U.S. Department of Transportation
Office of the Secretary of Transportation

The Inspector General

Office of Inspector General
Washington, D.C. 20590

December 18, 2000

The Honorable John McCain
Chairman, Committee on Commerce,
Science, and Transportation
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The Inspector General was invited to testify this past November before the Committee on Commerce, Science, and Transportation, Subcommittee on Aviation, on the Federal Aviation Administration's (FAA) efforts to modernize the National Airspace System and recent air traffic control equipment outages. This hearing was postponed to a later date. We are providing the substance of our testimony for your information and use in preparing for the upcoming year. Our observations focus on (1) flight delays and cancellations, (2) recent air traffic control outages, and (3) what level of relief the air traffic control modernization effort will provide.

As you well know, there is no single solution to the growing problem of delays and the resulting consumer concern over air travel. Solutions to these problems rest on a multifaceted approach that includes, among other things, new air traffic control technology, airline scheduling, airspace redesign, and infrastructure improvements (new runways). A range of market based solutions, including peak hour pricing, are also under consideration. However, important questions remain unresolved regarding the true causes of delays and the level of air traffic the Nation's top airports can safely and efficiently accommodate.

Earlier this month, the President directed FAA to reorganize its air traffic services into a results-oriented organization, sometimes referred to as a performance-based organization. In moving forward, a number of actions need to be taken by the Department and FAA that include:

- Developing a common system for tracking delays and cancellations, and their causes. The Department, FAA, and the airlines lack consistent and complete data on delays and cancellations. Last month, a Task Force—comprising representatives of the Department, airlines, and consumer groups—issued an

interim report[1] to the Secretary that aimed to improve the reporting process. While this is an important first step, considerable work remains to refine the details and implement a more useful reporting system. Meaningful discussions on the source and extent of the growing delay problem—and potential solutions—cannot take place without better information.

- Establishing capacity benchmarks for the Nation's top 30 airports. A set of capacity benchmarks is essential to understand what traffic load the air traffic control system can safely handle in the near and long term and to assess the impacts of airline scheduling practices. FAA has made good progress in establishing capacity benchmarks for six airports and expects to complete benchmarks for the remaining airports in January 2001.

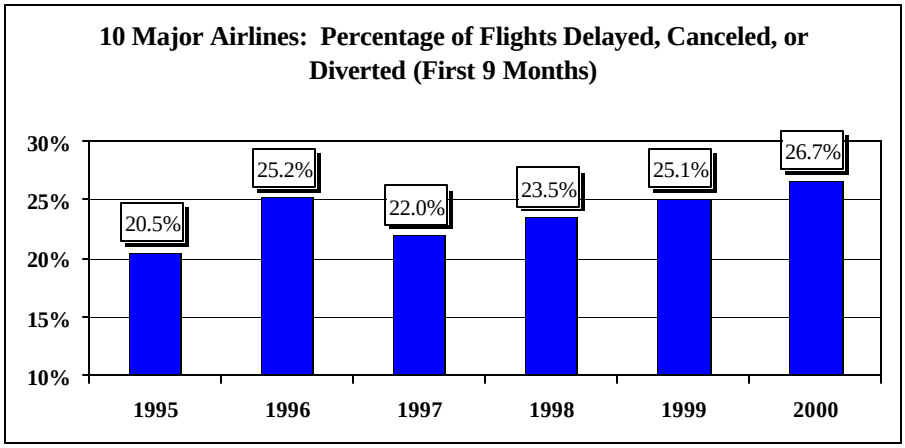
- Definitizing plans to replace the Host computer software at the Nation's en route air traffic control facilities. Last year, FAA replaced the Host computer processor at the Nation's en route centers on time and within budget, but most of the software still needs to be replaced. A series of equipment outages this past October were not caused by new Host hardware—rather, other equipment, Host software anomalies, or operator errors caused the outages. The outage in Los Angeles on October 19, 2000, shows the complexity and paralyzing effects of Host software failures on the National Airspace System. A clear-cut strategy for replacing Host software is important to ensure the overall maintainability of the Host system and for implementing new technologies planned for Free Flight.

- Clarifying the benefits from investments in new air traffic control technologies. This is important because a sizeable portion of FAA's ongoing modernization effort is geared to improve the safety and reliability of the National Airspace System—not to enhance capacity. Moreover, key efforts, such as transitioning to satellite navigation and data link communications, require considerable investments by both FAA and airspace users. Investments in new technology must also go hand in hand with infrastructure improvements (i.e. runways). Thus far, FAA's work to develop capacity benchmarks shows that the surest way to increase capacity is to build new runways.

[1] Interim Report to the Secretary of Transportation: Categories of Cancellation and Delay for Air Carrier On-Time Reporting, November 29, 2000

Flight Delays and Cancellations

Airline delays and consumer dissatisfaction are at an all-time high. For the first 9 months of this year, over 1 in 4 domestic flights—affecting approximately 119 million passengers—were delayed, canceled, or diverted, with the average delay exceeding 50 minutes. The following figure illustrates the growing percentage of domestic flights delayed, canceled, or diverted over the last 6 years.



Source: Bureau of Transportation Statistics

One cause of this increase is the continued growth in air traffic, which has come to exceed available airport and airspace capacity at some locations. This is particularly the case for LaGuardia airport, where the increases in air traffic have been met with even greater increases in delays. For example, between September 1999 and September 2000, the airlines reported an 11 percent increase in domestic flights at LaGuardia and an 82 percent increase in departure and arrival delays. In response, a lottery was held to limit flight operations at LaGuardia as an interim solution to relieve congestion and delays. The changes resulting from this lottery will take effect on January 31, 2001.

Over the past year, the Secretary and FAA have announced a number of initiatives to address the increase in flight delays and cancellations, including the Spring/Summer 2000 initiative for managing air traffic. These actions have the potential to make inroads in the delay problem. However, the potential contributions that can be made by these initiatives will be greatly constrained until the Department develops: (1) a uniform system for tracking delays and cancellations, and their causes; and (2) benchmarks for measuring capacity of the Nation's air traffic control system and airports.

In July 2000, we reported on the major differences in the methodologies used by FAA and the Bureau of Transportation Statistics (BTS) to determine flight delays.[2] For example, FAA tracks delays on the runway and airborne (en route and arrival). BTS tracks delays at the departure and arrival gates. As a result, the delay numbers reported by the two organizations tend to differ greatly.

We also reported on the lack of consistent and complete causal data on delays and cancellations. Overall, the lack of consistent, uniform data on delays and cancellations, and their causes has only fueled the ongoing debate within the aviation community as to the source and extent of the growing delay problem. To date, a task force—comprising representatives of the Department, airlines, and consumer groups—issued an interim report to the Secretary that aimed to improve the reporting process with respect to airline data submissions and the establishment of general causal categories, but considerable work remains.

A set of capacity benchmarks at the Nation's top 30 airports is essential to determine what traffic load the air traffic control and airport systems can reasonably be expected to accommodate—in the near term (over the next l or 2 years), the intermediate term (4 or 5 years), and the long term (8 to 10 years). Establishing benchmarks is critical to understand the true impact of airline scheduling practices and what relief can reasonably be provided using the funding made available in the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR-21). Since we testified before your committee in September 2000,[3] FAA has completed benchmarks for six airports, and projects that the remaining benchmarks will be completed some time in January 2001.

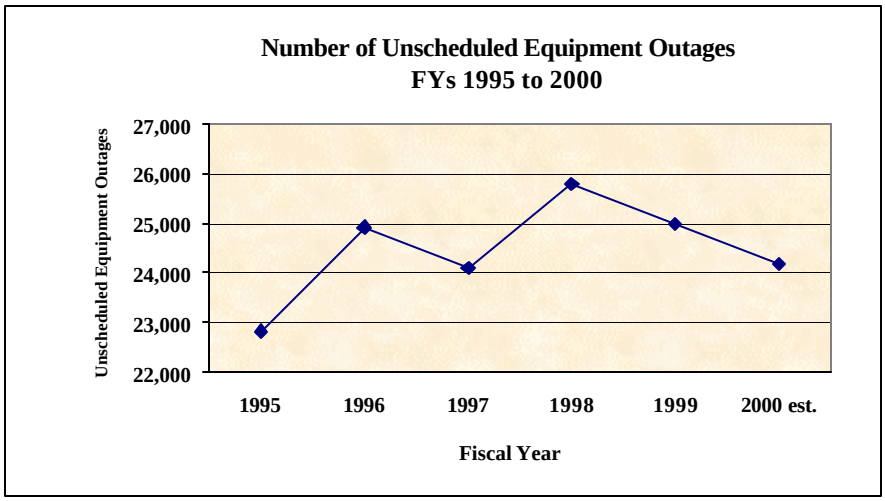
Air Traffic Control Equipment Outages

Unscheduled equipment outages of mission critical air traffic control systems, such as the rash of computer failures this past October, can have paralyzing effects on the National Airspace System and create major inconveniences to the traveling public. When unscheduled outages occur during peak travel times, such as early morning and afternoon, they can create ripple effects felt nationwide. Yet, as discussed earlier, we do not know the full impact of these outages because the Department, FAA, and the air carriers lack a common system to track delays.

Fortunately, the number of unscheduled equipment outages has declined over the past 2 years, some of which can be attributed to FAA's efforts to replace aging hardware, such as the Host computer. As shown in the chart below, the number of

[2] Audit Report No. CR-2000-112, Air Carrier Flight Delays and Cancellations, July 25, 2000.
[3] Inspector General's Statement before the Committee on Commerce, Science, and Transportation, U.S. Senate, "Flight Delays and Cancellations," September 14, 2000.

unscheduled equipment outages has decreased during the last 2 years but still exceeds the 1995 level.



Source: Federal Aviation Administration

Failure of mission critical equipment can create havoc for the flying public, depending on the time of day. For example, during a 12-day period from October 19 through October 31, 2000, FAA reported five equipment outages at FAA en route centers – three of the outages were attributed to the Host computer. The Host computer is a mission critical system that represents the nerve center for en route air traffic control because it receives, processes, and tracks all aircraft movement at high altitude.

While there have been several recent equipment outages, none of these outages were caused by newly installed Host hardware. Rather, they were caused by other equipment, Host software anomalies, or operator errors, as shown below.

FAA Equipment Outages From October 19 through October 31, 2000

Date	Location	Duration	Cause	Delays from the Outage	Total FAA Delays Reported That Day
10/19/2000 9:00 PM CDT	Ft. Worth	4 hours and 57 minutes	Display System Replacement Circuit Card	2	2,096
10/19/2000 6:50 AM PDT	Los Angeles	3 hours and 18 minutes	Host Software Error	766	2,096
10/21/2000 12:05 AM EDT	Boston	2 hours and 10 minutes	Operator Error Affecting Host	0	659
10/23/2000 5:05 AM PDT	Oakland	2 hours and 56 minutes	Operator Error Affecting Host	255	1,738
10/31/2000 4:05 PM EST	Indianapolis	6 hours and 55 minutes	Power Conditioning System Problem*	945	1,855
TOTAL				1,968	6,348

*The Indianapolis outage was caused by a power failure created when the backup power system did not work.

Three of five serious outages led to 1,966 delays, which are discussed below.

- On October 19, at 6:50 AM Pacific Daylight Time, the Host computer failed at the Los Angeles Center after a new software upgrade was installed. This failure resulted in aircraft ground stops at Los Angeles International Airport. After more than 3 hours, FAA specialists installed the previous software version and operations were restored. According to FAA, this outage resulted in 766 flight delays, excluding BTS reported gate delays[4] or cancellations that may have occurred due to this outage.

- A second Host outage occurred in Oakland on October 23, 4 days after the Los Angeles outage. The Oakland Center tested a Host software upgrade during a scheduled shutdown. At 5:05 AM, the original program was reloaded, but incorrect keyboard commands were used and the Host computer failed to properly restart. According to FAA, this outage resulted in 255 flight delays. After this outage, FAA invoked a moratorium on software changes to air traffic control systems nationwide.

- Indianapolis Center operations were shutdown on October 31, at 4:05 PM, 8 days after the Oakland outage, with a power failure because of a voltage overload. The power failure shut down communications, radar, computer displays, and the Host system. FAA switched to engine generators to restore power after the uninterruptible power supply failed. The cause of this failure is still under investigation. Power was restored by 11:00 PM. FAA reported 945 flight delays from this outage.

Last year, FAA replaced the Host computer processor at 20 en route centers and 3 oceanic and offshore sites on time and within budget. However, most of the Host software, which is written in old software programming language, still needs to be replaced. We reported earlier this year[5] that FAA needed to follow-through on several initiatives to address Host outages, including correcting Host software errors that had previously caused Host outages, providing refresher training to system operators, and replacing aging peripheral equipment (i.e., tape drives, printers, and storage devices). While FAA has taken some actions, FAA still needs to complete its plans to replace aging peripheral equipment and move forward to replace aging Host software.

[4] A gate delay occurs when a flight departs or arrives more than 15 minutes after the scheduled departure or arrival time.

[5] Audit Report No. AV-2000-042, Status Review of the Host and Oceanic Computer System Replacement Program, February 4, 2000.

Air Traffic Control Modernization

There is considerable confusion regarding what can be expected from the modernization effort in terms of enhancing capacity and reducing delays. As we testified earlier this year, it is important for FAA to clarify the impact of its investments in new technologies on enhancing capacity, given the anticipated growth in air travel in the years ahead.

Given the framework of AIR-21, FAA will invest about $9 billion on various air traffic control modernization initiatives between 2001 and 2003. A large portion of FAA's ongoing modernization effort is geared toward improving safety and reliability—not toward enhancing capacity.

Key efforts to enhance the overall reliability of the National Airspace System include the Standard Terminal Automation Replacement System, the Display System Replacement, and the Host Replacement, which currently account for $3 billion. There have been some successes with these efforts, and much of the hardware at the Nation's 20 en route centers is new.

FAA's Free Flight Phase 1 initiative, with an estimated cost of over $700 million, is now the agency's key effort for enhancing capacity in the near and intermediate term. Free Flight Phase 1—a limited deployment of new systems—is scheduled for completion in 2002. While Free Flight Phase 1 will provide incremental improvements in capacity at selected locations, it should not be viewed as a magic bullet.

FAA's recent experience with Free Flight Phase 1 technologies in airspace surrounding Dallas-Ft. Worth airport has shown that when incremental improvements are made, demand quickly fills in additional capacity. These small improvements in capacity coupled with unconstrained demand will likely lead to additional delays.

New communication, navigation, and surveillance technologies, which offer the potential for more flexible routes and closer spacing of aircraft, are longer term solutions. These efforts include transitioning to satellite navigation (i.e., Wide Area Augmentation System and Local Area Augmentation System) and Controller-Pilot Data Link Communications. FAA is pursuing data link communications, which is analogous to electronic mail for controllers and pilots, to, among other things, ease radio frequency congestion.[6] The implications of

[6] Audit Report No. AV-1999-057, FAA's Progress and Plans for Implementing Data Link for Controllers and Pilots, February 24, 1999.

radio frequency congestion in enhancing capacity—and potential solutions—warrant much closer attention in the next year.

In the last several months, there have been reports from both the Boeing Company and the National Aeronautics and Space Administration (NASA) about initiatives to address the Nation's congestion and delay problems. Boeing reportedly will focus on linking space- and ground-based systems into a new air traffic management architecture, while NASA will build on its automation work (for both pilots and controllers) and simulation technologies. These concepts have merit, but they will not provide relief in the near term, and the details and financial resources required to execute them have not yet been worked out.

Investments in new technology must go hand in hand with infrastructure improvements—new airports and runways. While new technology has potential, the largest increase in capacity will come from building new ground infrastructure. The role played by new runways and airports (and the airlines that use them) is of enormous importance. Between 1991 and 1999, a total of 5 new runways were added at the 29 largest airports, and another 15 are either under construction or proposed. This excludes, of course, the completion of the new Denver Airport. As illustrated by the Mid-America Airport in St. Louis, establishing a new commercial airport does not guarantee it will be used. It may sit idle, even when the local community wants it to be used. This underscores why the Federal role in coordinating infrastructure improvements needs to be examined.

Key Actions Need To Be Taken

At this juncture, a number of actions need attention.

- First, the Department needs to establish a common system for counting delays, cancellations, and their respective causes. As we reported in July 2000, the Department maintains several data systems that have little in common with respect to how delays are measured or what causal information is maintained.

  The need for complete and consistent data was further reinforced by Congress in AIR-21. This Act directs the Secretary of Transportation to modify existing regulations governing the air carrier data submissions to DOT ". . . to disclose more fully to the public the nature and source of delays and cancellations experienced by air travelers." On November 29, 2000, a task force comprising representatives of DOT, airlines, and consumer groups, issued an interim report to the Secretary of Transportation that aimed to improve the reporting process with respect to airline delay data submissions and the establishment of general causal categories, but considerable work remains. Until consistent causal data are available, examining the causes of delays and identifying effective long-term solutions will remain problematic.

- Second, there is a need for capacity benchmarks for the Nation's largest airports. As we reported to your Committee in September, establishing capacity benchmarks is central to understanding the true impacts of airline scheduling and what relief can be realistically provided by the air traffic control modernization effort, new procedures, and new ground infrastructure. The Secretary, the task forces recently commissioned by him, FAA, the Congress, and the airlines must have this information to get at the core issues. Without it, our ability to understand the impact of flight volume on flight delays and cancellations, and, in turn, to make informed decisions is severely constrained.

  The FAA Administrator is committed to developing these benchmarks, but their development has taken longer than previously anticipated. Before your committee on September 14, 2000, the FAA Administrator stated that the benchmarks would be completed in a month or so. As noted earlier, FAA has made good progress to establish capacity benchmarks for 6 airports and expects to complete benchmarks for the remaining 24 airports in January 2001.

- Third, FAA needs to definitize plans to replace Host computer software at the Nation's en route air traffic control facilities. In September 1999, FAA replaced the Host main computer processor at 20 en route centers and 3 oceanic and offshore sites on time and within budget. However, most of the older software programming code remains intact and needs to be replaced. Old Host software programming language places limits on FAA's ability to accommodate growth and potential improvements in system capacity planned for Free Flight. FAA needs to move forward and replace aging Host software.

- Fourth, FAA needs to clarify the benefits from its investments in new technology for modernizing the National Airspace System. This is particularly important for various Free Flight initiatives as well as new systems for detecting, predicting, and recovering from adverse weather. FAA is collecting data but it will not have a good handle on the benefits of Free Flight Phase 1 technologies (principally new automated controller tools) until 2002, when systems are fully deployed. We note that realizing the full benefits from new technologies depends on new procedures as well as airspace redesign efforts.

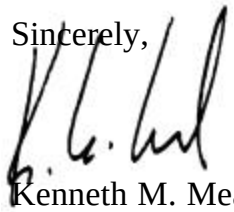
  Moreover, obtaining benefits from new communications, navigation, and surveillance technologies envisioned for Free Flight in terms of reduced flight times and more flexible routes depend on synchronized investments by FAA (in new ground systems) and airspace users (new avionics). As we have previously noted, the true nature and extent of benefits of these cutting edge technologies have not been conclusively quantified. FAA needs to continue to work with airspace users to get a better understanding of the expected benefits

of new technologies, how diverse users (i.e., general aviation or commercial air carriers) will benefit, and what it takes to obtain benefits.

FAA's work thus far on capacity benchmarks (and impacts of anticipated improvements) for six airports shows that the surest way to enhance capacity is to build new runways. However, it can take years for an airport to complete the process because of environmental and local concerns. A lack of funding for new runways is not the issue—AIR-21 will provide $9.9 billion in airport improvement funds from 2001 through 2003. A key question over the next several years will focus on whether FAA, or any other Federal agency, should move from a passive role (distribution of grant funds) to a more active one of facilitating a strategic view of airport expansion and resolving local concerns.

I would be glad to discuss these issues at your convenience. Please feel free to call me on (202) 366-1959 or my Acting Deputy, Todd Zinser, on (202) 366-6767.

Sincerely,



Kenneth M. Mead
Inspector General

cc: FAA Administrator