"OVERVIEW OF METEOROLOGICAL INPUTS TO NASP"

James C. Dziuk

As a background for this briefing, I would like to identify the key elements of the present aviation weather system (Figure 1).

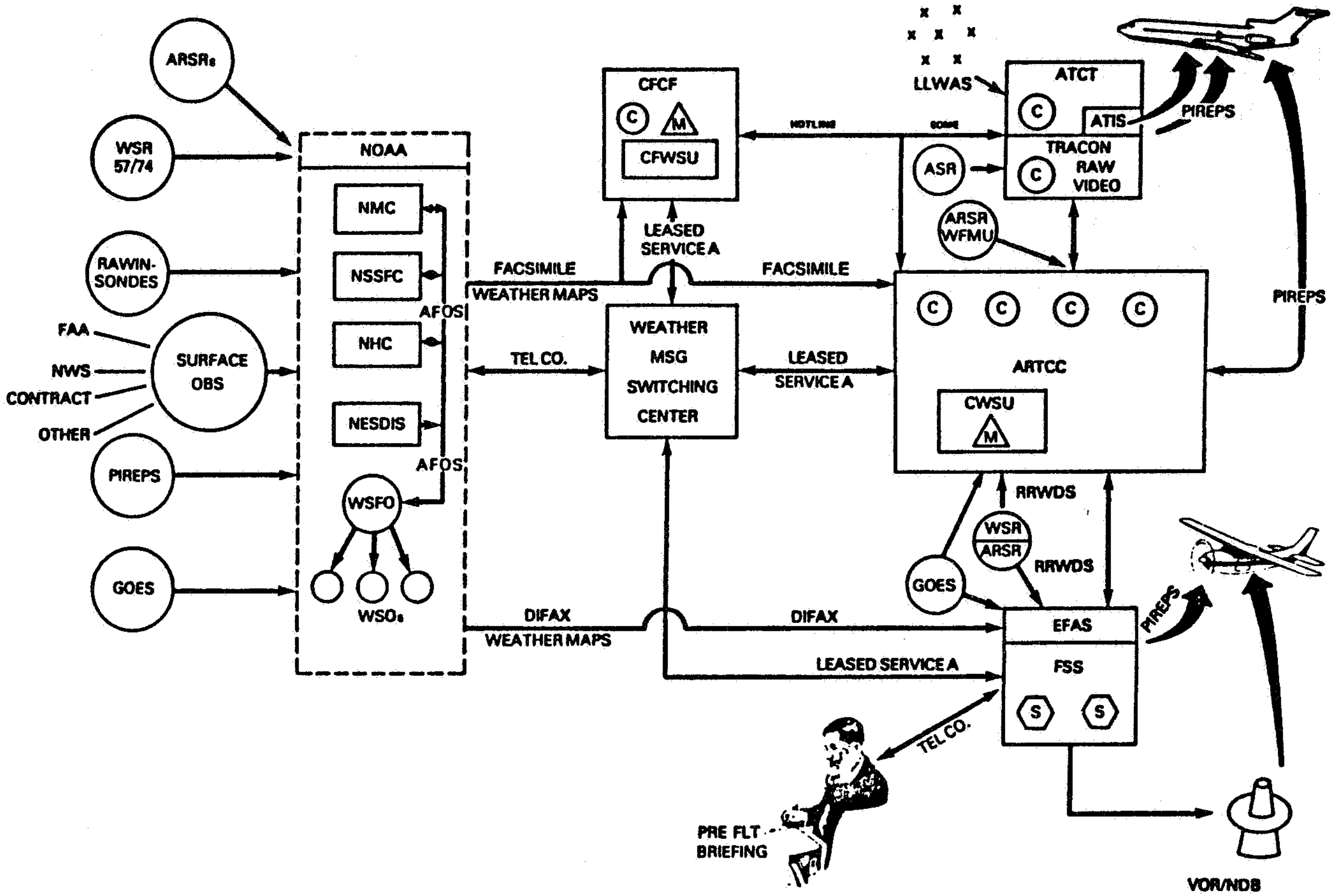

Figure 1. 1983 Aviation Weather Network

1. Surface observations are taken by several agencies, primarily NWS, FAA, DOD, and some contract observers.

2. Radar data on weather phenomena comes from weather contour circuits on our ARSR radars, the NWS WSR 57/74 series radars and from terminal ASR radars.

3. Satellite data, primarily from GOES, provides data on the CWSU and FSS facilities.

4. All forecasts and data base products are prepared by the National Weather Services and distributed to FAA and user facilities, primarily over FAA communications networks.

5. The primary focus for en route, TRACON and tower controller weather information is the CWSU staffed by NWS meteorologists. These meteorologists provide controller weather briefings, prepare and disseminate severe weather advisories and disseminate PIREPS received from controllers.

6. The weather products also go to the flight service stations for dissemination to pilots both by phone and face to face preflight briefings, and by radio for en route pilots. Current severe or hazardous weather information, is provided through the En route Flight Advisory Service (EFAS).

For the purposes of this overview briefing I have divided planned system improvements into near term and long term programs. I will also identify some unmet needs. The short term improvements are listed in Figure 2 and represent those actions which can be completed within a two to three-year time period.

- Revised pilot briefing procedures
- CWSU directive revision
- Complete Leased Service A installation
- RRWDS
- International EFAS (Miami, San Juan)
- Additional GOES (CWSU/EFAS Sites)
- High-altitude EFAS
- Hazardous In-flight Weather Advisory Service (HIWAS)
- Enhanced LLWSAS
- Automated Weather Observation System (AWOS) demonstration

Figure 2. FAA ACTIONS: Near-term program activities.

We have revised pilot briefing formats. Four types of briefings are now available to pilots. The first is the standard briefing which provides a synopsis of current weather including adverse weather, en route and destination forecasts, winds aloft observations and forecasts, and NOTAM's. The second type is an abbreviated format, designed to supplement data the pilot already has from prior briefings. The third is a briefing designed for planning purposes for flights scheduled to depart six hours or more in the future, which provides forecast data which is applicable to proposed route of flight. The fourth is an inflight briefing which corresponds to the preflight briefing, but which is given by radio. It is given by FSS briefers and is not available from EFAS positions.

The Center Weather Service Unit (CWSU) directive has been revised and is in coordination at this time. It redefines the duties and responsibilities of CWSU meterologists and the weather coordinator and it includes planned changes to improve critical weather dissemination. Other areas affecting CWSU operation include provision of Leased Service A terminals at all CWSU's which will improve PIREP distribution. The Leased Service A program will provide higher-speed communications and computer terminal equipment at all CWSU's and Flight Service Stations (FSS) by the end of 1984.

The radar remote weather display system program will equip 134 radars, 77 NWS WSR 57's and 57 FAA long range radars: The displays will provide six intensity levels in color. Implementation is scheduled for completion at all CWSU's and EFAS by December 1983, with all systems commissioned by March 1984.

International EFAS, to support over water operations in the Caribbean area, will be initiated in the Miami and San Juan IFSS's in 1984/85.

Data from geostationary orbiting environmental satellites is presently available at 20 Air Traffic Control Centers (ARTCC), 20 FSS's and the Central Flow Control Facility (CFCF). It will be available at En route Flight Advisory Service (EFAS) locations and selected level III FSS's by 1985. All 64 locations will be equipped with high resolution receivers/recorders. High altitude EFAS air-ground frequencies for high altitude EFAS will be implemented at 20 locations by 1985. A frequency allocation study is currently underway.

The Florida demonstration of the hazardous in-flight advisory service was successful and national implementation is planned. Our frequncy management people are currently in the process of allocating appropriate frequencies and consideration is being given to the provision of HIWAS on some UHF frequencies. Implementation is planned during 1984.

The Low Level Wind Shear Alert System (LLWSAS) is designed to provide controllers with information of hazardous surface wind conditions (on or near the airport) that create unsafe landing or departure conditions. The system was originally developed for gust front detection at airports and has successfully detected wind shear phenomena. LLWSAS is a real-time, computer controlled, surface wind sensor system which uses telemetry as a communiation link. LLWSAS uses minicomputer processing that evaluates wind speed and direction from sensors on the airport periphery with center field wind data. A 15 knot vector difference triggers an aural and visual alarm in the airport control tower. During the time that the alert is posted, air traffic controllers provide wind shear advisories to all arriving and departing aircraft. One-hundred-ten systems have been funded, 59 systems are installed and operating, and 51 systems are scheduled for installation in 1984/85.

In response to a Congressional directive, the LLWSAS at the New Orleans airport is being expanded to improve the capability of the system to detect microburst wind shear phenomena. Five additional sensors are being added to the current sensors to provide coverage along runways. Processor and software modifications are being made that will permit comparison of wind vectors between each pair of sensors as well as the center field sensor. Facility tests are scheduled to begin in February 1984 and will run for one year. This testing could result in recommendations for enhancement of the LLWSAS'.

The Automated Weather Observation System (AWOS) is being implemented to provide efficient, reliable, and cost-effective automated weather observations at a significantly greater number of locations than are available today. It will provide automated sensing of: wind direction and velocity, barometric pressure (altimeter setting), temperature, precipitation, dew point, and visibility. The primary output is a synthesized voice broadcast. Eventually data will be output to the national weather data base and, at some manned sites, supplementary data may be added.

Currently an AWOS demonstration program is in progress. Equipment has been installed and is operating at 14 demonstration sites. These demonstrations are designed to obtain equipment reliability data, correlation between manual and automatic observations, and pilot evaluation. Demonstration results will be used in preparing the production specification to be issued in 1984.

This next set of programs (Figure 3) represent those which will be implemented in the late 1980 time period. These include next generation weather radar, terminal Doppler radar, central weather processor, Mode S data link, flight service automation system, and NADIN.

- Next Generation Weather Radar (NEXRAD)
- Terminal Doppler radar
- Central weather processor
- Mode-S data link
- Flight service automation system
- National Airspace Data Interchange Network (NADIN)

Figure 3. FAA ACTIONS: Long-term program activities.

The objective of the NEXRAD program is to develop and implement a Doppler weather radar that will meet the weather detection needs of FAA, NWS, USAF, and other Government and private organizations. A network of radars is planned that will provide weather radar coverage above 10,000 feet throughout the entire country. The aviation weather products to be provided by NEXRAD include winds, wind shear, turbulence, thunderstorm detection, storm movement prediction, precipition, hail, frontal activity, icing conditions, freezing levels, mesocyclones/tornadoes, and hurricanes. Validation phase contracts were awarded earlier this year and are scheduled for completion in July 1985. Limited production unit No. 1 is scheduled for delivery in February 1988. Production units are to be installed from October 1988 through February 1992.

As a result of the Doppler weather research that FAA and other Government agencies have sponsored over the last ten years, as well as the results of the continued analysis of the joint airport weather studies data, FAA is planning to implement terminal Doppler weather radar systems at a number of airports where wind shear conditions are prevalent. The terminal radars will have somewhat different characteristics from the en route NEXRAD systems. They will operate to shorter ranges and the radar parameters will be tuned for detection of wind shear and other clear air phenomena. FAA has examined a number of alternatives for achieving the terminal Doppler radar capability including development of "C" band weather radar, addition of a Doppler weather channel to ASR-9, modification of commercial Doppler weather radars, and a NEXRAD derivative tuned for terminal wind shear detection. A plan is currently under development for procurement of terminal Doppler radars; this concept is supported by the Tri-agency NEXRAD council.

The center weather service unit is the central facility for accumulating, processing, and disseminating weather information to the air traffic controllers. The meteorologists at these positions provide controller briefings and generate and disseminate severe weather information to the controllers in the centers, TRACON's and towers.

The central weather processor, which is to be located in the area control facility, will be the focal point for the weather system processing for the CWSU meteorologists, air traffic controllers, and pilots. The initial system capability will provide automation of the meteorologist functions, which will include the capability to overlay satellite visual and infrared images and surface radar data and to translate them into the stereographic plan used by the ATC computers. A loop capability will be provided to allow meteorologists to study storm development and aid in the generation and dissemination of severe weather advisories. A mosaic of NWS and FAA NEXRAD and terminal Doppler radars will be available to the meteorologists. This automation program will also produce a type of hazardous weather contours. These contours will be displayed on controller and FSS specialist displays and, in the future, will be available to the cockpit over the Mode-S Link.

The Mode-S system provides both improved surveillance and data link services. Terminals in the aircraft will allow the pilot to directly access the ATC system weather data base. Our schedule is to have Mode-S ground sites operational in 1988, which will provide weather data. When the advanced automation system becomes operational in the early 1990's, most clearance information can flow automatically via data link. We are also considering the down-linking of airborne sensed weather information to update weather data base information.

The flight service program provides for two stages of implementation of specialist automation. The first, called Model One, provides automation of alphanumeric products; and the second, called Model Two, adds automation of graphic products. A subsequent enhancement program will provide telephone voice response units and direct user access through Direct User Access Terminals (DUATs) and airborne Mode-S equipment.

The FAA modernization program provides for the automation of 61 flight service stations. Model 1 delivery is scheduled to start in 1984. Model 2 delivery is scheduled to occur between 1985 and 1989, and will provide alphanumeric and graphic product automation at all 61 automated flight service stations.

The objective of the national airspace data interchange network (NADIN) is to replace the current data switching systems, provide cost-effective service, and be able to expand to meet future National Airspace System (NAS) needs. The NADIN system should provide improved dissemination of weather information, replace the Aeonautical Fixed Telecommunications Network (AFTN) switch, replace service "B", replace NASNET, provide flow control communications service, provide ARINC/ airline interfaces to weather and flight plan systems, and enhance NOTAM communications. The first phase of NADIN is scheduled to become operational in 1984 with the enhanced NADIN supporting the future systems becoming operational in 1987/88.

We believe that these programs will provide substantial improvement in the observation, processing and dissemination of weather information. However, there are some areas where improved technology is needed. These unmet needs include improved accuracy of winds aloft information. Improvement in sensors for present weather, cloud height, cloud type, vertical wind shear detection and wake vortex detection. Improvement in short-term forecasts, improved icing and turbulence forecasts, and development of airborne turbulence and wind shear sensing devices. We will, undoubtedly, discuss these areas in greater depth during our technical sessions.

The upgraded system of the Post 1990 period (Figure 4) will have the following capabilities:

In the sensor area, profiler and windsat are potential providers of improved wind and other data. Weather radar data will be derived from a network of terminal and en route Doppler weather radars.

Communications of many alphanumeric and graphic weather products will flow over a NADIN system. Some information, primarily radar data, may be routed directly to system processors. Processing of weather products occurs in the NWS facilities, the FAA aviation weather processor, which formats weather data for aviation users, the Flight Service Data Processing System (FSDPS), and the Central Weather Processor (CWP). Automatic storm signature analysis will be provided and annotated hazardous weather graphic information will be automatically generated and disseminated .

Pilots will have direct preflight access to the automated weather and NOTAM data bases either by Voice Response System (VRS) or direct user access terminals (DUAT). Pilots in flight may access the ground data bases by Mode-S data link; or, if not equipped, receive automatic broadcast of severe weather information, ATIS, wind shear alerts, Automated Weather Observation Systems (AWOS), and Transcribed Weather Broadcast (TWEB) information. En route Flight Advisory Service (EFAS) will continue into this time period. The pilot will have continuous access to real-time or frequently updated weather information throughout the flight.

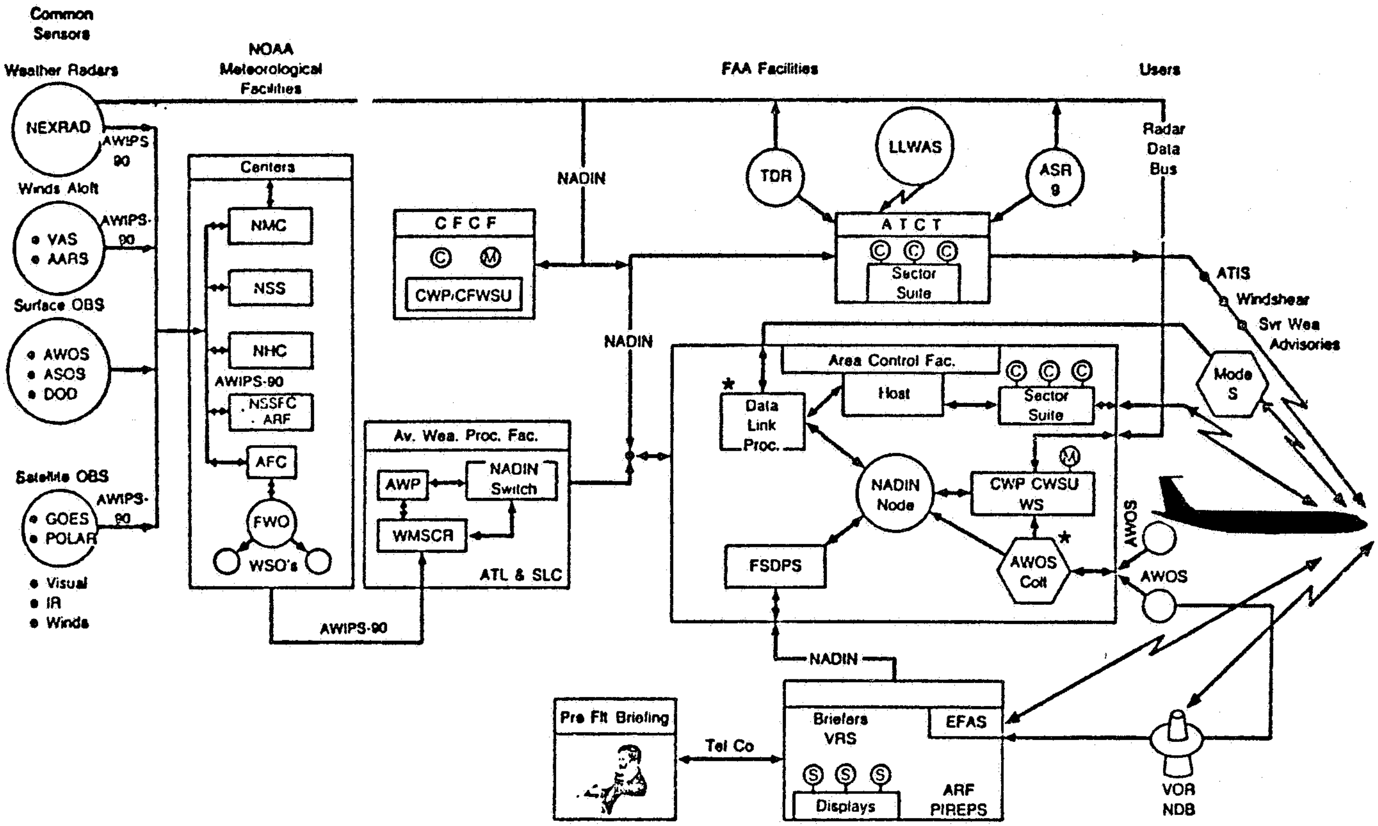

Figure 4. Aviation Weather System: 1993

procedures; mid-term program provides improvements in observations, severe weather detection, processing and dissemination; and the longer-term program is starting to define interagency activities to provide the basic technology for further enhancements in short- and long-term forecasting and improved automated observation systems. The goal is automated sensing, processing and real-time dissemination of weather products to the system users.

"AIRLINE METEOROLOGICAL REQUIREMENTS"

C. L. Chandler and John Pappas

Yesterday, as I was about ready to leave the office, the telephone rang. It was Walter asking for help. I will volunteer for anything, more or less, if it has to do with airplanes and weather. The only reason I volunteered to help is that immediately I knew in my mind who could give this paper much better than I. You don't have to twist his arm too hard. We have that man here today–Mr. John Pappas, who will present this paper; and, hopefully, both of us together can make up at least 30 % of Dan. Maybe not, but we will give it a try. Last night I asked Walter if I could give about an one-minute speech off the agenda, completely on another subject, and he said it would be all right.

Many of you may not realize that today is an historical date in aviation. Exactly 25 years ago on this date, Pan American started their transatlantic service with a 707-120 aircraft. In about T-8 hours, that 120 at Kennedy or Idlewilde, at that time, had about a 57-second ground roll; he had 6,000 pounds of water (some of you old-timers know what that water was for). My latest information tells me that tonight they are going to reenact that flight. I have not heard otherwise. They are going to take a 707 out of Kennedy to Gander to Paris with the same passenger load (I believe it was 94); they say they are going to serve the same kind of food. They found many of the members of