

CHAPTER 4

COMMUNICATIONS

4.1 Department of Commerce/National Oceanic and Atmospheric Administration (NOAA) Communications Systems

Various distribution methods are used by the National Weather Service (NWS), as appropriate, to make warnings available to NWS field offices, other Federal agencies, National Centers, and the public as rapidly as possible. The NWS Telecommunications Gateway (NWSTG) provides the majority of the connectivity between the producers and users of warnings for these distribution methods. Data collection is also accomplished by several methods within each agency and then shared between agencies. In addition, the NWSTG is the North and South American Regional Meteorological Telecommunications Network (RMTN) for the World Meteorological Organization (WMO) Global Telecommunications System (GTS) which provides global weather data and products to WMO members including the United States. It is also a network of interconnected military, civilian, and foreign computer interfaces used for collecting and distributing environmental data worldwide.

4.1.1 NOAA Weather Wire Service (NWWS)

The NWWS is the primary NWS medium for disseminating warning and forecasts to the media, emergency management agencies, and other users in the public and private sectors. It is a leased satellite communications system operated for the NWS by a private sector contractor. The NWWS will accept messages simultaneously entered from all NWS data entry nodes, primarily NWS Weather Forecast Offices (WFOs) and the National Centers. The system delivers the information to subscribers through a satellite broadcast with output in ASCII format. More information on this system is available via NWS web pages: <http://www.nws.noaa.gov/>.

4.1.2 NOAA Weather Radio (NWR)

NOAA Weather Radio (NWR) is a nationwide network of over 1000 radio transmitters, broadcasting continuous weather information directly from a nearby NWS office. NWR broadcasts NWS warnings, watches, forecasts, and other hazard information 24 hours a day. In conjunction with the Emergency Alert System, NWR provides an "all-hazards" radio network, making it a single source for comprehensive weather and emergency information. NWR also broadcasts warning and post-event information for all types of hazards: natural (e.g., earthquakes and volcano activity), manmade (such as chemical or environmental incidents), and terrorism-related.

NWS field offices equipped with NWR can transmit continuous weather information on one of following frequencies: 162.400, 162.425, 162.450, 162.475, 162.500, 162.525, and 162.550 MHZ. These radio transmitters provide continuous weather information to an area with a radius of about 40 miles (65 km). Local radio and TV stations can record and rebroadcast the material even when land lines in the area have been disrupted. These transmitters have a tone alert

capability used to activate specially designed, commercially available receivers. The NWR network continually broadcasts coastal and marine forecasts. Recorded voice broadcasts are in the process of transitioning to voice synthesis or concatenated voice. The network provides near-continuous coverage of the conterminous United States (CONUS), the Great Lakes, Hawaii, Guam, and the populated Alaska coastline. Typical coverage is 25 nm offshore. A listing of all NWR stations can be found at: <http://www.weather.gov/nwr/nwrbro.htm>.

NWR 1050 Hz Warning Tone Alarm

An analog 1050 Hz warning alarm precedes many critical watch and warning issuances to activate receivers in a preset muted condition to alert listeners of impending hazards.

NWR Specific Area Message Encoder (SAME)

SAME is a device that puts a special digital code at the beginning and end of selected transmissions of voice messages. The NWS employs SAME with NWR. The SAME code specifies both the type of message (tornado warning, severe thunderstorm watch, etc.) and area (by county) to which the message applies. This gives users, with a decoding device within listening range of the NWR signal, the ability to choose which site-specific hazardous weather messages will automatically interrupt their normal programming. Users of SAME include radio and television stations, schools, cable companies, businesses, and dispatchers. Although SAME will provide much more specificity in both message content and area alerted than the analog 1050 Hz warning alarm, the 1050 Hz warning alarm will continue to be used since it is a long-standing feature of NWR. Many radio manufacturers have designed and developed SAME decoding capability in consumer and industrial grade NWR receivers.

4.1.3 Emergency Managers Weather Information Network (EMWIN)

EMWIN was developed by NWS in partnership with the Federal Emergency Management Agency (FEMA) to ensure access for the emergency management community to a set of NWS products at no recurring cost. The EMWIN data stream contains current weather warnings, watches, images, advisories, and forecasts issued by the NWS.

The information present in the EMWIN data stream originates from WFOs and other sources. This information is collected at the NWS office in Silver Spring, Maryland, then uplinked to the GOES-11 (GOES-West) and GOES-13 (GOES-East) weather satellites from a transmission site in Wallops Island, Virginia.

There are three methods to receive EMWIN data. It can be obtained directly from the GOES satellites using a radio receiver. If the EMWIN signal is being broadcast on a VHF or UHF frequency in a given area, it can be received using a low cost scanner and decoder. It is also available through an Internet connection. Each method requires different hardware and/or software combinations.

EMWIN is continuously broadcast at 9.6 kbps from the GOES-West Satellite (GOES I-M) on a frequency of 1690.725 MHz and at 19.2 kbps on the GOES-East Satellite (GOES N-P) on a frequency of 1692.7 MHz. It contains real-time warnings, watches, advisories, and most of the

routine products that are currently on the NWS system. EMWIN also broadcasts satellite imagery and graphics. More information on EMWIN data content and reception methods is available on the EMWIN website at EMWIN.net.

4.1.4 Low-Rate Information Transmission (LRIT)

The EMWIN data stream is incorporated into the NOAA/NESDIS Low-Rate Information Transmission (LRIT) service provided by GOES-East and GOES-West satellites. This system provides unidirectional broadcast link connectivity between the originating uplink from the NOAA Command and Data Acquisition Stations (CDAS) at Wallops Island, Virginia (WCDAS) and a large number of outlying ground LRIT terminals (LRITT). These LRITTs are typically small receive-only stations.

In addition to EMWIN data, GOES imagery products are generated at the NESDIS Environmental Satellite Processing Center (ESPC) in Suitland, Maryland, and delivered to the CDAS as part of the LRIT data stream for rebroadcast via the GOES satellites. Also included is a copy of the GOES Data Collection System (DCS) data stream and other environmental products including: tropical storm information from the NOAA/National Hurricane Center and Japan Meteorological Agency MTSAT imagery and EUMETSAT Meteosat MSG in graphic format, also produced at the ESPC. The LRIT downlink frequency of 1691 MHz is then converted to an intermediate frequency at the LRITT with a bandwidth that allows a data rate of up to 256 kbps. The GOES system consists of several observing subsystems including the data collection system (DCS). The DCS uses the GOES spacecraft for the relay of data from remotely located insitu sites at or near the Earth's surface.

4.1.5 Really Simple Syndication (RSS)

The NWS leverages multiple technologies to disseminate weather information via the Internet. In addition to the primary NWS web site, www.weather.gov, the NWS has begun to provide RSS feeds at www.weather.gov/rss/. Really Simple Syndication (RSS) is a family of web formats used to publish frequently updated digital content. Users of RSS content use programs called feed 'readers' or 'aggregators' (newer versions of Web browsers offer built in support for RSS feeds): the user 'subscribes' to a feed by entering the link of the RSS feed into their RSS feed reader; the RSS feed reader then checks the subscribed feeds to see if any have new content since the last time it checked, and if so, retrieves the new content and present it to the user.

4.1.6 NOAA Family of Services

NWS provides external users with access to weather information through a collection of data services called the Family of Services (FOS). FOS is accessible via dedicated telecommunications access lines from the Washington, D.C., area. Users may obtain individual services from NWS for a one-time connection charge and an annual user fee. The part of FOS that specifically pertains to forecasts, watches, and warnings is the Public Product Service (PPS). The PPS carries all public warnings and watches, as well as various hydrological, agricultural, and miscellaneous forecasts and products. The Domestic Data Service (DDS) carries basic observations and various aviation, marine, and miscellaneous products.

4.1.7 NOAAPort

The NOAAPort broadcast system provides a one-way broadcast of NOAA environmental data, forecasts, and watch and warning information to NOAA sites and to external users. This service is implemented by a commercial provider using C-band satellite communications. The Advanced Weather Interactive Processing System (AWIPS) Network Control Facility (NCF) routes products and data to the appropriate NOAAPort channels for uplink and broadcast (see Figure 4-1). All products available via FOS and NWS are also available on NOAAPort, including access to digital NOAA GOES and POES satellite data. Satellite data are passed to NWSTG, NCF, and NOAAPort by NESDIS ESPC in Suitland, Maryland. The NOAAPort User's Page is available online at <http://www.nws.noaa.gov/noaaport/html/noaaport.shtml>.

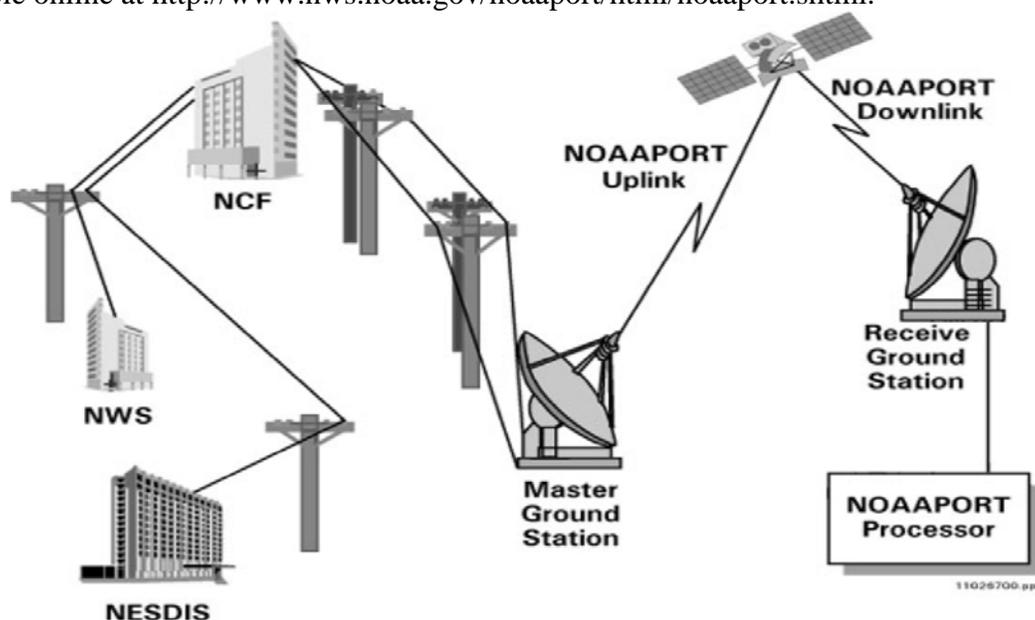


Figure 4-1. NOAAPort Flow of Operational Data and Products

4.1.8 Data Collection and Distribution

Weather data are collected by satellite environmental sensors and surface-based observing systems and processed to create products. Weather data from GOES and POES satellite environmental sensors and Federal agency observations available from NWS WFOs, National Centers, the DOD Automated Weather Network (AWN), and other sources are collected by the NWSTG. As stated previously, satellite data are passed to NWSTG, NCF, and NOAAPort by NESDIS ESPC in Suitland, Maryland. In addition, the NWSTG distributes the data to the nation's operational processing centers and other national and international users through direct links to the NWSTG, the Shared Processing Program (SPP) network, and the Domestic Data Service (DDS). All WFOs have access to the digital GOES satellite data stream through AWIPS workstations. A large amount of satellite data is also available on a number of web-site servers, operated by both governmental agencies and the private sector.

Marine Data Collection Communications

Moored buoy and Coastal Marine Automated Network (C-MAN) data are transmitted by ultrahigh frequency communications via GOES to NESDIS and then relayed to the NWSTG for processing and dissemination. Drifting buoy data are telemetered through the NOAA polar-orbiting satellites to the U.S. Argos Global Processing Center, Largo, Maryland.

Moored buoy observations are formatted into the World Meteorological Organization (WMO) FM 13-IX SHIP code. C-MAN measurements are formatted into C-MAN code, which is similar to the WMO FM 12-IX SYNOP code. The full description of the C-MAN code is contained in the C-MAN Users' Guide, available from National Data Buoy Center (NDBC). Drifting buoy observations are processed and formatted by Service Argos into the WMO FM 18 BUOY code. The messages are then routed to the NWSTG for distribution. Both the SHIP and BUOY codes are defined in the WMO *Manual on Codes*, Volume I.

Radar Products Central Collection/Distribution Services (RPCCDS)

Through the RPCCDS, the AWIPS network collects radar products from NWS, DOD, and FAA wather radar (WSR-88D) sites and delivers them to central radar product collection servers integrated into the NWSTG. All radar products collected are available to users from RPCCDS servers. More information about RPCCDS is available at: <http://www.nws.noaa.gov/tg/rpccds.html> .

4.2 Department of Homeland Security (DHS)

4.2.1 FEMA Communications System

National Warning System (NAWAS)

NAWAS is the primary system for emergency communications from the Federal government to both State and county warning points. This FEMA-operated, hotline, interstate telephone system connects FEMA warning points with the NOAA/NWS WFOs and National Centers. Figure 4-2 gives the location of FEMA warning points, and Appendix D contains a list of State contacts.

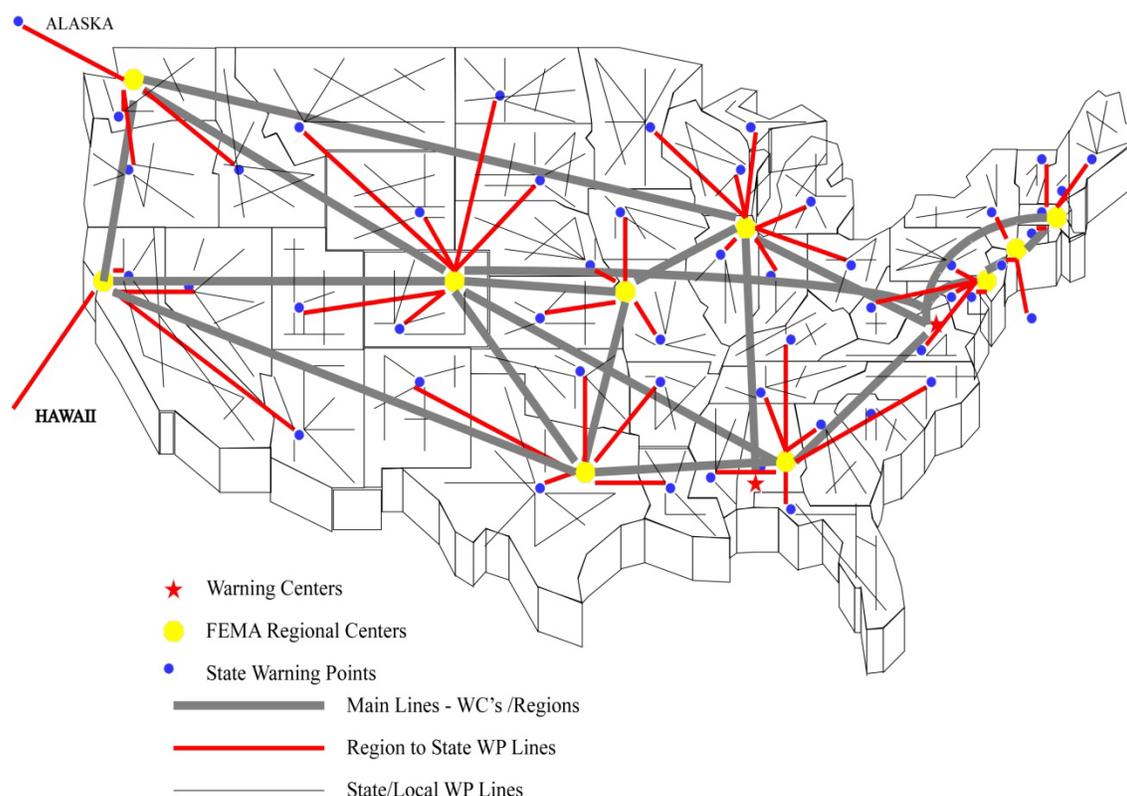


Figure 4-2. The National Warning System (NAWAS) is FEMA’s Operational Hotline Telephone System

4.2.2 U.S. Coast Guard (USCG) Marine Weather Broadcast Systems

The USCG broadcasts forecast, watch, and warning products that include information on severe local storms issued by the NWS National Centers for Environmental Prediction (NCEP) Marine Prediction Center (MPC) and Storm Prediction Center (SPC) and by NWS WFOs. The broadcast of these products supports U.S. participation in the Global Maritime Distress and Safety System, which provides communications support to the International Maritime Organization's global search and rescue plan.

Global Maritime Distress and Safety System (GMDSS)

The goals of GMDSS are to provide more effective and efficient emergency and safety communications, and to disseminate maritime safety information to all ships on the world's oceans, regardless of location or atmospheric conditions. These goals are defined in the International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended in 1988. GMDSS is based upon a combination of satellite and terrestrial radio services and has changed international distress communications from being primarily ship-to-ship based to ship-to-shore (rescue coordination center) based. GMDSS provides for automatic distress alerting and locating, and requires ships to receive broadcasts of maritime safety information that could prevent a distress from happening in the first place. The NWS participates directly in the GMDSS by preparing weather forecasts and warnings for broadcast via two primary GMDSS systems—NAVTEX and Inmarsat-C SafetyNET.

NAVTEX

NAVTEX is an international, automated system for instantly distributing maritime navigational warnings, weather forecasts and warnings, search and rescue notices, and similar information to ships. The International Maritime Organization has designated NAVTEX as the primary means for transmitting urgent coastal marine safety information to ships worldwide. NAVTEX is broadcast from twelve USCG facilities, and coverage is reasonably continuous along the East, West, and Gulf coasts of the United States, as well as in the areas around Kodiak, Alaska; Guam; and Puerto Rico. The typical NAVTEX transmission coverage ranges from 200 to 400 nm.

SafetyNET

Satellite systems operated by Inmarsat, a satellite telecommunications company, offering global mobile services are an important element of the GMDSS. Additional information on Inmarsat can be found at <http://www.inmarsat.com/>. Inmarsat-C provides ship-to-shore, shore-to-ship, and ship-to-ship store-and-forward data and telex messaging; the capability for sending preformatted messages to a rescue coordination center; and the SafetyNET service. The SafetyNET service is a satellite-based worldwide maritime safety information broadcast service for high-seas weather warnings, navigational warnings, radio navigation warnings, ice reports, warnings generated by the USCG-conducted International Ice Patrol, and other information not provided by NAVTEX.

Coastal Maritime Safety Broadcasts

In addition to NAVTEX and NWR, the USCG and other government agencies broadcast maritime safety information using a variety of radio systems to ensure coverage of different ocean areas for which the United States has responsibility and to ensure ships of every size and nationality can receive this vital safety information.

Very High Frequency (VHF) Marine Radio

The USCG broadcasts near-shore and storm warnings of interest to mariners on VHF channel 22A (157.1 MHz) following an initial call on the distress, safety, and calling channel 16 (156.8 MHz). Broadcasts are made from over 200 sites covering the coastal areas of the United States, including the Great Lakes, major inland waterways, Puerto Rico, Alaska, Hawaii, and Guam. All ships over 20 meters in length in U.S. waters are required to monitor VHF channel 16 and must have radios capable of tuning to the VHF simplex channel 22A. Typical broadcast coverage is 25 nm offshore.

Medium Frequency (MF) Radiotelephone (Voice)

The USCG broadcasts offshore forecasts and storm warnings of interest to mariners on 2670 kHz, after first being announced on the distress, safety, and calling frequency 2182 kHz.

Additional Information

Further information concerning these broadcasts can be found at the following Internet sites:

- <http://www.navcen.uscg.gov/?pageName=maritimeTelecomms>

- <http://weather.noaa.gov/fax/marine.shtml>

In addition, National Geospatial-Intelligence Agency (NGA) Publication 117 contains detailed information on USCG radio schedules. This publication is available from local National Ocean Service chart agents; it can also be ordered by calling 1-800-638-8972 or 301-436-8301 or by visiting the NOAA Internet site at <http://www.nauticalcharts.noaa.gov/staff/chartspubs.html>.

4.3 Federal Communications Commission (FCC) Communications System

4.3.1 National Emergency Alert System (EAS)

Formerly known as the Emergency Broadcast System, the National EAS is a nationwide network of broadcast stations and cable systems that provide a readily available and reliable means to communicate emergency information to the American people. State and local authorities have their own EASs, which may also be used to broadcast information on major disasters or emergencies. The FCC designed the National EAS as a tool for officials to quickly send out important emergency information targeted to a specific area. The EAS digital signal uses the SAME coding protocols that the NWS uses on NWR. This allows an NWR signal to be decoded by the EAS equipment at broadcast stations and cable systems, facilitating almost immediate retransmission of NWS weather warning messages to their audiences. The EAS digital system architecture allows broadcast stations, cable systems, participating satellite companies, and other services to send and receive emergency information quickly and automatically even if those facilities are unattended. The National EAS requires monitoring of at least two independent sources for emergency information, to help ensure that emergency information is received and delivered to viewers and listeners. EAS digital messages can be automatically converted into any language used by the broadcast station or cable system or input to external devices used to alert special populations such as the hearing impaired.

4.4 Department of Defense (DOD) Communications Systems

4.4.1 Air Force Communications Systems

Joint Air Force and Army Weather Information Network (JAAWIN) and Joint Environmental Toolkit (JET)

JAAWIN provides access to products via the Internet for any user at a military computer (Internet extension .mil), using digital authentication and encryption technologies. To gain access to the network, nonmilitary users must first request an account and be issued a user name and password. The Internet URL is <http://www.afweather.af.mil/>.

4.4.2 Navy Communications Systems

Fleet Numerical Meteorology and Oceanography Center (FNMOC)

The U.S. Navy's FNMOC (Internet website <https://www.fnmoc.navy.mil/public/>) plays a significant role in the National capability for operational weather and ocean prediction through

its operation of sophisticated global and regional models whose coverage extends from the top of the atmosphere to the bottom of the ocean. FNMOC is linked with the data collecting and distributing networks of the U.S. Air Force (USAF), NOAA, and WMO. Through these sources, FNMOC collects and assimilates massive volumes of global meteorological and oceanographic (METOC) data for input into its numerical models and distribution to DOD forces worldwide. Utilizing this collection of data, basic and applied computer-generated METOC products are produced for distribution on Navy, Marine Corps, and Joint Command, Control, Communications, Computers, and Intelligence (C⁴I) systems.

Many of FNMOC's products are distributed to users over the Internet via the personal computer-based METCAST system and subsequently displayed and manipulated on a user's computer with the Joint METOC Viewer (JMV) software. This includes all standard meteorological and oceanographic fields, synoptic observations, and satellite imagery. For those who require only graphical representation, FNMOC provides a Web-based capability called MyWxMap, which can be accessed through a Web browser for quick display of METOC fields for any user-defined geographical region.

Naval Oceanographic Office (NAVOCEANO)

NAVOCEANO, located at Stennis Space Center, Mississippi, is the primary oceanographic production center for the Navy. It is responsible for collecting, processing, and distributing hydrographic, oceanographic, and other geophysical data and derivative products. Products available from NAVOCEANO include ocean fronts and eddies analyses and surface and three-dimensional ocean thermal fields, which are distributed through the Navy, Marine Corps and Joint C⁴I systems.

4.4.3 Data Collection

The Automated Weather Network (AWN) provides the means for data collection within DOD and serves as the DOD link to the WMO GTS through the NWSTG. The AWN currently terminates at AFWA, located at Offutt Air Force Base (AFB). In addition, the High-speed Asynchronous Transfer Mode (ATM) Weather Communications Network (HAWCNET) links Air Force and Navy centers with NOAA's NESDIS and NWS centers to enable sharing of data and products.

Alphanumeric support is provided to end users via the DOD Nonsecure Internet Protocol NETwork (NIPRNET). In addition, the Automatic Digital Network (AUTODIN) via landline, standard DOD C⁴I systems, and the Joint Operational Tactical System (JOTS) provides additional means to send METOC data to FNMOC and AFWA and to distribute METOC data and products to users.

4.5 DOT Communications Systems

4.5.1 Federal Aviation Administration (FAA) Systems

Collection of Data and Distribution of Watches, Warnings, and Severe Weather Reports

All FAA air traffic facilities are required to accept and relay pilot reports (PIREPs). FAA satellite, voice, and telecommunications will be used to collect and distribute the following observations and products for severe local storms:

- Routine aviation weather reports (METARs)
- Selected aviation special weather reports (SPECIs)
- PIREPs [Routine pilot reports (UA)/Urgent pilot reports (UUA)]
- Convective Significant Meteorological Information reports (Convective SIGMETs)
- Center Weather Advisories

Weather Message Switching Center Replacement (WMSCR)

WMSCR is the FAA's main weather alphanumeric message switching system. It is designed to store and forward automatically all the various alphanumeric weather messages that contain a proper WMO header. The system consists of two sites, one in Atlanta, Georgia, and the other in Salt Lake City, Utah. These sites normally share the load, but each can support the entire system if the other site is not available.

Automated Flight Service Stations (AFSSs)/Flight Service Stations (FSSs)

The AFSSs/FSSs collect and disseminate PIREPs and broadcast weather information and alerts via air-to-ground radio, telephone recordings, and navigational aids. Requests for information not available at the AFSS/FSS are forwarded to the appropriate NWS office for resolution. These stations also routinely pass information from observers, airport personnel, and pilots to the appropriate NWS office. The FAA and NWS have agreed on the communications methods used to pass this information.

On February 1, 2005, the FAA awarded a contract for the services provided by the 58 AFSSs in CONUS, Puerto Rico, and Hawaii to Lockheed Martin Corporation. Lockheed Martin assumed responsibility for providing AFSS flight services on October 4, 2005. With continued FAA oversight, Lockheed Martin will maintain deliverance of flight services, according to the FAA's strict safety and service requirements. AFSS/FSS in Alaska continues to be operated by the FAA.

4.6 Interagency Shared Processing Program

Polar-orbiting satellite data are processed and exploited by the DOD and NOAA to meet their requirements and are forwarded to each other through the ATM/Shared Processing Program

(SPP) network. The data and products are further distributed to other agencies and the public as appropriate. The ATM/SPP network interconnects the NWSTG with the five U.S. operational processing centers at NCEP, NESDIS, AFWA, FNMOC, and NAVOCEANO. The USAF/USN piece of this SPP connection is HAWCNET (described under DOD systems), which is also used for the exchange of numerical weather prediction model products. The NWS is working to make all of the NOAA polar-orbiting satellite data available over AWIPS. These data are archived on tapes and passed to the National Geophysical Data Center (NGDC) at the University of Colorado for permanent archive.