

AN OVERVIEW OF AVIATION WEATHER SERVICES

John W. Connolly
National Oceanic and Atmospheric
Administration (NOAA)

I appreciate this opportunity to be with you today, and talk, not necessarily about meteorology as the agenda states, but about aviation weather services. I will present a brief overview of where we are and where it appears we are going in aviation weather.

To set the stage for my remarks, I would like to indicate the magnitude of the problem we face in our National Weather Service, a problem incidentally which we share with the Federal Aviation Administration (FAA). Weather is the most frequently cited causal factor in fatal, general aviation accidents and has been for several decades. From 1964 through 1972, over 2,000 fatal, weather-involved accidents killed 4,700 persons. These weather-involved accidents represent 36.0 percent of the total fatal, general aviation accidents for this period. Extrapolating these figures through 1975 shows no significant improvement.

Since 1967, the trend of fatal, weather-involved, general aviation accidents has been increasing steadily, while the trend of the accident rate for all fatal accidents has been downward generally. I do not have similar figures for the air carrier industry but I am told by the National Transportation Safety Board (NTSB) that, if I were to plot the accident figures for the air carriers, the slopes of the two sets of curves would be quite similar and the 36 percent figure for the total weather-involved fatal accidents would also be nearly correct.

It is clear from these statistics, which were prepared by the NTSB, that weather is a contributing factor in a significant number of aircraft accidents and incidents. I am sure that this comes as no surprise to this audience. However, the magnitude of the involvement may be noteworthy to some.

Although safety of flight is the first concern of the aviation weather service, the economics of air transportation is a second area of major interest. Weather is a significant causal factor impacting on the efficiency of air transportation. Over a five-year period from 1970-1975 the percentage of weather-caused delays in commercial air transportation varied from 65-90 percent, with the total number of delays averaging more than 30,000 per year; 1975 was a 90 percent year.

As you might expect, the supply of aviation weather service has not kept up with the demand. In recent years, however, the gap has widened due in large measure to the increasing demands of an ever-growing general aviation community. In spite of the gap, aviation weather is big business, with the Department of Defense providing more than 55 percent of the manpower and perhaps as much as 70 percent of the dollars involved. FAA is the second largest contributor of resources since, in accordance with a formal FAA/NOAA Memorandum of Agreement, FAA is responsible for dissemination of aviation weather service to the pilot and the controller, as well as providing weather observations used solely for aviation. Although a junior partner in terms of resources, the National Weather Service (NWS) is a major provider in terms of aviation weather services. Aviation forecasts are prepared by 52 Weather Service Forecast Offices (WSFOs). These WSFOs prepare and distribute three-times-a-day, a total of 466 forecasts for specific airports in the 50 states

and the Caribbean. They also prepare the route forecasts and synopses for the conterminous U.S. used in transcribed weather broadcasts (TWEB), The Pilots Automatic Telephone Weather Answering Service (PATWAS), and for briefing purposes. Twelve WSFOs also prepare area forecasts for aviation, covering designated geographical areas, and issue in-flight advisories called SIGNETS and AIRMETS to warn pilots of potentially hazardous weather. Briefings are handled by telephone, face-to-face, or by mass dissemination methods. Pilots may call Weather Service Field Offices as well as FAA Flight Service Stations (FSS) for preflight briefing information. Forecast texts are prepared and furnished to FAA for pilot weather briefing, and for dissemination via the PATWAS and the TWEB programs.

In recent discussions between the Director of the National Weather Service (NWS) and the Administrator of the FAA, agreement was reached on a number of high-priority weather-related programs to which both agencies must give increased emphasis during the coming years in an attempt to improve the service and thereby decrease the number of weather-involved accidents. Identified as the number one priority item is the dissemination of aviation weather information to the pilot and to the air traffic controller. A close second on the priority list is pilot weather knowledge. Both agencies are working to improve the existing dissemination system to insure that the pilot and the air traffic control system possess the timely weather information available within the system. There is much we can do to improve the responsiveness of the current system and we are currently working to that end. But in the longer run, we are aware that automation will play a major role in significantly improving timely availability of hazardous weather information. Both FAA and NOAA have

programs underway which will produce automated dissemination systems.

The National Weather Service has established the **AFOS** program (Automation of Field Operations and Services), to help meet the ever-increasing need for more and better forecast and warning services. We are in the **AFOS** program because we can no longer keep up with the increasing need for people in labor-intensive programs, and because we believe that faster response will ultimately save lives. The FAA has a development underway, similar to the NWS **AFOS** program, which will be incorporated into the modernized Flight Service Station System. Both systems, **AFOS** and the FAA System, are being coordinated throughout their development phases so that when the systems are operational they will be able to talk to each other.

But we need to take advantage of these and other strides in automation of the weather system. To handle the projected future pilot briefing workload, there is an urgent need for updated mass dissemination systems. Needed is a nationwide **PATWAS** System containing multiple line entry and guaranteeing no busy signals and the latest weather forecasts. The NWS and the FAA are cooperating in testing a prototype system in the New York area. A nationwide **TWEB** System fed directly by computer is also needed.

To round out this system of the future, we must take advantage of programs like the recent Public Broadcast System "Aviation Weather" TV program. Cable television offers a medium which would allow a pilot to get a local flight briefing at any hour right in his own home. There is even the futuristic capability of using a touch-tone telephone to talk directly to a computer and see the result on TV. I do not think it is too much of a blue sky

philosophy to believe that we are on the threshold of some dramatic improvements in providing aviation weather services. The first NWS Field Stations to be equipped with the AFOS System are scheduled to be in operation by the beginning of 1978, with the entire system equipped by the end of 1980. FAA is currently testing one prototype of its FSS Automation System in Atlanta - and a second prototype version in Leesburg, Virginia. Voice response systems are already in being, although their adaptation to aviation weather dissemination is possibly further down the line.

So it would appear that there is remarkable progress being made in disseminating aviation weather information. And there are, of course, great advancements in aviation technology--improved aircraft, NAVAIDS, and traffic control. Flight Advisory Service to pilots on the ground and in the air is manifold better with respect to quantity and quality than in the past. In fact, improvements are coming so rapidly that the novice can easily get the impression that he does not have to think anymore--just push a button and some electronic gadget will make sure that the flight will be made safe and pleasant.

I do not wish to detract from the advances that are being made in all areas of technology--they are excellent and essential to flight planning and for safe and efficient flight execution. This must continue and even be accelerated. New and even better advances in aircraft, navigational aids, traffic control and weather services will be forthcoming. We are in an era of technological explosion and we can expect better things to come. But as good as this news is, I can see nothing in the future that will replace the need for better pilot knowledge and judgement. And that's the second high priority item that I want to talk about.

Over the past few years I have participated in meetings with various aviation groups, where we discussed flight weather problems and aviation weather services. The one thing that emerges loud and clear from these discussions is the great need for pilot education in weather. There is a need to know more about the weather and its possible effects on safe flight, as well as how to cope with hazardous weather while in flight.

The aviation weather service is excellent, but imperfect. It will continue to be short of perfection for a long time to come. As you well know, an airport observation only represents the state of the weather at the surface of the earth at a particular location for an instant in time. It is made from a fixed location on the ground. It does not necessarily represent the state of the weather at the surface five miles away, nor the condition observed by the pilot in the air in the immediate vicinity of the airport. In order to have good "weather sense," the pilot must know what the observation does and does not represent. He must appreciate the fact that the weather between two stations can be quite different from that reported at the terminal points. It is not unusual for the terminals to be clear and the weather between to be below VFR minimums. Even if there were a perfect observational system which described the weather exactly as it is everywhere all the time, forecasts still would not be completely accurate because of lack of a complete understanding of what makes weather and how it moves. An aviation weather forecast is the best judgement of a professional meteorologist based on the facts at hand. It is always subject to revision and updating. The pilot must also recognize these limitations in terminal-and enroute-forecasts and warnings. The pilot needs knowledge not only about the limitations of observations and

forecasts, but also about weather itself. He has to know about the danger inherent in thunderstorms with the associated turbulence, hail and lightning. He has to know the difference between an isolated or scattered thunderstorm and a squall line. He needs to know almost as much about weather as the weatherman himself.

As I said in the beginning, there were over 2,000 fatal general aviation accidents from 1964-1972 killing over 4,700 people and 36 percent of these accidents were considered to be weather involved. The statistics do not explicitly show it, but we can assume with some certainty that in many of these accidents the pilot and passengers died unnecessarily. Many times the pilot did not have sufficient knowledge about weather, or else he disregarded the available information, or he proceeded into a situation he was unable to cope with. I am convinced that significant reductions in fatalities and property damage can be made through better weather knowledge. The current expansion in general aviation makes this a "must." I would like to close by putting my comments into context, lest I be misunderstood.

Obviously the Aviation Weather System has its limitations, but it would be derelict to leave the impression that we have not made significant progress over the years in the science of meteorology and in the application of technological advancements to observing, forecasting, and to some extent, disseminating weather information for aviation. The weather satellite program is one of the more exciting advancements. Satellite pictures of clouds over the entire earth, taken from many miles above, have added a new dimension to watching the weather. Weather radar has increased our ability to detect and track thunderstorms, line squalls and tornadoes. Much is being learned about

the turbulence, hail and lightning that are associated with these storms, which pose constraints on aviation operations. Computer technology now permits the production of large-scale analyses and forecasts including entire hemispheres and these are produced many times faster and as accurate as those produced manually. Further strides in the application of numerical weather prediction to forecasting smaller-scale phenomena, such as wintertime storms and perhaps hurricanes and tornadoes, are in the offing. We are seeing the application of acoustic sounding techniques to wind-shear and wake-vortex observations, and various forms of lasers are being used to observe and sound the atmosphere. Digital communications are on the way and will, to a large extent, replace the 100 word-per-minute teletypewriter in the NWS before this decade is finished.

As I said earlier, I believe we are indeed on the threshold of some dramatic improvements in providing aviation weather services. However, I don't want to oversell the role of automation in the system, since the science of meteorology will continue to require the human intervention of the meteorologist for at least as far as I can see into the future. Finally, I do not want to leave the impression that I believe aviation is unsafe. Air safety today stands as a monumental record of man's ability to cope with the multi-sciences required to create the conditions we call flight. All of us who are interested in making the airplane an efficient vehicle for the average citizen should be concerned about the utility of the airplane in business, industry and pleasure. However, as long as there continues to be a significant number of fatalities which might be avoided by some effort on our part, we must continue to improve that safety record.