A SYNOPSIS OF THE WEATHER PROBLEMS FACING TODAY'S GENERAL AVIATION PILOTS

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Flying is frequently defined as "Hours and hours of utter boredom punctuated by moments of stark terror." It is probably realistic to assume that a high percentage of that punctuation is generated by weather involvement.

A review of the National Transportation Safety Board statistics on fatal general aviation accidents for the past ten years reveals a very interesting pattern. The number of fatal accidents from year to year is reasonably constant. Moreover, weather-related accidents comprise an almost consistent 36 percent of each year's total. Initially, it would appear that we aren't making much progress in either accident prevention or weather education. The facts are that we are constantly improving both, but with the ever-increasing numbers of airplane owners and pilots, as the safety ratio increases, the actual numbers and fatalities remain rather constant, thus camouflaging the progress we have been achieving.

John H. Shaffer, former FAA Administrator, is quoted as saying that 'We need more pilots with good judgement." When asked how we develop this good judgement, he answered, "Through experience." In answer to the obvious final question of how do we gain this experience, Mr. Shaffer retorted, "Through bad judgement, of course!" The

challenge obviously is to achieve good judgement through the media of education and information. On the subject of education, many forces are at work. Excellent safety programs and government flight clinics, and aviation seminars are a wonderful way of life for thousands of pilots ambitious to develop better judgement. Unfortunately, there are other untapped thousands who are lacking in both ambition and education, and therein lies one of our major challenges.

Once a pilot has education and a reasonable amount of good judgement, he then begins to seek more information--and usually, this sought-after information is in the field of aviation weather. Are pilots satisfied with our aviation weather dissemination system? Are we satisfied with the system? Answers to both these questions are perhaps admirably addressed by a synopsis titled "Weather and Air Safety," authored by the National advisory Committee on Oceans and Atmosphere, in their "A Report to the President and Congress." The following "essential findings" take on particular significance.

> "Aviation weather service seems to be deteriorating."
>
> "Weather information dissemination seems to be largely routine."
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> "Pilot education and certification for general aviation pilots, as related to weather, do not seem adapted to practical needs..."

Further, the report recommends that:

> The Federal Aviation Administration put greater emphasis on the early recognition of deteriorating weather situations in civilian pilot training and on the requirement for weather knowledge in pilot certification;
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> The National Weather Service improve the quality of air weather information by computer checks on

observations, by post-mortems on forecasts, and by training in format and enunciation for voice communicators;

Aviation weather expertise be put back into the traffic control environment and, especially, that the Kansas City test (integrating controllers and professional weather personnel) be extended and developed throughout the nation (for controlled flights) and the Enroute Flight Advisory Service (largely for general aviation) also be extended throughout the nation;

The agreements between, and the directives to, the the National Weather Service and the Federal Aviation Administration, splitting the responsibility for aviation weather service, be reviewed and updated and the requirements for aviation weather service be reviewed in the light of technological advance on a broad front.

If acronyms could provide the answer to weather dissemination, we wouldn't have any problems: witness ATIS, PATWAS, FSS, EFAS, SIGMETS, PSBT, PIMPS, TWEB, ETV, AFOS, CATV, AWANS, *MAPS*, just to name a few. Each of these programs, however, contributes to our total goal of weather information availability. In addition, the prototype Flight Service Station at Leesburg, Virginia, is the first of its kind to involve a consolidation of several satellite Flight Service Stations with co-location at an Air Route Traffic Control Center (ARTCC). This effort has the support of many general aviation organizations and is the first major effort of its kind to evaluate a myriad of concepts and technology in an effort to reduce manpower requirements while concurrently improving many pilot services, particularly weather information dissemination.

We have been concentrating to date primarly on weather at the points of observation. True, there have been efforts to obtain and disseminate en route weather through pilot reports (PIREPS), but the efforts have been comparatively meager. We need now to concentrate our cooperative efforts on the application of technology to the acquisition and dissemination of this vital en route weather data- for those pilots in the air as well as those who are flight planning on the ground.

Visualize a comprehensive, three-dimensional computer storage system (3DWX) that receives weather information from all aircraft on IFR flight plans and stores this information by altitude and geographical coordinates. We have today the technology in the form of computers and read out CRT displays to provide a total view of FSS personnel and pilots of all en route weather. Work has already begun on improving the format of PIREPS, a good first step in the right direction. En route pilot weather reporting has left much to be desired, primarily because the information is not effectively utilized. This new 3DWX program would have the potential to not only improve safety, but to greatly increase operational reliability and aircraft utilization--both IFR and VFR. But let's take such a program one more step forward and develop combination airborne weather sensors and transmitters that will automatically read out weather conditions in flight and send this data to the 3DWX computers. Such a program could be initiated tomorrow. Shall we begin now, or will we procrastinate as we continue to quote the Latin expression: "El Evictus es Manifesto Su Flexiatus", which, when translated, means "Indecision is the keynote to Flexibility'!

PROGRESS AND OUTLOOK FOR THE FEDERAL AVIATION ADMINISTRATION'S AVIATION WEATHER RESEARCH, ENGINEERING AND DEVELOPMENT

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I have been asked to report on the Federal Aviation Administration's Research, Engineering and Development Aviation Weather Program, from the aspect of past, present, and future, and I welcome the opportunity to do so. I do not intend to dwell on the past; suffice it to say, let the record speak for itself. Some will say that it's good and others that it's bad; however, I think all will agree that, compared to say 1955, we are measuring more weather elements more accurately and more often. There are also more specialized aviation weather forecasts produced and transmitted to more locations and in shorter time. There are other advances too numerous to list, but even more important than our advances in hardware, software, and communications, has been our increased knowledge of the weather and the impact that it can and does have on flight operations. However, and this is one of the reasons why we are here, we can also all agree we haven't come far enough.

We should take advantage of the past to get direction for the future. Since one of the principal objectives of our Aviation Weather Program is to reduce weather involved accidents let's review some statistics. Starting with general aviation weather involved fatal accidents,

we see in Figure 1 that between 1964 and 1972 the rate of such accidents per 100,000 aircraft hours slightly decreased, but we also see that percentage-wise the record didn't improve, actually there was a slight rise to where in 1972, over 30 percent of all general aviation fatal accidents were weather involved. A comparison which is somewhat shocking is that between 1964 and 1970 the number of fatalities in weather involved general aviation accidents was nearly three times as many as the number caused by hurricanes and tornadoes. Such statistics should be considered when we set priorities for assignment of resources in weather work. Weather involved aircraft accidents are not limited to general aviation. Looking at wind shear related accidents between 1971 and 1976 five out of the six were air carrier aircraft.

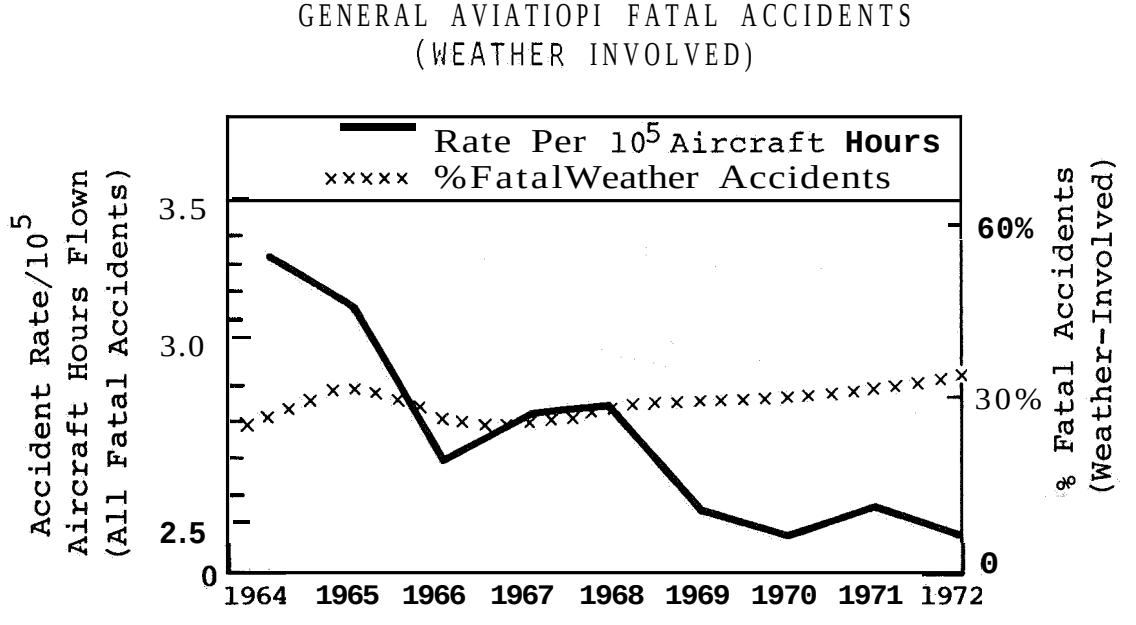
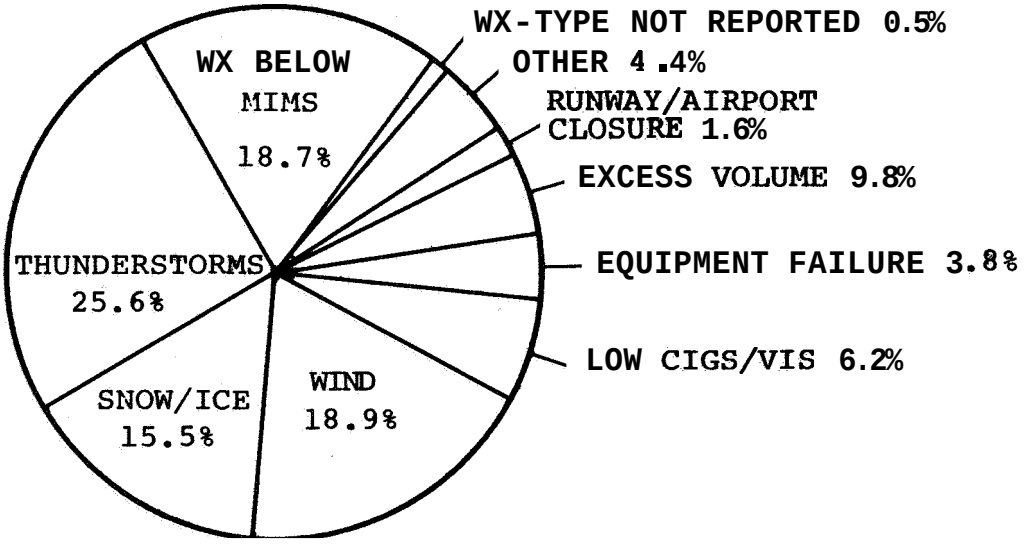


Figure 1

We can look at another statistic, not as critical as fatal accidents since lives are not lost, but still an important and costly item to commercial aviation. It's the cause for air traffic delays of thirty minutes or longer, (Figure 2). We see that nearly 80 percent of these are caused by some type of weather. Even knowing that realistically we won't ever zero out accidents and delays caused by weather, it seems almost certain that improved aviation weather information in the hands of the pilots and air traffic controllers can reduce them.

CAUSE FOR AIR TRAFFIC DELAYS-1975
(30 minutes or longer)



WX RELATED-27,047
NON WX-4,625
TOTAL DELAYS-31,672

Figure 2

Today there is a gap between the demand for aviation weather service and the fulfillment of this demand, (Figure 3). This gap was very wide in the *1940's* because of the introduction of large numbers of aircraft during and shortly after World War II. The gap closed in the late 1950's, but with the introduction of jet aircraft into the commercial fleet and the unprecedented growth of general aviation through the 1960's, the gap today is again open, even though there are enormous resources in manpower and dollars allocated to aviation weather. We estimate that the Federal Aviation Administration allocates more than *4,500* man years and *58* million dollars annually on this problem. If we add in the Department of Commerce, Department of Defense, Airlines and others we come up with a total allocation of over *14,500* man years and 222 million dollars allocated in this area.

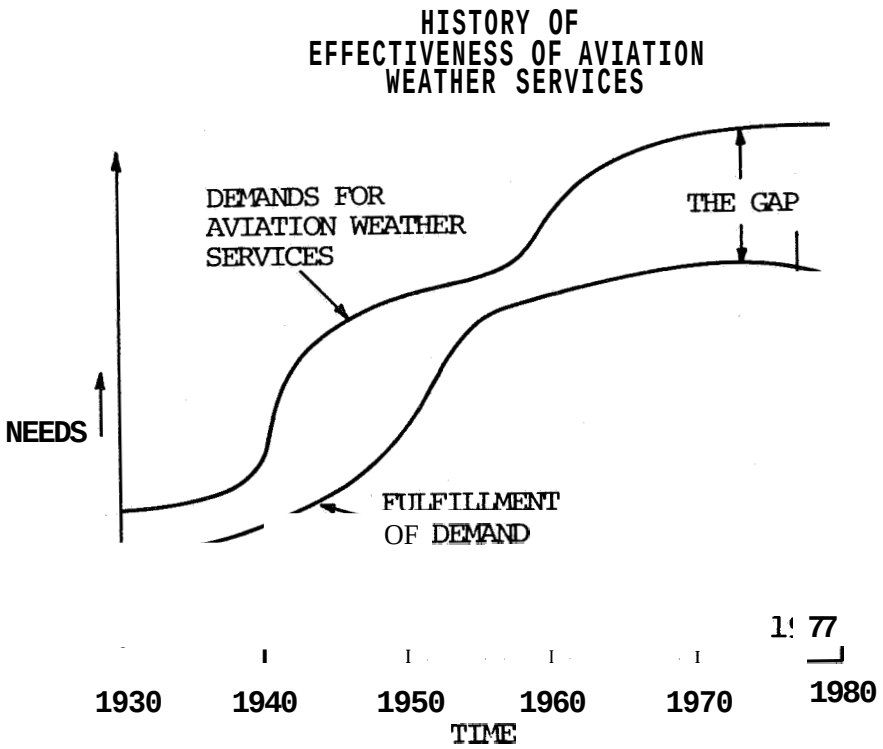


Figure 3

Our Aviation Weather Program is geared to improving on past statistics with respect to the costly effects, in both lives and dollars, of weather on aircraft operations. To accomplish this the specific objectives of the program are to:

1. Reduce the need for manual aviation weather observations at towers and Flight Service Stations.
2. Improve the measurement of aviation weather parameters.
3. Provide real-time severe weather information in the National Airspace System.
4. Improve the forecasting of visibility, ceiling, wind shear, clear air turbulence and severe weather.

There are many elements that make up the Aviation Weather Program, (Figure *4)*, and its interfaces with other programs, such as, the Flight Service Station Program, and the Wake Vortex Program.

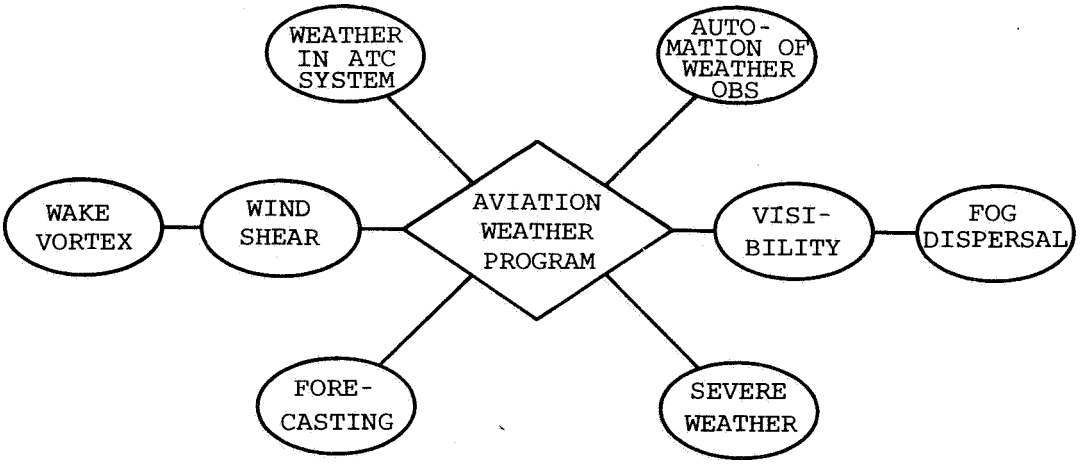


Figure 4

Let's look at some of the things that we are trying to accomplish. Today we measure horizontal visibility with our Runway Visual Range (RVR) system. An additional operationally useful measurement for very low visibility approaches would be one that gives the pilot the distance that he will see when he is at his decision height. We call this Slant Visual Range (SVR). A system that has promise of meeting this requirement is under test at the Federal Aviation Administration's test facility at Atlantic City, New Jersey.

There are about one thousand locations in the conterminous United States where aviation weather observations are being taken. Automation of the aviation weather observation is designed to free specialists from doing this task at those locations where it will be cost effective. We have under development an automatic observation system called AV-AWOS, which is designed to provide an aviation weather observation, including automating ceiling, sky cover, and visibility for those airports where Flight Service Station (FSS) specialists now provide this service.

Only a few of our FSS's have near real time radar information available. Such information is particularly valuable in pinpointing thunderstorms. F M , in cooperation with the National Severe Storms Laboratory and Bendix Avionics, has developed a digital radar relay system which can be used on both weather and air traffic control radars. The system permits transmission of Plan Position Indicator presentations over telephone lines and gives excellent detail at the receiver end.

I have mentioned several items from our Aviation Weather Program that will help FSS specialists. There is a major FSS Program underway to make the FSS system less labor intensive through automated data handling and dissemination. The AWANS system now operating at the Atlanta

FSS is a first step in this direction. In future systems it is planned that pilots will interface directly with the data base in about 70 percent of briefing situations.

Wind shear has been identified as a hazardous weather phenomena that has caused aircraft accidents, some quite recently. The FAA's wind shear program is well funded and addresses the problem on a broad front. It includes efforts to: (1) characterize wind shears, (2) to define "the wind shear" hazard, (3) to develop both airborne and ground based equipment which will give warning of the hazard, (4) to establish a wind shear data base and to test techniques for forecasting the onset and intensity of wind shear. A ground based wind shear measuring system has been installed and is being tested at Dulles International airport as part of this program.

What does the future hold? First, and foremost is the successful completion of on-going programs, but beyond that we think we see an integrated aviation weather support system for the National Airspace System. A system which will take advantage of modern technology to insure that fresh tailored weather information is in the hands of the pilot, air traffic controller, or Flight Service Station specialist when he needs it. We have a concept and plan for developing such a system and we are ready to move toward a detailed design.