

124800
~~34345~~

United States General Accounting Office

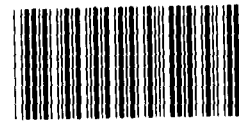
GAO

Briefing Report to Congressional
Requesters

April 1986

AVIATION WEATHER HAZARDS

FAA System for Disseminating Severe Weather Warnings to Pilots



129808

035332



UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

RESOURCES, COMMUNITY,
AND ECONOMIC DEVELOPMENT
DIVISION

B-222882

April 22, 1986

The Honorable George F. Brown, Jr.,
Chairman
The Honorable Dan Glickman,
Ranking Majority Member
The Honorable Tom Lewis
Ranking Minority Member
Subcommittee on Transportation,
Aviation and Materials
Committee on Science and Technology
House of Representatives

On August 14, 1985, you requested that we investigate the Federal Aviation Administration's (FAA's) current procedures for disseminating severe weather information in airport terminal areas. You expressed particular concern about frequent reports that pilots are not provided timely information about potentially hazardous weather during the critical takeoff and landing phases of flight. You asked that we determine if dissemination of severe weather warnings to pilots was timely, and if not, was the problem due to:

- technology,
- procedures,
- a lack of experienced controllers,
- saturation areas in the air traffic system,
or
- other possible contributing causes.

We briefed your offices on the results of our work on March 4, 1986; as requested, this briefing report summarizes the information discussed during that meeting.

Limitations in the existing aviation weather system hinder timely detection and dissemination of potentially hazardous weather conditions and can result in insufficient weather information being available to pilots during critical takeoff

and landing phases of flight. Specifically, we found that existing FAA airport radars have limited real-time¹ weather detection capability and are designed primarily for keeping aircraft separate. They cannot discern the types and severity of weather. We also found that hazardous weather warnings are frequently not provided to pilots as soon as they are available because controllers are too busy separating aircraft during peak traffic periods.

As agreed with your office, we examined FAA's current policy and procedures for disseminating hazardous weather information at the nation's five busiest airports: Chicago's O'Hare, Atlanta's Hartsfield, Los Angeles International, Dallas/Ft. Worth International, and Denver's Stapleton. We reviewed local facility procedures and interviewed air traffic controllers and supervisors at these facilities to obtain their perceptions of whether hazardous weather information is being provided to pilots as quickly as available. We interviewed FAA headquarters officials responsible for implementing National Airspace System plan aviation weather programs, and reviewed planning documents and reporting requirements to identify any problems and their planned solutions for weather information dissemination. In addition, we used data obtained from a statistically valid nationwide sample of FAA controllers,² as well as documentary evidence of the actual hazardous weather messages provided pilots. We did not independently verify what FAA sources told us about the existing weather detection systems, but we did assess controller views about how experience level and work load affect weather information dissemination.

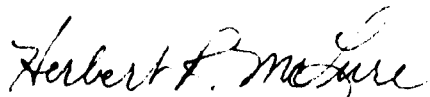
We did not obtain written comments on this report but did discuss its contents with FAA officials. They concurred with the facts, and their comments have been included where appropriate.

As you know, FAA is developing several new weather detection and dissemination technologies as part of its National Airspace System plan. As agreed with your office, we will examine these planned new weather systems to ascertain how likely they are to assure better weather detection and dissemination.

¹Real time is the period in which the occurrence and reporting of an event are almost simultaneous.

²Aviation Safety: Serious Problems Concerning the Air Traffic Control Work Force (GAO/RCED-86-121, March 6, 1986).

We plan no further distribution of this report until 7 days from the date of this letter. At that time we will provide copies to FAA and make copies available to others upon request. If you have any further questions on these matters, please contact me at 275-7783.



Herbert R. McLure
Associate Director

C o n t e n t s

	<u>Page</u>
FAA SYSTEM FOR DISSEMINATING SEVERE WEATHER WARNINGS TO PILOTS	5
ISSUES ADDRESSED	6
REVIEW SCOPE	8
RESPONSIBILITIES FOR PROVIDING AVIATION WEATHER DATA	10
SOURCES OF HAZARDOUS WEATHER INFORMATION	12
TECHNOLOGICAL LIMITATIONS AFFECTING WEATHER DISSEMINATION	16
PROCEDURAL PROBLEMS DISSEMINATING WEATHER INFORMATION AS QUICKLY AS POSSIBLE	20
CONTROLLER EXPERIENCE MAY AFFECT WEATHER DISSEMINATION	24
HUB-AND-SPOKE TRAFFIC SYSTEM HINDERS TIMELY WEATHER DISSEMINATION	27
CONCLUSIONS	30

ABBREVIATIONS

AIRMET	Airmen's Meteorological Information
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
CWA	Center Weather Advisories
FAA	Federal Aviation Administration
FPL	Full Performance Level
GAO	General Accounting Office
LWAS	Low Level Wind Shear Alert System
NAS	National Airspace System
NWS	National Weather Service
PIREP	Pilot Report
SIGMET	Significant Meteorological Information
TDWR	Terminal Doppler Weather Radar

**AVIATION WEATHER HAZARDS:
FAA SYSTEM FOR DISSEMINATING
SEVERE WEATHER WARNINGS TO PILOTS**

PREPARED AT THE REQUEST OF THE
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
COMMITTEE ON SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

ISSUES ADDRESSED

GAO WAS ASKED TO DETERMINE IF DISSEMINATION OF SEVERE WEATHER WARNINGS TO PILOTS WAS TIMELY AND, IF NOT, WAS THE PROBLEM DUE TO:

- ° TECHNOLOGY
- ° PROCEDURES
- ° A LACK OF EXPERIENCED CONTROLLERS
- ° A RESULT OF SATURATED POINTS IN THE HUB-AND-SPOKE TRAFFIC SYSTEM, OR
- ° A RESULT OF OTHER POSSIBLE CONTRIBUTING CAUSES

ISSUES GAO WAS ASKED
TO ADDRESS

On August 14, 1985, you requested an investigation of FAA's current procedures for disseminating severe weather information to inbound and outbound flight crews in terminal areas. You expressed particular concern about frequent reports that pilots are not provided timely information about potentially hazardous weather during the critical takeoff and landing phases of flight. You asked that we determine if there is a problem and, if so, whether the problem is technological, procedural, or stems from a lack of experienced controllers, saturated points in the hub-and-spoke traffic system, or other possible contributing causes.

REVIEW SCOPE

○ WE VISITED AND OBTAINED DATA FROM THE FOLLOWING:

- 5 BUSIEST AIRPORTS

CHICAGO O'HARE
ATLANTA HARTSFIELD
DALLAS/FT. WORTH INTERNATIONAL
DENVER STAPLETON
LOS ANGELES INTERNATIONAL

- FEDERAL AVIATION ADMINISTRATION

AVIATION WEATHER PROGRAM

AIR TRAFFIC SERVICE

○ WE USED A NATIONAL SURVEY OF RADAR-QUALIFIED
AIR TRAFFIC CONTROLLERS

- 20 EN ROUTE CENTERS

- 54 TERMINAL FACILITIES

SCOPE OF REVIEW

As agreed with your office, we determined whether FAA's current weather procedures were being followed at the nation's five busiest airports: Chicago, Atlanta, Los Angeles, Dallas/Ft. Worth, and Denver. These airports were selected because they had the largest number of commercial aircraft operations in the country during 1985. We reviewed local facility procedures and interviewed air traffic controllers and supervisors at both FAA's air traffic control towers and terminal radar approach control facilities at these airports because they are responsible for providing severe weather information to pilots. We asked them how they disseminate weather information and obtained their perceptions about whether it was provided as quickly as possible and how dissemination was affected by controller experience and work load.

We interviewed FAA headquarters officials responsible for implementing National Airspace System (NAS) aviation weather programs and reviewed planning documents and reporting requirements to identify any problems and determine existing and planned weather detection and dissemination capabilities. We interviewed Air Traffic Service officials and examined FAA policy and procedures for weather dissemination to assess facility compliance with agency standards, as well as examined documentary evidence of actual hazardous weather messages provided to pilots.

In addition, we used data from a GAO survey of radar certified controllers conducted at 74 FAA facilities between May 2 and July 26, 1985. The principal purpose of the survey was to determine how prevalent those directly involved in air traffic control feel certain problems are. The survey covered such issues as work load, staffing levels, and training of developmental controllers. The results of the survey were published in Aviation Safety: Serious Problems Concerning the Air Traffic Control Work Force (GAO/RCED-86-121, March 6, 1986).

RESPONSIBILITIES FOR PROVIDING
AVIATION WEATHER DATA

- STATUTORY: FEDERAL AVIATION ACT OF 1958
 - FAA PROVIDES EQUIPMENT AND PERSONNEL FOR DISSEMINATING WEATHER INFORMATION
 - NWS PROVIDES WEATHER REPORTS, FORECASTS, AND WARNINGS TO FAA
- FAA ORDER: CONTROLLER RESPONSIBILITY
 - FIRST PRIORITY IS AIRCRAFT SEPARATION AND COLLISION AVOIDANCE
 - WEATHER INFORMATION IS PROVIDED BY CONTROLLERS AS TIME ALLOWS
 - SIMILAR FACILITY ORDERS GOVERN CONTROLLER RESPONSIBILITIES FOR DISSEMINATING WEATHER

STATUTORY RESPONSIBILITIES FOR PROVIDING
AVIATION WEATHER DATA

FAA's primary mission, stated in the Federal Aviation Act of 1958, as amended (49 U.S.C. 1463), is to assure safe and efficient use of airspace. In fulfilling this mission, FAA is responsible for providing aviation weather information to pilots. The act directs FAA to develop, procure, operate, and maintain equipment for disseminating weather information. In addition, the act directs the National Weather Service (NWS) to provide FAA with reports, forecasts, and warnings for aviation use.

FAA AIR TRAFFIC CONTROL ORDER:
CONTROLLER RESPONSIBILITY

Air traffic controllers currently disseminate hazardous weather information to pilots. According to FAA's "Air Traffic Control" handbook--FAA 7110.65D--the controllers' first priority is separating aircraft. However, additional duties, such as providing pilots with weather information, are to be accomplished "to the extent possible" contingent on other, higher priority duties. In addition, each of the major terminal facilities has similar orders and policies governing controller responsibilities for disseminating aviation weather hazards information to pilots. (See page 21.)

SOURCES OF HAZARDOUS WEATHER INFORMATION

- FIVE PRIMARY SOURCES OF HAZARDOUS AVIATION WEATHER INFORMATION AT MAJOR AIRPORTS
 - SIGMETs: SEVERE WEATHER WARNINGS FROM NWS
 - CWAs: WEATHER ADVISORIES FROM FAA
EN ROUTE CENTERS
 - PIREPs: PILOT REPORTS OF IN-FLIGHT
WEATHER CONDITIONS
 - ASRs: AIRPORT RADARS WITH LIMITED WEATHER
DETECTION CAPABILITIES
 - LLWASs: SURFACE WIND SHEAR DETECTION DEVICES

FIVE SOURCES OF HAZARDOUS
AVIATION WEATHER INFORMATION

Terminal air traffic controllers provide pilots with hazardous weather information for the critical takeoff and landing phases of flight from five primary sources:

- NWS Significant Meteorological Information Advisories (SIGMETs),
- FAA's Center Weather Advisories (CWAs),
- FAA's Pilot Reports (PIREPs),
- FAA's Low Level Wind Shear Alert Systems (LLWASs), and
- FAA's Airport Surveillance Radars (ASRs).

SIGMETs

SIGMETs are severe weather advisories issued in hourly and special bulletins for the eastern, central, and western regions of the country by NWS in Kansas City, Missouri. There are three kinds of these severe weather advisories. Convective SIGMETs are warnings of the most severe weather conditions; they are issued for tornadoes and very severe thunderstorms. SIGMETs are issued for severe and extreme turbulence, icing, and widespread obstructions to visibility such as sand and dust. AIRMETs are less extreme potential hazards to aircraft such as moderate icing conditions. All of these NWS weather advisories are referred to in this report simply as SIGMETs.

CWAs

CWAs are unscheduled severe weather advisories. They are developed by Center Weather Service Unit meteorologists at FAA's 20 air route traffic control centers in the continental United States through analysis and interpretation of area forecasts,

terminal forecasts, SIGMETs, PIREPs, and other sources of available weather information. CWAs may also supplement or redefine existing SIGMETs.

PIREPs

PIREPs are reports from pilots concerning hazardous and routine in-flight weather conditions. FAA requires pilots to give information to ground facilities, such as airport towers, whenever ceilings are reported or forecast at or below 5,000 feet; or when visibility is reported or forecast at or less than 5 miles; or if either thunderstorms, light icing conditions, moderate turbulence, or wind shears¹ are reported or forecast for the area.

ASRs

ASRs are aircraft surveillance radars. The radars collect data that identify aircraft location, altitude, airspeed, and flight number and display the data on the controller's display. The display is the controller's primary means of "seeing" and separating aircraft. The radars also detect precipitation but do not differentiate between its type or severity and cannot detect turbulence. Also, the controller display does not show weather and aircraft data simultaneously. To obtain weather data, the controller must adjust the display, thereby removing information on aircraft altitude, airspeed, and flight numbers.

LLWAS

LLWASs are surface wind shear detection devices composed of five wind sensors located around the airport, a sixth sensor at the center-field location, and a small processor that

¹Wind shear refers to large and rapidly changing variations in air velocity over small distances. The most serious effects of wind shear for aircraft are loss of lift and altitude. This is particularly hazardous when an aircraft is close to the ground, either landing or taking off.

continuously compares the difference in wind speed and direction of these sensors with the centerfield location. LLWAS provides pilots and controllers with information on potentially hazardous surface wind conditions at or near the airport. When more than a 15-knot difference in windspeed exists between any of the sensor locations and the center-field sensor, a wind shear alert device sounds an alarm. The controller provides the wind shear alert to incoming and departing pilots. At present, about 80 of these systems are in operation and an additional 30 are planned to be installed by 1989. In addition, an enhanced low level wind shear alert system is planned for these 110 locations with twice the number of remote wind sensors to detect microbursts.²

²Microbursts are a form of wind shear in which air descends rapidly downward. When the descending air strikes the earth's surface, it spreads in all directions, causing an aircraft to encounter increasing head winds, and when a pilot attempts to compensate by reducing power to maintain target airspeed, he quickly flies into the descending air. By that time, the aircraft nose is usually down, power is throttled back, and there may not be enough power for the pilot to return aircraft to full power before the combination of sinking air and increasing tail wind forces the airplane to the ground.

TECHNOLOGICAL LIMITATIONS AFFECTING
WEATHER DISSEMINATION

- EXISTING AIRPORT WEATHER DETECTION AND DISSEMINATION TECHNOLOGIES ARE LIMITED
 - RADARS DETECT ONLY PRECIPITATION, NOT SEVERE WEATHER
 - WIND SHEAR DETECTION SYSTEM MAY NOT DETECT MICROBURSTS AND FREQUENTLY REPORTS ARE FALSE ALARMS
 - NO AUTOMATED SYSTEM EXISTS FOR DISSEMINATING HAZARDOUS WEATHER TO PILOTS

HAZARDOUS AVIATION WEATHER DETECTION
AND DISSEMINATION TECHNOLOGIES
ARE LIMITED

The current aviation weather system is limited in its ability to rapidly acquire weather data and to process and disseminate operationally significant information to pilots. Capabilities to detect real-time, hazardous weather information that could adversely affect safety are also limited. This is evident in the five systems we examined. These systems do not provide adequate and timely hazardous weather warnings in the terminal area because existing airport surveillance radars do not discern the type and severity of weather; the low level wind shear warning system is not reliable and currently cannot detect microbursts; and there are no automated systems for disseminating weather warnings to pilots.

Radar precipitation reflections
and storm severity

ASRs are designed to detect aircraft, not weather. Controllers cannot determine storm intensity, specific locations, or areas of dangerous clear air accompanying storms from the radar's precipitation reflections. Without such information, controllers are reluctant to advise or suggest alternative routes through bad weather.

Beginning in 1987, FAA plans to replace existing ASRs at 101 high density airports with ASR-9s, the latest state-of-the-art surveillance radars. In addition to improving surveillance, ASR-9s will have near real-time weather processing capabilities on an independent weather channel. The weather channel will provide controllers with a graphic outline of the hazardous weather in the terminal area and differentiate any two of six intensity levels of severe weather established by the National Weather Service.

Wind shear and microburst detection

LLWAS does not provide reliable detection of microbursts, the most dangerous, downward-rushing type of wind shear, according to the report of the Committee on Low Altitude Wind Shear and Its Hazard to Aviation of the National Research Council, National Academy of Science. Moreover, the present LLWAS sensors frequently provide false alarms. We were told by an FAA official that pilots tend to disregard LLWAS warnings because of these problems.

Microbursts may not be detected because of their small size and the location of LLWAS sensors on the airfield, according to the National Academy of Sciences report.³ LLWAS has six sensors distributed over an entire airfield. Microbursts may hit the ground between the sensors. In addition, the committee, made up of National Center for Atmospheric Research, Air Force Geographics Laboratory, and National Severe Storm Laboratory officials, reported that some microbursts may never strike the ground, failing to trigger ground-based sensors. Also, should microbursts occur outside of the airport perimeter on flight paths where aircraft are still close to the ground, they would not be detected by LLWAS. Despite these limitations, LLWAS is the only available operational means of detecting wind shears at airports.

According to FAA officials, LLWAS false alarms are caused by air turbulence created by large aircraft and winds deflected from large structures shielding sensors from winds. At the Chicago and Atlanta airports, for example, we observed pilots routinely taking off and landing through wind shear alerts. A controller at Chicago O'Hare told us that frequent alerts at one location were

³Low-Altitude Wind Shear and Its Hazard to Aviation, National Academy Press, ISBN0-309-03432-9, 1983.

caused by prevailing winds deflected from a large building. He told us that he was confident that the alerts from that sensor were false alarms but that controllers would still provide the warnings to pilots.

FAA is attempting to improve LLWAS performance. The number of airport sensors is being increased from 6 to 12 to assure broader airfield coverage. New software is being developed for the processor to provide more data. By 1990, 12-sensor LLWASs with improved software and new controller displays are to be installed at all 110 LLWAS locations.

FAA also plans to develop the terminal doppler weather radar (TDWR) to enhance weather detection, primarily wind shear and microbursts in terminal areas. The TDWR should provide the controller with real-time detection and warning of these phenomena for immediate dissemination to pilots. According to FAA officials responsible for implementing the enhanced LLWAS, TDW and LLWAS will be companion systems and weather information from both will be given to pilots.

Automated communications
won't exist until 1990's

No automated system for disseminating hazardous weather information to pilots currently exists. FAA depends on controllers to disseminate SIGMETS, CWAs, and other hazardous weather messages to pilots when their primary duties allow. They do not always have time to promptly provide weather warnings. The agency plans to develop technologies with the capability of exchanging real-time hazardous weather information among aircraft and various detection devices and data bases. However, this critical data link service is not scheduled to be implemented before the 1990's.

PROCEDURAL PROBLEMS DISSEMINATING WEATHER
INFORMATION AS QUICKLY AS POSSIBLE

- PROCEDURAL PROBLEMS CONTRIBUTE TO LACK OF PROMPT DISSEMINATION
 - PASSING SIGMETS AND CWAs FROM CONTROLLER TO CONTROLLER TO READ ON HIS/HER FREQUENCY IS NOT FAST ENOUGH
 - PILOTS MAY MISS WEATHER WARNINGS BECAUSE OF RADIO FREQUENCY CHANGES

CONTROLLER EXPERIENCE MAY AFFECT
WEATHER DISSEMINATION

o CONTROLLERS ARE DIVIDED ON HOW EXPERIENCE AFFECTS
WEATHER DISSEMINATION

- GAO SURVEY SHOWS CONTROLLERS BELIEVE
WEATHER TRAINING IS NOT ADEQUATE
- GAO REPORTED THAT DECLINING NUMBERS AND
EXPERIENCE LEVEL OF AIR TRAFFIC
CONTROLLERS AFFECT SAFETY

PROCEDURAL PROBLEMS CONTRIBUTE
TO LACK OF TIMELY WEATHER DISSEMINATION

The principal procedural problem in disseminating weather information is a lack of prompt communication of weather information from air traffic controllers to pilots. We found that weather warnings are often delayed because of the procedure of passing weather messages from one controller to another. Moreover, pilots may miss weather messages because they must frequently change radio frequencies when passing from one controller's sector of airspace to another's.

The procedure of passing SIGMETs and CWAs from one controller to another hinders prompt weather dissemination. SIGMETs and CWAs are received at the terminal on a teletypewriter. Under existing procedures, the teletyped strips of paper containing weather information are given to one controller by the supervisor to read to pilots on his radio frequency. When finished, the controller passes the strips to the next controller position in the arrival and departure sequence. This procedure continues until the strips are read at all terminal controller positions. Controllers read these warnings as time permits. If they are busy separating aircraft, the warnings are delayed, and in some cases not given.

The average time taken to disseminate SIGMET and CWA severe weather advisories at Dallas/Ft. Worth was 23 minutes. This represents an average time for 50 SIGMETs and CWAs to be read during a 2-week period from November 19 to December 1, 1985. This average consisted of the elapsed time between the first and last reading of each weather warning. Dallas/Fort Worth data were a result of a facility order creating a special recording form following the Delta Air Lines accident last August.

The other four major airports we visited did not have a similar reporting form to record the time when SIGMETs and CWAs

were read by the controllers. While the average time at Dallas/Fort Worth may not be representative of all five major airports, they all follow the same procedure of passing SIGMETs and CWAs from one controller to another.

Another procedural problem with disseminating SIGMETs and CWAs concerns numerous changes in radio frequencies. When passing from one controller's airspace into another, pilots must switch radio frequencies. SIGMETs and CWAs may be missed if the pilot is leaving airspace where the warning has not yet been transmitted but is entering airspace where the warning has already been read.

CONTROLLERS ARE DIVIDED ON HOW THEY
BELIEVE EXPERIENCE LEVEL AFFECTS
WEATHER DISSEMINATION

We received differing views from the controllers we talked to at five airports concerning the effect of experience on timely dissemination of aviation weather information. The majority of controllers said they did not believe controller experience significantly affects timely dissemination of aviation weather information. Some controllers, however, disagreed. They told us that less experienced controllers may require more time to separate aircraft, thereby having less time to disseminate weather information. Further, some controllers feel that less experienced controllers may not be as well prepared to deal with the unusual situations that accompany hazardous weather conditions.

GAO's national controller survey covered controller training for bad weather conditions. The results suggest support for the views of some controllers that less experienced controllers may need more time to control traffic, thereby leaving less time to disseminate weather information, and that less experienced controllers may be less able to deal with unusual situations accompanying hazardous weather conditions. When asked to rate the quality of on-the-job training given developmental controllers for handling heavy traffic, 37 percent of the 3,282 controllers responding to the survey rated this training as less than adequate. Moreover, 55 percent of the controllers rated training for controlling aircraft in bad weather as less than adequate.

GAO reported that both the number and experience level of air traffic controllers are significantly lower than before the 1981 strike, and that the Flight Safety Foundation concluded that the system is less safe now than it was in 1981. Nationwide, the number of full-performance-level (FPL) controllers was

13,205 as of July 31, 1981, and only 8,315 as of September 30, 1985. Similarly, the number of FPLs at the five busiest airports was 418 in July 1981, and was 291 in September 1985. (See table.)

Number of FPLs Before and After Strike

<u>Airport</u>	<u>FPLs as of July 1981 pre-strike</u>	<u>FPL As Of Sept. 1985</u>	<u>Decrease in number of FPLs</u>	<u>Percent of decline</u>
Chicago	81	76	(5)	6
Dallas	93	59	(34)	37
Atlanta	104	69	(35)	34
Denver	61	37	(24)	39
Los Angeles	<u>79</u>	<u>50</u>	<u>(29)</u>	<u>37</u>
Total	418	291	(127)	30

While the number of full-performance-level controllers has decreased, the number of developmental, less experienced controllers has increased from 3,039 to 4,217 nationwide. At the nation's five busiest airports, the number of developmental controllers has increased from 25 in July 1981 to 140 in September 1985.

HUB-AND-SPOKE TRAFFIC SYSTEM
HINDERS TIMELY WEATHER DISSEMINATION

- ° CONTROLLERS SAY THEY ARE HANDLING TOO MUCH TRAFFIC DURING PEAK PERIODS
- ° CONTROLLERS SAY THEY ARE SOMETIMES TOO BUSY HANDLING TRAFFIC DURING PEAK PERIODS TO GIVE WEATHER INFORMATION

HUB-AND-SPOKE TRAFFIC SYSTEM
HINDERS TIMELY WEATHER
DISSEMINATION AT AIRPORTS

The hub-and-spoke operating pattern currently used by many commercial airlines results in airplanes arriving and departing in clusters during peak passenger travel hours and tends to create periods of high density traffic that can delay dissemination or result in denial of hazardous weather information to pilots. Controllers at each of the five airports we visited stated they occasionally do not have time to give weather information to pilots, particularly during peak traffic periods. Similarly, our nationwide survey of controllers showed that controllers sometimes are too busy to give weather information.

About two-thirds of the controllers we interviewed at the five airports told us they occasionally delay or do not give weather information to pilots because they are too busy separating traffic. GAO's national survey confirmed that weather advisories are not always given. Overall, 53 percent of the responding controllers in the national survey reported they occasionally do not provide weather advisories to pilots, and one in five of the 3,282 controllers responding said they often decline to give weather advisories.

When asked how often, if ever, they decline to provide weather advisories, controllers represented in GAO's national survey from the five busiest airports responded:

	<u>Chicago</u>	<u>Atlanta</u>	<u>Denver</u>	<u>Los Angeles</u>	<u>Dallas</u>
	----- (Percentage) -----				
Very often	8	13	6	0	9
Often	14	4	17	0	7
Occasionally	35	23	37	9	26
Seldom if ever	43	60	40	91	58

Controllers and their supervisors told us that the reason they do not give weather information is that they are too busy with their first priority duty of separating air traffic.

Seventy percent of the controllers responding to our nationwide survey felt they were handling more traffic during peak periods than they should have been. Similarly, 63 percent of the controller responses in the national survey from the five airports we visited indicated controllers felt they were handling too much traffic during peak periods. Controllers in our national survey were asked if they believed that they typically are required to handle more traffic than they should be handling, less than they should be handling, or an appropriate amount of traffic while working radar during peak periods. Their responses are shown below.

<u>Category</u>	<u>Nation- wide average</u>	<u>Atlanta</u>	<u>Chicago</u>	<u>Dallas/ Ft. Worth</u>	<u>Denver</u>	<u>Los Angeles</u>
------(Percentage)-----						
Much more	15	9	6	16	13	10
Somewhat more	55	48	53	63	58	10
Appropriate level	28	41	41	21	29	70
Somewhat less	2	2	0	0	0	10

Not only did controllers believe they were handling more traffic during peak periods than they should, their supervisors believed that the traffic work load was having some negative impact on system safety. Seventy-eight percent of the supervisors represented in GAO's nationwide survey indicated that the amount of traffic was having a negative impact on maintaining system safety. Supervisors were asked how much positive or negative impact, if any, the amount of traffic work load was having on maintaining system safety. Their responses are shown below.

	<u>Total percent of supervisors</u>
Significant positive impact	4
Some positive impact	6
No impact	13
Some negative impact	54
Significant negative impact	24

CONCLUSIONS

- CONTROLLERS SOMETIMES DO NOT HAVE TIME TO
DISSEMINATE WEATHER
- HAZARDOUS WEATHER INFORMATION MAY NOT BE PROVIDED
FAST ENOUGH TO AVOID HAZARDS
- AIRPORT HAZARDOUS WEATHER DETECTION IS LIMITED

CONCLUSIONS

Controllers at the nation's busiest airports sometimes do not have time to disseminate weather information to pilots. In addition, when weather information is given, it may not be given as soon as possible because controllers are too busy performing their primary duty of separating aircraft. FAA's procedure for communicating weather warnings by having controllers read them over their radio frequencies is too slow to avoid potential hazards, and some pilots may not receive any warning because of radio frequency changes. On-airport weather detection systems (LLWAS and ASR) do not provide controllers adequate detection or information about potentially hazardous weather because the radar cannot detect storm intensities, and the wind shear system cannot reliably detect the most dangerous form of wind shear, microbursts.

The lack of controller time for disseminating weather information, combined with deficiencies in existing weather detection and reporting, can result in insufficient weather information being available to pilots during the critical takeoff and landing phases of flight.

FAA is developing several new weather detection and dissemination systems as part of the NAS plan to address these deficiencies. Specifically, improved airport surveillance radars are supposed to have real-time weather detection capabilities for the terminal areas. Also, terminal doppler weather radars and an enhanced LLWAS are being developed in order to improve detection of wind shear, primarily microbursts. Weather information is planned to be made available to pilots through improved data collection and processing capabilities and direct communications links between ground and air.

(341099)



Requests for copies of GAO reports should be sent to:

**U.S. General Accounting Office
Post Office Box 6015
Gaithersburg, Maryland 20877**

Telephone 202-275-6241

The first five copies of each report are free. Additional copies are \$2.00 each.

There is a 25% discount on orders for 100 or more copies mailed to a single address.

Orders must be prepaid by cash or by check or money order made out to the Superintendent of Documents.

34 345

United States
General Accounting Office
Washington, D.C. 20548

First-Class Mail
Postage & Fees Paid
GAO
Permit No. G100

Official Business
Penalty for Private Use \$300