also served as the main gathering place for many a strategy meeting during late fall fires, since they were the only shelter in fire camp that had propane heaters.

4. FIRE WEATHER MOBILE UNITS: 1960s 1970s AND MID 80s

To be effective, campers had to be located near fire-prone areas in order to be deployed quickly. From 1961 through 1963, the Weather Bureau instituted a nine-phase program to “improve and expand” fire weather services. This program included the creation of 16 “fire weather offices (FWOs)” in the western states, each equipped with a dedicated “fire weather mobile unit” consisting of a standard-ized truck-mounted camper, generator, meteorological equipment, and a high frequency transceiver.

Even with the advent of the fire weather mobile unit as a fixture in fire camps, remote fires still were supported by innovative schemes. One such unique dispatch was the 1961 Meridian Creek Fire on the Sawtooth National Forest, where Chuck Syverson, tent, weather equipment and radio gear were helicoptered to a ridge near the fire.

The use of mobile units over time proved to be restrictive and costly. The campers could not be used in primitive areas without roads, and in many cases, forecasters would spend hours - or even days - driving to reach a fire site. For the next two and half decades, interagency working groups periodically formed to explore alternatives to the fire weather mobile units. Their goal was a rapid deployment capability to meet onsite user requirements.

Figure 3 Vintage 1960s Fire Weather Camper. NWS historical photograph, photographer unknown.

In the early 70s, saw another major upgrade to the fire weather mobile units with new campers, trucks, and new equipment. High

frequency transceivers became more powerful and facsimile recorders were added to produce paper weather maps. Due to the transient nature of high frequency radio propagation, obtaining weather maps via a clean strong radio signal was marginal at best. Forecasters still spent many an hour copying weather data by hand over the radio.

After the 1976 grounding of the Argo Merchant off the coast of Nantucket and the inability to support onsite disaster operation on the east coast, NWS with the help of fire agencies stepped up its activity to build an air-portable alternative. A prototype and two commercial built "air-portable" units were manufactured. These units quickly proved to be impractical: at 2300 pounds, a military helicopter was required to transport the big, expensive units.

5. AIR TRANSPORTABLE MOBILE UNIT: MID 1980s AND 1990s

In the mid 80s, work continued on an air-portable prototype. The first "truly" Air Transportable Mobile Units (ATMU) were built and tested during the 1984 fire season. One unit was developed in Redding and tested in California. A second unit was developed in Boise and tested in Montana. The units consisted of equipment from existing mobile units repackaged into shipping containers. These initial tests were limited to flying equipment and fire weather forecaster together to the fire.

On September 11, 1984, the Eltapom Wildfire in the Shasta-Trinity National Forest proved an ideal case to test the concept of having hardware arrive from one location while the forecaster came from another. The U.S. Forest Service in Redding flew the equipment to the fire while Milo Radulovich, fire weather forecaster at Sacramento, California, flew to the fire from another location. The two were successfully married up and Milo remained on the fire for three days. The ATMU concept had been proven, thus opening up a new era of speed and flexibility.

Further testing was conducted in 1985. Six units were eventually built and successfully used on California and Oregon Fires in 1986. These successful deployments led to interagency evaluations and national approval. In 1987, 13 more ATMUs were built in Redding California. This resulted in 19 ATMUs which were cached at 13 user sites throughout the western states. Three more ATMUs were built during the winter of 1987-88, and cached at Duluth, Minnesota; London, Kentucky; and Fairbanks, Alaska. The ATMU concept and onsite support to wildfires and natural disasters were now considered a national program.

The final ATMU configuration consisted of seven modules with a total weight under 400 pounds. The modules were small enough to be placed in a Forest Service Beech-Baron aircraft. Each ATMU contained a satellite receiving and display system for receipt of weather maps, a portable weather station, theodolite for calculating winds aloft, two belt weather kits, office supplies, and a 300 baud "dumb" terminal for text data acquisition.

Improvements continued to be made on the ATMUs. In spring, 1989, the satellite data service made the switch from the aging and delicate facsimile recorder to paper printers.

Logistical support at fire camps were becoming less primitive and telephone lines, once a rarity at a fire camp, were now common place. Telephone access allowed for the use of computers in obtaining weather data. Personal computers were first tested by NWS Western Region forecasters during the Yellowstone fires in the summer of 1988. This gave fire weather forecasters routine access to far more data than ever before and in a more reliable way.

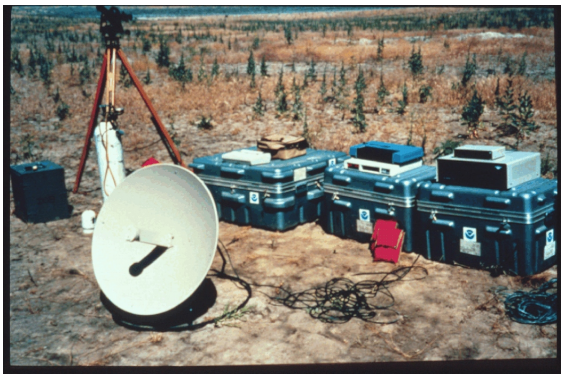

Figure 4 Air Transportable Mobile Unit 1988. Photo: Gorski

6. INCIDENT METEOROLOGISTS AND FIRE WEATHER COMPUTERS: 1990s

The success in using computers in Yellowstone lead to each NWS Western Region Fire Weather Office being issued a portable computer system for fire weather applications in 1990. The computer was used in conjunction with the satellite data service. These AC powered portables were later replaced by laptops. Accessing data via computer gradually became the preferred method of obtaining forecast models and the latest satellite imagery. By 1996, laptop computers became officially part of the national ATMU configuration.

Upgrade to the portable weather stations supporting the ATMU occurred during the early 90s. The old portable stations were replaced by a more sophisticated radio accessed data platform known as a Micro Remote Environmental Monitoring Unit (MicroREMs). These would be cached at the National Interagency Fire Center in Boise, ID and ordered at the same time as an ATMU.

In the mid 90s, the need arose for a four letter acronym to adhere to the Incident Command System (ICS) dispatch ordering forms to identify the fire weather forecaster on the incident. This lead to the adoption of the term Incident Meteorologist (IMET). The term gained popularity in the fire community and has been adopted throughout the NWS. Training and certification standards were formalized for this position within the NWS by the late 90s. Annual regional or national workshops have been conducted to maintain IMET proficiency and certification.

The portability of the ATMU and the ability of the IMETs to fit into any ICS organization, created demands for onsite weather services beyond wildfire suppression. Immediately after the devastating San Francisco earthquake in 1989, Jeanne Hoadley, WSO Sacramento forecaster, was dispatched with an ATMU to a site near the earthquake's epicenter to provide weather support. The ATMU and IMETs have also supported numerous hazardous spill incidents across the county. The most recent notable incident support was for the "New Carissa Marine Accident" off the coast of Oregon in 1999.

7. ADVANCED TECHNOLOGY METEOROLOGICAL UNIT: LATE 90S

The old ATMU satellite data delivery system had one major draw back. The data stream was geared for a national audience and therefore lacked vital local data sets. The rise of the internet and almost universal access to this communication network provided an opportunity to tailor a request reply data acquisition system that would include local data for the IMETs.

The next evolutionary step in the ATMU concept was to take advantage of the strengths of the internet and adapt it to support onsite services. New laptop computers were purchased, equipment from a commercial satellite based internet provider was modified, and items from the old Air Transportable Mobile Unit were re-packaged. The transition to the new ATMU setup was completed in 1999. The new unit kept the old acronym but was renamed the Advanced Technology Meteorological Unit (ATMU).

Figure 5 Advanced Technology Meteorological Unit Yr 2000. Photo: Gary Bennett

8. FUTURE ATMU: 2001 AND BEYOND

The present ATMU provides the NWS with a tremendous amount of capability and flexibility in providing meteorological support to both wildfire suppression and other natural

disasters. However, the current configuration relies heavily on legacy systems to provide critical data sets.

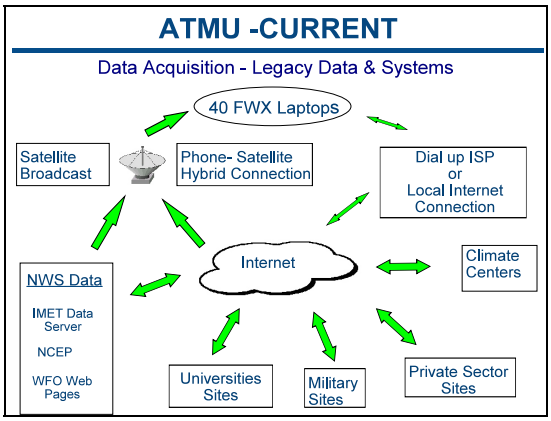

Figure 6 Current ATMU uses combination of multiple data sources and legacy systems.

Since it depends on these legacy systems, it does not have the most advanced data sets and display capabilities available to forecasters at the local Weather Forecast Offices. The NWS has embanked on testing the feasability of using National Oceanic and Atmospheric Administration's (NOAA) Forecast System Laboratory's (FSL) FX-Net system. The FX-Net system provides internet access to NWS's Advanced Weather Information Processing System's (AWIPS) data stream. The FX-Net client on a laptop has the look and feel of an AWIPS workstation, but with resolution and complexity reduced to allow for rapid internet response.

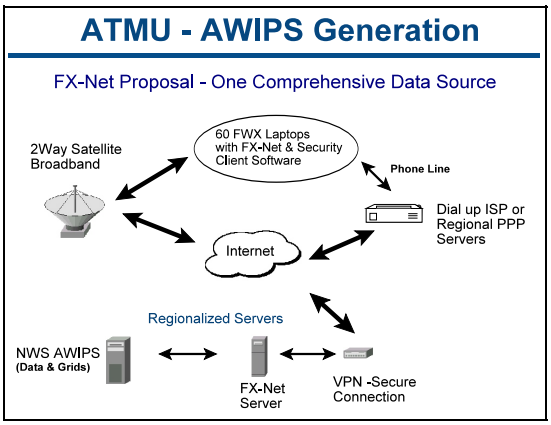

Figure 7 Future AWIPS data support via FXNet servers and laptops.

Initial 2001 field trails on the Tonasket Complex in Eastern Washington and the Moose Fire in Montana indicate that data acquisition over fire camp telephone lines are within acceptable limits for onsite operational forecasting. Further tests will be conducted with a second generation two way satellite internet service later this fall and spring of 2002. A security interface was also implemented to support the FX-Net system and was tested at NWS Western Region Headquarters during the summer operational tests.

FSL and Western Region's Scientific Services Division will continue to refine and upgrade the software through this fall and will use the system to support the Salt Lake City 2002 Winter Olympics. Experiences using the system during the Winter Games will lead to further enhancements and stabilization of the software for further testing during the 2002 fire season.

8. CONCLUSION

NWS has had a long and proud history of supporting wildfires. Its innovative and adaptive use of the latest technologies throughout its history has allowed forecasters to bring weather support to the front lines of the fire fighting efforts. The harsh and remote locations have provided challenges to both forecasters and the many men and women that have contributed in the development of the special equipment and technologies to support those efforts. These challenges will continue as NWS looks towards the next round of upgrades to our fire weather capabilities in the twenty first century.

9. ACKNOWLEDGMENTS

The authors thank Dave Goens, Meteorologist in Charge, Missoula, MT (retired) for providing several historical photographs.

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