



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 Idlewild, 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

the original flight crew and cabin attendants; and I understand they will also have about a week-long party in Paris for the invitees. I tell you that because I am proud. I was a part of that operation at that time. So was E. B. Buxton. One more thing, I would like for the aircraft manufacturers and the air traffic control people from FAA that are here today to give a little thought to what I'm about to say now.

In 1961, the schedules between Atlanta and Dallas/Fort Worth as a typical airline city pair were fifteen minutes faster than they are today, and it was real. We made it in one hour forty-five minutes in those days. It takes two hours now. We doubled the speed overnight in 1958. We went from 230 knots to 460 knots overnight; but in over 20 years, we are slowing down. Keep in mind, a passenger buys a ticket because of the fastness of the airplane in most cases. So, this is something for you people to think about. John Pappas has about 20 years in the air weather service. He was our manager at Southeast Weather in Atlanta for about five years and for the past seven years, he's been Manager of Meteorology at Western in Los Angeles. I would like to present John Pappas.

#### John Pappas

You heard what Chan said about being called upon to do this impromptu and how quickly he accepted. Of course, what he had in mind was making the introduction and I would make the presentation. So, welcome to the "Chan and John Show"—how do you like us so far?

The operational objectives of an airline are: Safety, convenience, comfort, and economy. Our meteorological requirements necessary to reach and maintain these objectives are many. The first thing that comes to mind is what I call "Weather Data Communication Reliability." It is not enough to develop systems that improve upon current systems. Systems that increase data storage capacities and allow us to transmit data at phenomenally faster and faster speeds are great; but meaningless unless the data that these systems provide get to the user.

From the users point of view, and the airlines are users, there is nothing more frustrating to an airline dispatcher or meteorologist who has to make a continuous wide array of decisions that require meteorological data around the clock, and the data isn't there. The data is available, and the equipment to transmit and receive it is available, but it

is not getting through. Many manhours are spent on the telephone desperately trying to find someone in the communication chain that can help get that data to you. "Weather data communication reliability"—we want to confidently know that the data communication systems are reliable and we will receive data consistently.

Our other requirements are mostly traditional. Of course, we require accurate hourly observations. Moreover, they should be complete, and contain all significant elements, including remarks that amplify or enhance particular elements. For example, clear NW, lightning South. We're concerned that automated weather observations will not be able to provide significant remarks. For those preparing forecasts and those making operational decisions, remarks are important.

There is also a requirement for a special observation whenever the ceiling or visibility goes above or below 2,000 feet and/or three miles. This is required to enable airlines to satisfy alternate requirements. We feel very strongly about this.

Upper-air observations are needed. We must have a system that provides accurate temperature, humidity, and pressure height data, as well as wind direction and speed. There is lots of interest in the radar-profiler today to provide upper-air data. To reiterate and emphasize, we must have pressure height data, accurate temperature and humidity information, as well as wind direction and speed.

There is a continuing requirement for radar observations. We, of course, want equipment designed specifically for weather surveillance, the NEXRAD idea. Weather satellite observations are required. A few years ago, requirements for satellite data did not exist. Today, these observations are a very important part of airline requirements and are becoming increasingly important.

We need accurate terminal forecasts, including forecasts of severe weather phenomena, low-level wind shear, icing, snow, ceilings, and visibility.

RVR forecasts are definitely something that should be provided. Moreover, forecasts that correspond to the operational ceiling/visibility categories are necessary to make aviation forecasts more meaningful. The special category for ceilings and/or visibility of 2,000 feet and/or three miles, mentioned earlier, would permit IFR flight planning without an alternate and save millions of dollars in unnecessary expenses.

Improved upper-air forecasts have been a special requirement since the dawn of commercial aviation. It is even more significant today. Operating costs of most airlines have quadrupled during the past decade. There has been very little improvement in the forecast models that could offset some of these rising costs. We are encouraged with the work of NASA's Bob Steinberg and his MERIT program. This kind of research is encouraged by the aviation community. Some examples of the impact of upper winds on operating costs are the following:

For an airline the size of Delta, that operates approximately 1,500 flight segments per day, a change in wind that affects the flight time by as little as six seconds and 20 pounds of fuel adds up to approximately \$ 3,900.00 per day in operating costs. This is almost \$ 1.5 million per year. This kind of money is more than enough to cover the operating budget of an airline's meteorological/flight planning department. One knot of tailwind for a DC-10 operating between Los Angeles and Honolulu is worth 200 pounds of fuel. One knot! These are real numbers. Wind speeds equal to 40 percent or more of a commercial jet's true airspeed occur. Not all of the time, but they do happen,

and we feel that ATC system does not consider the impact of this phenomenon. We could plan and fly great circle routes on every trip. However, we must use the wind as an energy source, a free energy source. Atmospheric winds are not constant; large variations with time, as well as vertically and horizontally, mandate that we plan and fly in order to reduce the negative impact of headwinds and increase the beneficial effect of tailwinds. Temperatures are important also but wind makes the greater impact on economy. Upper wind forecasts must be improved.

Finally, the requirement for meteorological instrumentation needs to be mentioned. Many of you in the audience probably deal with this and have a similar interest. The low-level wind shear alert system (LLWSAS) is an airline requirement - absolutely! We need further development and installation of the Doppler Radar System. These, and all other weather measurement instruments and systems, are going to be of interest to the airlines for many years to come.

This concludes our presentation on Airline Meteorological Requirements. I thank you for listening and bearing with us.

## "GENERAL AVIATION'S METEOROLOGICAL REQUIREMENTS"

Dennis Newton

The theme of this year's workshop is Communication and Application of Atmospheric Data for Aviation Needs. One could certainly say that this theme has been implicit in all of these workshops. However, the stress on communication seems to me to be both important and appropriate, for two reasons. First, the value of weather data to aviation is often extremely perishable. It becomes quite useless if not quickly and accurately communicated to the people who need it. Furthermore, communication of weather theory and information about weather service products to pilots in an accurate and comprehensible manner is essential to flying safety in general. Probably no one needs weather knowledge more than the people who fly through it.

The specific subject of this overview paper is General Aviation's Meteorological Requirements. However, before one addresses the subject of General Aviation's requirement for anything, it is well to say something about what is meant by the term,

General Aviation. In the broad view, the term can be, and often is, taken to mean all of civil aviation except the airlines. It would be virtually impossible to cover the meteorological needs of all of that in a single paper, in addition to which, one result of trying would be considerable overlap with Mr. Olcott's forthcoming paper. Therefore, I would like to limit the subject somewhat by listing some common characteristics of that portion of the broad category of General Aviation with which this paper will be concerned. The following items should not be taken as a definition, but more as a working hypothesis derived from experience of the makeup of the spectrum of weather customers, if you will, whose needs are considered here.

- 1) The segments of General Aviation treated here will be those which operate below an altitude of about 25,000 feet. Within that operating regime, there is a broad spectrum of aircraft types, ranging from light, single-engine airplanes to pres-