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STATEMENT OF

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BEFORE THE

SUBCOMMITTEE ON AVIATION

OF THE

SENATE COMMITTEE ON COMMERCE, SCIENCE,

AND TRANSPORTATION

ON

THREE SAFETY ISSUES RELATING TO AVIATION

Madam Chairman and Members of the Subcommittee:

We appreciate this opportunity to comment on three safety issues relating to aviation--current conditions within the air traffic control (ATC) workforce, variations in the type and frequency of the Federal Aviation Administration's (FAA's) inspections of air carriers, and FAA's progress in developing a terminal doppler weather radar system to detect and warn of low level wind shears. In the midst of civil aviation's worst year for fatalities, this hearing is particulary timely in that these three issues have become the focus of public attention and concern.

In response to several congressional requests we have, over the past year, initiated assignments addressing all three of these issues. My testimony today will summarize our findings and observations to date on each issue. We will then be available to participate in the respective panel discussions.

Aviation safety today relies heavily on the performance of people. The air traffic controller and the surveillance inspector are two critical human links in maintaining a safe national airspace system. The Department of Transportation (DOT) has recently announced substantial increases in both workforces. My comments today are intended to assist the Congress and FAA in determining what further actions appear warranted.

THE AIR TRAFFIC CONTROL WORKFORCE

FAA has been faced with an extraordinary challenge in rebuilding the air traffic control workforce following the controller strike 4 years ago and the loss of so many experienced personnel. FAA's management of this recovery has been monitored by the Congress, particularly in light of FAA's goal of employing fewer controllers than before the strike while safely controlling increasing amounts of air traffic and maintaining harmony among controllers. In addition, airline accidents this year have fostered an atmosphere of increased concern over the operation of the air traffic control system.

Against this backdrop, we did a comprehensive and systematic survey of FAA's controller workforce. We sent questionnaires to about 4,500 full performance level (FPL) and developmental controllers,[1] 1,000 first-line supervisors, and the managers at the 20 enroute centers and the 54 busiest terminal facilities in the continental United States to obtain their views and observations on several key topics, including

--controller workforce staffing levels, composition, and attrition;

--air traffic activity and controller workload;

--overtime;

--sick and annual leave;

--training of new controllers; and

[1]A full performance level controller is one who is fully certified to operate all positions in a defined area. The developmental controller is one who is undergoing training and those we surveyed have been certified to operate at least one radar position at their facility.

--FAA's automated operational error-detection program.

All told, we received about 4,200 responses by our July 26 cutoff date, for an overall response rate of 75 percent. We have, to date compiled the responses and I will provide some of the highlights for you today.

In addition to answering our questions, about half of the respondents provided narrative comments which we are just starting to analyze. We are also examining FAA data regarding staffing and the other topics covered in our survey in order to compare this information with the questionnaire responses.

Responses say system is safe, but raise concerns about maintaining safety

Most of the controllers, supervisors, and managers who answered our questionnaire rated the overall safety of the ATC system as adequate to excellent. Eighty-three (83) percent of the controllers, 93 percent of their supervisors, and all the facility managers shared this opinion. Their responses, however, identified several safety-related concerns that appear inconsistent with this rating and must be addressed if the current level of safety is to be maintained.

Staffing levels, composition, and attrition

As a result of the 1981 strike, the system-wide controller staffing level fell by 75 percent. The strike and dismissals resulted in the loss of about 11,700 controllers--9,200 of them at the full performance level. This left about 4,000 controllers, 3,400 of them at the full performance level, to operate the system.

The process of rebuilding the controller population has gone slower than FAA anticipated. For every 100 new controllers hired, barely half are able to remain and succeed in reaching full performance level status.

In June 1982, FAA said its goal was to have about 6,600 full performance level controllers by July 1984. But, as of June 1985 they were still short of the 1984 goal by 300. This is true even though a new controller can reach the full performance level in about 2 years. Before the strike, it took 4 to 5 years of experience to reach the full performance level.

The rebuilding process is also complicated by the fact that FAA may lose many of its experienced controllers and supervisors through retirement. About 15 percent or 570 controllers responded that they will be eligible to retire within 2 years and of that number 84 percent said they probably will retire. Percentage-wise, attrition of first line supervisors could be much greater. Of 880 supervisors responding, half said they will reach retirement eligibility within 2 years; of that number, 81 percent said they probably will retire. Supervisors reported that they spend about 36 percent of their time actually controlling traffic.

Overall 86 percent of the supervisors, 91 percent of the controllers, and 72 percent of the responding facility managers said that there are now fewer full performance level controllers than are needed. Moreover, 36 percent of the facility managers said their authorized level of such controllers is not sufficient. The majority of supervisors and controllers said

that the current number of full performance controllers is having a negative impact on their ability to maintain a safe system. More than one-third of the facility managers also held that view.

Air traffic activity and controller workload

Respondents to our questionnaires also cited safety concerns about the level of air traffic activity and controller workload. The volume of air traffic has returned to prestrike levels but is now being controlled by a systemwide controller workforce comprised of 5,000 fewer full performance level controllers than were present before the strike. FAA forecasts increases in air traffic and the first major labor-saving features of FAA's planned automated air traffic control system will not be available until at least the early 1990s. Thus, controller workload will likely continue to be a concern for some time.

Our survey showed that 70 percent of the radar controllers believe they are required to handle more traffic during daily peak periods than they should be handling. Their supervisors said that a much lower percentage--38 percent of the controllers under their supervision--are required to handle too much traffic, but even their estimate represents over 2,000 controllers. Facility managers,on the other hand, disagreed with both the controllers and supervisors stating that only 4 percent of the radar controllers are required to handle more traffic than the managers feel is appropriate.

Overall, 69 percent of controllers believe that the heavy workload is adversely affecting the safety of the system. For example, we asked questions about two air traffic control duties having a direct bearing on safety: responding to pilots' requests for traffic advisories and providing pilots with weather advisories. Even though about 26 percent of the controllers said they seldom, if ever, declined requests for traffic advisories, 32 percent said they often did. The overall situation was better concerning weather advisories in that 48 percent said they seldom, if ever, declined such requests, although 19 percent said they often did.

Training of developmental controllers

What about the quality of training received by developmental controllers? More than half the supervisors said the skill level of developmental controllers is having a negative effect on maintaining system safety; 45 percent of the controllers shared this opinion.

We asked controllers, supervisors, and managers to rate the quality of the on-the-job training that developmental controllers were receiving at their facility. Overall, facility managers rated the training as adequate to excellent. Again supervisors and controllers saw things quite differently. For example, in rating the quality of training for controlling traffic in bad weather, 35 percent of the supervisors and 55 percent of the controllers rated it less than adequate to poor. In another important skill area, knowledge of the operational characteristics of different types of aircraft, 34 percent of

the supervisors and 42 percent of the controllers rated the training as less than adequate to poor.

Adding new controllers may not ensure system safety

Responses to our survey clearly indicated that controllers and supervisors believe that workload pressures are mounting to a point where it will be difficult to maintain the existing level of system safety. The recent DOT decision to increase the controller workforce by about 1,000 positions during fiscal years 1986 and 1987 on the surface appears to be a step in the right direction. But increasing the number of controllers represents only a partial, long-term remedy to the current conditions within the ATC workforce. We believe that the low success rate of new controllers in reaching full performance level status, their low level of experience and training, and the loss of experienced staff through retirements also need attention if the existing level of safety is to be maintained.

VARIATIONS IN FAA'S INSPECTIONS OF AIR CARRIERS

In addition to hiring more controllers, DOT has also recently announced a planned increase in the number of FAA air carrier inspectors. These FAA inspectors monitor and inspect air carrier operations and maintenance practices to ensure compliance with federal safety regulations and FAA-approved air carrier policies and procedures.

From fiscal years 1981 to 1984 the number of authorized inspectors decreased about 24 percent (from 674 to 508 inspectors) while the number of operating aircraft more than

doubled. In fiscal year 1984 the Congress, concerned that these reductions could have long-term safety implications for the nation's airlines, authorized an additional 166 inspectors to restore the workforce to its authorized 1981 level. The Congress is presently considering adding an additional 200 inspector positions in fiscal year 1986.

Apart from the need for increased staffing, recent commercial aircraft accidents and the results of DOT and FAA studies have raised questions about how well the FAA inspector program is being managed. These studies showed that FAA regions do not interpret or apply FAA regulations and policies uniformly; that FAA offices do not communicate with each other effectively; and that FAA orders, handbooks, and other documents that guide inspections need to be revised and updated.

FAA has recognized the need to address these questions and has undertaken an extensive review of its management of air carrier inspections. Some congressional concern has also been expressed over whether FAA should be hiring new inspectors until there is adequate analysis of FAA's current inspection program and staffing standards.

GAO's August 1985 inspector report

At the request of two House Subcommittee Chairmen, we compiled and analyzed data on the type, frequency, and results of fiscal year 1984 inspections covering air carrier personnel, aircraft, and maintenance and other facilities for a sample of 92 of the nation's approximately 500 scheduled commercial air

carriers.[2] We reviewed about 12,000 reports of avionics (aircraft electronics), operations, and maintenance inspections.

Comparison of operating hours and FAA inspections

To compare FAA's inspections, we grouped the air carriers according to their fiscal year 1984 operating hours. We found that

--some air carriers with a similar number of operating hours had significant differences in the total number of FAA inspections, and

--some air carriers with similar numbers of FAA inspections had large differences in total operating hours.

For example, an airline with about 41,000 operating hours had 571 FAA inspections whereas another airline with about a thousand more operating hours had only about one-third that number of inspections. Conversely, an airline with about 90,000 hours received 274 inspections, whereas another airline with about 56 percent more hours received the same number of inspections.

Some air carriers had no avionics or operations inspections

Our review also showed that 29 air carriers (about 32 percent of our sample) had no FAA avionics inspections during fiscal year 1984. Four air carriers did not receive any FAA operations inspections. Two of the air carriers received neither an avionics nor an operations inspection. Twenty-five

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[2]Compilation and Analysis of the Federal Aviation Administration's Inspection of a Sample of Commercial Air Carriers (GAO/RCED-85-157, August 2, 1985)

of the air carriers (86 percent) that did not receive avionics or operations inspections had their operating certificates in FAA's Alaska or Southern regions and almost all were small air carriers.

Variances among FAA regions

Our review found that FAA regions varied in the proportion of operations, maintenance, and avionics inspections they performed, and in the percentage of inspections that resulted in unsatisfactory ratings for the carrier. For example, we found that in 4 of the 5 regions we visited, about 87 to 92 percent of total inspections were operations and maintenance inspections while the remaining 8 to 13 percent were avionics inspections. In the other region, we found a relatively even distribution among operations, maintenance, and avionics inspections.

Similarly, we found variances in the results of FAA's inspections of air carriers among the five regions reviewed. Unsatisfactory operations inspections ranged from 3 to 11 percent, unsatisfactory maintenance inspections varied from less than 1 percent to 24 percent, and unsatisfactory avionics inspections ranged from 1 to 9 percent.

FAA's response to GAO's report

FAA has stated that they found our report to be very beneficial in that it gave them an independent and different perspective. FAA also indicated that there are valid reasons for some of the variances we found among the carriers in our sample. According to FAA, comparing FAA inspections with fleet operating hours, alone, should not be used to assess FAA

surveillance performance. FAA believes other factors, including fleet size, aircraft type, age of the carrier, expansion rate, and history of regulatory compliance, should also be considered. Nevertheless, FAA said it has begun to improve the inspection program by correcting staffing deficiencies and implementing guidelines which specify minimum numbers of inspections. According to FAA, these and other implemented or proposed changes will restructure and revitalize their inspection program.

GAO's follow-on review

At the request of the two House Subcommittee Chairmen who had requested the basic inspection data presented in our August report, we have begun a review to determine the reasons for the variations in FAA's inspections of air carriers as well as the adequacy of FAA's implemented and proposed changes to its inspection program. They have also asked us to address other issues that reach beyond the adequacy of the number of FAA inspectors. These include

--the adequacy of FAA's standards, guidance, and priorities for air carrier inspections and surveillance and the extent to which they are being followed;

--the reasons why FAA generally does not know how often an air carrier is inspected and whether it is receiving sufficient inspections; and

--the reasons why violations of federal aviation regulations have gone undetected for long periods of time for some carriers and why detected problems with some carriers continued to go uncorrected.

We plan on completing our work on this request next spring.

FAA'S TERMINAL DOPPLER RADAR EFFORTS

In summarizing our observations on the third safety-related issue--FAA's efforts to develop a terminal doppler weather radar system to detect and warn of low level wind shear--I would like to return to the response of controllers to our question on providing pilots with weather advisories. About one out of every five acknowledged that they often decline to provide pilots with weather advisories while working daily peak traffic periods. This may be important if advisories are not given in severe weather conditions.

In March of this year, we began evaluating FAA's research efforts to develop a terminal doppler weather radar system. We are reviewing the status of research activities conducted under several FAA contracts related to terminal doppler radar development and the wind shear hazard.

My statement today is based on this ongoing GAO work. On July 19th, we met with the Administrator of FAA to share our observations and suggestions relating to FAA's terminal doppler efforts. Subsequently, the crash of Delta Flight 191 at the Dallas/Ft. Worth airport heightened congressional concern about the wind shear hazard to aviation and FAA's progress in developing a terminal doppler radar. Our ongoing work provides insight on (1) the difference between the terminal doppler radar

and the next generation weather or NEXRAD radar, (2) the status of the two radars' development, and (3) other measures FAA can take to increase safety by minimizing the risk associated with wind shear.

Differences between NEXRAD and the terminal doppler radar

NEXRAD and the terminal doppler radar differ in both their purpose and their technical requirements.

The NEXRAD is a long-range (145 to 290 miles) weather surveillance radar. Its purpose is to identify severe storms as part of the national weather needs of the Departments of Commerce, Transportation, and Defense which are jointly funding its development. NEXRAD doppler characteristics are to identify very large wind shear formations, like tornadoes, gust fronts, and severe air turbulence, as well as precipitation normally associated with severe storms. National Weather Service radar meteorologists operating NEXRAD will provide enhanced aviation weather information, but they will not address airport wind shear hazards.

The terminal doppler is to be a short-range (12 miles) radar. Its purpose is to detect small, low wind shears, including extremely violent, rapidly developing, vertical wind shears called microbursts, in the approach and takeoff glide paths around airports and rapidly warn controllers. In these areas, aircraft are close to the ground and pilots have little time to adjust to abrupt changes in air speed. Research to

develop this radar and its displays to warn controllers is being conducted under contract with FAA by the National Center for Atmospheric Research (NCAR) and MIT's Lincoln Laboratory as part of the NAS plan.

Because of their different purposes, NEXRAD and terminal doppler radars have different technical requirements especially clutter suppression, data updating, and automation. Because NEXRAD radars are long-range components of a national weather network, each can be located with some local flexibility in order to minimize signal interference from aircraft and other radars and from "ground clutter" such as buildings and other obstructions. Conversely, terminal doppler radars must be located on or near airports in order to identify rapidly developing microbursts in the glide paths. Ground clutter and signal interference at the airports are likely to be a major problem. Thus, a terminal doppler radar may have to have more signal interference and clutter suppression capability than a NEXRAD.

Further, since some microbursts can become hazardous very quickly, terminal dopplers must be able to provide new information on the entire terminal coverage area very rapidly. Radar data must be updated every minute in order to provide adequate advance warning. In contrast, NEXRAD will provide updated information to meet long-range weather detection needs every 5 minutes.

In order for a terminal doppler weather radar to provide adequate advance warning, FAA says that it must be fully automated because there are no radar meteorologists to interpret the data from the doppler radars and warn controllers of wind shears. FAA also believes there is only about 45 seconds total operating time to identify a wind shear and provide a warning. Since NEXRAD will be operated by National Weather Service radar meteorologists and its data are not as time critical, it does not require a fully automated system.

Status of the two radars

Solutions to the technical requirements of terminal doppler radars depend on further research and development. More specifically, FAA plans to continue the research of Lincoln Laboratory on radar siting and wind shear detection capabilities and of NCAR on controller wind shear displays through 1987.

In contrast, the NEXRAD radar program has reached the procurement stage. Prototypes have been developed by two contractors and are being tested. Once tests are completed and the results evaluated, FAA plans to award a limited production contract in September 1986 to operationally field test 10 radars, with delivery of these radars beginning late in 1988. Plans are to award a full scale production contract for about another 150 radars in 1987 with delivery from 1989 through 1993.

Martin Marietta, FAA's NAS plan Systems Engineering Intergration Contractor, estimates that a prototype terminal doppler radar could be tested in 1988, with an operational radar delivered by July 1990. FAA believes that this proposed schedule may be close enough to the NEXRAD schedule to permit adding the terminal doppler radar procurement to the NEXRAD contract. If this could be done, Martin Marietta claims that about 3 years could be saved simply by avoiding repeating the first two key decision points of OMB A-109 competitive selection process.[3]

The most recent information which we have seen, however, clearly indicates that the NEXRAD and terminal doppler radar schedules are not in the same phase of development. As stated previously, technical solutions to the terminal doppler radar's clutter suppression, data update rate, and fully automated warning capabilities, have not been devised. According to FAA officials, they are now considering a different antenna, a different frequency band, and a different beam width than the NEXRAD radar in order to address these technical requirements and its planned research will not be completed until 1987, a year after the limited NEXRAD production contract is to be awarded.

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[3]There are four key decision points in the A-109 process--exploration of alternative systems, competitive demonstration, full-scale development/initial production, and full-scale production.

GAO'S observations of FAA's efforts to develop a terminal doppler radar

At our July 19th meeting with FAA's Administrator, we identified three issues where FAA actions were critical to improving terminal doppler radar efforts--siting priority, operational testing, and reducing costs. For each issue, we suggested actions FAA might take and asked the agency to respond to our suggestions.

Wind frequency data are required to establish siting priorities

First, adequate national data on wind shear frequency are not availble to establish siting priorities. Aside from data relating to thunderstorms in the summer months, FAA has aggregate time series data on the number of wind shear occurrences for only four airports. Therefore, FAA does not know at which airports wind shears occur most frequently.

Several years ago, the National Academy of Sciences, the National Transportation Safety Board, and NCAR cited the need for such data and suggested using the existing Low Level Wind Shear Alert System (a network of ground based wind sensors on an airport joined to a small computer to show when there are divergent winds) to collect it. These systems are presently installed at 59 airports, and will soon be installed at 110 potential terminal doppler radar airports.

Because FAA had not collected these data, we suggested to FAA's Administrator that FAA use the existing Low Level Wind

Shear Alert System to develop wind shear frequenty data. FAA has now agreed to use these systems to collect frequency data to supplement the traffic and thunderstorm activity data it presently uses to site wind shear detection and warning systems.

Initial production units should be tested in an operational environment

Second, FAA's planned efforts to expedite terminal doppler radar procurement do not include time to test and evaluate initial production units in an operational environment. A fully automated research doppler radar operating without a meteorologist to interpret the data and warn controllers is to be tested in Denver in 1987.

The integration of an automated terminal doppler radar warning system is extremely complex. Microbursts must be detected by a radar, interpreted by a computer, and warnings issued to a controller who must rapidly relay the warning to a pilot. Because of the complexity of the system and the life-critical decisions a controller and pilot must make relying on a terminal doppler radar, we suggested to FAA that initial production units be tested and evaluated in an operational environment to ensure effective performance. FAA is confident, however, that the operational aspects of the system can be thoroughly developed through research testing.

A study by an FAA contractor of several major systems acquisitions said that failure to adequately test operational systems in the field prior to full procurement is a major cause

of subsequent performance problems. This supports our belief that operational testing of initial production units is crucial.

Terminal doppler radar costs should be re-examined

Third, although siting criteria based on the traffic levels, thunderstorm frequency, and low level wind shear alert system data may support installing terminal doppler radars at a large number of airports, the results of a benefit-cost analysis suggest a more limited deployment unless the doppler's cost can be reduced. The life-cycle cost of each terminal doppler radar is $4 million. Using this cost, Martin Marietta found that less than 15 airports had positive benefit-cost ratios when considering only the safety-related benefits. When efficiency-related benefits were added to the analysis by assuming that terminal doppler radars would reduce thunderstorm-related delays by 5 to 10 percent, 15 to 27 airports showed sufficient net benefits to justify their installation.

Martin Marietta added the positive net benefits from the 15 to 27 airports to the benefit-cost ratios of airports with negative net benefits. This approach increased the number of airports where the radars appear justified to between 41 and 101.

We understand that Martin Marietta has recently revised its benefit-cost ratios to include a higher technical and schedule program risk and to capture the effects of the recent crash of the Delta flight at the Dallas/Ft. Worth airport. The former

would tend to reduce costs by having FAA assume a greater risk of failure while the latter would tend to increase program benefits by including the lives and aircraft lost in the Delta crash. This could increase the number of airports having positive benefit-cost ratios. We have not had an opportunity to review Martin Marietta's revised analysis.

We agree with FAA that terminal doppler radars should be installed at airports when frequency data indicate wind shear to be a hazard to aviation. However, we also support the rationale that program funding should be based on the safety and efficiency benefits to be derived. Rather than manipulate the benefit-cost justifications, we urged FAA to re-examine its cost-driving requirements in an effort to reduce the cost of terminal doppler radars.

FAA disagreed with us, citing Martin Marietta's conclusion that FAA's preferred radar would be the optimum system and the most cost-effective. However, Martin Marietta's conclusion was not based on a review of the terminal doppler radar's cost-driving requirements. Rather, the requirements were held constant and Martin Marietta based its conclusion primarily on the assumption that FAA's perferred terminal doppler radar will be added to the interagency NEXRAD procurement contract.

Martin Marietta believes that 3 years could be saved by avoiding repeating the first two key decision points of the OMB A-109 process. As we have pointed out earlier, this assumption

may not prove accurate since the NEXRAD and terminal doppler radar schedules are not now in the same phase of development and FAA has not yet found solutions to the technical requirements that differentiate the terminal doppler radar from NEXRAD.

FAA's Deputy Associate Administrator for Engineering testified before the Congress that development of alternative designs for a terminal doppler radar is being initiated and that FAA is looking at alternative ways in which to make the appropriate acquisition. According to the Director of the NEXRAD Joint System Program Office, NEXRAD's cost-driving requirements were re-examined in June 1982. The re-examination resulted in reduced system requirements and revised cost proposals. We believe that a similar re-examination could result in reduced system requirements and revised costs for terminal doppler radars.

Other Measures

There are also other measures FAA can take to increase safety by minimizing the risk associated with wind shear. In March of this year, the National Transportation Safety Board issued a report identifying 34 wind shear-related recommendations made by the Board to FAA over the last 10 years. While FAA has acted on some of these recommendations, a number remain open. They include

--the need to evaluate methods and procedures for using current weather information as criteria for delaying arrivals and departures in severe weather conditions;

--the need to develop training aids such as educational video tapes for pilots and controllers and to encourage air carriers to provide their pilots with simulator training that incorporates microburst models for avoiding and escaping wind shears; and

--the need to promote development of airborne wind shear detection devices as well as airborne flight management systems to detect and escape wind shear.

Martin Marietta calculated that about 29 percent of all aviation wind shear accidents would still occur even with a fully automated terminal doppler system. Therefore, providing pilots with the training needed to take preventive or evasive action could be a top priority. Accordingly, FAA is planning to award a contract to a consortium of aircraft manufacturers, airlines, and scientists for the development of an improved pilot training program on wind shear. This program is to be conducted over a 2-year period and will provide training suitable for all categories of pilots.

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This concludes my testimony Madam Chairman. I will be happy to answer any questions you may have at this time.

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