United States General Accounting Office

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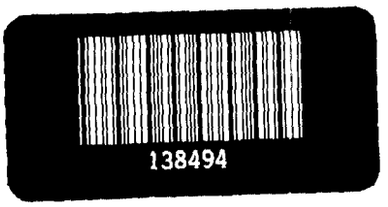
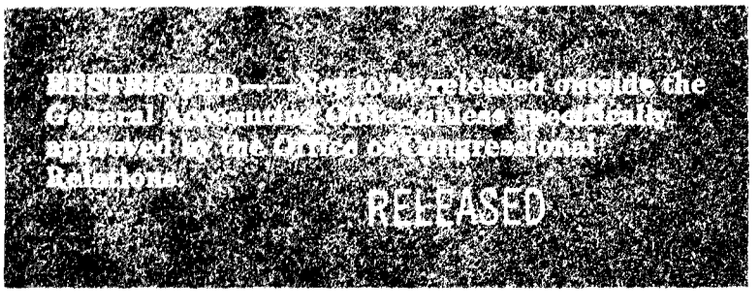
Report to the Honorable
Paul Simon, U.S. Senate

April 1989

AVIATION SAFETY

FAA Action Plan for Chicago O'Hare International Airport





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GAO

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

Resources, Community, and
Economic Development Division

B-232095

April 19, 1989

The Honorable Paul Simon
United States Senate

Dear Senator Simon:

As requested in your letter of October 27, 1988, we have assessed the Federal Aviation Administration's (FAA) response to Senate Resolution 497. The resolution—prompted by the upsurge in controller operational errors during 1988—directed FAA to provide the Congress with an action plan to address air traffic control problems at Chicago O'Hare International Airport. In response to the resolution, FAA produced an action plan listing about 100 recommendations with corresponding milestones for completion. This plan was the result of a "System Safety and Efficiency Review" FAA conducted in August 1988 to examine staffing and training, facilities and equipment, communications, airspace, and ground environment problems at O'Hare.

As agreed with your office, our review of FAA's action plan focused primarily on staffing and training initiatives and whether these initiatives address problems in these areas at O'Hare. Our review of FAA's equipment initiatives was limited to examining problems FAA has in replacing equipment at O'Hare in three major areas—controller displays, the tower voice-switching system, and computer software for the terminal radar approach control system.

Results in Brief

FAA is making a concerted effort to improve the situation at O'Hare. Recruiting, retaining, and training controllers at O'Hare have been long-standing problems, and much of the equipment that supports operations at O'Hare is aging or difficult to maintain. FAA actions have resulted in some immediate relief to O'Hare's personnel problems. However, the impact of all action plan initiatives to improve staffing, training, and equipment will not be known for some time. More specifically,

- staffing has increased at O'Hare as a result of action plan initiatives, but FAA believes the key to further improvement rests with the success of FAA's project to increase pay at O'Hare and other facilities, and
- FAA actions to improve training are not complete or fully implemented, but actions such as simulator enhancements should improve O'Hare's capability to train developmental controllers.

In addition, O'Hare has encountered some difficulties in replacing equipment in three areas included in our review. These difficulties are illustrative of how air traffic control system modernization delays have exacerbated local site conditions.

Distinct from the action plan, FAA has taken other steps to improve operations at O'Hare by monitoring and controlling the number of aircraft arriving in the Chicago airspace. According to FAA, controls over arrivals to Chicago will continue even after the action plan is fully implemented.

Background

Between May 1986 and August 1988, the National Transportation Safety Board (NTSB) conducted four investigations of air traffic controller operations at O'Hare. These investigations found that major factors contributing to operational errors included chronic staffing shortages and the level of traffic volume at O'Hare.[1] Among other things, NTSB recommended that FAA ensure that air traffic controller staffing levels and performance limitations be taken into account in determining traffic capacity acceptance rates.

FAA staffing has been the topic of several GAO reports (see app. V). We made several recommendations in our earlier work directed at the current problems at O'Hare and elsewhere. We recommended that FAA (1) revise its staffing standard to more accurately reflect controller and maintenance technician work load and field conditions at facilities such as O'Hare, (2) develop a national recruitment strategy for controllers, and (3) establish a pipeline of trainees to offset future retirements of maintenance technicians. In response, FAA has stated that it recognizes the need for accurate staffing standards and will take steps to revalidate these standards. However, FAA has not increased hiring to offset expected attrition.

[1] An operational error is an occurrence attributable to an element of the air traffic control system that results in less than the applicable separation minimum between two or more aircraft, or between an aircraft and terrain or obstacles and obstructions.

Staffing Problems at O'Hare and Planned Actions to Resolve Them

FAA has a number of actions planned to increase O'Hare's controller and maintenance technician staffing. Some of these initiatives have already increased staffing. According to FAA, however, the key initiative to solving staffing problems is the pay demonstration project.

Historically, O'Hare has been difficult to staff because of its high traffic volume and complex operations. FAA officials said that experienced controllers from other facilities have been reluctant to work at O'Hare's complex environment without a pay differential. For the past several years, O'Hare's TRACON (terminal radar approach control) has been unable to increase its full performance level controller staffing beyond 58 percent of its authorized controllers.[2] FAA managers prefer full performance level staffing at O'Hare to be at least 75 percent. We found in February 1987 that technician retirements and training attrition at O'Hare were affecting FAA's ability to reach staffing goals.[3] (Apps. I and II provide additional information on controller staffing and technician levels at O'Hare.)

Planned Staffing Actions

Pay Demonstration Project

On November 2, 1988, the Secretary of Transportation and the Office of Personnel Management announced a demonstration project to provide up to 20 percent additional pay for personnel at difficult-to-staff FAA facilities. This project will include air traffic controllers and maintenance technicians at O'Hare as well as the Chicago Air Route Traffic Control center. FAA expects the project to begin in June 1989.

During the first year of this 5-year project, approximately 530 controllers and technicians at the Chicago facilities will receive up to 20 percent of their basic pay as a "retention allowance" paid on a quarterly basis. The cost of this first year is estimated to be almost $2 million for O'Hare. FAA anticipates that the project will result in "full and stable employment at the selected facilities; more experienced employees occupying safety-related positions; higher levels of full-performance-level employees; and reduced use of overtime."

[2]Controller facilities at airport terminals are usually divided into two environments: (1) the tower cab, where controllers visually guide aircraft as they depart and land and (2) the radar room (or TRACON), where controllers use radar and computer surveillance.

[3]Aviation Safety in Airspace Controlled by Two Major FAA Facilities in the Chicago Area (GAO/T-RCED-87-2, Feb. 27, 1987).

Officials in the Great Lakes region said the region is already benefiting from the project even before it has been implemented because a greater number of experienced controllers are now bidding on O'Hare positions. During November and December 1988, 41 people bid on TRACON positions compared with 42 for the entire 12-month period from September 1987 through August 1988. In addition, 32 percent of the bidders during November and December were from Level-4 and -5 facilities compared with 14 percent for the prior period.[4]

Use of Former O'Hare Controllers on Temporary Detail

To assist with current work load, five former O'Hare controllers returned voluntarily to O'Hare in October and November 1988 on 120-day temporary details, two additional controllers arrived in January 1989, and three more are scheduled to arrive in May. This program has allowed three current O'Hare controllers who were in staff positions to resume full-time air traffic control responsibilities. Two of the five returnees had recent experience at O'Hare, so they were recertified in the TRACON and are controlling traffic.

Recruitment

FAA relies on individual regions to recruit to meet their needs. Regions recruit journeymen-level controllers from other facilities and controller candidates to attend the FAA Academy in Oklahoma City. The action plan identified several recruitment measures, but some of these measures, such as sending out teams of controllers to recruit, have been delayed until the results of the pay demonstration project are known. The action plan also recommended that FAA establish a program that ensures that each controller assigned to Chicago has a firm release date with a subsequent reassignment guaranteed. However, officials in the Great Lakes region cannot implement this recommendation because one region cannot guarantee placement in another region.

Increasing Maintenance Technician Staffing and Establishing a Pipeline

To address the shortage of journeymen maintenance technicians, FAA has given O'Hare special authorization to increase its staffing level by 10 percent. With this increase, O'Hare was given five additional positions. The Great Lakes region is recruiting more technicians with the goal of reaching a fully staffed level for O'Hare by October 1989.

[4]FAA facilities are classified or grouped from least busy to busiest. There are five classifications, or levels, of terminals. These facility levels are based on hourly traffic density. For example, level 4 terminals have an hourly density factor of 60 to 99.9 radar approaches; level 5 terminals have an hourly density factor of 100 or more radar approaches.

The Safety and Efficiency Review also recommended that FAA establish a pipeline of trainees for the Chicago area to provide a continual source of technicians for training and development before experienced technicians leave or retire. About 34 percent, or 24 of the 70 technicians in the Chicago sector, are eligible to retire by 1990. As we reported in September 1987, the absence of a pipeline of maintenance technicians is a nationwide problem.[5] About 45 percent of FAA's maintenance work force will be eligible to retire by 1995. Without significant hiring, FAA will be faced with losing much of the experience and expertise of its current work force.

Training Actions

FAA recommended two actions to improve training of O'Hare controllers in the short term: (1) continuing and enhancing contract instructor support for developmental training and (2) expediting installation of simulator enhancements. These actions are not yet complete, but actions such as simulator enhancements, when fully implemented, should improve O'Hare's capability to train developmental controllers.

Continue Contract Training

FAA has contracted for training at O'Hare with a contractor currently providing controller training at en route centers in the United States. This contractor has hired a staff of seven instructors to provide classroom and laboratory instruction at O'Hare. While the instructors are former controllers and supervisors, only three of the instructors have had experience in controlling air traffic at O'Hare. They are currently learning the airspace and FAA procedures for the Chicago area. The contractor is expected to begin classroom instruction at O'Hare in April 1989 and simulator laboratory training by October 1989.

Enhance Simulator Capability

FAA is taking action to improve the capability of training simulators at O'Hare. The present simulators have two major limitations: (1) the limited number of targets and flight plans that can be shown on a display and (2) the time-consuming and labor-intensive process used to build and update scenarios. FAA's technical center is developing a new software program that should significantly increase the simulator's capacity to generate targets and flight plans. However, no firm date has been established for its completion. Most of the equipment required for updating scenarios has been installed. In addition, O'Hare officials are

[5]FAA Staffing: Challenges in Managing Shortages in the Maintenance Work Force (GAO/RCED-87-137, Sept. 25, 1987).

examining available computer-based software packages being used at other facilities to update scenarios.

Simulation equipment is a nationwide problem. In response to a recent GAO questionnaire to the controller work force, more than half of facility managers nationwide responded that the amount of simulation equipment available at their facilities was not adequate.[6] However, FAA plans, as part of its training initiatives, to upgrade simulation capability.[7]

Splitting the TRACON

In November 1988, the O'Hare facility manager made a decision to "sectorize" or divide the radar room (TRACON) into smaller operational sectors. According to facility managers, splitting the TRACON would expedite training by reducing the number of positions on which a controller would need to be certified in order to become a full performance level controller. They said that staffing would also benefit, because the proportion of controllers at full performance level in the TRACON would grow.

Options on how to split the TRACON have been discussed. A study group of O'Hare supervisors, controllers, and union representatives have developed several options, and a final decision is to be made in April 1989.

Equipment Deficiencies

Our analysis of equipment concerns in three areas identified in FAA's Safety and Efficiency Review suggest that the difficulty in replacing aging and obsolete systems at O'Hare is related to National Airspace System (NAS) Plan project delays.[8] Equipment reliability and capability shortfalls—in such air traffic control systems as the TRACON computer and the tower voice switch—are being addressed as part of the long-term modernization projects in the NAS Plan. However, as in the case of new controller displays, replacements will arrive later than expected because of project delays. FAA is now faced with situations in which it

[6]See FAA Training: Continued Improvements Needed in FAA's Controller Field Training Program (GAO/RCED-89-83, Mar. 29, 1989).

[7]FAA's Administrator announced a series of training initiatives in August 1988 aimed at modernizing FAA's training program.

[8]We recently reported on project delays associated with the multibillion dollar NAS Plan. See Air Traffic Control: Continued Improvements Needed in FAA's Management of the NAS Plan (GAO/RCED-89-7, Nov. 10, 1988).

must devise both immediate and interim steps to counter the late delivery of NAS Plan equipment. (App. III provides additional details on how FAA is coping with this problem in three critical areas: controller displays, tower voice-switching system, and TRACON computer software.)

Traffic Management Program in Chicago

In addition to the action plan, FAA initiated a program in October 1988 to further improve O'Hare operations by monitoring and controlling the number of aircraft arriving in Chicago airspace. This program, referred to as the Traffic Management Program, is not related to the action plan, and its purpose is to smooth out the peaks and valleys in Chicago airspace demand. The program controls the number of arrivals into Chicago airspace in 15-minute intervals rather than by the hour. The airlines and FAA have agreed to reschedule flights in accordance with these 15-minute intervals. According to FAA, these controls will continue even after the action plan is fully implemented. (App. IV contains more information on O'Hare's Traffic Management Program.)

Conclusions

FAA is devoting a great deal of effort and attention to improving the operations at O'Hare. FAA's planned actions for staffing should result in increased staffing, and training actions, such as simulator enhancements, should improve O'Hare's capability to train controllers. Similarly, with respect to equipment, FAA's planned actions to add or enhance equipment should improve equipment reliability. However, the impact of these actions will not be known for some time.

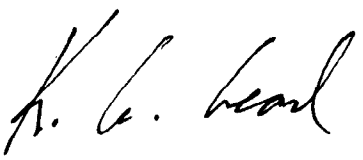
The Traffic Management Program at O'Hare will continue even after the action plan is fully implemented. FAA officials recognize that air traffic at O'Hare must be managed at a level that does not exceed airspace and controller capacity. FAA is working with the airline industry to optimize flight schedules and routes to accommodate as much demand as the air traffic system can safely handle.

Appendix I provides additional information on O'Hare operations and staffing. This report is based on work at FAA's headquarters, Great Lakes region, Chicago area facilities—Chicago O'Hare Airport, Chicago Center, and the Chicago Airway Facilities Sector—and at the NTSB. We also met with industry and National Air Traffic Control Association representatives to discuss their opinions of FAA's proposed actions for O'Hare. We discussed the contents of this report with FAA headquarters officials. They agreed with the information presented, and we have

incorporated their views where appropriate. However, as agreed with your office, we did not obtain official agency comments on the report.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days from the date of this letter. At that time, we will make copies available to the Secretary of Transportation; the Administrator, FAA; and other interested congressional committees. Major contributors to this report are listed in appendix VI.

Sincerely yours,



Kenneth M. Mead
Director, Transportation Issues

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Abbreviations

AAS	Advanced Automation System
ARTS	Automated Radar Terminal System
FAA	Federal Aviation Administration
GAO	General Accounting Office
NAS	National Airspace System
NTSB	National Transportation Safety Board
TRACON	terminal radar approach control

Background Statistics

Table I.1: Growth in Total Airport Operations at O'Hare and Midway, Calendar Years 1987-88

Facility	1987	1988[a]	Percent change
O'Hare			
Commercial[b]	754,807	768,111	2
Other[c]	37,079	34,917	−6
Total	**791,886**	**803,028**	**1**
Midway			
Commercial[b]	148,488	197,065	33
Other[c]	119,610	106,980	−11
Total	**268,098**	**304,045**	**13**

[a]Preliminary data.

[b]Includes air carrier and air taxi.

[c]Includes general aviation and military.

Source: Office of Management Systems, FAA.

Table I.2: Controller Staffing at O'Hare and Midway, 1985-88

Facility	10/1/85 Total/FPL[a]	10/1/86 Total/FPL	10/1/87 Total/FPL	10/1/88 Total/FPL
O'Hare				
TRACON	50/25	50/33	53/38	57/34
Tower	42/29	39/29	38/27	45/27
Midway	18/14	16/14	17/14	22/12

[a]Full Performance Level (FPL) controllers are fully certified to operate all positions within a defined area.

Source: Air Traffic Division, Great Lakes region.

Table I.3: Operational Errors at O'Hare, Calendar Years 1985-88

	1985	1986	1987	1988
TRACON	11	15	9	28
Tower	3	8	3	7
Total	**14**	**23**	**12**	**35**

Source: Air Traffic Division, Great Lakes region.

Table I.4: Increase in Maintenance Technician Staffing at Chicago Airways Facilities Sector, 9/1/88 to 1/31/89

	9/1/88	1/31/89
Total on-board staffing	91	102
Electronic technicians	67	70

Source: Chicago Airways Facilities Sector, Great Lakes region.

1988 Controller Staffing Levels

As of February 28, 1989, Chicago O'Hare International Airport employed a total of 61 full performance level controllers and 44 developmental controllers. In the radar room (or TRACON), only 33 (or 57 percent) of the controllers are at the full performance level. TRACON staffing is also lower than that projected in the model FAA uses to calculate controller staffing requirements. For fiscal year 1989, FAA projected the need for 65 TRACON controllers; as of February 28, 1989, 58 were on-board.

Staffing levels at the O'Hare tower are considerably higher than those projected in FAA's model (staffing standard). Although the staffing standard called for a total of 30 O'Hare tower controllers in fiscal year 1989, O'Hare was authorized 42 and had 45 on-board as of December 31, 1988. As we reported in June 1988, FAA's current staffing standards underestimate requirements for facilities with complex traffic patterns such as the crossing runways at O'Hare.[1] FAA is developing a new staffing standard for terminal facilities.

[1] FAA Staffing: Improvements Needed in Estimating Air Traffic Controller Requirements (GAO/RCED-88-106, June 21, 1988).

Examples of Equipment Problems at O'Hare

The following examples illustrate equipment replacement problems at O'Hare:

- Delayed delivery of replacement controller displays. Radar displays are critical components of a safe air traffic control system because they provide actual depiction of aircraft flying through controlled airspace. At the O'Hare TRACON, there are two types of displays—vertical displays and horizontal displays. Since 1984, TRACON management has identified the need to replace these horizontal displays. An official from the Great Lakes region—to which the TRACON reports—stated that horizontal displays cause fatigue and back problems because controllers must constantly bend over to see targets moving on the display. In addition, he said that horizontal displays also detracted from the concentration of controllers because three controller positions generally shared the same display.

  Horizontal radar displays at the O'Hare TRACON were scheduled to be replaced during consolidation of en route and TRACON facilities. New displays will be provided through the Advanced Automation System (AAS). However, AAS program delays have postponed the initiation of nationwide replacement until 1994. The action plan states that, initially, FAA will secure three vertical displays from the New York TRACON and one used at O'Hare for maintenance purposes. As of the completion of our audit work, FAA has not determined how it would secure the five additional vertical displays it needs at O'Hare. Although FAA was aware of the need to enhance terminal automation, including displays, as early as 1984, no procurement action was developed until recently to acquire interim vertical displays for O'Hare and other TRACONs. Plans are now being developed to provide newer technology displays on an interim basis for larger TRACONs in response to pressing needs caused by the AAS program delay. At this time, FAA cannot estimate when these interim displays will be provided to the O'Hare TRACON.

- Inadequate voice-switching system capability at the O'Hare tower. In the Safety and Efficiency Review, the existing WECO 30A voice-switching system at the O'Hare tower was identified as old and obsolete. The system integrates three separate voice communications subsystems used by controllers to talk with other controllers in the same facility, with controllers in other facilities, and with pilots in aircraft. Failure of the WECO 30A system was identified in FAA's review as creating confusion and additional work load for controllers. In the event of a failure, controllers must remove their headsets and use hand-held microphones and speakers.

Replacement of the WECO 30A was scheduled during the previously described facility consolidation. However, because of the extended date for completing such action—the mid-1990s at the earliest—the action plan indicated that FAA was considering redesigning a smaller voice-switching system initially earmarked for the Detroit TRACON; Detroit would receive another system through a follow-on contract. However, upon further study, FAA altered its strategy. Regional officials stated that AT&T has recently improved its maintenance support and believe this will result in improved system availability. According to these officials, AT&T is rebuilding parts from other WECO 30A systems being removed from service and making them available for the O'Hare system. In addition, the existing voice-switching system is being expanded to enable controllers manning the new vertical displays to communicate with other controllers through additional key switches. This expansion is scheduled to be completed in May 1989. As a result of this new strategy, FAA no longer plans to divert Detroit's system.

- ARTS IIIA software installation delays at the O'Hare TRACON. The Automated Radar Terminal System (ARTS) IIIA computer at the O'Hare TRACON processes data received from surveillance radars and generates targets on the controller's display. The computer is now operating with an interim software version, which cannot make full use of the hardware installed. One of these functions would enable O'Hare to continuously record operational data. This would permit O'Hare to reconstruct events, such as identifying how two planes got closer than standards permit. The Safety and Efficiency Review report stated that the final software version to be installed—version A3.03—would have prevented 1,005 delays that occurred on August 1, 1988, because of its ability to better deal with computer component outages.

  FAA has experienced delays nationwide in its efforts to install ARTS IIIA software. The most recent delay in installing version A3.03 at O'Hare was caused by the agency's decision to first resolve problems it was encountering with the new software version at the Dallas-Fort Worth TRACON. FAA assumed that the software malfunctions present at Dallas-Fort Worth would be repeated at O'Hare since the computers at both locations capture aircraft information from multiple radars and combine the information prior to display to the controller. FAA now believes these software problems have been resolved, and 18 of O'Hare's 23 displays are scheduled to be operational using the new software in April 1989. The other five displays are planned to be operational by November 1989.

Traffic Management Program in Chicago

To further improve O'Hare operations, FAA has initiated other actions to monitor and control the number of aircraft arriving in Chicago airspace. The decision to manage traffic in Chicago by controlling the number of arrivals in 15-minute increments rather than by the hour did not result from the Safety and Efficiency Review. According to FAA headquarters, traffic congestion in Chicago airspace and the number of operational errors at O'Hare (35 in CY 1988) has been a growing concern.

During 1988, total operations at O'Hare airport increased 1 percent from 1987, while operations at Midway Airport, located approximately 13 miles southeast of O'Hare, grew by 13 percent. Midway is now the 19th busiest airport in the country. On October 3, 1988, FAA introduced a traffic management program whose primary goal is to deliver a steady stream of arrivals into Chicago airspace in 15-minute increments for both O'Hare and Midway. The program is intended to relieve the airspace congestion that occurs during peak travel times. For example, on September 26, 1988, 108 flights arrived at O'Hare between 5:00 p.m. and 6:00 p.m.; 71 flights departed. In addition, there is a tendency for air traffic to peak within the first or last 15 minutes of any given hour. For example, 44 flights may be scheduled to arrive at O'Hare at 9:00 A.M, but only 21 are scheduled for 9:15. When FAA announced its traffic management program for Chicago, the hourly arrival goal for O'Hare was set at 80; for Midway, 28. Since that time, FAA has increased the number of hourly arrivals at O'Hare to 85, with about 22 to 23 arrivals every 15 minutes.

Both we and the NTSB have expressed concern about the growing demands placed on the air traffic control system. In a 1986 report and during Senate testimony in 1987, we recommended limitations on the quantity of air traffic in FAA's busiest control sectors at their busiest times.[1] In a 1988 letter to FAA, NTSB said that FAA should establish operational acceptable levels of traffic for 15-minute time periods at O'Hare.

Although FAA initiated the traffic management program after a series of operational errors, both controllers and FAA officials said there is no direct linkage between operational errors and the number of aircraft being monitored by a controller. According to FAA officials, operational errors, systemwide, do not occur at peak traffic periods.

[1] Aviation Safety: Serious Problems Concerning the Air Traffic Control Work Force (GAO/RCED-86-121, Mar. 6, 1986) and NTSB Recommendations (GAO/T-RCED-87-28, May 28, 1987).

The traffic management program has not reduced the number of total daily operations in Chicago, but it has created ground delays for flights destined for Chicago. In the 30-day period prior to October 3, 1988, total operations at O'Hare were 66,052. For the 30-day period immediately after October 3, total operations were 67,390. According to one major carrier, 82 percent of its arrivals into Chicago during September 1988 landed within 15 minutes of their published arrival time. In October, after the traffic management program was initiated, the figure dropped to 75 percent. However, FAA and the airlines are working together to eliminate these delays. In December 1988, all interested carriers servicing the Chicago area met with FAA and agreed to even out the flow of arrivals to O'Hare by rescheduling flights, effective March 1, 1989, using FAA's goal of 22 to 23 arrivals every 15 minutes as a guide. The largest carrier at Midway Airport, Midway Airlines, has also rescheduled flights.

The traffic management program in Chicago is permanent, but FAA officials said there will probably be incremental increases in the hourly capacity as demand is spread more evenly throughout the hour. FAA officials and controllers at O'Hare support continuing traffic management at O'Hare.

Prior GAO Reports on FAA Staffing (September 1987 to September 1988)

FAA Staffing: Recruitment, Hiring, and Initial Training of Safety-Related Personnel (GAO/RCED-88-189, Sept. 2, 1988).

FAA Staffing: Improvements Needed in Estimating Air Traffic Controller Requirements (GAO/RCED-88-106, June 21, 1988).

FAA Staffing: FAA's Definition of Its Controller Work Force Should Be Revised (GAO/RCED-88-14, Oct. 23, 1987).

FAA Staffing: Challenges in Managing Shortages in the Maintenance Work Force (GAO/RCED-87-137, Sept. 25, 1987).

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