STATEMENT OF NEAL A. BLAKE, DEPUTY ASSOCIATE ADMINISTRATOR FOR ENGINEERING, FEDERAL AVIATION ADMINISTRATION, BEFORE THE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION, SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT, CONCERNING THE AVIATION WEATHER PROGRAM, DECEMBER 6, 1983.

Thank you Mr. Chairman. I appreciate this opportunity to discuss the FAA's aviation weather plans and programs with you. With me today are Kenneth S. Hunt, Director, Office of Flight Operations, in Aviation Standards, and Willard Reazin, Manager, Procedures Division, of the Air Traffic Service.

This morning I will give you a brief overview of some changes we have made in the management of the weather program; a brief review of the current system elements; a summary of the areas where improvements are planned; a description of some of our programs designed to provide the needed improvements; an identification of areas where new technology is needed in order to achieve further improvements; and, finally, a summary of the continually improving capabilities and services that will be available to the FAA and system users.

In 1982, Congress urged the FAA to designate a single focal point for all aviation weather programs and activities. In January 1983, Administrator Helms established the Weather Coordination Program Office (WCPO) reporting to the Associate Administrator for Development and Logistics. In order to be certain that the Program Office activities and responsibilities were responsive to the FAA needs, Mr. Helms established a Weather Program Steering Committee composed of the Associate Administrator for Development and Logistics, the Associate Administrator for Aviation Standards, and the Director of the Air Traffic Service. The Program Office is to:

size of the organization, it operates in a matrix relationship with the other offices and services in the FAA.

The scope of the activities of the Weather Coordination Program Office is extensive. During 1983, the office conducted a review of the documented output from the various organizations, committees, panels, and user groups which had identified aviation weather system requirements or areas where improvements were needed. The material reviewed was received from such sources as the General Aviation Safety Panel (Olcott Panel), Congressional Subcommittees, Meteorological Workshops (jointly conducted by the National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration, and the FAA), Air Line Pilots Association, Aircraft Owners and Pilots Association, Air Transport Association, National Business Aircraft Association, Helicopter Association International, and the National Transportation Safety Board. We eliminated duplicate requirement recommendations and developed a summary of aviation weather system requirements based upon this input data, as well as what the FAA sees as its needs to carry out its mission.

Using these requirements and following the general guidelines of phased enhancements to the existing system and minimal disruptive impact on the system users, we produced an Aviation Weather System Plan. The contents of the draft plan were briefed to the user community on August 18, 1983. User comments on the plan were solicited and received, and a revised plan will be published in December. It is our intention to review the plan annually and to provide significantly more definition on the longer term activities in future editions.

The recommendations of the study cover the need for:

- An integrated wind shear program.
- A wind shear education program.
- Standardized pilot/controller communications.
- Further development of wind shear detection systems.
- Enhancement of the Low Level Wind Shear Alert System (LLWAS).
- Recording and analyzing LLWAS data.
- Use of available radar data.
- Continued development of the Next Generation Weather Radar (NEXRAD).
- Development of an airport terminal weather radar.
- Determination of operational use of airport terminal weather radar observations.
- Development of airborne remote sensors.
- Determination of wind shear effects on flight characteristics.

Weather Radar (NEXRAD) and the Interagency Council for the Joint Automated Weather Observing Program (JAWOP). A member of the Program Office also represents the FAA on the Interdepartmental Committee for Meteorological Services and Supporting Research. Another major activity of the Program Office is the identification and resolution of issues and problems that arise in the conduct of the weather program. Finally, the Program Office must ensure that the activities covered by the Aviation Weather System Plan are converted into specific programs leading to implementation of improved weather services in the National Airspace System.

The provision of aviation weather information is a joint venture directly involving a number of Federal agencies and the aviation community. Basic meteorological data is collected through observations taken by the National Weather Service, FAA, Department of Defense, and others. This data is sent to the National Weather Service for processing into weather forecasts and other products, many of which are specifically produced for aviation. These products are then distributed to the FAA and other users.

I believe it would be helpful to identify the key elements of the present aviation weather system as a background for the system needs and improvement programs that I will describe later.

Surface observations are taken by several agencies, as well as contract observers. Radar data on weather phenomena comes from weather contour circuits on our long-range air route surveillance radars, the National Weather Service weather radars, and from our short-range terminal radars. Satellite

- Improvement of short-term forecasts (0-4 hours) for strategic traffic planning and nowcasts (0-30 minutes) for tactical avoidance of severe weather.

- Improvement in real-time dissemination and communication of weather data by increasing national communication network speeds, upgrading interfacility communications capabilities and procedures, and expanding direct user access capabilities, including weather briefings and flight plan filing.

- Provision of automated means for collection, entry, processing, screening, distribution, and call-up for pilot reports.

- Improvement in flight service station preflight briefings through better accessibility to the weather data base, standardized formats to reduce sensitivity to briefer variations, and use of more timely, concise, route-oriented briefing information.

- Provision of real-time detection and tracking of hazardous weather, including low level wind shear and icing areas.

- Development of real-time cockpit display of ground weather data.

- Improvement in weather services in offshore areas and at low altitudes to support helicopter operations.

- Implementation of a hazardous in-flight weather advisory service.

- Enhancement of the low level wind shear alert system.

- Automation of weather observations.

I would like to briefly describe each of these activities.

We have revised our pilot briefing procedures to provide three distinct types of briefings to better meet pilot needs. The standard briefing includes a synopsis of current weather conditions emphasizing adverse conditions, if any; en route and destination forecasts; winds aloft forecasts; and Notices to Airmen (NOTAM). The abbreviated briefing is designed to supplement data the pilot has previously received from mass dissemination media or a prior briefing. The outlook briefing is specifically designed for planning flights scheduled 6 hours or more in the future and includes only forecast data applicable to the proposed route of flight. All three types of briefings are available by telephone, in person, or by radio while in flight.

The Center Weather Service Unit directive is being revised and is in coordination. It redefines the duties and responsibilities of the Center Weather Service Unit meteorologist and the weather coordinator and includes planned changes to improve critical weather dissemination. Other areas affecting the Center Weather Service Unit operation include provision of Leased Service A terminals at all the Center Weather Service Units which will improve pilot report distribution. In addition, the FAA and the National

An Interim Voice Response System is being procured to permit pilots in the continental United States to retrieve weather information by telephone directly from an automated weather data base. Sixteen systems, located throughout the country using a combination of local and foreign exchange telephone circuits, will provide service to 25 major population centers. Pilots will receive surface observations, terminal forecasts, grid winds, transcribed weather broadcasts, convective SIGMET's, and severe weather forecast alerts. Implementation will begin in 1984 and should be completed in 1985. This interim system will help meet the demand for service while the Flight Service Automation Program is being implemented.

A High Altitude En Route Flight Advisory Service will be implemented at 20 locations by 1986. A frequency allocation study has been completed to provide communications capability throughout the continuous United States from the 20 selected locations.

The Hazardous In-Flight Weather Advisory Service (HIWAS) was successfully demonstrated in Florida and is now an established program in the Miami and Jacksonville Center areas. VOR frequencies are now being identified to expand this service nationally by 1985. Based upon user comments, procedures are being amended so that controllers will advise pilots when a HIWAS update has occurred. In addition, center weather advisories will be included in the broadcast information.

The objective of the Low Level Wind Shear Alert System (LLWAS) is to provide pilots and controllers with information on hazardous surface wind conditions (on or near the airport) that create unsafe landing or departure

The Automated Weather Observing System is being implemented to provide efficient, reliable, and cost-effective automated weather observations at a significantly greater number of locations than presently have such service today. The system will provide automated sensing of wind direction and velocity, altimeter setting, temperature, precipitation, dew point, and visibility. At some manned sites, supplementary data may be added through a keyboard. The primary output is a synthesized voice broadcast. Eventually, the data will be output to the national weather data base.

An Automated Weather Observing System Demonstration Program is in progress at 14 airport sites. These demonstrations are designed to obtain equipment reliability data, correlation between manual and automatic observations, and pilot evaluations. These results will be used in preparing the production specification to be issued in 1984. The demonstration sites are Houghton, Michigan; Valdez, Alaska; Washington, D.C.; Santa Fe, New Mexico; Galena, Alaska; Muncie, Indiana; Palm Springs, California; Dubuque, Iowa; Bremerton, Washington; Keene, New Hampshire; Houston, Texas; Auburn, Alabama; Houma, Louisiana; and San Luis Obispo, California.

Our long-term development programs are those which will be implemented in the mid to late 1980's. These include:

- Next Generation Weather Radar.

- Terminal Doppler Radar.

- Central Weather Processor.

continued analysis of the Joint Airport Weather Study data. The FAA is considering the implementation of terminal Doppler weather radar systems at a number of airports where wind shear conditions are prevalent. The 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 the ASR-9, terminal ATC radar modification of commercial Doppler weather radars, and a Next Generation Weather Radar derivative tuned for terminal wind shear detection.

The Central Weather Processor (CWP) Program will provide near real-time processing and dissemination of weather information. This system, which is to be located in the Area Control Facility, will be the weather system processing focal point for the Center Weather Service Unit meteorologists, air traffic controllers, flight service station specialists, and pilots. The initial system capability will provide automation of the Center Weather Service Unit meteorologist work stations and will include the capability to overlay satellite visual and infrared images and surface radar data and translate them into the stereographic plane used by the air traffic control computers. A video loop capability will be provided to allow meteorologists to study storm development and to aid in the generation and dissemination of severe weather advisories. A mosaic of the National Weather Service and FAA Next Generation Weather Radar and terminal Doppler radars will be available to the meteorologists. This automation program will enable the meteorologist to produce annotated contours of hazardous weather. These contours will be displayed on controller and flight service station specialist displays and will also be

airborne sensed weather information via Mode S data link to be used for updating weather data base information. Later, weather services may include forced Mode S displays of severe weather along the route of flight and significant changes in destination weather conditions.

The Flight Service Automation System (FSAS) Program was undertaken to promote flight safety through more accurate and timely pilot briefings, to meet forecast increased demand for services, and to reduce the cost of providing these needed services. The program provides automated assistance to flight service station specialists and pilots covering pilot weather briefings, flight plan filing, in-flight assistance services, emergency assistance, mass weather dissemination, En Route Flight Advisory Service, and other air traffic control system support.

We have conducted several tests of flight service station automation which have provided valuable experience in defining the Flight Service Automation System. The first was the Aviation Weather and NOTAM System (AWANS) test at the Atlanta and Indianapolis Flight Service Stations. The second was the test of the Meteorological and Aeronautical Presentation System (MAPS) equipment at the collocated Flight Service Station and Air Route Traffic Control Center facilities at Leesburg, Virginia. These systems are in operational use today.

The Flight Service Station Program provides for several stages of automation for specialists. The first provides automation of alphanumeric products for flight service station specialists via modern computer terminals and incorporates a flight plan filing capability. Closed-circuit television and high resolution facsimile will supply graphic products. The next automation level builds

An important enhancement to the Flight Service Station Automation Program is the Automated Route Forecast Program. This program is designed to replace the current broad area forecasts with more specific route-oriented forecast information. The program objective is to generate route-oriented aviation weather forecasts automatically for pilot self-briefing and to facilitate flight service station specialist briefings. The Automated Route Forecast employs a new "grid" data base concept that uses the forecast cloud cover, visibility, precipitation, convection, icing, and turbulence in adjoining 22 by 22-mile square blocks to provide weather information directly pertinent to the pilot's filed route of flight. National Weather Service personnel using supporting automated systems will formulate forecast information in a manner that will support this program. The initial test and demonstration of the concept was completed in the fall of 1982. The National Weather Service and the FAA are continuing system development with a primary focus on automation of the meteorologist's input process to reduce the manual workload associated with "gridding" the data.

We have also begun the establishment of a National Airspace Data Interchange Network which will replace current data switching systems, provide cost-effective service, expand to meet the future National Airspace System needs, and also possibly provide communication support to other elements of the Department of Transportation. The National Airspace Data Interchange Network, through its higher speed and greater capacity, will provide improved dissemination of weather information. It will replace the Aeronautical Fixed Telecommunications Network switch, Service "B," National Airspace System Network, and provide flow control communications service, as well as Aeronautical

to achieve full benefits from the advanced automation program. These include more accurate conflict-free flight path planning and less maneuvering for separation assurance. The better we know the wind, the better the flow planning or traffic management system will work. Many sensors are being studied, developed, and tested. Of the ones being examined, a ground-based upper air profiler in combination with other detection systems, including Next Generation Weather Radar, may offer perhaps the earliest improvements in wind measurement in domestic areas. The problem of measurement in oceanic areas is more difficult. For the short-term, reporting of wind data from onboard sensing systems via data link may offer some improvement. For the longer term, perhaps WINDSAT (a satellite-based wind measuring system) in combination with satellite visual and infrared pictures may offer some hope.

Improved forecast models are also desirable. The National Aeronautics and Space Administration's Minimum Energy Routes Using Interactive Techniques (MERIT) Program is an effort to develop an improved upper air data base using pilot reports on wind data to improve wind forecasting between the 25,000 and 45,000-foot altitudes. This program will be completed in 1984 and follow-on programs may be needed. For the longer term, improved forecast models may become available from the National Stormscale Operational and Research Meteorology (STORM) Program sponsored by the National Academy of Sciences.

The FAA's interest in this program is to achieve improved basic mesoscale weather services. This includes development of improved forecast models of small-scale weather phenomena for icing, turbulence, convective storm formation and movement, and wind shear formation and movement. The program will ultimately result in the establishment of a well defined field network of observation stations meeting the observation and forecast data input requirements of all users.

Implementation of our Aviation Weather System Plan will provide a structures transition from today's system to the upgraded system of the post-1990 time period. In that time period, Doppler weather radars will be able to detect wind shear, microbursts, turbulence, and other weather features not detectable today.

It is expected that many airports with instrument approaches will have an associated automated surface weather observation system. Upper air winds and other data will be measured by improved sensors.

Communications of most weather products will flow over the National Airspace Data Interchange Network System. Some information, primarily radar data, may be routed directly to system processors.

The National Weather Service processed weather data will be received by the FAA Weather Message Switching Center Replacement where it will be formatted and forwarded to aviation users via the Aviation Weather Processor, the Flight Service Data Processing System, and the Central Weather Processor.

Automatic storm signature analysis will be provided and severe and hazardous weather contours will automatically be sent to air traffic control and flight service specialist displays. These weather displays will be augmented by analysis and comments from the Area Control Facility Weather Service Unit meteorologist.

EVOLUTION OF THE AVIATION WEATHER SYSTEM

IMPROVEMENT AREAS	CY 83 CURRENT	84 NEAR TERM	86 87 88 89 90 91 92 LONG TERM	93 94 95 FUTURE
• OBSERVATIONS				
- SURFACE	MANUAL, AWOS DEMO	ASOS DEMO	AWOS & ASOS IMPL	
	ADV. SENSOR DEV. (PRESENT WX, LPATS, ETC)		ADV. SENSOR DEV. (CONTINUING)	
- WINDS ALOFT	RAWINSONDE & GOES		ADV. SENSOR	
	AMDAR & ASDAR		MODE S	
- RADAR, VISUAL & INFRARED WEATHER DETECTION	ARSR-WFMU		ASR-9 WX CHANNEL	
	WSR 57 & 74		NEXRAD	
	GOES RRWDS			
• WIND SHEAR				
- STUDIES	JAWS			
- TRAINING	PILOT PROCEDURES & SIMULATION PROFILE UPDATES			
- DETECTION	LLWAS & LLWAS TEST BED	ENHANCED LLWAS	DOPPLER RADAR	AIRBORNE DOPPLER LIDAR
		AIRBORNE DOPPLER RADAR IMPROVEMENTS		GROUND BASED DOPPLER LIDAR
• PROCESSING (FAA)				
- FSS AUTOMATION	MANUAL	AWP & SPECIALIST AUTO.	ARF & PILOT SELF BRIEFING	
- CWSU AUTOMATION	PROFS		CWP/CWSU WORKSTATION	CWP ENHANCEMENT

EVOLUTION OF THE AVIATION WEATHER SERVICES

IMPROVEMENT AREAS	CY 83 CURRENT	84 NEAR TERM	86 87 88 89 90 91 92 LONG TERM	93 94 95 FUTURE
• PROCESSING (FAA)				
- FSS AUTOMATION	•STANDARDIZED PILOT FORMATS	•SPECIALIST AUTOMATED AIDS	•FULL AUTOMATION FOR SPECIALIST •ROUTE ORIENTED WX BRIEFINGS •DIRECT USER ACCESS SERVICES	
- CWSU AUTOMATION	•REAL-TIME HAZARDOUS WX INFO FOR ARTCC'S & TOWERS •REVISION OF CONTROLLER & METEOROLOGIST RESPONSIBILITIES		•AUTOMATED WX DATA PROCESSING FOR METEOROLOGIST •CONTOURED HAZARDOUS WX DATA FOR CONTROLLERS •CONTOURED HAZARDOUS WX DATA UPLINKED TO AIRCRAFT	•IMPROVED SHORT-TERM HAZARDOUS WX PRODUCTS
• DISSEMINATION				
- INTERFACILITY	•CURRENT WX INFO TO ALL ATC FACILITIES	•INITIAL HIGH SPEED DATA DISTRIBUTION NETWORK	•NATIONWIDE HIGH SPEED DATA DISTRIBUTION TO ALL FACILITIES/USERS	
- BROADCAST	•SELECTED ROUTE WX INFO	•HAZARDOUS IN-FLIGHT WX ADVISORIES	•AUTOMATIC BROADCAST OF REAL-TIME, ACCURATE SURFACE OBSERVATIONS	
- GROUND	•TELEPHONE ACCESS TO TRANSCRIBED WX BRIEFINGS	•TELEPHONE ACCESS TO AUTOMATED VOICE WX BRIEFINGS	•FULLY AUTOMATED DIRECT USER ACCESS TO REAL-TIME WX DATA & ROUTE ORIENTED WX BRIEFINGS	
- AIR/GROUND	•VHF ACCESS EN ROUTE FLIGHT ADVISORY SERVICE	•INTERFERENCE FREE SERVICE THRU ADDITIONAL FREQUENCY ASSIGNMENTS	•MODE S DATA LINK SERVICES -DIRECT ACCESS TO FSS WX DATA BASE & CWP PROCESSED RADAR INFO	•MODE S DATA LINK SERVICES -AUTO AIRCRAFT WX REPORTING -FORCED DISPLAY OF HAZARDOUS WX

EVOLUTION OF THE AVIATION WEATHER SERVICES

IMPROVEMENT AREAS	CY 83 CURRENT	84 NEAR TERM	86 87 88 89 90 91 92 LONG TERM	93 94 95 FUTURE
• FORECASTING				
- LARGE SCALE (SYNOPTIC)	•UPGRADED PRODUCTS FOR USERS FROM NMC INCLUDING WINDS ALOFT FORECASTS		•BETTER UNDERSTANDING OF METEOROLOGICAL PROCESSES	•ADVANCED FORECAST MODELS & REAL-TIME UPDATE OF NATIONAL WX DATA BASE
- STORMSCALE (0-8 HRS.)		•IMPROVED STORMSCALE FORECASTS (JET STREAM, CONVECTIVE ACTIVITY)	•FULLY AUTOMATED WX INFO PROCESSING SERVICES TO ALL USERS	
- SHORT TERM (0-30 MIN.)		•IMPROVED HAZARDOUS WX ADVISORIES	•SHORT TERM FORECASTS OF STORM MOVEMENT & INTENSITY	
- WINDS ALOFT	•IMPROVED FUEL EFFICIENT ROUTE FORECASTS			•ADVANCED UPPER AIR FORECAST MODELS BASED ON REAL-TIME DATA UPDATE
• ICING		•ICING HANDBOOK	•UPDATES	
- ATMOSPHERIC CHARACTERIZATION	UPDATED CERTIFICATION CRITERIA FOR: •SUPERCOOLED CLOUDS BELOW 10,000 FEET	•SUPERCOOLED CLOUDS ABOVE 10,000 FEET •SNOW	•FREEZING RAIN/MIXED CONDITIONS	
- SIMULATION	•RESEARCH & DESIGN TOOL	•FACILITY DEFINITION & USE FOR CERTIFICATION		
- ANALYTICAL METHODS		•AIR VEHICLE ICING MODELS	•MODEL USE IN DESIGN •VALIDATION TESTING	
- ICE PROTECTION		•ANTI-ICING/DEICING SYSTEMS, PRIMARILY FOR HELICOPTERS		
- FORECASTING		•NATIONAL ICING FORECAST STUDIES	•ACCURATE ICING FORECASTS	