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# Reforming the Federal Aviation Administration: Lessons from Canada and the United Kingdom

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IBM Center for
The Business of Government

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TRANSFORMATION SERIES

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# FOREWORD

On behalf of the IBM Center for The Business of Government, we are pleased to present this report, "Reforming the Federal Aviation Administration: Lessons from Canada and the United Kingdom," by Clinton V. Oster, Jr.


Albert Morales

Over the next 20 years, the Federal Aviation Administration (FAA) will face changes to its scope and methods of service delivery. The volume of air traffic control activity is projected to increase dramatically in this period. In addition, substantial technological improvements are needed to FAA's air traffic control infrastructure that is responsible for accommodating this larger traffic volume, while also supporting FAA's continued drive toward increased air safety. These challenges will require substantial capital investment to maintain the air traffic control system's capacity and technological currency.

The increased volume of air traffic and the availability of new technologies are predictable and, therefore, can be planned for. Of larger concern are the less predictable issues of governance and sources of funding. The nation's air traffic management system serves a diverse group of stakeholders with varied, and sometimes conflicting, interests. As a branch of the federal government, the air traffic management system is subject to political direction, and this has at times diffused accountability for the system.


John Kamensky

Closely tied in with governance issues is the challenge of funding major capital investments. In this important report, Professor Oster examines air traffic control systems in Canada and the United Kingdom to see whether their experience with funding capital investments might be applicable to the United States. Both Canada and the United Kingdom have converted to private sector operating models for their air traffic control systems.

The current method of funding the air traffic management system in the United States has proven more volatile in behavior than the related cost structures, leading to swings in funding gaps or surpluses. This mismatch of funding and costs, compounded by the requirement for a substantial capital investment to maintain the system's effectiveness and safety, has increased the likelihood of a crisis in major capital funding for the U.S. air traffic management system.

This report explores the key issues facing FAA and describes the alternative models being used by Canada and the United Kingdom. By evaluating their successes and challenges, Professor Oster provides valuable information and insights that we trust will be helpful in the forthcoming debate over alternative air traffic management models for the United States.

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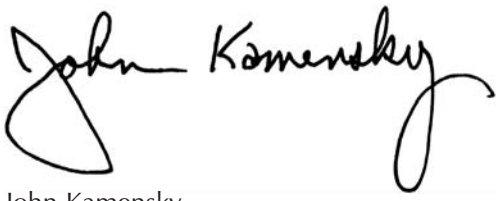

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# EXECUTIVE SUMMARY

Delivering air traffic control services was for many years the exclusive province of government. Historically, most countries provided air traffic control through civil aviation departments operated with annual budget appropriations from the central government. More recently, in over 30 countries, most notably Canada and the United Kingdom, air traffic control is being provided by autonomous authorities operating on market-based principles with considerable managerial discretion and funded by fees collected for the services they provide. In the United States, the Federal Aviation Administration (FAA) remains a government agency and faces serious problems both in operating the air traffic control system and particularly in making the productive, long-term capital investments necessary for that system to accommodate the anticipated growth in aviation. This report compares the experiences of FAA in the United States, NAV CANADA in Canada, and National Air Traffic Services (NATS) in the United Kingdom in terms of their ability to manage their air traffic control systems in the face of changing traffic volumes and travel patterns and their ability to manage and finance modernization and long-term capital investments.

The problems facing FAA have been recurring themes for decades. For nearly 20 years, a series of special commissions have called for reforms in how FAA is funded, organized, and managed. While most of the reforms have not been enacted, there have been changes including a fixed five-year term for the FAA administrator and more flexible personnel and procurement systems. Most recently, the air traffic control operations and the investment in facilities and equipment have been brought together in FAA's Air Traffic Organization, or ATO.

The ATO may be an important step in improving air traffic control in the United States, but formation of the ATO did not respond to three fundamental challenges that, unless addressed, will severely hinder both management of the air traffic control system and efforts to modernize it to keep pace with the anticipated growth in aviation:

- Air traffic control funding has a fundamental disconnect between the factors that drive the costs of providing the services and the factors that drive the revenues used to provide the financial support.
- Air traffic control modernization programs continue to be hampered by the poor performance and high costs of capital investment programs.
- Air traffic control lacks organizational independence, which prevents resources from being used in the most effective ways and which also results in self-regulation of the air traffic control system.

NAV CANADA and NATS are examples of two different types of autonomous authorities. While these two organizational forms are quite different, they share the characteristic that both have overcome the fundamental challenges that remain with FAA. Both are financially solid organizations that are better positioned than FAA not only to modernize to meet the growing needs of their own airspace, but also to extend their provision of various air traffic management services to other parts of the world.

# Introduction

Delivering air traffic control services, including the accompanying communications, navigation, and surveillance services, has long been the exclusive province of government. Historically, most countries, including the United States, provided air traffic control through civil aviation departments operated with annual budget appropriations from the central government. Starting in 1987, when Airways Corporation of New Zealand was formed as a stand-alone State-Owned Enterprise, governments in many countries began to reassess how air traffic control might be provided. As a result, in many countries, air traffic control is now provided by autonomous authorities operating on market-based principles with considerable managerial discretion and funded by fees collected for the services they provide. More than 30 countries have implemented major organizational and financial reforms to operate as autonomous air traffic control providers. Together, these organizations provide about 40 percent of the world's air traffic control services. Notable among the countries that have introduced significant reforms are Canada, the United Kingdom, Germany, Australia, and New Zealand.

Of particular importance to the United States are the changes enacted by Canada in 1996 and by the United Kingdom in 2001, which are quite distinct from each other and also quite distinct from recent changes in the United States. These countries' air traffic control systems share similar challenges and operating environments. Taken together, they jointly administer air travel across the North Atlantic, the busiest international air travel corridor in the world.

FAA has long been criticized by the U.S. Government Accountability Office (GAO), the inspector general of the U.S. Department of Transportation (DOT), and numerous special study commissions for both management shortcomings and its consistent inability to complete capital investment projects on time and within budget.[1] In February 2004, FAA's air traffic control function was reorganized into the Air Traffic Organization (ATO), a "performance-based organization," and a chief operating officer was appointed. The new organizational structure sought to break some of the existing "stovepipes" and bring together the key organizational units responsible for both the management and the modernization of air traffic control services. This reorganization, however, was largely a realignment of the reporting lines of some existing branches within FAA. The ATO remains an agency within a civil aviation department funded by annual budget appropriations from Congress. Thus, there is still not a direct financial link between the ATO and the customers who use its services. The ATO still faces a multi-billion-dollar shortfall between projected funding and modernization needs. It cannot manage its revenue through a fee structure and continues to have poor performance and high costs in its capital investment programs. Perhaps, most importantly, political considerations are still a major part of the ATO management and decision-making process.

Of all the air traffic control organizational restructurings in the world, Canada's has been the most dramatic. On November 1, 1996, the responsibility for Canada's air traffic control system and facilities was transferred from Transport Canada, part of the Canadian federal government, to a private company, NAV CANADA, for C$1.5 billion (Canadian). NAV CANADA provides airlines and aircraft owners and operators with air traffic control, flight information, weather briefings, airport advisory services, and electronic aids to navigation. NAV CANADA's revenue comes from the fees it charges users for these services. The company's safety performance is regulated by Transport Canada.

NAV CANADA was the first private sector company in the world to use a non-share capital structure to commercialize a national government service. Governance and management are in the hands of a stakeholder cooperative with a board designed to represent various constituencies—airlines, government, passengers, labor unions, general aviation, and airports. NAV CANADA is the second largest air traffic control system in the world (after the United States), with annual revenues of slightly less than C$1 billion. At inception, the payment to the Canadian government and subsequent financing needs led NAV CANADA to borrow heavily. This leveraged structure was particularly vulnerable in the wake of the industry downturn and the fallout from September 11 and the outbreak of Severe Acute Respiratory Syndrome, or SARS. NAV CANADA has also had to grapple with the effects of the bankruptcy of Air Canada, its largest customer.

In the United Kingdom (UK), National Air Traffic Services (NATS) provides en route air traffic control for the UK and part of the North Atlantic. NATS also provides air traffic control services at 14 British airports including Heathrow, Gatwick, Stansted, Birmingham, Manchester, and Glasgow. NATS handles more than 2 million flights annually, carrying over 160 million passengers. Its revenues come from fees charged to users for these services. The British model is different from Canada or the United States in terms of ownership, governance, and regulation. NATS is a public-private partnership between the Airline Group, a consortium of seven UK airlines that together hold 42 percent of the ownership; NATS employees, who hold 5 percent; the UK airport operator BAA plc, which holds 4 percent; and the British government, which holds 49 percent and a "golden share," giving it a super-majority on major decisions. The Airline Group consists of British Airways, bmi British Midland, Virgin Atlantic, Britannia, Monarch, easyJet, and Airtours.

The Civil Aviation Authority of Britain has responsibility for both economic and safety regulation, and must approve most changes in fees, services, and financing. Among the most important differences from NAV CANADA are the role of the government as owner and the degree to which regulatory oversight shapes incentives and flexibility. While the traffic declines in 2001–2002 were not as severe as in the United States or Canada, NATS was forced into a prolonged and contentious financial restructuring. The recovery plan includes a major financial restructuring of NATS,

## Abbreviations and Acronyms

| | |
|---|---|
| ANS | air navigation system (Canada) |
| ARTCC | Air Route Traffic Control Center (U.S.) |
| ATC | air traffic control |
| ATO | Air Traffic Organization (part of FAA) |
| CAA | Civil Aviation Authority (UK) |
| CAATS | Canadian Automated Air Traffic System |
| CAB | Civil Aeronautics Board (U.S.) |
| DOT | U.S. Department of Transportation |
| FAA | U.S. Federal Aviation Administration |
| FIR | Flight Information Region (UK) |
| GAO | U.S. Government Accountability Office |
| IATA | International Air Transport Association |
| ICAO | International Civil Aviation Organization |
| IFR | instrument flight rule |
| ILS | instrument landing system |
| MMC | Monopolies and Mergers Commission (UK) |
| NAS | National Airspace System (U.S.) |
| NATS | National Air Traffic Services (UK) |
| NERL | NATS En Route Ltd (UK) |
| PBO | Performance-Based Organization |
| PPP | public-private partnership |
| RPI | retail price inflation (UK) |
| TRACAB | Terminal Radar Approach Control in the Tower Cab facility |
| TRACON | Terminal Radar Approach Control facility |
| VFR | visual flight rule |

the injection of £130 million of new shareholder capital from the government and BAA, an additional £200 million of cost savings, and protection against significant loss of revenues due to falls in air traffic.

The recent experiences of FAA, NAV CANADA, and NATS provide an opportunity to compare how these different approaches to delivering air traffic control services have fared in a challenging and largely unanticipated environment. The sharp drops in air traffic in the wake of September 11 were compounded by the recession, which had started in early 2001, and the reduction in international travel because of concerns about SARS. For NATS and NAV CANADA, these drops in air travel had a much larger impact on revenues from fees than on the costs of providing the service. NAV CANADA, for example, saw a 10 percent drop in traffic during fiscal year 2001–2002. While FAA is funded through government appropriations rather than user fees, much of the funding comes through the ticket taxes paid to the Airport and Airway Trust Fund. In April 2001, trust fund revenues for 2003 were forecast to be $12.9 billion. In fact, they turned out to be only $9.3 billion. Thus, all three organizations found their financial or budget environment changed, albeit in different ways and with different managerial implications.

An overriding characteristic of delivering air traffic control services is that both the patterns of demand for the services and the most efficient methods and technology for providing those services are frequently changing. A critical question for the United States is whether a different organizational structure for providing air traffic control services, with corresponding differences in management freedoms, might be better suited to adapt to these changes. In February 2005, when the ATO proposed to close control towers between midnight and 5:00 a.m. at 48 lightly used airports, the reaction from the U.S. representatives of the districts where these airports were located was immediate, strongly negative, and seemingly unrelated to whether those services were needed or even used. Conversely, when NAV CANADA undertook a level of service review[2] in 2003, the impetus for the review was from users. When the study was completed in October 2004, decisions, jointly made by NAV CANADA and the users of air traffic control services, included the outright closure of a control tower, several flight service stations, and 23 contract weather offices, yet there was neither an adverse political reaction nor any attempt to reverse the decisions. Beyond the differences in political influence, the entire management decision process appears to have been much different in the two organizations. NATS also plans to consolidate the number of air traffic control facilities and will likely face a third different management environment.

This report compares the experiences of FAA, NAV CANADA, and NATS in terms of their ability to manage their air traffic control systems in the face of changing traffic volumes and travel patterns. The report also examines the ability of each organization to manage and finance modernization and long-term capital investments.

A third important dimension of the performance of each of these organizations is their ability to maintain high levels of safety and reliability. In the course of the study, however, it quickly became clear that all of the available evidence suggests that the three organizations have been able to maintain extremely high levels of safety in their air traffic control operations and that in the case of both NAV CANADA and NATS, the transition to a new organizational structure has not been accompanied by any deterioration in the safety performance of the air traffic control systems that they manage. Thus, the safety issue will not be addressed in the remainder of the report.

The first part of this report provides an overview of FAA and the three fundamental challenges it faces as it looks to meet the current needs of the aviation industry and to modernize for the future. It also examines the reforms in Canada and the United Kingdom and how the reforms addressed these challenges. Then it assesses the options for reform in the United States. The sections that follow examine each of the three air traffic organizations in greater depth.

# Part I:
# Reforming the Federal Aviation Administration

# Reforming the Federal Aviation Administration

## The Need for Reform and the Three Challenges

Throughout the world, the task of ensuring safe operations of commercial and private aircraft falls on the air traffic control system. An air traffic control system must coordinate the movements of aircraft both in the sky and on the ground, keep them at safe distances from each other, direct them during takeoff and landing from airports, direct them around bad weather, and ensure that traffic flows smoothly with minimal delays. The United States has the largest air traffic control system in the world and handles an average of nearly 50,000 flights each day. These flights are handled 24 hours a day, seven days a week, by over 20,000 air traffic controllers and technicians in over 600 facilities using over 70,000 pieces of equipment to monitor over 17 million square miles of airspace. Safety is the paramount concern in air traffic control, since a single mistake or failure in the system can cause the collision of two aircraft, resulting in hundreds of deaths.

Delivering air traffic control services, including the accompanying communications, navigation, and surveillance services, has until recently been the exclusive province of government. Historically, most countries, including the United States, provided air traffic control through civil aviation departments operated with annual budget appropriations from the central government. Starting in 1987, when Airways Corporation of New Zealand was formed as a stand-alone State-Owned Enterprise, some governments began to reassess how air traffic control might be provided. As a result, in many countries air traffic control is being provided by autonomous authorities operating on market-based principles with considerable managerial discretion and funded by fees collected for the services they provide. More than 30 countries have implemented major organizational and financial reforms to operate as autonomous air traffic control providers. Together, these organizations provide about 40 percent of the world's air traffic control services. Notable among the countries that have introduced significant reforms are Canada, the United Kingdom, Germany, Australia, and New Zealand.

In the United States, the Federal Aviation Administration provides air traffic control as a civil aviation department operated with annual budget appropriations from the central government. FAA faces serious problems both in operating the air traffic control system and particularly in making the long-term capital investments necessary for that system to accommodate the anticipated growth in aviation. FAA has long been criticized by the U.S. Government Accountability Office (GAO), the inspector general of the U.S. Department of Transportation, and numerous special study commissions for both management shortcomings and FAA's consistent inability to complete capital investment projects that meet the original specifications, on time and within budget.[3]

The problems facing FAA are not new, but have been recurring themes for decades. For nearly 20 years, a series of special commissions have called for reforms in how FAA is funded, organized, and managed. While the most far-reaching of these reforms have not been enacted, there were some changes in the mid-1990s including a fixed five-year term for the FAA administrator and more flexible personnel and procurement systems. Most recently, in 2004, both the air traffic control operations and the investment in facilities and equipment portions of FAA have been brought together in a single branch of FAA called the Air Traffic Organization, or ATO. Some

potentially important changes have been brought about by the ATO, including the development of performance metrics and the setting of operational goals based on those metrics, as well as the continuing development of a cost accounting system to allow a better understanding of the costs of providing various services.

While the ATO may be an important step in improving air traffic control in the United States, the formation of the ATO did not respond to three fundamental challenges that, unless addressed, will severely hinder both management of the air traffic control system and efforts to modernize it to keep pace with the anticipated growth in aviation:

- Air traffic control funding has a fundamental disconnect between the factors that drive the costs of providing the services and the factors that drive the revenues used to provide the financial support.
- Air traffic control modernization programs continue to be hampered by the poor performance and high costs of capital investment programs.
- Air traffic control lacks organizational independence, which prevents resources from being used in the most effective ways and which also results in self-regulation of the air traffic control system.

## Disconnect in Funding

The first challenge is that FAA's funding continues to have a disconnect between factors that drive the costs of the system and the factors that drive the revenues used to provide most of the financial support for the system. Under the current arrangements, when the costs increase, the revenues don't necessarily follow. The costs of the air traffic control system are driven by the number of aircraft that the system must handle, but most of the revenues that support the system are driven by the total amount that passengers pay for airline tickets. If the average number of passengers per airplane changes or if ticket prices change, then changes in the revenue available to support the service may not reflect changes in the cost of providing the service.

Some of FAA's funding comes from the General Fund, but most of it comes from the Airport and Airway Trust Fund. The main source of revenue for the General Fund is the individual income tax. The main source of revenue for the trust fund is a 7.5 percent excise tax applied to the price of passenger airline tickets. Throughout the first two decades of the trust fund, average aircraft sizes were increasing, particularly with the spread of wide-body aircraft. As a result, ticket tax revenue per aircraft operation increased, which worked in favor of helping trust fund revenues keep pace with the cost of providing air traffic control service.

Recent changes have not been favorable for air traffic control funding. The spread of operations of low-fare carriers such as Southwest has resulted in more passengers traveling on low fares, so that the tax revenue per passenger has declined. A jet aircraft operated by Southwest Airlines generates less ticket tax than the same-sized jet operated by a legacy airline charging higher fares. However, both jets impose the same workload on the air traffic control system irrespective of the fares paid by passengers. Thus, the growth of low-fare airlines has resulted in less revenue per aircraft operation but has not reduced the air traffic control costs of handling those operations. Compounding this trend has been the rapid growth in the use of small 30- to 50-passenger regional jets. Even at similar ticket prices, a regional jet generates far less revenue per flight than a larger jet, but imposes the same air traffic control costs. The reliance on an excise tax on tickets has created a mismatch between the primary driver of revenues, passenger ticket revenue per plane, and the primary driver of costs, the number of airline operations. The DOT inspector general found that while air traffic levels continue to show improvement from the sharp declines that began early in 2001, the expected trust fund revenues have not materialized because of these two effects.

The disconnect between cost drivers and revenue drivers is not confined to commercial airline operations. For cargo and mail, a similar problem exists in that the tax paid into the trust fund is 6.25 percent of the price paid for the transportation of cargo by air. A change in aircraft size or a change in the prices charged to ship cargo can change revenue in a way that does not necessarily reflect a change in costs. There is also a potential mismatch with the general aviation contribution to the trust fund. General aviation pays fuel taxes that together generate a little over 3 percent of trust fund revenues.

The costs that general aviation impose on the air traffic control system are hard to estimate. Even so, it would be possible for the mix of general aviation flights to change in a way that changed the costs imposed on the air traffic control system without any change in the revenue available to support the system.

### Poor Performance and High Costs of Capital Investment Programs

Most FAA modernization projects have a record of (1) promising more capability than they ultimately deliver, (2) being completed later than promised, and (3) costing far more by the time they are completed than the initial cost estimates. As GAO reported in 2004, "Initially FAA estimated that its ATC modernization efforts would cost $12 billion and could be completed over 10 years. Now, two decades and $35 billion later, FAA expects to need another $16 billion through 2007 to complete key projects, for a total of $51 billion."[4] The DOT inspector general concurred in 2005: "We found that cost growth, schedule delays, and performance shortfalls with FAA's major acquisitions continue to stall air traffic modernization. Overall, 11 of the 16 projects we reviewed will experience a total cost growth of about $5.6 billion, and 9 of the 16 will have schedule slips from 2 to 12 years, based on current estimates."[5]

A second challenge is the continuing poor performance and high costs of its capital investment programs. One cause of this problem is diffused accountability. As the Mineta Commission reported, "There are 'too many cooks' making authority and accountability too diffused."[6] From time to time, both Congress and the administration have exerted considerable influence over FAA's actions and, on occasion, have simply imposed their decisions on FAA. In some cases, FAA has been prevented from doing things they would like to do, such as consolidating facilities, and in other cases, they have been forced to do things they would not otherwise have chosen, such as budget cuts or reducing employment to meet administration-imposed targets. Such control is part of the oversight roles of Congress and the administration and may well be appropriate. However, one effect of others exerting control over FAA is that FAA is much less accountable for its actions. Instead, accountability is shared with both Congress and the administration. As the Mineta Commission also reported, "Because there is so much dispersed power and authority in making budget decisions, FAA managers, industry, and the Congress can always point fingers when something goes awry."[7]

Diffused accountability can result in inadequate incentives for financial discipline. Differences in financial discipline are among the most striking differences between FAA and both NAV CANADA and NATS. It manifests itself in at least two ways: (1) the types of capital projects undertaken and (2) the pressure to complete those projects. Both NATS and NAV CANADA must project the impact of investment programs on future user charges. Users see and judge the "worth" of investments in very tangible terms: Does what they are going to get justify the cost in terms of the impact on future user charges?

A major difference between FAA and NAV CANADA is the type of capital projects undertaken. With NAV CANADA, a strong "business" case has to be made before a project is undertaken. Given NAV CANADA's board structure, representatives of the people who will ultimately pay for the project—the users of the ATC system—must agree that the project will provide benefits that are worth the cost. Perhaps as a result, NAV CANADA undertakes projects that are more incremental in nature, of a more modest scale, and with a shorter time horizon than the projects typically undertaken by FAA. FAA, in contrast, tends to look much farther into the future in designing its projects and undertakes larger-scale projects that are a greater technological leap. By looking so far into the future, some of these projects have had unrealistic expectations or turn out to be much more complex than anticipated.

Looking into the future is critical for developing ATC improvements, but the question is how far into the future to look with any given project. NAV CANADA, by taking on more incremental improvements, is looking into the future, but in any one step, they aren't looking as far into the future. This incremental approach has some advantages for a system that has to operate on a continual basis with an extraordinarily high degree of reliability and accuracy. Incremental improvements to equipment are less likely to bring on unanticipated technological challenges than great leaps and are likely to require less dramatic adaptation by the workforce. Indeed, the motivation behind some incremental changes may well come from the controller and maintenance technician

workforce. Even if the motivation for change comes from outside the workforce, it's easier to solicit and incorporate feedback from the workforce for incremental changes than it is for great leaps.

Incremental projects also come with inherently more financial discipline than projects requiring great technological leaps. It's easier to estimate both the costs and the benefits of a project using technology that's already been developed than for a project requiring new technology. It's also easier to hold project managers accountable on shorter-term projects. These projects can be completed while the cost and benefit estimates are still remembered and are still applicable. If costs are underestimated or benefits are overestimated, it's easier to hold the people who developed those estimates and the project managers accountable. There's a quick feedback loop, and managers who "low ball" cost estimates, overstate benefits, or underestimate the time it takes for completion to get a proposed project approved will quickly lose credibility, and perhaps their jobs. That environment creates a very strong incentive, not only to make the best possible cost and benefit estimates, but also to bring the project in on time, within budget, and up to the promised performance.

Longer-term projects that rely on unproven or yet to be developed technology present a much different environment. With such projects, the longer the time between making the initial cost, benefit, and timing estimates and the completion of the project, the less relevant those initial estimates are. In part, that's because it can be more difficult to estimate the costs of developing new technology than of implementing existing technology in a new application. Also, with a long-duration project, there is more of a temptation to change the specifications, and therefore the costs and benefits, of the project as it progresses than with a shorter project. When the specifications are changed, the original estimates must be updated to reflect the changes, reducing the accountability for those original estimates. With such projects, there may well be a temptation to make "optimistic" estimates to improve the chances of the project being selected, and there is much less penalty, or more likely no penalty at all, for estimates that prove to be inaccurate. Perhaps it shouldn't be surprising that the history of FAA ATC modernization projects has a nearly universal pattern of projects being over budget, under performing, and late.

With NAV CANADA and NATS, the financial discipline comes primarily from the role of aircraft operators in approving and overseeing capital investment decisions. NAV CANADA has four directors nominated by air carriers and one nominated by business aviation. NATS currently has 42 percent of its stock owned by the Airline Group, with only the government owning a larger share. The use of private capital markets may also add some financial discipline to NAV CANADA and NATS to the extent that these markets closely review investment plans.

However, were FAA to use private capital markets, it wouldn't necessarily bring added financial discipline to their capital investment programs. To the extent that the private debt was guaranteed by the government, there is no reason for private financial markets to be concerned about potential risk of the proposed project. Indeed, even if the debt isn't formally guaranteed, the markets might assume that there is an implicit guarantee by the government and behave as if the debt were guaranteed. The Tennessee Valley Authority (TVA), for example, has the right to issue private debt that is not guaranteed by the government, but because of TVA's role as a government entity, the markets still treat that debt as if it were guaranteed. Thus, simply using private financial markets to finance capital investments would not necessarily bring added financial discipline to FAA's capital investment program.

### Lack of Organizational Independence

The final challenge is FAA's lack of organizational independence, which prevents FAA from using its resources most effectively and creates a system of self-regulation for air traffic control. The constraints on resource use can come from both Congress and the administration. Congress has repeatedly intervened in FAA decision making to prevent improved efficiency through facilities consolidation because of local concerns about possible job loss in specific congressional districts. Time and again, facilities consolidation plans have been drastically scaled back or abandoned in the face of congressional opposition based not on whether the consolidation would improve overall performance and efficiency, but based on local job concerns.

FAA is an agency in the executive branch and as such has periodically been subject to budget and employment pressures unrelated to its performance

or mission. For example, the National Commission to Ensure a Strong Competitive Airline Industry expressed concerns about a reluctance to spend out of the trust fund because trust fund balances counted against federal budget deficits. From time to time, there has also been pressure on executive branch agencies to reduce their number of full-time employees, or head count as it's often known. These pressures are not intended to necessarily save money nor do they typically stem from a belief that the employment level in any specific agency is too high. Instead, a reduction in the overall number of government employees is regarded as an appropriate end in itself.[8]

Two problems can emerge from pressure on head count. One is that instead of saving money, in agencies such as FAA it often ends up costing more. When the head count is reduced without a corresponding reduction in responsibilities, the agency has to turn to contracting with outside companies. There are many cases where turning to outside companies can result in substantial savings for government agencies, such as when highly specialized expertise is needed. However, doing it for what had been normal functions of the agency prior to the head count reductions is likely to end up costing more rather than less. The second problem from pressure to reduce head count is that opportunities for FAA employees to do the same work for higher pay for contractors can lead to a loss of technical expertise within FAA. Indeed, one of the concerns that a panel of air traffic control experts assembled by GAO found was that a short-fall in technical expertise needed to design, develop, or manage complex air traffic systems had developed in FAA and, as a result, FAA has to rely on contractors, whose interests may differ from its own.[9]

Every air traffic control system has two goals, and these goals can often pull in different directions. One goal is to operate the air traffic control system safely. The other goal is to provide enough capacity to avoid excessive and persistent delays. Some of the potential ways of improving safety can reduce capacity and increase delays, and some potential ways of increasing capacity can reduce safety. Much the same trade-offs exist in airline operations, where some of the ways of reducing costs have the potential to reduce safety. In the case of airline operations, there is an external government regulator, FAA, that makes sure that safety isn't compromised as airlines strive to reduce costs. If an airline wants to change something about its operations to save costs, FAA will evaluate that proposed change in a public forum and decide whether or not to allow it.

With air traffic control, FAA is both the operator of the system and the regulator of the operations. Thus, FAA makes the capacity versus safety trade-offs internally. With the formation of the ATO, there is greater separation of regulations from operations than previously. However, both the regulatory and operations offices are still part of FAA. FAA, in effect, self-regulates air traffic control rather than having arm's-length regulation, as it has with airline operations, aircraft design and manufacture, and virtually every other aspect of aviation. Self-regulation of air traffic control creates long-recognized potential conflicts of interest when there are decisions to be made about trade-offs between safety and capacity. In all the major countries where air traffic control has been switched to autonomous authorities operating on market-based principles, the air traffic control system is subject to arm's-length regulation by a separate government authority that is not part of the same organization that has operational responsibility for the air traffic control system.

## Reforms in Canada and the United Kingdom

NAV CANADA and NATS are examples of two different types of autonomous authorities operating on market-based principles with considerable managerial discretion and funded by fees collected for the services they provide. Both NAV CANADA and NATS operate as monopolies. One of the key challenges in organizing a monopoly function such as air traffic control is getting the organization's incentives right, with sufficient checks and balances so that the monopoly power is not abused. NAV CANADA was the first private sector company in the world to use a non-share capital structure to commercialize a government service. Governance and management is in the hands of a stakeholder cooperative with a board designed to represent various constituencies—airlines, government, passengers, labor unions, general aviation, and airports. NAV CANADA's revenue comes from the fees it charges users for these services. The company's safety performance is regulated by Transport Canada.

NATS is a public-private partnership between the Airline Group, a consortium of seven UK airlines that together hold 42 percent of the ownership; NATS employees, who hold 5 percent; the UK airport operator BAA plc, which holds 4 percent; and the British government, which holds 49 percent and a "golden share," giving it a super-majority on major decisions. Its revenues come from fees charged to users for these services. The UK Civil Aviation Authority has responsibility for both economic and safety regulation, and must approve most changes in fees, services, and financing.

While these two organizational forms were quite different, they share the characteristic that neither faces any of the three fundamental challenges that remain with FAA. These organizations represent two different approaches to overcoming these challenges.

### NAV CANADA

Canada's air traffic services had historically been provided by Transport Canada as a governmental function in much the same way FAA provides services in the United States. But Canada's airline deregulation in the mid-1980s spurred rapid growth in air traffic, especially in major cities such as Toronto. At the same time, federal government fiscal constraints had led to major budget cuts, including the air navigation system. Of particular concern was a growing shortage of air traffic controllers at key locations. This resulted in major delays to airlines and to business aviation. The air traffic controllers' union began to raise concerns that the rising workload, consistent required overtime, and reduced budgets were affecting safety.

Concerns about the performance of the air traffic system began to be shared by all stakeholders. Together, the airlines, unions, and business aviation recommended that the government explore commercialization options to improve the performance of air traffic services. The consultation process was extraordinarily thorough, built around an advisory committee that included virtually all stakeholders in the air traffic system: airlines, airports, unions, pilots, general and business aviation, safety organizations, and equipment suppliers. The resulting consultation reports concluded that a commercialized air navigation system (ANS) structure would be better able to provide improvements to services while maintaining system safety.

The government chose to establish a special-purpose, not-for-profit corporation that would purchase and operate the ANS. Because charging systems would be set for fixed periods, the not-for-profit status required that any surpluses of revenue over costs be used for capital investment or go into a reserve fund that would serve to facilitate rate stabilization. Since there would be no shareholders, the Canadian Corporations Act provided for member organizations that could nominate board directors. This board structure is designed to provide major stakeholders a significant role in governance. The board is supported in these efforts by an advisory committee composed of representatives from various aviation groups across Canada.

Once the board structure was in place, the new corporation was empowered to negotiate the purchase of the ANS from the government. The detailed negotiations were complex, but led to an Agreement in Principle in December 1995, establishing sale price and terms and conditions to be resolved before transfer. The process was shaped by the commitment to a new user fee structure, so that value was determined on a net present value basis rather than on asset values (which presented significant valuation problems in themselves). Another issue involved the regulatory environment under a new structure. It was widely accepted that safety regulation would be retained by Transport Canada. With regard to economic regulation, concern that NAV CANADA would be a monopoly provider was tempered by three factors: the not-for-profit status, legal requirements that limited charges to full cost recovery, and recognition that the presence of user groups on the board would create incentives for efficiency and avoidance of "gold-plating" the system. As a result, economic regulation was minimal, based on legal requirements to adhere to certain principles, along with an appeal process to the government.[10]

Since NAV CANADA's revenues were derived from a user fee system, there is a close match between the factors that drive the costs of providing the services and the factors that drive the revenues. As discussed in the section on NAV CANADA (beginning on page 42), the structure of its user fees don't mirror the determinants of costs precisely, but they are far closer than is the case with FAA, and NAV CANADA is moving to align them even more closely. As a private sector company, NAV CANADA was able to access financial markets and has achieved and

maintained a high credit rating so that its borrowing costs remain low. Finally, as a private sector company, NAV CANADA is no longer constrained by government or parliamentary intervention in its ability to manage its resources and consolidate facilities when necessary. NAV CANADA does not self-regulate, but instead is regulated by Transport Canada, the same government agency that regulates airline operations.

The first five years of operation saw significant improvement in operational and financial performance, with improvement in a number of safety indicators. The implementation of the user fee system resulted in 11 percent lower charges to air carriers, while robust traffic growth of 20 percent led to a surplus of C$75 million in NAV CANADA's rate stabilization reserve fund. NAV CANADA had undertaken an extensive capital program totaling about C$1 billion over the 1996–2001 period.

Other than FAA in the United States, no ANS provider was more dramatically affected by the events of September 11 than NAV CANADA. NAV CANADA was faced with an immediate traffic and revenue decline of more than 10 percent, which would result in a C$145 million shortfall versus budget for fiscal 2002. Longer term, NAV CANADA anticipated a cumulative 2002–2005 shortfall of C$360 million, which would make debt service extremely difficult and make it almost impossible to sustain even a modest capital program.

The rate stabilization reserve fund was depleted from its C$75 million balance to a negative position of C$116 million. In effect, NAV CANADA was able to run at an operating deficit, albeit with the intention of recouping these cumulative losses over five years. Rates, which were reduced 15 percent in 1999 and were to have been frozen until 2002, were raised 6 percent in 2002, an additional 3 percent in January 2003, and an additional 6 percent in August 2003. Overall, NAV CANADA's rate increases since 1999 have been slightly below inflation, and remain approximately 20 percent below the Air Transportation Tax it replaced. Cost reductions were implemented in the form of cuts to management and board salaries and compensation. Suppliers were also required to provide concessions. Capital spending was reduced and deferred. Overall, annual cost savings of C$100 million were achieved.

By the end of 2004, traffic volumes were close to 2001 levels, and NAV CANADA had made significant progress in paying down the deficit in its rate stabilization account. By August 2005, the company had further recovered, with revenue increasing 13 percent over 2004. This increase was in part due to traffic growth, but more so from a further increase in charges of 7.9 percent, effective September 2004. The increased revenue enabled NAV CANADA to retire the deficit in the rate stabilization account, ending with a surplus of C$38 million by August 2005.

**NATS**

At the end of World War II, air traffic services in the United Kingdom were placed in the Ministry of Civil Aviation, and subsequently were reorganized to achieve greater segregation of civil and military air traffic. Following a major study in 1961, National Air Traffic Control Services was established in 1962 as a unified civil/military organization to operate Britain's air traffic control. The shorter title and acronym NATS was adopted in the early 1970s. In 1972, NATS was absorbed into the newly established Civil Aviation Authority (CAA). Service and regulatory aspects were linked as an act of policy. The controller of NATS rotated between military and civilian staff on a three-year cycle.

The growth of aviation in the 1980s put significant pressure on NATS to cope with more flights. However, as part of the government, NATS was subject to an external financing limit known as the Public Sector Borrowing Requirement. As such, NATS became highly dependent on government grants for investment funds. These grants peaked at £130 million in 1993, but it was widely recognized that NATS was unable to fund the investment required to replace outdated equipment in the London center, let alone finance capital needed to keep pace with growth and changes in technology. NATS' normal operating surpluses of about £50 million could only cover about half of investment needs. NATS' ability to borrow was also constrained by the overall level of government debt.

NATS' operational and safety performance was widely respected. However, there was growing criticism of NATS' level of charges to airlines and its recurring difficulties in managing its investment program. By the late 1980s, there also was growing concern about

air traffic control safety and the dual function of NATS as regulator and provider of air traffic services. By 1989, following a House of Commons Transport Select Committee inquiry, responsibility for air traffic control safety regulation was transferred to the CAA's Safety Regulation Group. A 1990 review of NATS by the Monopolies and Mergers Commission (MMC) recommended the separation of regulation and safety activities, with a management structure led by a civil chief executive appointed from outside. The MMC report also added that the logical conclusion of these initial steps would be creation of a NATS organization independent of the CAA.

In 1996, NATS was established as a separate company structure, wholly owned by the CAA. This was generally viewed as a step in preparation for privatization. In 1998, the incoming Labour government announced plans for NATS to be restructured as a public-private partnership (PPP), to help NATS have more control over its operating budget and to be able to access additional capital for its deferred investment program. The restructuring also was intended to separate regulation of air traffic services from their provision, and to be more responsive to users. Following a consultation period, a regulated PPP structure was chosen. The Labour government concluded that this structure would provide a solution to the financial and operational problems of NATS, by untying NATS from the government budgetary constraints and capital restraints due to NATS' falling under the Public Sector Borrowing Requirement.

As with NAV CANADA, NATS is funded by user fees so that the factors that drive the revenues to operate and invest in the system are closely linked to the factors that drive the costs to operate the system. NATS' organizational structure was specifically chosen to allow NATS to access capital markets, and it has been able to do that. Finally, while parliamentary intervention in operations and facilities issues was not as serious a problem in the UK as it had been in Canada and continues to be in the United States, self-regulation was felt to be a serious problem. NATS operation of the air traffic control system is regulated at arm's length by the Civil Aviation Authority. Thus, as was the case with NAV CANADA, the NATS reorganization addressed the three fundamental challenges that continue to plague air traffic control in the United States.

Some concerns have been raised about the financial difficulties faced by NAV CANADA and NATS following 2001. Both NAV CANADA and NATS started out with highly leveraged financial structures, although for different reasons and with some important differences. Both were severely affected by the airline industry downturn that started in 2001. NAV CANADA saw its rate stabilization account go into deficit and increased its charges. NATS had to restructure its debt and raise additional equity investment. However, both NAV CANADA and NATS have emerged from the 2001–2004 period as financially solid organizations that are both well positioned not only to modernize to meet the growing needs of their own airspace, but also to extend their provision of various air traffic management services to other parts of the world. So long as these three fundamental challenges remain for FAA, it will continue to struggle with modernization.

## Assessing the Options for FAA

How might the United States address the challenges facing its air traffic control system? There are undoubtedly many options, but they all seem to fall into one of two categories. The first is to reform the ATO within FAA, and the second is to remove the ATO from FAA and establish it as an autonomous authority.

### Reforming the ATO

One approach would be to try to address these three challenges by reforming the ATO while leaving it as part of FAA.

The first challenge—the disconnect between the factors that drive the costs of providing services and the factors that drive the revenue used to provide financial support—could, in principle, be addressed while leaving the ATO part of FAA. To address this challenge would require that the ATO be funded by user fees, in a manner similar to NAV CANADA and NATS. In principle, there is nothing that would make this impossible, but in practice it could be complicated to implement. One question is how the user fees would be set. The ATO's cost allocation system has improved and is continuing to receive attention, but whether it is yet able to determine the costs of each of the various services the ATO provided is an open question. Moreover, if and when it reaches that point, there is likely to still be controversy about the structure of the

user fees. Simply put, any change to a system of user fees will almost certainly change what various users of the system pay. Those asked to pay more will object, while those asked to pay less will applaud the change. Implementing any change where there are winners and losers is difficult, but when the losers are clearly defined and well-organized groups, the change is even more difficult. Nevertheless, financing air traffic control with a system of user fees would address the first challenge and could be done with the ATO remaining within FAA.

The second challenge—the poor performance and high costs of capital investment programs—would be difficult to solve with the ATO remaining part of FAA and continuing to share accountability with both Congress and the administration. Until users of the air traffic control system have a strong voice in making capital investment decisions and a strong stake in how those investments turn out, it will be difficult to bring about substantially more financial discipline.

The third challenge—lacking organizational independence—is more problematic to address with the ATO remaining in FAA and thus as part of another organization. But it might be possible to gain some small measure of organizational independence even if the ATO remained part of FAA. Recall that there are two distinct parts to the organizational independence issue: intervention by Congress or the executive branch to change FAA's or ATO's operational, facilities consolidation, and investment decisions and potential problems from self-regulation. With regard to the first part, the ability of Congress or the executive branch to intervene in a decision is based in part on the "power of the purse," or the ability to control the resources available to the ATO. If the ATO had an independent revenue stream that was not subject to the normal federal budget process, then that power would be eliminated. However, Congress would still have the ability to intervene in ATO decisions through legislation, and the executive branch would still have the ability to intervene through executive order or through the power to change personnel assignments. And, if the ATO were still part of FAA, its operations would still be regulated by another part of FAA, so there could still be the potential problems from self-regulation.

### Removing the ATO from FAA

A second approach to addressing the three challenges would be to remove the ATO from FAA and establish it as an autonomous organization, in a manner similar to what has happened in Canada, the United Kingdom, and many other countries. Of course, there are many variants to this approach including making the ATO a government corporation, a public-private partnership, a private for-profit corporation, a nonprofit corporation, or an independent government agency, to name only some of the more obvious alternatives. Each of these alternatives has potential advantages and potential disadvantages, and each has its supporters and detractors. It clearly would be possible, as NAV CANADA and NATS have demonstrated, to address the three challenges with this general approach.

# Part II:
# Case Studies in Air Traffic Control Systems

# United States: The Federal Aviation Administration

## An Overview of FAA Today

The Federal Aviation Administration is the primary organization in the United States responsible for air traffic management and air safety regulation. FAA was created with its current responsibilities as an independent agency by the Federal Aviation Act of 1958 under the name Federal Aviation Agency. FAA was renamed Federal Aviation Administration in 1967 and was brought into the newly formed Department of Transportation.

The air traffic management system that FAA oversees and operates is by far the largest in the world and contains some of the most heavily traveled corridors and some of the most complex airspace. Table 1 provides some summary statistics for the U.S. aviation system. As can be seen in the table, FAA monitors over 17 million square miles of airspace, operates over 600 air traffic control facilities, and handles nearly 50,000 flights per day. By any measure, this system operates with an extraordinary level of safety. For those not familiar with how an air traffic control system operates, the Appendix contains a description of how the various elements of the air traffic management system work together to control flights and maintain separation between aircraft.

Most of FAA's resources are devoted to air traffic management. FAA operates a network of air traffic control towers, terminal radar control facilities, and air route traffic control centers that control aircraft so as to maintain separation. FAA also operates a network of flight service stations that provide weather briefings and flight planning services, primarily to general aviation pilots. FAA develops air traffic rules and procedures and assigns the use of airspace. FAA has built these facilities and has built or installed both visual and electronic aids to navigation. FAA maintains and operates these facilities as well as voice and data communications equipment, radar facilities, computer systems, and visual display equipment at flight service stations.[11]

A second major function of FAA is safety regulation. In addition to regulating its own operation of the air traffic control system, FAA develops and enforces regulations governing the design, manufacture, maintenance, and operation of aircraft. FAA licenses both the pilots who fly the aircraft and mechanics who maintain them.

**Table 1: U.S. Aviation by the Numbers**

| | |
|---|---|
| Airports | 19,815 |
| Active pilots | 749,834 |
| Flight instructors | 89,396 |
| Total number of regulated aircraft | 319,549 |
| FAA budget | $13,858,197,000 |
| Pieces of equipment | 71,000 |
| Ground-based navigational aids | 2,200 |
| Square miles of airspace monitored | 17,017,092 |
| Total commercial passengers | 688,500,000 |
| Total commercial miles flown | 714,500,000,000 |
| Air traffic control facilities | 617 |
| En route control centers | 21 |
| Oceanic control centers | 3 |
| Terminal radar approach facilities | 162 |
| Flights handled per day | 49,545 |
| FAA air traffic controllers | 14,577 |
| FAA aviation safety inspectors | 4,563 |
| FAA technicians | 5,860 |

*Source: Federal Aviation Administration, Flight Plan 2006–2010, Executive Summary and GAO-06-154.*

**Figure 1: Federal Aviation Administration Organization**

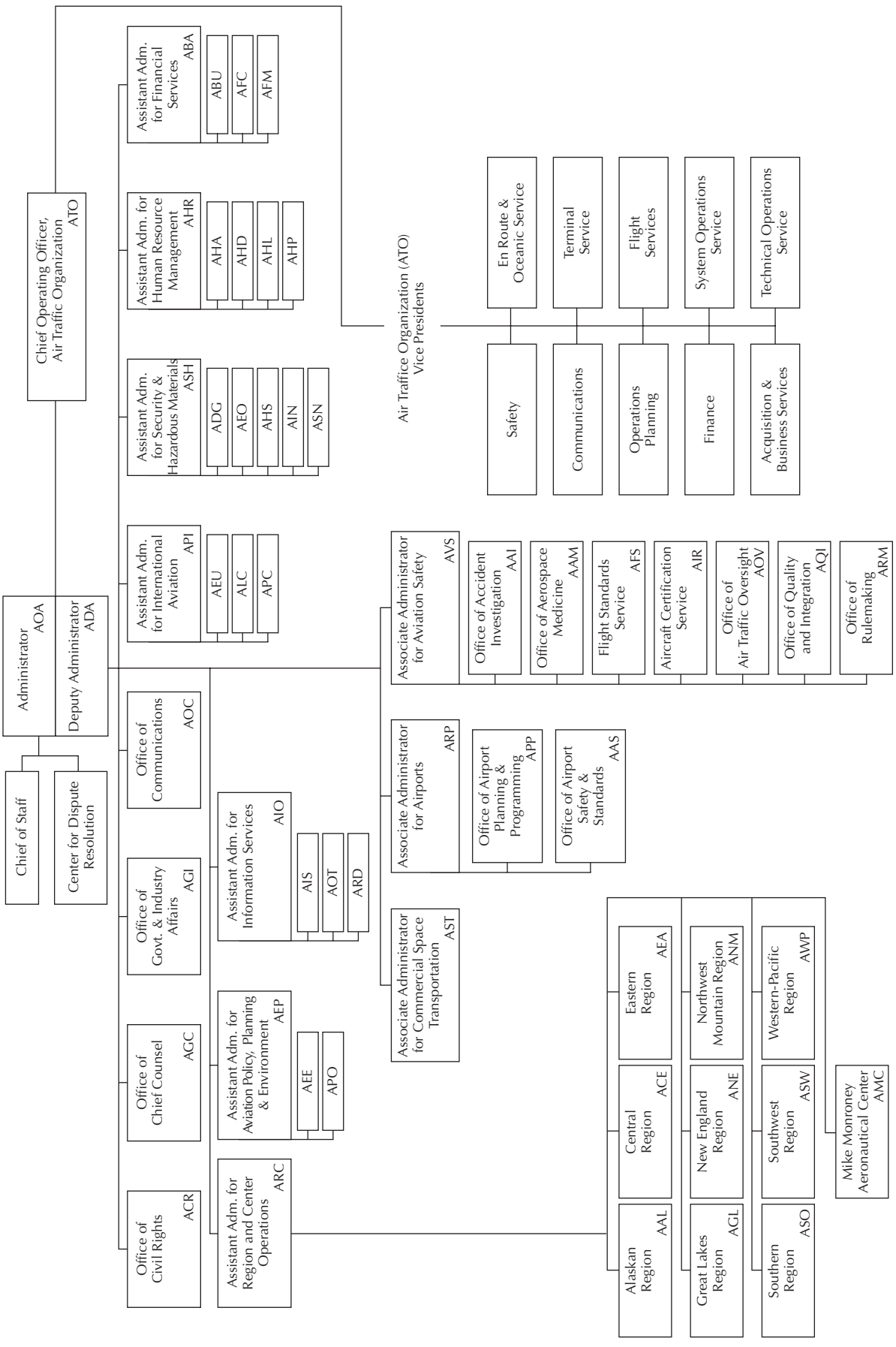
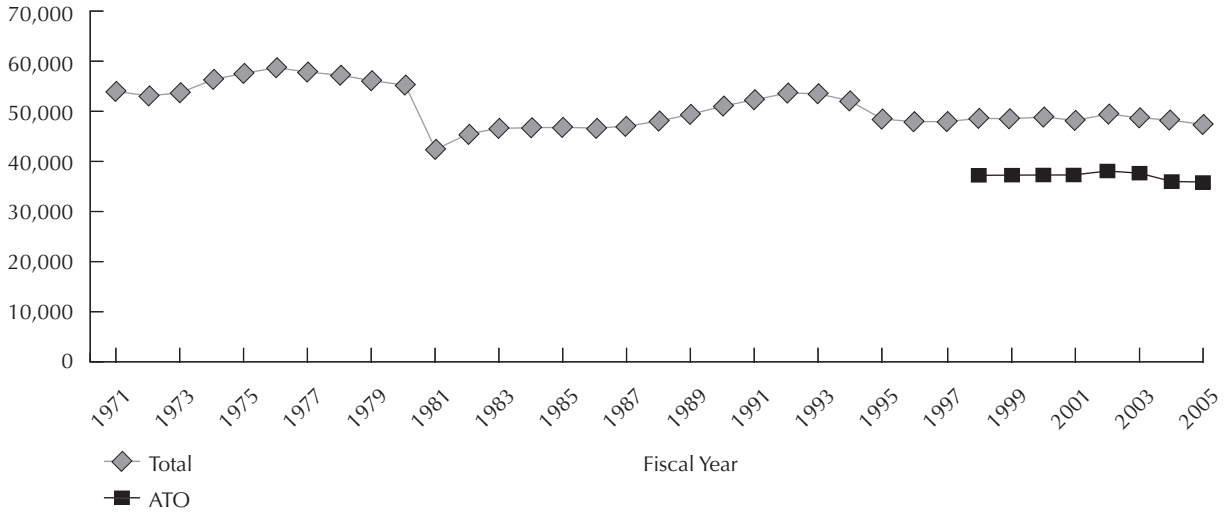


**Figure 2: Permanent Employment at FAA**




FAA works with foreign aviation authorities to promote aviation safety abroad. It certifies foreign repair stations, provides technical assistance and training, and negotiates airworthiness agreements with other countries. FAA also administers an airport improvement and grant program to improve and expand airport facilities in the United States. FAA is responsible for regulating the U.S. commercial space industry including licensing commercial space launch facilities and the private launches on expendable launch vehicles.

## FAA Organization, Budget, and Revenue Structure

FAA's organizational structure is outlined in Figure 1 (previous page). FAA is managed by an administrator. The safety regulation function, airport development function, and commercial space transportation function are each the responsibility of separate associate administrators. The various components of the air traffic management function have recently been consolidated into a single organization within FAA, the Air Traffic Organization, or ATO, managed by a chief operating officer. In 2004, FAA had 47,329 permanent employees, of which 36,328 (77 percent) were part of the Air Traffic Organization. Figure 2 shows FAA employment since 1971. Whereas airline traffic increased about 4.5 times between 1971 and 2004, total FAA employment actually declined by more than 13 percent over the same period.

Table 2 summarizes FAA's budget of $13.9 billion for FY 2005. Most (56 percent) of FAA's budget is devoted to operations, that is, to operating the air traffic management and safety functions. One fourth of FAA's budget goes to its grant-in-aid program for airport development. About 18 percent goes to new facilities and equipment, either to replace obsolete equipment or to expand capabilities with new equipment. Finally, a small portion of FAA's budget is devoted to research and development.

FAA's funding comes from two sources: the Airport and Airway Trust Fund and the General Fund. The

**Table 2: FAA FY 2005 Budget Summary (in Thousands of Dollars)**

| | Total | Share | Trust Fund | General Fund |
|---|---|---|---|---|
| Operations | $7,706,537 | 56% | $4,878,728 | $2,827,809 |
| Grant in Aid for Airports | $3,500,000 | 25% | $3,500,000 | |
| Facilities and Equipment | $2,524,780 | 18% | $2,524,780 | |
| Research Engineering and Development | $129,880 | 1% | $129,880 | |
| | $13,861,197 | 100% | $11,033,388 | $2,827,809 |

*Source: Federal Aviation Administration, Budget in Brief, FY 2006.*

**Table 3: Current Aviation Excise Tax Structure (Taxpayer Relief Act of 1997, Public Law 105-35)**

| Aviation Taxes | Comment | Tax Rate |
|---|---|---|
| **PASSENGERS** | | |
| Domestic passenger ticket tax | Ad valorem tax | 7.5% of ticket price (10/1/99 through 9/30/2007) |
| Domestic flight segment fee | "Domestic segment" = a flight leg consisting of one takeoff and one landing by a flight | Rate is indexed by the Consumer Price Index starting 1/1/02<br>$3.00 per segment during calendar year (CY) 2003<br>$3.10 per segment during CY2004<br>$3.20 per segment during CY2005 |
| Passenger ticket tax for rural airports | Assessed on tickets on flights that begin/end at a rural airport.<br>Rural airport: <100K enplanements during 2nd preceding CY, and not located within 75 miles of another airport with 100K+ enplanements. | 7.5% of ticket price (same as passenger ticket tax)<br>Flight segment fee does not apply. |
| International arrival & departure tax | Head tax assessed on passengers arriving or departing for foreign destinations (& U.S. territories) that are not subject to passenger ticket tax. | Rate is indexed by the Consumer Price Index starting 1/1/99<br>Rate during CY2003 = $13.40<br>Rate during CY2004 = $13.70<br>Rate during CY2005 = $14.10 |
| Flights between continental U.S. and Alaska or Hawaii | | Rate is indexed by the Consumer Price Index starting 1/1/99<br>$6.70 international facilities fee + applicable domestic tax rate (during CY03)<br>$6.90 international facilities fee + applicable domestic tax rate (during CY04)<br>$7.00 international facilities fee + applicable domestic tax rate (during CY05) |
| Frequent flyer tax | Ad valorem tax assessed on mileage awards (e.g., credit cards) | 7.50% |
| **FREIGHT/MAIL** | | |
| Domestic cargo/mail | | 6.25% of amount paid for the transportation of property by air |
| **AVIATION FUEL** | | |
| General aviation fuel tax | | Aviation gas: $0.193/gallon<br>Jet fuel: $0.218/gallon |
| Commercial fuel tax | | $0.043/gallon |

trust fund receives revenue from a series of aviation taxes on passengers, cargo, and fuel. Table 3 lists these taxes and the tax rates. There are six separate taxes on passengers, although not all six apply on any single trip. For domestic travel, the principal taxes are the domestic passenger ticket tax, currently 7.5 percent of the ticket price, and the domestic flight segment fee, which is indexed to the Consumer Price Index and was $3.20 per segment in calendar year 2005.[12] For passengers whose flights begin or end at a rural airport, the domestic flight segment fee does not apply, but instead a passenger ticket tax for rural

**Table 4: Trust Fund Tax Receipts FY 2004 (in Millions of Dollars)**

| | Net Tax | Share |
|---|---|---|
| Transportation of persons* | $6,501 | 70.9% |
| Transportation of property | 499 | 5.4% |
| Use of international air facilities** | 1,456 | 15.9% |
| Aviation fuel – commercial | 434 | 4.7% |
| Aviation fuel other than gas (non-commercial) | 255 | 2.8% |
| Aviation gasoline (non-commercial) | 30 | 0.3% |
| **Total tax receipts** | **$9,174** | **100.0%** |

* Transportation of persons includes domestic passenger ticket tax, domestic flight segment fee, rural airports ticket tax, and frequent flyer tax.

** Use of international air facilities includes international arrival/departure tax and Alaska/Hawaii tax.

Note: Total does not add up due to rounding.

airports of 7.5 percent of the ticket price is levied. Passengers on flights between the continental United States and Alaska or Hawaii incur an additional international facilities fee, which was $7 in 2005. There is also an international arrival and departure tax assessed on passengers arriving from or departing for foreign destinations. This tax is indexed to the Consumer Price Index and was $14.10 in 2005. Finally, there is a frequent flyer tax of 7.5 percent assessed on mileage awards such as those given by some credit cards.

The domestic cargo/mail tax is 6.25 percent of the amount paid for the transportation of property by air. Finally, there are three fuel taxes. The commercial fuel tax is $.043 per gallon. There is also a general aviation fuel tax on aviation gasoline of $0.193 per gallon and on jet fuel of $0.218.[13]

Taken together, the taxes on passengers provide the overwhelming majority of tax receipts to the Airport and Airway Trust Fund, as can be seen in Table 4. Taxes on domestic passenger travel provide 70.9 percent of receipts, and taxes on passenger use of international facilities provide another 15.9 percent. By contrast, taxes on fuel for general aviation provide a combined 3.1 percent.

## History and Background

Although FAA was created by the Federal Aviation Act of 1958, the federal role in civil air transportation began much earlier. This section traces the evolution of the government's role in air traffic management. As will be seen, the major problems facing FAA today are not new but are recurrent themes that date back for years or even decades.

### Prior to 1930

Federal government involvement with civil aviation began with the U.S. Post Office. Funds for the carriage of airmail were provided as early as 1916 from monies appropriated for "Steamboats or Other Power Boat Service."[14] Using aircraft and pilots supplied by the U.S. Army, the U.S. Post Office began airmail service on May 15, 1918, and assumed full control of that service by August. Passenger air transportation was rarely successful during that era because the aircraft of the day could barely compete with surface transportation in terms of speed or safety. Passenger air travel was still considered a novelty and was largely limited to a few short routes to island destinations. It was only with the advent of transcontinental airmail service that the potential advantages of airplanes began to become apparent. By 1925, the Post Office had developed a transcontinental system of night lighting and landing fields from New York to San Francisco. The Contract Air Mail Act of 1925 (commonly knows as the Kelley Act) was the first major piece of U.S. civil aeronautics legislation.[15]

On May 20, 1926, President Calvin Coolidge signed the Air Commerce Act of 1926, which instructed the secretary of commerce to foster air commerce; designate and establish airways; establish, operate, and maintain aids to air navigation (but not airports); arrange for research and development to improve

such aids; license pilots; issue airworthiness certificates for aircraft and major aircraft components; and investigate accidents. The Aeronautics Branch (renamed the Bureau of Air Commerce in 1934) was formed within the Department of Commerce to take on these responsibilities. The first airway light beacon erected by the Aeronautics Branch began operation in December 1926. This type of beacon reached its peak in 1946, when 2,112 were in service. Their number declined during the 1950s, and, despite tremendous technological advancement, the last was not decommissioned by FAA until April 1973.

### The 1930s

On July 1, 1933, the Aeronautics Branch assumed sole responsibility for constructing and maintaining airways, ending the prior arrangement under which this function had been part of the Bureau of Lighthouses. Under the Aeronautics Branch, the first organizational consolidation took place when the number of districts in which this function was organized was reduced from eight to six.

The Federal Aviation Commission submitted its report to the president on January 22, 1935, and recommended the establishment of an independent Air Commerce Commission that would eventually be absorbed, along with agencies regulating other forms of transportation, into an overall transportation agency. The idea garnered considerable support, but it took over 30 years, until 1967, for the Department of Transportation to be formed.

On November 1, 1935, increased commercial air traffic caused the Bureau of Air Commerce to impose the first restrictions on general aviation, restricting their operations along the routes and at the airports used by air carriers. On July 6, 1936, the Bureau of Air Commerce took over operation of the three airway traffic control centers at Newark, Chicago, and Cleveland, signaling the beginning of federal government operation of air traffic control. Up to this time, these centers had been operated by private airline companies. In the fall of 1936, the Bureau of Air Commerce solidified its grip on air traffic control and began commissioning additional air traffic control centers elsewhere in the country. In 1937, the Bureau of Air Commerce launched the first of what would become many air traffic control modernization and extension programs, allocating $5 million to modernize the existing airways and $2 million to extend the airways system.

A major development in the government's role in civil aviation came on June 23, 1938, when President Roosevelt signed the Civil Aeronautics Act of 1938. This law created the Civil Aeronautics Authority, or CAA, as a new kind of federal agency that assumed the responsibilities of the old Bureau of Air Commerce. The administrator of the CAA was appointed by the president with the concurrence of the Senate, giving Congress an explicit role in the management of the air traffic control system for the first time. The administrator's functions under the law were the encouragement of civil aeronautics and commerce, establishment of civil airways, provision and technical improvement of air navigation facilities, and the protection and regulation of air traffic along the airways. Airports were not excluded from the facilities that the administrator could establish and maintain, as they had been under the Air Commerce Act of 1926, although the administrator was prohibited from acquiring any airport by purchase or condemnation.

### The 1940s

On November 1, 1941, the CAA began operating airport air traffic control towers. Prior to this time, towers were operated by local airport authorities, except at CAA-managed Washington National Airport. On August 15, 1946, CAA instituted the first user charges by requiring a fee of $5 for registering and recording aircraft titles, with an additional fee of $5 for titles involving liens or other encumbrances. Later in 1946, CAA began providing air traffic control over the North Atlantic in conjunction with the establishment of the North Atlantic Region of the International Civil Aviation Organization (ICAO).

On June 30, 1948, Bell Telephone Laboratories made the first public demonstration of the transistor, developed by two Bell scientists, John Bardeen and Walter Brattain. Another Bell scientist, William Shockley, invented a simpler and improved amplifying device, the junction transistor, which was announced in 1951. Great advances in electronics followed the introduction of first the transistor and then integrated circuits, which quickly replaced the vacuum tube. As had been the case with light beacons, however, FAA was slow to replace vacuum tubes with more advanced technologies. Indeed, it wasn't until 1982

that FAA developed a plan to replace all vacuum tubes in navigational aids with solid state equipment. And, even when the plan was released, the replacement wasn't scheduled to be completed for another 20 years.

### The 1950s

In the development of air transportation, 1951 was the first year that passenger miles traveled by air exceeded passenger miles traveled in Pullman railroad cars; 1958 was the first year that the total number of transatlantic passengers traveling by air exceeded the number traveling by sea.

The Civil Aeronautics Authority first experienced budget instability in 1954 when the Eisenhower administration's retrenchment cut CAA's budget to $115.9 million, $20 million less than the agency received in fiscal 1953 and the lowest amount since 1949. The reduction forced the elimination of 1,500 positions, discontinued control tower operations at airports with light commercial traffic, decommissioned nonessential communications stations, and curtailed services to private fliers.

On August 14, 1957, President Eisenhower signed the Airways Modernization Act, which established the Airways Modernization Board charged with "the development and modernization of the national system of navigation and traffic control facilities to serve present and future needs of civil and military aviation." This was the second major modernization initiative, following the initial one in 1937.

On August 23, 1958, President Eisenhower signed another major piece of aviation legislation, the Federal Aviation Act of 1958. The new statute repealed the Air Commerce Act of 1926, the Civil Aeronautics Act of 1938, the Airways Modernization Act of 1957, and those portions of the various presidential reorganization plans dealing with civil aviation, and assigned the functions exercised under these repealed laws to two independent agencies—the Federal Aviation Agency (FAA), which was created by the act, and the Civil Aeronautics Board (CAB), which was freed of its prior administrative ties with the Department of Commerce. The new FAA focused on air traffic management and safety regulation while the CAB focused on the economic regulation of the airlines.

### The 1960s

On March 8, 1961, President Kennedy requested FAA to conduct a scientific, engineering review of aviation facilities and related research and development and to prepare a long-range plan to ensure efficient and safe control of all air traffic within the United States. The review was completed in September and found that the air traffic control system was "being expertly operated by a highly skilled organization," but concluded, in language that would be repeated by numerous studies over the next 40+ years, that substantial improvements were needed to meet the future challenge of aviation's projected growth. FAA urgently needed an overall systems plan. In effect, the recommended improvement involved a major reorientation of the modernization effort that had been launched only four years earlier.

On February 4, 1964, as part of a continuing effort to modernize the National Airspace System, FAA announced the first phase of a long-range plan to gradually reduce the number of flight service stations in the contiguous 48 states from 297 to 150. By now, aviation was a strong and growing commercial and political force in the United States. Whereas earlier consolidations had proceeded without interference, this plan encountered strong resistance from general aviation organizations, individual private pilots, and Congress, reflecting the concerns of communities where facilities were scheduled to be closed. In view of this opposition, Congress attached a rider to the fiscal year 1965 Independent Offices Appropriations Act restraining FAA from closing any flight service stations during fiscal 1965. After restudying their plan, FAA in August 1965 informed Congress that it would not implement the consolidation program; instead, it would evaluate the service needed in each flight service station area on a case-by-case basis. This was the first major case of Congress preventing FAA from consolidating facilities to achieve greater efficiency. It set a pattern that continues to the present.

On April 1, 1967, the Department of Transportation began operations in the same basic form that had first been recommended in 1935. As part of the formation of DOT, FAA ceased to be the independent Federal Aviation Agency and became the Federal Aviation Administration, a modal agency within the new department.

In response to growing congestion, FAA implemented a rule on June 1, 1969, placing quotas on instrument flight rule (IFR) operations at five of the nation's busiest airports between 6 a.m. and midnight. Originally implemented for a six-month period, this so-called "High Density Rule" was subsequently extended to October 25, 1970. At that point, the hourly limitations on operations were suspended at Newark Airport, but retained at New York LaGuardia, New York Kennedy, Washington National, and Chicago O'Hare. Today, nearly 40 years later, these four airports remain the four most congested airports in the United States.

## The 1970s

The Airport and Airway Trust Fund was born on May 21, 1970, when President Nixon signed Public Law 91-258, of which Title I was the Airport and Airway Development Act of 1970 and Title II was the Airport and Airway Revenue Act of 1970. The concerns that led to these acts were that airport and airway development programs had been inadequately funded from the General Fund and had failed to keep pace with the growth in aviation activity, resulting in a severe strain on the air traffic control system. The hope was that by establishing an Airport and Airway Trust Fund modeled on the Highway Trust Fund, airport and airway development would be free from having to compete for general Treasury funds. The Airport and Airway Trust Fund would receive new revenues from aviation user taxes levied by the Airport and Airway Revenue Act, plus other funds that Congress might choose to appropriate to meet authorized expenditures. The concern, and disagreement, about how much of the trust fund could be used for operating expenses as opposed to capital expenditures emerged the following year and continues to this day. The hope that airport and airway development would not have to compete with general Treasury funds has not been realized.

On September 26, 1973, DOT submitted to Congress a Cost Allocation Study on how the federal costs of the airport and airway system should be shared among the various users. The report concluded that the proportion should be about 50 percent for air carriers, 30 percent for general aviation, and 20 percent for the military and the public sector. The study also concluded that taxes at the time failed to recover more than 55 percent of the total costs, with the general aviation sector accounting for the largest shortfall. The study recommended that at least a high percentage of the shortfall be recovered through user fees. The issues in this study—the share of costs that should be covered by general aviation and the use of user fees to pay for the airport and airway system—continue to be controversial today.

In January 1978, FAA submitted to Congress a new master plan for the long-delayed modernization of FAA's 292 flight service stations. The first stage involved the installation of semi-automated computer equipment at the 43 busiest stations. The second stage involved a choice between the eventual consolidation of all 292 stations into 20 large ones, co-located at the 20 Air Route Traffic Control Centers, or modernization of up to 150 of the existing stations at their present sites. The decision on this stage was not anticipated until 1982. The third stage would add the capacity for pilot self-briefings, thus completely automating the most important flight service station function. Again, the proposed consolidations were opposed by general aviation groups and by Congress. Two years later, in 1980, the plan was revised to consolidate the flight service stations into 61 automated stations instead of the original 20 and not to co-locate flight service stations with air route traffic control centers. In 1981, FAA announced a planned regional consolidation that would reduce the number of regional headquarters from 11 to six. That plan also aroused political opposition, and FAA agreed to review the decision. Later that year, FAA announced a revised regional consolidation plan under which the number of regions would be reduced from 11 to nine.

## The 1980s and Later

On January 28, 1982, FAA released a National Airspace System Plan, a comprehensive 20-year blueprint for modernizing the nation's air traffic control and air navigation system. That plan called for consolidation of 20 air route traffic control centers into 16, but was revised a year later to retain all 20 of the centers.

On September 3, 1982, President Reagan signed the Tax Equity and Fiscal Responsibility Act, general tax legislation that increased aviation user taxes. These taxes were earmarked as renewed funding for the Airport and Airway Trust Fund, which had received no tax revenues for nearly two years. This was the first interruption in funding for the trust fund. In 1996, there was a second interruption of funding for the Airport and Airway Trust Fund when, on December 31, 1995,

the authority to collect aviation user taxes expired at midnight. Loss of this revenue quickly reduced the amount of money in the Airport and Airway Trust Fund. Legislation enacted on August 20, 1996, temporarily reinstated these taxes, but they expired again at the end of 1996. The taxes were reinstated in August 1997 to remain in effect until September 2007. However, the original hope from the 1970s that the trust fund would provide stability in funding for modernization still was not realized.

On March 22, 1983, FAA presented to Congress another approach to facility consolidation that was to be reflected in a revised National Airspace System (NAS) Plan. The number of Air Route Traffic Control Centers (ARTCCs) in the continental U.S. was to be reduced from 20 to 16, and the 188 existing terminal radar approach control (TRACON) and terminal radar approach control in the tower cab (TRACAB) facilities were to have been consolidated into about 30 regional or hub TRACONs. Again, the proposed consolidations were not well received by Congress, and eventually, on April 19, 1993, FAA modified its consolidation plan to continue to operate all of the existing ARTCCs and to operate 170 to 175 stand-alone TRACONs and five consolidated TRACONs.

In 1983, FAA started a small pilot program to contract out the operations of a few airport towers that had low volumes of traffic and that handled only visual flight rule (VFR) operations. The pilot program produced cost savings and was expanded to 17 locations by 1987. FAA concluded that significant cost savings could be achieved with this program and developed a plan to expand it in 1989. By 2002, the operations of 219 towers had been contracted out at an estimated annual savings of $60 million.

On March 30, 1994, another outside factor had an important effect on FAA operations when President Clinton signed the Federal Workforce Restructuring Act of 1994. The act targeted a reduction of 272,900 federal employees between 1993 and 1999 through a program of buyouts of up to $25,000 to personnel willing to leave federal service. The buyout was offered in conjunction with an early retirement option. FAA initially offered the buyout to its personnel between March 31 and May 3, 1994. Some employees received subsequent buyout offers, some with a deferred retirement option, during 1994 and 1995. Eventually, more than 3,000 FAA employees received buyouts. These buyouts were a major factor in the reduction of FAA's full-time equivalent workforce, which fell from 52,352 in fiscal 1992 to 47,738 at the end of fiscal 1996. Thus, much of the decline in employment seen in Figure 2 was not due to efficiency gains or a careful assessment of FAA needs, but because FAA was caught up in a broad-brush government-wide effort to reduce federal employment.

### History and Background: Major Themes

Several themes seem to run through the evolution of FAA. One is that new modernization initiatives have been a recurrent theme since 1936. FAA has not been quick to replace old technology, using light beacons into the 1970s and vacuum tubes well into the 1990s. Concerns about being able to upgrade and expand the air traffic control system to accommodate anticipated growth in air traffic have been almost continual since the early 1960s. Indeed, many of the conclusions of the reports written over the last 40 years sound as if they could have been written today.

A second theme is that both FAA and its predecessor agencies have been subject to uncertain and unstable funding. Indeed, the Airport and Airway Trust Fund was formed because of concerns about the inadequacy of funding from general Treasury funds. However, the trust fund hasn't worked out to be the funding solution its originators had hoped. In every year but one since 1970, a portion of FAA's funding has had to come from general Treasury funds and even the trust fund revenues have had to go through the congressional budget process. In addition, the taxes that feed the trust fund have been allowed to expire on two separate occasions.

A third theme is that Congress, often at the urging of aviation special interest groups, has become involved in FAA management decisions. In the clearest example, Congress has repeatedly blocked, in one way or another, virtually every attempt FAA has made to improve the efficiency of their operations through facilities consolidation.

## Calls for Reform

Concerns about FAA's persistent difficulties in modernizing and expanding the nation's air system to accommodate growth in air travel and about the impacts of uncertain and irregular funding have given rise to a series of calls for reform of FAA.

While the most far-reaching proposals have not been enacted, some important changes have been made as a result of these calls for reform.

The first presidential commission to call for substantial reforms for FAA was the Aviation Safety Commission, which released its report in April 1988. Among its conclusions was that instability and uncertainty in the level of resources available to FAA contribute to many of the problems observed in field operations including uneven flows of new hires, particularly among safety inspectors, airways facilities technicians, air traffic controllers, and support staff. The commission also found that throughout the budget cycle, as much as one-fourth of FAA management time that could have been devoted to operations in the field was devoted instead to contingency planning for possible budget cuts. Personnel, procurement, budget, and appropriations practices were found to be major obstacles to implementing the necessary changes in air traffic control. Among the Aviation Safety Commission's recommendations was that FAA be removed from the Department of Transportation and established as an independent organization funded by user fees that would cover all capital and operating costs including the provision of navigational aids, with the exception of those services provided to the military. It was also recommended that FAA be allowed to develop its own personnel and procurement rules. Finally, the Aviation Safety Commission was concerned about the frequent turnover among FAA administrators and recommended a fixed seven-year term.

On August 19, 1993, the National Commission to Ensure a Strong Competitive Airline Industry released its recommendations. The commission focused primarily on the economic health of the commercial airline industry, but its report called for FAA to become an independent federal corporate entity with its expenditures and revenues removed from the federal budget. The new body was proposed to be exempt from the rigidities of government procurement and personnel rules, and to maintain accounting practices that were consistent with best practices in the private sector. It would also be granted the right to raise capital in the manner of a private firm by issuing long-term bonds. This commission pointed out that one of the difficulties faced by FAA under its structure as an agency within DOT and under governmental budgeting rules was that the Airport and Airway Trust Fund's budget surplus was used to count against or mask the federal government's general deficit in the same way the Social Security surplus was used, rather than being available to support investments in air travel infrastructure. The unified budget concept forced all government fiscal operations to share a common bottom line, and so encouraged the reduction of services and capital spending throughout government in response to deficit concerns. One of the commission's goals was to remove the provision of air traffic management services from this constraint.

About a month later, on September 7, 1993, Vice President Gore released the report of the National Performance Review, a study of the operations of the federal government. The report's most far-reaching recommendation concerning FAA was its proposal for creating a government-owned corporation to provide air traffic control services. Following up on that recommendation, on March 3, 1994, Vice President Gore and Transportation Secretary Federico Peña announced the Clinton administration's proposal to create a new Air Traffic Services Corporation to operate, maintain, and modernize the air traffic system. Under the proposal, 38,000 FAA employees involved in providing air traffic services would become part of a new not-for-profit government corporation. Financial support for the corporation would be derived from user fees levied upon commercial aviation, subject to approval by the Department of Transportation.

Almost immediately, aviation leaders in Congress objected to the proposal. The chairmen of the House and Senate aviation subcommittees at that time, Representative James Oberstar and Senator Wendell Ford, issued a joint statement arguing that Congress should retain a role in overseeing air traffic control, but that under this proposal they would have none. Similarly, the chair of the Senate Commerce Committee, Senator Fritz Hollings, stated that instead of creating an air traffic control, or ATC corporation, the "real" problems in FAA needed to be addressed.

While the proposal to create the United States Air Traffic Services Corporation did not succeed in overcoming this opposition, the mounting pressure to address FAA's problems did have some results. On August 23, 1994, as part of the Federal Aviation Administration Authorization Act of 1994, which

provided fiscal year 1994–96 funding and authorization for FAA's programs, a fixed five-year term of office for the FAA administrator was established to counter concerns about frequent turnover in the job. In August 1997, Jane Garvey was sworn in as the first FAA administrator appointed for a fixed term.

On April 1, 1996, reforms were enacted that gave FAA new flexibility on personnel and procurement policies, a change made possible by legislative relief from various statutory requirements passed the previous year. The new acquisition management system aimed at reducing the time and cost of acquiring systems and services while making the acquisition workforce more accountable. The new personnel system was intended to speed recruitment and to reward outstanding employees while dealing effectively with substandard performance.

On February 12, 1997, the White House Commission on Aviation Safety and Security released its final report. Among its recommendations were that the users of the National Airspace System should fund its development and operation. The commission found that the system of funding air traffic control through the excise taxes operating through the trust fund provided little direct connection between the excise taxes paid and services provided or the amount made available to FAA through the budget and appropriations process. This commission recommended replacing the traditional system of excise taxes with user fees so that revenues and spending might be more closely matched.

## The Mineta Commission and the Air Traffic Organization

In December 1997, the National Civil Aviation Review Commission, chaired by former Congressman Norman Mineta, issued its report. The so-called Mineta Commission was blunt in its three major criticisms of FAA's situation. The first was that federal budget rules were found to be "crippling." They concluded that federal budget procedures were "inappropriate for a system controlling commercial operations that needs to be driven by demand for services." The second criticism was that there were "too many cooks" involved in air traffic management decisions, which made authority and accountability too diffused. They stated that while FAA, DOT, the aviation industry, the administration, and Congress all wanted to make the system work efficiently, there were simply too many different groups who viewed themselves as in charge. Finally, they found that increasing operational costs were "freezing out" capital investments under federal budget caps. None of these criticisms were new, but they reflected the belief that the fixed term for the administrator and the personnel and procurement reforms were not going to be sufficient to solve FAA's problems.

The Mineta Commission's recommendations were not as dramatic or far-reaching as those of earlier commissions and studies. They recommended neither a corporatization of FAA nor removing air traffic control activities from FAA or from DOT. Instead, they recommended that services related to the air traffic system be placed in a Performance-Based Organization (PBO), which would be managed by a chief operating officer and overseen by a board of public interest directors. In addition, they recommended that FAA should institute a cost accounting system and be given authority to implement innovative programs involving leasing and borrowing authority. They also recommended, in line with their major criticisms, that the revenue stream funding air traffic control activities become more cost based and that it be shielded from federal budget caps.

These recommendations were not nearly as objectionable to some of the established aviation interests as earlier commissions' recommendations had been. The PBO proposal didn't take Congress, the administration, the secretary of transportation, or the FAA administrator out of the loop, nor did it remove air traffic control from FAA, thereby leaving FAA dramatically smaller in terms of budget and employment.

The Mineta Commission recommended that the FAA be primarily funded through cost-based user fees for commercial passenger and air cargo carriers and a fuel tax for general aviation. The commission acknowledged that the current general aviation fuel tax did not cover the costs general aviation imposed on the system and recommended that the magnitude of the fuel tax be re-evaluated. Even so, the general aviation and business aviation communities did not feel nearly as threatened that this proposal would lead to substantially increased costs for them, as had been the concern with some of the earlier proposals.

The PBO proposal was generally well received and in December 2000, President Clinton signed an executive order and Congress passed supporting legislation that, together, provided FAA with the authority to create the performance-based Air Traffic Organization, or ATO, to control and improve FAA's management of the modernization effort. Working out the details of what the ATO would include and finding a chief operating officer took some time. It wasn't until February 2004 that FAA reorganized, transferring 36,000 employees, most of whom worked in air traffic services and research and acquisitions, to the ATO. The chief operating officer is Russell Chew, a highly respected former pilot and executive at American Airlines.

While the ATO faces substantial challenges, some encouraging steps have been taken since February 2004. One major aspect of the ATO organizational structure is that capital investment and operations were brought more closely together. In principle, this should allow the ATO to improve overall program management, including areas such as on-time delivery of modernization programs and management of program costs. Historically, FAA capital projects were geared to introduce newer technology and more reliable services. But FAA developed capital and operating budgets separately, with success for capital investments defined simply as completing the capital programs. It has always been striking that FAA's justification for new capital projects virtually never included what might be called the business case for capital investments resulting in operating cost savings. While the business case was sometimes examined quietly within FAA, it was rarely used as a justification for choosing one potential project over another. The result has typically been higher operating costs even when capital projects were completed. The ATO is now changing investment priorities to also emphasize operating cost efficiencies.

A second important change with the formation of the ATO has been a new emphasis on developing a cost accounting system and a labor distribution system. There had been attempts to develop cost accounting systems prior to the formation of the ATO, but they had been more in the nature of demonstration projects applied to a limited portion of FAA's activities rather than an operational system designed to support management decision making. Such systems are difficult to develop and implement and are not yet complete, but as they improve, they should allow the ATO to do a better job of managing costs and focusing resources in line with their business plan.

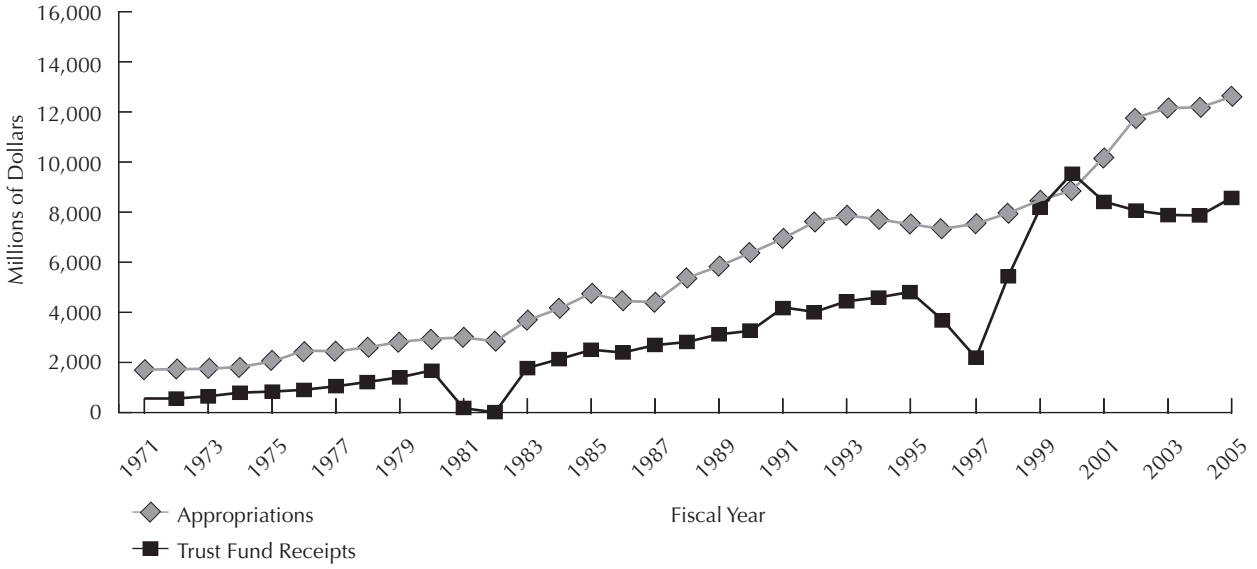
A third change with the ATO has been the development of performance metrics and operational goals based on those metrics. ATO's management believes that much of their success will depend on how effectively performance is measured and how well those measurements are used to reinforce individual and organizational accountability and improvement. As a further step to improve accountability, the ATO has reduced the layers of management from 11 to six. The metrics also reflect ATO's move to more of a customer focus than has governed air traffic control decisions in the past.

Many in the aviation community are hopeful that the ATO can result in some improvements both in how the air traffic management system is operated and in the capital investment program. However, the ATO has only been in operation for about two years, and it's clearly too soon to tell how successful the changes the ATO is trying to implement will be. The ATO also faces a culture of resistance to change among many of its employees. A panel of air traffic control experts assembled by GAO concluded that FAA is an environment where multiple stakeholders with entrenched interests struggle to preserve their interests and to retain control or influence.[16] There are also concerns that the ATO still faces at least three fundamental challenges to effective long-term management of the air traffic management system.

## Fundamental Challenges That Remain

FAA faces a difficult task in its capital projects under any circumstances because they tend to be complex and often push the edge of available technology. In 1995, GAO designated the ATC modernization program a high-risk information technology initiative because of its size, complexity, cost, and problem-plagued past.[17] Three fundamental barriers remain that severely impede FAA or the ATO from building and operating an efficient air traffic management system to handle the anticipated growth in air traffic. The first is the continuing disconnect between the cost drivers and the revenue drivers. The second is the continuing high cost and poor performance of the capital investment programs. The third is the lack of organizational independence for the organization providing air traffic management service.

**Figure 3: Airport and Airway Trust Fund Receipts and FAA Appropriations**




## Disconnect Between Cost Drivers and Revenue Drivers

Figure 3 shows the Airport and Airway Trust Fund receipts over the life of the trust fund and FAA appropriations for the same period. Several things are clear from the figure. First, except for 1999, trust fund receipts have not been sufficient to cover FAA's budget. The original intent of the trust fund was not to cover all of FAA's budget. Rather, it was recognized that a portion of FAA's budget covered air traffic control services to military and government aircraft and programs that benefit the public such as safety and security. However, the growing gap between trust fund revenues and total FAA expenditures is placing an increasing burden on the General Fund. Second, the trust fund has not been a stable source of funding. On two separate occasions, taxes have been allowed to lapse, interrupting the flow of revenue into the trust fund. More importantly, since 2000, trust fund revenues have declined even as traffic has rebounded from 2001 and while FAA appropriations have increased.

The decline in trust fund revenues in recent years is not due to a lapse in taxing authority but rather to a structural change in the airline industry. As discussed earlier, the main source of revenue for the trust fund is an excise tax applied to the price of passenger tickets. The spread of low-fare carriers such as Southwest has resulted in more passengers traveling on low fares, with the result that the tax revenue per passenger has declined. A jet aircraft operated by Southwest Airlines will generate less ticket tax than the same-sized jet operated by a legacy airline charging higher fares. However, the Southwest jet will impose the same workload on the air traffic control system, even though it contributes less revenue to the operation of the system. Thus, the growth of low-fare airlines has resulted in less revenue per aircraft operation but has not reduced the air traffic control costs of handling those operations. Compounding this trend has been the rapid growth in the use of small 30- to 50-passenger regional jets. At similar ticket prices, a regional jet will also generate less revenue per flight than a larger jet, but will impose the same air traffic control costs. The reliance on an excise tax on tickets has created a mismatch between the primary driver of revenues, passenger ticket prices, and the primary driver of costs, the number of airline operations. The DOT inspector general's office found that although air traffic levels continue to show improvement from the sharp declines that began early in 2001, expected trust fund revenues have not materialized. Their analysis showed that in March 2000, the average cost of a ticket for a 1,000-mile flight was $149, while in March 2005, it was about $118, a drop of over 20 percent.[18]

The growth of low-fare carriers and the spread of regional jets is not the first structural change in the airline industry, but it's the first one that has resulted in a drop in revenues per commercial aircraft operation. Throughout the first two decades of the trust fund, average aircraft sizes were increasing, particularly with the spread of wide-body aircraft. This trend

caused the ticket tax revenue per aircraft operation to increase, which worked in favor of helping trust fund revenues keep pace with the cost of providing air traffic control service. So the mismatch between cost drivers and revenue drivers has been there from the beginning of the trust fund. It's only these most recent structural changes that have reduced revenues relative to costs rather than helped revenue. Future structural changes will also have a different impact on revenues than on costs so that the disconnect between cost drivers and revenue drivers will continue to complicate air traffic control funding. Only a user charge system is likely to solve this problem.

The disconnect between cost drivers and revenue drivers is not confined to commercial airline operations, but almost certainly exists for general aviation operations as well. General aviation pays fuel taxes that together generate a little over 3 percent of trust fund revenues. It's certainly true, as general aviation interests claim, that many general aviation flights operate in uncongested areas under visual flight rules and impose few, if any, costs on the air traffic control system. General aviation interests also contend that the way to think about the costs they impose on the system is to argue that the air traffic control system was built to accommodate commercial airline operations, and general aviation imposes only very small incremental costs on this system. Assessing the true costs general aviation imposes on the air traffic control system is difficult and probably won't be able to be done with any precision until the ATO's cost accounting and cost allocation systems are more fully developed.

As the cost accounting system continues to be developed, the evidence that is available casts considerable doubt on whether general aviation's roughly 3 percent contribution to the revenue stream is sufficient to cover its costs. Most of the carefully done cost allocation studies have placed general aviation's share of air traffic control costs between 10 and 25 percent. Consider also Figures 4 and 5. Figure 4 shows the number of aircraft handled by FAA Air Route Traffic Control Centers from 1997 through 2004. As can be seen, far fewer general aviation planes are handled by ARTCCs than air carrier aircraft. However, during the 1997 through 2004 period, general aviation aircraft represented about 19 percent of the aircraft, substantially more than the 3.1 percent contributed to trust fund revenues. Figure 5 shows the number of instrument operations at FAA towers by type of operation. Here, general aviation aircraft are the largest users of instrument operations and are responsible for 39 percent of instrument operations over the period, substantially more than either air carriers or air taxis. While these figures don't demonstrate conclusively that general aviation isn't paying for the costs it imposes on the air traffic control system, they do point out the need for a careful accounting of the costs that each type of user imposes on the system.

**Figure 4: Aircraft Handled by FAA ARTCCs**

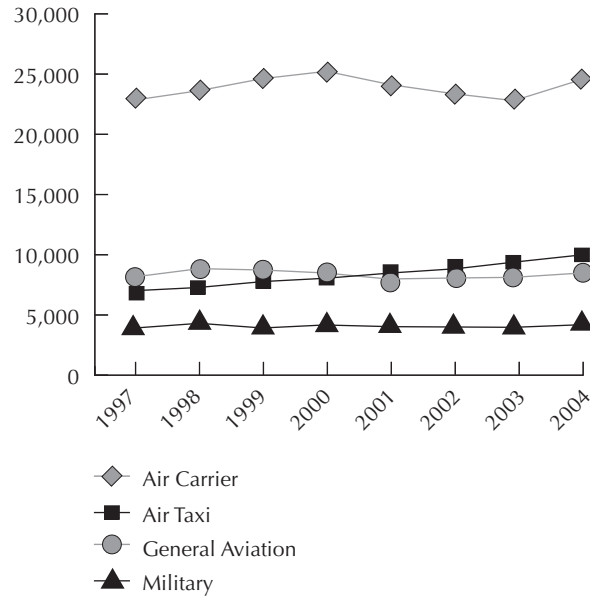
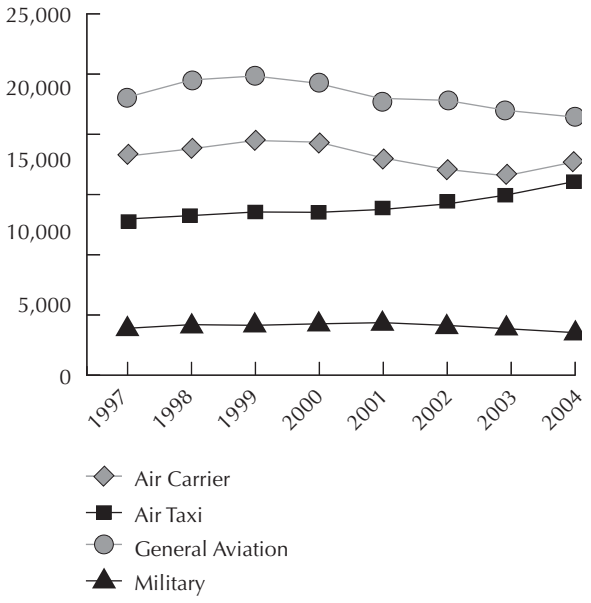


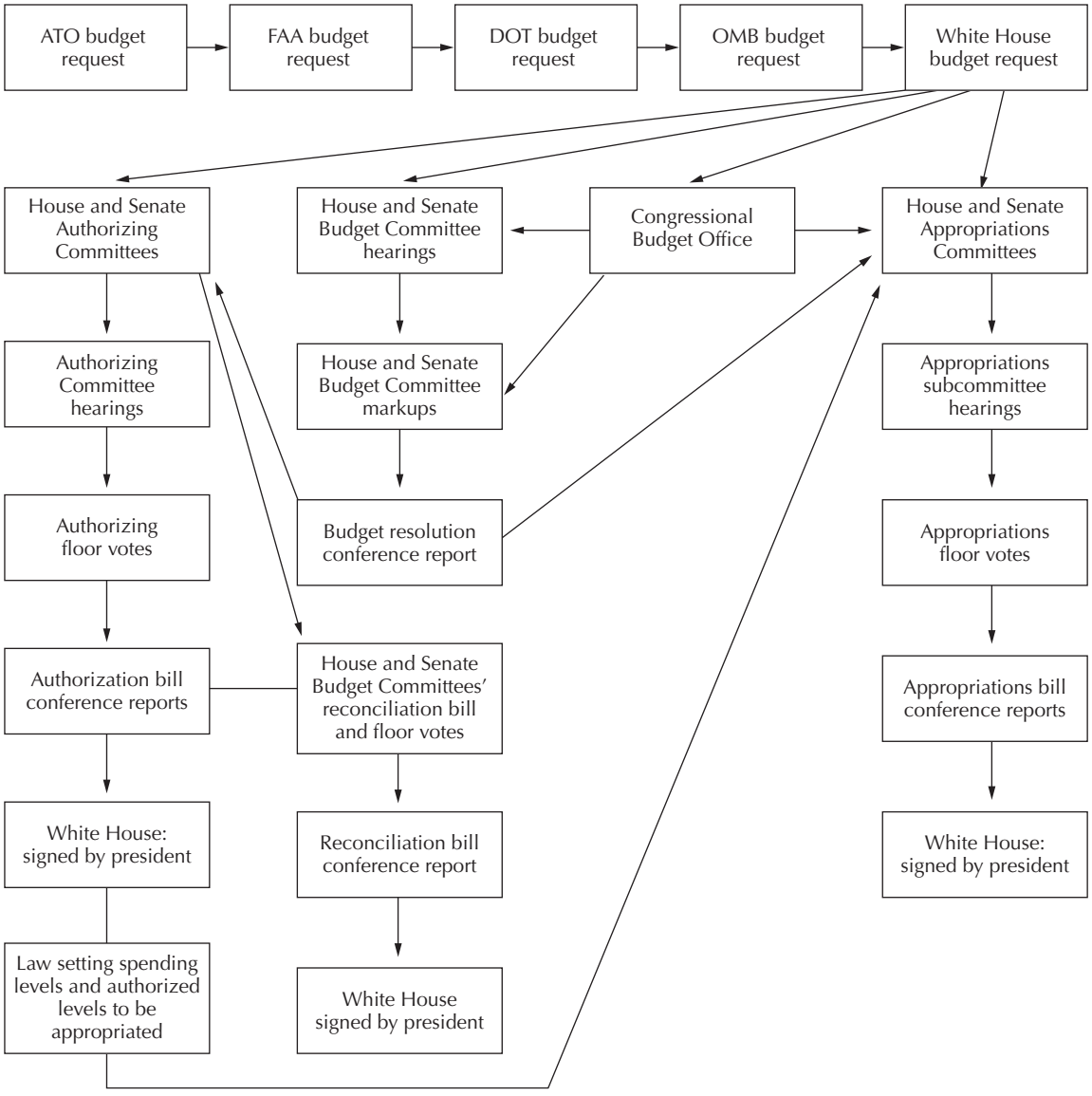

**Figure 5: Instrument Operations at FAA Towers**



The nature of the budget process for the ATO adds another level of disconnect. As mentioned earlier, the funds to support the ATO come from two sources, the Airport and Airway Trust Fund and the General Fund. The various tax rates that determine the flow of money into the Airport and Airway Trust Fund are determined by Congress with input from FAA and various constituent groups. The decisions about how much money is available to support the operations of the ATO and the investment in capital are determined through the standard federal budget process.

The U.S. federal budget process involves both many steps and many different actors. Figure 6 presents a highly simplified flowchart of how that process works when it works smoothly and assumes no presidential vetoes or continuing resolutions. The budget request for the Air Traffic Organization becomes part of FAA's budget request, which in turn becomes part of DOT's budget request, which in turn becomes part of the president's budget request. This request goes to Congress, where there are separate authorization, appropriations, and budget committees in both the

**Figure 6: Simplified Flowchart of the Budget Process to Which the ATO Must Adhere**




Note that the House and Senate have parallel processes that are represented as a single process on this flowchart and that the flowchart assumes there are no presidential vetoes. It is further assumed that no continuing resolution is needed.

*Source: Adapted from the Senate Budget Committee, March 2005.*

House and the Senate, all of whom have an opportunity to influence the resources available to the ATO, as do individual members of Congress who are not on any of these committees.

### Poor Performance and High Costs of Capital Investment Programs

FAA modernization projects have a long record of (1) promising more capability than they ultimately deliver, (2) being completed later than promised, and (3) costing far more by the time they are completed than the initial cost estimates. As GAO reported in 2004, "Initially FAA estimated that its ATC modernization efforts would cost $12 billion and could be completed over 10 years. Now, two decades and $35 billion later, FAA expects to need another $16 billion through 2007 to complete key projects, for a total of $51 billion."[19] The DOT inspector general concurred in 2005: "We found that cost growth, schedule delays, and performance shortfalls with FAA's major acquisitions continue to stall air traffic modernization. Overall, 11 of the 16 projects we reviewed will experience a total cost growth of about $5.6 billion, and 9 of the 16 will have schedule slips from 2 to 12 years, based on current estimates."[20]

A second challenge is the continuing poor performance and high costs of its capital investment programs. One cause of this problem is diffused accountability. As the Mineta Commission reported, "There are 'too many cooks' making authority and accountability too diffused."[21] From time to time, both Congress and the administration have exerted considerable influence over FAA's actions and, on occasion, have simply imposed their decisions on FAA. In some cases, FAA has been prevented from doing things they would like to do, such as consolidating facilities, and in other cases, they have been forced to do things they would not otherwise have chosen, such as budget cuts or reducing employment to meet administration-imposed targets. Such control is part of the oversight roles of Congress and the administration and may well be appropriate. However, one effect of others exerting control over FAA is that FAA is much less accountable for its actions. Instead, accountability is shared with both Congress and the administration. As the Mineta Commission also reported, "Because there is so much dispersed power and authority in making budget decisions, FAA managers, industry, and the Congress can always point fingers when something goes awry."[22]

Diffused accountability can result in inadequate incentives for financial discipline. Differences in financial discipline are among the most striking differences between FAA and both NAV CANADA and NATS. It manifests itself in at least two ways: (1) the types of capital projects undertaken and (2) the pressure to complete those projects. Both NATS and NAV CANADA must project the impact of investment programs on future user charges. Users see and judge the "worth" of investments in very tangible terms: Does what they are going to get justify the cost in terms of the impact on future user charges?

A major difference between FAA and NAV CANADA is the type of capital projects undertaken. With NAV CANADA, a strong "business" case has to be made before a project is undertaken. Given NAV CANADA's board structure, representatives of the people who will ultimately pay for the project—the users of the ATC system—must agree that the project will provide benefits that are worth the cost. Perhaps as a result, NAV CANADA undertakes projects that are more incremental in nature, of a more modest scale, and with a shorter time horizon than the projects typically undertaken by FAA. FAA, in contrast, tends to look much farther into the future in designing its projects and undertakes larger-scale projects that are a greater technological leap. By looking so far into the future, some of these projects have had unrealistic expectations or turn out to be much more complex than anticipated.

Looking into the future is critical for developing ATC improvements, but the question is how far into the future to look with any given project. NAV CANADA, by taking on more incremental improvements, is looking into the future, but in any one step, they aren't looking as far into the future. This incremental approach has some advantages for a system that has to operate on a continual basis with an extraordinarily high degree of reliability and accuracy. Incremental improvements to equipment are less likely to bring on unanticipated technological challenges than great leaps and are likely to require less dramatic adaptation by the workforce. Indeed, the motivation behind some incremental changes may well come from the controller and maintenance technician workforce. Even if the motivation for change comes from outside the workforce, it's easier to solicit and incorporate feedback from the workforce for incremental changes than it is for great leaps.

Incremental projects also come with inherently more financial discipline than projects requiring great technological leaps. It's easier to estimate both the costs and the benefits of a project using technology that's already been developed than for a project requiring new technology. It's also easier to hold project managers accountable on shorter-term projects. These projects can be completed while the cost and benefit estimates are still remembered and are still applicable. If costs are underestimated or benefits are overestimated, it's easier to hold the people who developed those estimates and the project managers accountable. There's a quick feedback loop, and managers who "low ball" cost estimates, overstate benefits, or underestimate the time it takes for completion to get a proposed project approved will quickly lose credibility, and perhaps their jobs. That environment creates a very strong incentive, not only to make the best possible cost and benefit estimates, but also to bring the project in on time, within budget, and up to the promised performance.

Longer-term projects that rely on unproven or yet to be developed technology present a much different environment. With such projects, the longer the time between making the initial cost, benefit, and timing estimates and the completion of the project, the less relevant those initial estimates are. In part, that's because it can be more difficult to estimate the costs of developing new technology than of implementing existing technology in a new application. Also, with a long-duration project, there is more of a temptation to change the specifications, and therefore the costs and benefits, of the project as it progresses than with a shorter project. When the specifications are changed, the original estimates must be updated to reflect the changes, reducing the accountability for those original estimates. With such projects, there may well be a temptation to make "optimistic" estimates to improve the chances of the project being selected, and there is much less penalty, or more likely no penalty at all, for estimates that prove to be inaccurate. Perhaps it shouldn't be surprising that the history of FAA ATC modernization projects has a nearly universal pattern of projects being over budget, under performing, and late.

With NAV CANADA and NATS, the financial discipline comes primarily from the role of aircraft operators in approving and overseeing capital investment decisions. NAV CANADA has four directors nominated by air carriers and one nominated by business aviation. NATS currently has 42 percent of its stock owned by the Airline Group, with only the government owning a larger share. The use of private capital markets may also add some financial discipline to NAV CANADA and NATS to the extent that these markets closely review investment plans.

However, were FAA to use private capital markets, it wouldn't necessarily bring added financial discipline to their capital investment programs. To the extent that the private debt was guaranteed by the government, there is no reason for private financial markets to be concerned about potential risk of the proposed project. Indeed, even if the debt isn't formally guaranteed, the markets might assume that there is an implicit guarantee by the government and behave as if the debt were guaranteed. The Tennessee Valley Authority, for example, has the right to issue private debt that is not guaranteed by the government, but because of TVA's role as a government entity, the markets still treat that debt as if it were guaranteed. Thus, simply using private financial markets to finance capital investments would not necessarily bring added financial discipline to FAA's capital investment program.

### Lack of Organizational Independence

The lack of independence from congressional concerns has hampered FAA throughout most of its history, as described earlier. Members of Congress may base funding decisions on how jobs in their districts will be affected by proposed FAA actions, rather than on how reasonable the business cases for actions may be.[23] The National Commission to Ensure a Strong Competitive Airline Industry expressed concern about a reluctance to spend out of the trust fund because trust fund balances counted against federal budget deficits.

The lack of organizational independence made FAA vulnerable to the Federal Workforce Restructuring Act of 1994, which targeted a reduction of 272,900 federal employees between 1993 and 1999. In response to that act, more than 3,000 FAA employees eventually received buyouts, which were a major factor in the reduction of FAA's full-time equivalent workforce from 52,352 in fiscal 1992 to 47,738 at the end of fiscal 1996. While this was one specific example, there is often pressure on government agencies to reduce their number of full-time employees,

or head count, as it's often known. These pressures are not intended to necessarily save money, nor do they typically stem from a belief that the employment level in any specific agency is too high, but instead reducing the number of government employees is regarded as an end in itself.

Two problems emerge from this pressure on head count. One is that instead of saving money, it often ends up costing more. When the head count is reduced, the agency's responsibilities are not lessened, so that the agency has to increasingly turn to contracting with outside companies for activities that were previously done in house. There are many cases where turning to outside companies can result in substantial savings for government agencies, such as when highly specialized expertise is needed. However, doing it for what had been normal functions of the agency prior to the head count reductions is likely to end up costing more rather than less. For example, an investigation by DOT's inspector general revealed that the contractor's work may not differ from work FAA employees do but that it may be at substantially higher costs to the government.

The second problem from pressure to reduce head count is that opportunities for FAA employees to do the same work for higher pay for contractors can lead to a loss of technical expertise within FAA. Indeed, one of the concerns that a panel of air traffic control experts assembled by GAO found was that a shortfall in technical expertise needed to design, develop, or manage complex air traffic systems had developed in FAA and, as a result, FAA has to rely on contractors, whose interests may differ from its own.[24]

Another problem related to a lack of organizational independence is that FAA both operates the air traffic control system and regulates itself in its operation of that system. In other aspects of U.S. aviation, such as the design and manufacture of aircraft and aircraft components, the training and certification of pilots and mechanics, the procedures used to maintain aircraft, and the procedures under which airline operations are conducted, FAA provides independent regulatory oversight. FAA has no operational responsibilities in any of these areas. Instead, the operations are left to other organizations, and FAA's responsibility is to develop and approve the rules and procedures under which these organizations operate and to make sure that the rules and procedures are followed properly.

Air traffic control is different. As with other aspects of aviation, FAA has the responsibility to develop the rules and procedures for air traffic control and has the enforcement responsibility to ensure that these rules and procedures are followed. Unlike other aspects of aviation, however, FAA also has operational responsibility for the air traffic control system. The rules FAA develops are for itself, and the enforcement of those rules is enforcement of itself. In other words, FAA self-regulates air traffic control.

Self-regulation of air traffic control creates long-recognized potential conflicts of interest when there are decisions to be made about trade-offs between safety and capacity. As the Aviation Safety Commission stated in their 1988 report, "Both safety and public confidence in the safety of the system might be enhanced if greater separation existed between the functions of regulating the ATC system and operating it."[25]

FAA has two goals in operating the air traffic control system, and these goals can often pull in different directions. One goal is to operate the air traffic control system safely. The other is to provide enough capacity to avoid excessive and persistent delays. Some of the potential ways of improving safety can reduce capacity and increase delays, and some potential ways of increasing capacity can reduce safety. Currently FAA, as both regulator and operator of the air traffic control system, makes the capacity versus safety trade-offs internally. If excessively conservative standards are imposed, capacity is reduced, delays increase, and FAA faces the capacity penalty in the form of dissatisfied airlines and passengers. Alternatively, if FAA shades its procedures too much toward enhancing capacity, safety may be reduced and passengers and crews could be placed at greater risk.

The trade-offs between safety and capacity are inherent in air traffic control, and they are often subtle. To be sure, many forms of capacity enhancements do not reduce safety, and others may even increase safety. These decisions are relatively straightforward. However, other capacity-related decisions such as aircraft separation standards and the conditions under which various runway configurations are used can pose a trade-off between safety and capacity that FAA must make. These trade-offs are difficult because while it may be easy to determine the capacity enhancement implications of a

particular proposal, it can be extremely difficult or even impossible to determine how much that proposal might degrade safety or if, indeed, it would degrade safety at all.

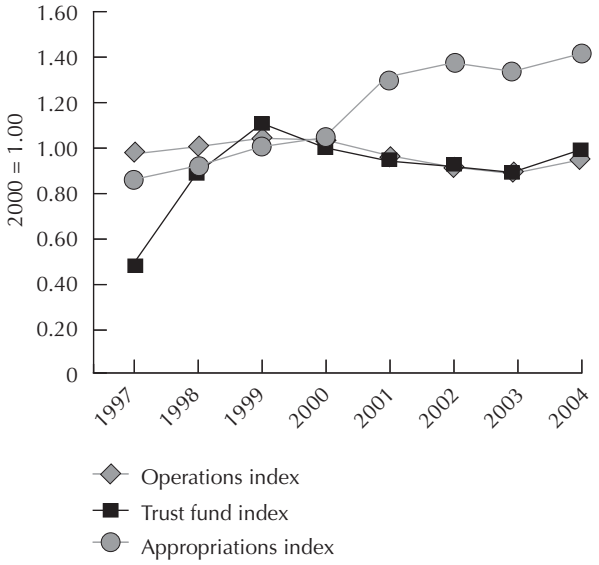
Were the air traffic control system to be reorganized to place air traffic control operations into one organization and air traffic control regulation into another, the situation would change. The same trade-offs between safety and capacity would remain and be just as technically difficult, but the regulatory tensions that are now internal to one organization would become external and between two different organizations. Decisions that are now made internally would become external in a manner similar to safety regulatory decisions in other aviation sectors. The debate about trade-offs between safety and capacity would be more public and open to outside scrutiny. The air traffic control operating organization would have to consider carefully any changes to the minimum safety standards they propose and clearly state the justification for that proposal. The regulatory organization would have to consider, specify, and defend the criteria it used for selecting one standard over another, and for accepting or rejecting any proposed changes.

With the formation of the ATO, there is now greater separation between the regulation of air traffic control and its operation. Starting in 2005, FAA's Office of the Associate Administrator for Regulation and Certification established a separate Air Traffic Safety Oversight Service, which will have the responsibility to establish, approve, and/or accept safety standards for the ATO. The ATO itself also has a separate safety unit directed by a vice president. This restructuring is an important step and has added more separation between operations and regulation. However, all of these units are still within FAA, so there remains a degree of self-regulation.

## FAA Since 2001

While the growth in airline travel had started to slow in late 2000, the continued decline was aggravated by the events of September 11, 2001, as well as a reduction in international traffic due to SARS and the Iraq war. Figure 7 presents indices of trust fund receipts and appropriations drawn from Figure 3 and an index of air traffic control operations drawn from summing the activities represented in Figures 4 and 5. All indices in the figure are set to have the entry for 2000 equal to 1.00.

**Figure 7: Indices of Operations, Trust Fund Receipts, and Appropriations**




As can be seen in Figure 7, both air traffic control operations and trust fund receipts declined in the post-2001 period and, while they had started to recover by 2004, they were still below their 2000 levels. Appropriations, on the other hand, continued to grow in 2001 and 2002, before leveling off in 2003 and 2004. While FAA was certainly affected by these events, its budget was not strongly affected. In essence, the appropriations process and the General Fund acted as a reserve fund to see them through the drop in revenues from the various taxes as a result of the downturn in traffic and the changing structure of the airline industry.

In this instance, FAA's status as a government agency relying on both trust fund revenues and General Fund revenues and subject to the annual budget process provided some insulation from the economic shocks of the post-2001 period. At the same time, it shielded FAA from the pressures to look for added efficiencies and cost reductions that their user-fee-based counterparts in Canada and the United Kingdom had to face.

In 2004, FAA conducted a public-private competition to operate 58 automated flight service stations, facilities that provide weather briefings and flight planning services primarily to general aviation pilots. In February 2005, FAA selected Lockheed Martin to operate these facilities. Under the contract, in April 2006, Lockheed Martin will begin an incremental

consolidation of these flight service stations, and it's expected that there will be 20 sites operating by the end of March 2007. FAA estimates that this contract will result in savings of $2.2 billion since the inception of the program.

## Lessons from the FAA Experience

**Lesson 1:** The problems facing FAA today are not new, but have been recurring themes for decades.

- Large scale, multi-year modernization plans date back to at least 1937.
- Budget cuts for air traffic control stemming not from anything related to air traffic control needs but rather to overall federal government budget guidelines date back to at least 1954.
- Congress prohibiting the consolidation of facilities because of concerns of the employment impacts in specific districts dates back to at least 1964.
- Concerns that aviation taxes didn't reflect the costs of providing air traffic management services to various user groups dates back to at least 1973.

**Lesson 2:** The Airport and Airway Trust Fund was intended to insulate investment in airport and air navigation facilities from having to compete for general Treasury funds, but it has failed to do so.

**Lesson 3:** The Airport and Airway Trust Fund has not been a stable source of funding for airport and air navigation facilities because the taxing authority that supports the trust fund has been allowed to expire on two separate occasions.

**Lesson 4:** In response to calls for reform by a series of special commissions, there have been several important reforms in the way FAA is able to manage itself. Chief among these are a fixed five-year term for the FAA administrator and reforms providing more flexibility in personnel and procurement policies.

**Lesson 5:** The most recent and potentially far-reaching reform has been the formation of the Air Traffic Organization.

- The ATO has begun to develop performance metrics and has set operational goals based on those metrics.
- The ATO has brought operations and capital investment in facilities and equipment into an organizational structure where they are more closely linked.
- The ATO has placed more emphasis on developing and implementing cost accounting systems that will allow them to have a much better idea of the costs of providing various services.

**Lesson 6:** While the ATO may be an important step in improving how FAA is managed, several fundamental challenges to effective management remain that, unless addressed, will severely hinder FAA's ability to manage an air traffic control system that will keep pace with the anticipated growth in aviation.

- FAA's funding has a disconnect between cost and revenue drivers, which leaves FAA funding vulnerable to structural changes in the aviation industry.
- FAA's air traffic control modernization programs continue to be hampered by the poor performance and high costs of capital investment programs.
- FAA lacks organizational independence, which prevents FAA from using its resources in ways that would be most effective in managing the air traffic control system.

# Canada: NAV CANADA

NAV CANADA is a private, non-share capital corporation that owns and operates Canada's civil air navigation system, or ANS. NAV CANADA operations include seven area control centers, one stand-alone terminal control center, and over 100 airport control towers and flight service stations. These facilities manage over 12 million aircraft movements annually, including takeoffs, landings, and overflights.

## History and Background

Canada's air traffic services historically were provided by Transport Canada as a governmental function in much the same way FAA provides services in the United States. But Canada's airline deregulation in the mid-1980s spurred rapid growth in air traffic, especially in major cities such as Toronto. At the same time, federal government fiscal constraints had led to major budget cuts, including for the air navigation system. Of particular concern was a growing shortage of air traffic controllers at key locations. This resulted in major delays for airlines and business aviation. The air traffic controllers' union began to raise concerns that the rising workload, consistently required overtime, and reduced budgets were affecting safety.

Concerns about the performance of the air traffic system began to be shared by all stakeholders. Together, the airlines, unions, and business aviation recommended that the government explore commercialization options to improve the performance of air traffic services. Following a series of studies, Transport Minister Doug Young made such a recommendation. A team was established within Transport Canada to analyze the potential benefits and costs of commercialization. This small team undertook a comprehensive review of organizational alternatives, international experience, revenue and user fees, capital investment, financing, and regulatory issues. The team recommended further public consultations, which were launched in early 1994.

The consultation process was extraordinarily thorough and built around an advisory committee that included virtually all stakeholders in the air traffic system: airlines, airports, unions, pilots, general and business aviation, safety organizations, and equipment suppliers. The resulting consultation reports concluded that a commercialized ANS structure would be better able to provide improvements to services while maintaining system safety.

The consultation process also concluded that a variety of organizational options could be effectively undertaken, but that these options were likely to provide many benefits compared to continued government provision:

- Better procurement decisions and management
- Access to capital markets for funding
- A more stable user-funded system more responsive to customers

The study team evaluated the following five key areas:

1. Organizational options for commercialization
2. Safety regulation
3. Economic regulation
4. International experience and lessons
5. User charging systems and fees

As the review process unfolded, it became clear there was strong support for shifting the underlying funding structure from the Air Transportation Tax (based on a percentage of ticket prices paid by travelers) to a user fee structure. Studies indicated that user fees based on internationally agreed guidelines and practices would produce revenues that would not only enable full cost recovery, but also provide enough surpluses to fund debt service for capital market finance.

Another result of the study was recognition that Canada was missing a significant source of revenue in the form of overflight charges, especially for flights between Europe and the United States that transited Canadian airspace. To that point, these services had been provided at no charge. Recognizing this opportunity, the government instituted a fee system that generates about C$200 million annually. These incremental charges enabled revenues for the Canadian air traffic system to approximately equal costs for the first time. This changed the perception of the financial viability and attractiveness of the Canadian ANS, and gave increased importance to the value of the assets and activities being considered—especially if they were to be transferred from governmental to private control.

The adoption of overflight fees and the general commitment to shift from a ticket tax to user fees also shifted the nature of discussion about organizational alternatives. While the air carriers were supportive of a shift to user charges, they also felt strongly that they should play a significant role in ANS governance. (This became known as "user pays, user says.") This spurred additional interest by other stakeholders in governance.

In this context, the government chose to establish a special-purpose, not-for-profit corporation that would purchase and operate the ANS. Because charging systems would be set for fixed periods, the not-for-profit status required that any surpluses of revenue over costs be used for capital investment or go into a reserve fund that would serve to facilitate rate stabilization. Since there would be no shareholders, the Canadian Corporations Act provided for member organizations that could nominate board directors.

The agreed board structure has 15 members:

- 4 directors nominated by air carriers
- 1 director nominated by business aviation
- 2 directors nominated by unions
- 3 directors nominated by government
- 4 directors appointed by the above 10 members
- the CEO of NAV CANADA

This board structure is designed to provide major stakeholders a significant role in governance. The board is supported in these efforts by an Advisory Committee composed of representatives from various aviation groups across Canada.

Once the board structure was in place, the new corporation was empowered to negotiate the purchase of the ANS from the government. The detailed negotiations were complex, but led to an Agreement in Principle in December 1995 establishing sale price and terms and conditions to be resolved before transfer. The process was shaped by the commitment to a new user fee structure, so that value was determined on a net present value of income basis rather than on asset values (which presented significant valuation problems in themselves). Negotiations over valuation focused on growth and risk scenarios, as well as the forecast of expected capital investments required (and the associated debt service costs).

Another issue involved the regulatory environment under a new structure. It was widely accepted that safety regulation would be retained by Transport Canada. With regard to economic regulation, concern that NAV CANADA would be a monopoly provider was tempered by three factors: the not-for-profit status, legal requirements that limited charges to full cost recovery, and recognition that the presence of user groups on the board would create incentives for efficiency and avoidance of "gold-plating" the system. As a result, economic regulation was minimal, based on legal requirements to adhere to certain principles, along with an appeal process to the government.[26]

The negotiation resulted in an agreed valuation of C$1.8 billion, to take the form of a cash payment to the government of C$1.5 billion, and the assumption of C$0.3 billion in existing financial obligations by NAV CANADA. Because there was no shareholder equity in the structure, the sale proceeds and the initial working capital would have to be raised in debt markets, with future revenues pledged as collateral (a revenue bond structure). A high credit rating was received, based on the designated monopoly status, stable and growing demand, a flexible user charge system with fees comparable to other countries, guaranteed government revenue support for the first two years, and broad support for the process and organizational structure.

NAV CANADA was able to secure a C$3 billion credit facility. The company drew C$2 billion in actual borrowing, three-fourths of which was used to purchase the system from the government, and the remainder to provide working capital and establish reserves. Legislation was enacted in June 1996, and NAV CANADA purchased the ANS from the government on November 1, 1996. Following the transfer, a bond offering was arranged to replace the majority of the bank loan with long-term, lower-cost permanent finance.

Unions had supported a transfer of ANS from the government to a new entity, in part because of growing workload and safety concerns, but also because under governmental operation they had been subject to a six-year-long wage freeze and because the right to strike was prohibited. The new organization extended existing job security provisions and executed a new collective bargaining agreement. Negotiations for this new agreement were quite contentious, but resulted in a significant pay raise for the controllers while avoiding a strike.

## NAV CANADA's Performance 1996–2001

The first five years of operation saw significant improvement in operational and financial performance, with improvement in a number of safety indicators. The implementation of the user fee system resulted in 11 percent lower charges to air carriers, while robust traffic growth of 20 percent led to a surplus of C$75 million in NAV CANADA's rate stabilization reserve fund. NAV CANADA had undertaken an extensive capital program, totaling about C$1 billion over the 1996–2001 period.

Other than FAA in the United States, no ANS provider was more dramatically affected by the events of September 11 than NAV CANADA. Immediately following the attacks and the closure of both U.S. and Canadian airspace to civil aviation, the employees of NAV CANADA were able to guide 1,500 aircraft to safe landing, including 239 U.S.-bound international flights diverted from the North Atlantic to Canada. By the end of the day, all flights had been handled safely, without one single incident or loss of separation.

Once the operational situation had settled, NAV CANADA was faced with an immediate traffic and revenue decline of more than 10 percent, which would result in a C$145 million shortfall versus budget for fiscal 2002. Longer term, NAV CANADA anticipated a cumulative 2002–2005 shortfall of C$360 million, which would make debt service extremely difficult and make it almost impossible to sustain even a modest capital program. In this context, NAV CANADA adopted what it termed a "balanced approach" in which all stakeholders were asked to make a contribution.

### Revenues

The rate stabilization reserve fund was depleted from its C$75 million balance to a negative position of C$116 million. In effect, NAV CANADA was able to run at an operating deficit, albeit with the intention of recouping these cumulative losses over five years. Rates, which were reduced 15 percent in 1999 and were to have been frozen until 2002, were instead raised 6 percent in 2002, an additional 3 percent in January 2003, and an additional 6 percent in August 2003. Overall, NAV CANADA's rate increases since 1999 have been slightly below inflation, and remain approximately 20 percent below the Air Transportation Tax it replaced. Air carriers were offered a temporary payment deferral and an extension of payment terms to help manage their cash flow.

### Cost Savings

Cost reductions were implemented in the form of cuts to management and board salaries and compensation. A wage freeze was proposed, but not agreed to, for unions. Suppliers were also required to provide concessions. Capital spending was reduced and deferred. Overall, annual cost savings of C$100 million were achieved.

### Financial Restructuring

A review of capital assets led to a series of lease-back deals totaling C$600 million, which helped generate cash flow to support operations and required capital spending.

The successful initial period of operations from 1996 to 2001, along with its unique governance structure, strongly influenced NAV CANADA's response to this dramatic change in its operating and financial outlook.

## NAV CANADA's Current Performance and Outlook

The effects of the downturn continued to be felt by NAV CANADA through 2004. The severity and duration were worsened by the advent of the Iraq war, traffic declines in Asian markets resulting from SARS, and the bankruptcy filing of Air Canada in October 2003. Air Canada was NAV CANADA's largest single customer, and at the time of bankruptcy owed C$45 million. Through this time, the company sought to maintain operational and safety performance while managing its financial position as best as possible. The rate stabilization fund, which had a C$75 million reserve as of September 11, 2001, was drawn down into a negative position, reaching (C$166 million) by 2003.

By the end of 2004, traffic volumes were close to 2001 levels, and NAV CANADA had made significant progress in paying down the deficit in its rate stabilization account. By August 2005, the company had further recovered, with revenue increasing 13 percent over 2004. This increase was in part due to traffic growth, but more so from a further increase in charges of 7.9 percent, effective September 2004. The increased revenue enabled NAV CANADA to retire the deficit in the rate stabilization account, ending with a surplus of C$38 million by August 2005. The intention was to build this reserve to C$50 million.

The stabilization of the company's financial position has enabled NAV CANADA to look further ahead. The company is entering a new stage, which is characterized by an implementation of its 2003–2004 review of operations, proposed revisions to the system of rates and charges, further modernization of the ANS system, an enhanced investment program, and the restructuring of the balance sheet to provide additional flexibility and lower-cost financing.

### Operational Initiatives

The company concluded new collective bargaining agreements with unions, albeit with considerable difficulty. Improving labor relations remains a major issue, especially in the areas of staffing levels, training, and employee involvement in project planning and implementation.

Other operational initiatives have been sought through technology deployment. These projects include national rollout of the Canadian Automated Air Traffic System (CAATS), one of the world's most advanced flight data processing systems. Still other projects include enhanced computer displays, upgraded radars, and Instrument Landing System (ILS) replacements.

### Rates and Charges

In January 2005, NAV CANADA initiated a review of its customer charges, including charging and cost allocation methodologies, the rate stabilization account, and the provision of aeronautical publications. The major change is to reduce the aircraft weight factor in the formula for the Terminal Charge in two phases. The international convention of charging units defined by weight and distance has been an attempt to include both cost drivers and some measure of ability to pay or value of service. Inclusion of a weight factor also recognizes that the majority of the infrastructure and operating costs of the Canadian ANS system is driven by commercial airlines operating large commercial aircraft. Studies undertaken for NAV CANADA indicate that a weight factor of .60 is consistent with costs, while the current 0.90 factor is a proxy for ability to pay by air carriers operating larger planes. However, given the

recent performance of the industry, the type of aircraft flown by an airline is not a clear indicator of the carrier's financial health.

The proposed NAV CANADA change is a small move away from this historical "ability to pay" system. In effect, the proposed charging system is moving to align charges closer to cost drivers. It also is consistent with proposals in Europe to apply a weight factor of 0.7 across its charging systems. In practice, the change would decrease charges for wide-body aircraft, be roughly neutral for most jets, and raise charges for smaller regional jets and for propeller and turboprop aircraft. Another aspect of the proposed changes is differential (lower) pricing for International Communication Services using data link technology rather than sole reliance on voice communication. This reflects the more extensive interaction and higher costs incurred by voice-only communication. Overall, the changes in the rates and charging system are designed to better align costs and charges; to better balance charges and costs for large and small aircraft; and to reflect the impact of lower-cost ANS technologies.

### Investment Program

NAV CANADA's capital planning follows an incremental approach with an emphasis on existing technology. The company believes this approach minimizes technical, cost, and delay risks while maintaining a continuously functioning system. NAV CANADA has adopted a three- to five-year horizon as best matching ANS technology and systems. For example, NAV CANADA's 2005–2008 Business Plan focuses on implementation of the CAATS system for automated exchange of operational data, and more controller and ATC decision support tools, enhancing area and satellite navigation coverage. There is an emphasis on making sure that investments match customer equipage, and that planning is focused on the issues that create the most problems for users, such as improving air traffic flow management and increasing airspace capacity and flexibility.

The other main feature of NAV CANADA's approach to capital investment is efforts to use "off the shelf" technology but adapt it in-house to meet needs. This approach has enabled NAV CANADA to develop commercial opportunities for systems and products that it has developed in-house. The best example of this is the sale to National Air Traffic Services in the United Kingdom of the EXCDS touch-screen-based flight display systems for London airports and of oceanic software for Shanwick Automated Air Traffic System.

### Financial Restructuring

Looking ahead to future financing needs, NAV CANADA proposed changes to its Master Trust Indenture, which governed the C$750 million of long-term debt carried by the company. After discussions with bondholders, NAV CANADA has decided to leave the terms of the existing bonds unchanged and proceed with a new financing platform that will enable the issuance of additional debt as unsecured general obligations, subordinate to existing bonds. This should provide additional financing for the new capital program. In addition, the rate stabilization fund has been reaffirmed as a valuable tool to manage industry downturns and to stabilize rates over longer periods.

## Lessons from NAV CANADA

**Lesson 1:** The extensive review and consultation process made the transition from government to private provision more acceptable to all parties. The process was focused on how to improve performance by examining options, rather than attempting to prescribe a particular model at the outset.

**Lesson 2:** The replacement of the passenger ticket tax and general revenue funding by a system of user charges was facilitated by careful studies that identified new sources of revenue (overflight fees) and indicated that charges would be in line with international levels and less than the tax being replaced.

**Lesson 3:** The adoption of a user charge system in principle increased the desire for users to play a role in governance. The not-for-profit structure with board representation by stakeholders creates good incentives for cost control and improved capital program management, and reduces the need for economic regulation.

**Lesson 4:** The not-for-profit, non-shareholder structure required NAV CANADA to be heavily leveraged to purchase the ANS from government in 1996. However, the company was able to retain some degree of financial flexibility with its credit facilities and has sustained an investment grade rating throughout the downturn.

**Lesson 5:** NAV CANADA's organizational structure turned out to be an asset in the wake of the severe downturn since 2001. The stakeholder model in effect required all parties to make contributions and sacrifices. The nonprofit status established a clear financial objective during the period, while the rate stabilization fund allowed the company to manage the consequences of the downturn over a longer period. In effect, the NAV CANADA stakeholder model served an equity-like risk-bearing role during the period.

**Lesson 6:** Experience mattered in managing financial distress. The operating and performance record of NAV CANADA from 1996 to 2001 provided the company with credibility and support for its efforts to cope with the industry's crisis.

**Lesson 7:** The customer orientation appears to extend to a capital program and planning approach that has been much better at both modernization and the development of new technology with respect to cost, delay, and performance.

# United Kingdom: National Air Traffic Services

National Air Traffic Services is responsible for the planning and provision of air traffic services in UK airspace and (by international agreement) over part of the North Atlantic. NATS manages the UK's two flight information regions (FIRs), operates five air traffic control centers, and provides air traffic services at 14 major UK airports. The Scottish FIR is the largest in Europe, and the London center is one of the busiest in the world. NATS handles annually more than 2.2 million flights carrying more than 160 million passengers.

## History of Reform Efforts

At the end of World War II, air traffic services were placed in the Ministry of Civil Aviation, and subsequently were reorganized to achieve greater segregation of civil and military air traffic. Following a major study in 1961, National Air Traffic Control Services was established in 1962 as a unified civil/military organization to operate Britain's air traffic control. The shorter title and acronym NATS was adopted in the early 1970s. In 1972, NATS was absorbed into the newly established Civil Aviation Authority. Service and regulatory aspects were linked as an act of policy. The controller of NATS rotated between military and civilian staff on a three-year cycle.

The growth of aviation in the 1980s put significant pressure on NATS to cope with more flights. However, as part of the government, NATS was subject to an external financing limit known as the Public Sector Borrowing Requirement. As such, NATS became highly dependent on government grants for investment funds. These grants peaked at £130 million in 1993, but it was widely recognized that NATS was unable to fund the investment required to replace outdated equipment in the London center, let alone finance capital needed to keep pace with growth and changes in technology. NATS' normal operating surpluses of about £50 million could only cover about half of investment needs.

NATS' operational and safety performance was widely respected. However, there was growing criticism of NATS' level of charges to airlines and its recurring difficulties in managing its investment program. Of particular visibility was NATS' largest project, the en route center at Swanwick, which opened more than five years late and £150 million over the £475 million budget.

By the late 1980s, there also was growing concern about air traffic control safety and the dual function of NATS as regulator and provider of air traffic services. By 1989, following a House of Commons Transport Select Committee inquiry, responsibility for air traffic safety regulation was transferred to the CAA's Safety Regulation Group. A 1990 review of NATS by the Monopolies and Mergers Commission (MMC) recommended the separation of regulation and safety activities, with a management structure led by a civil chief executive appointed from outside. The MMC report also added that the logical conclusion of these initial steps would be creation of a NATS organization independent of the CAA.

In 1993, the Conservative government announced that it was reviewing options for the privatization of NATS. Another Transport Committee review in 1994–1995 recommended that NATS be converted into a for-profit public sector company that would be able to borrow in capital markets. While this proposal was deferred, the Conservative government did act on a CAA proposal that NATS be restructured

to achieve maximum possible separation within the existing legislative framework. In 1996, NATS was established as a separate company structure, wholly owned by the CAA. This was generally viewed as a step in preparation for privatization.

The mixed experiences with privatization in the UK led to a rethinking of how to restructure activities that had a substantial public interest component. Labour, who had previously declared "our air is not for sale," had come to recognize the need for a change in NATS. In 1998, the incoming Labour government announced plans for NATS to be restructured as a public-private partnership, or PPP, to help NATS have more control over its operating budget and to be able to access additional capital for its deferred investment program. The restructuring also was intended to separate regulation of air traffic services from their provision and to be more responsive to users.

The change to a Labour government in 1998 led to a review of organizational options, including:

- Privatization as a regulated utility (similar to electricity and water companies)
- A nonprofit trust (similar to NAV CANADA)
- A chartered, independent, publicly owned company (similar to the BBC)
- A public corporation (similar to Airways New Zealand)
- A modified version of the Private Finance Initiative (similar to schools and hospitals). This model was rejected because it was limited to individual projects or new investments. This would make systems modernization programs much more difficult.

The NAV CANADA model was rejected, ostensibly because it was believed that the structure might still be subject to the Public Sector Borrowing Constraint. While this may have been true if the exact NAV CANADA model had been adopted, Britain had a history of nonprofit public trusts, particularly in the ports sector. It also was believed that NAV CANADA's structure gave fewer incentives for efficiency and might not be able to handle major capital programs.[27]

Following a consultation period, a regulated PPP structure was chosen. The Labour government concluded that this structure would provide a solution to the financial and operational problems of NATS, by untying NATS from the government budgetary constraints and capital restraints due to NATS falling under the Public Sector Borrowing Requirement. It was also believed that the PPP provided greater incentives for efficiency than either a public corporation or a nonprofit structure. While NATS was not required to make a profit, it was expected to generate a return on capital employed between 6 percent and 8 percent on average.

Perhaps most importantly, the government fiscal situation put increasing emphasis on the budgetary impact of the NATS PPP. There was much discussion about the need for other government transport programs to benefit from the revenue derived from the proceeds of NATS' share sale.

The necessary legislation was introduced to Parliament in December 1999, and the Transport Act was approved in late 2000. The legislation provided for:

- A system of safety and economic regulation by the now-separate CAA
- Operating license conditions concerning public service obligations
- Government to retain a 49 percent shareholding and a "golden share," intended to preclude takeovers, and also to retain control over major corporate actions
- Government nomination of two directors with veto power on key strategic issues

## Moving Toward Corporatization

The designation of NATS as a regulated PPP required a new structure focused on civil air navigation services. Military air traffic services were transferred to the Ministry of Defence. Given the pending regulatory structure, it was necessary to transfer NATS from the CAA to direct government control, pending the sale to private sector participants. Following the sale, NATS was to be structured as a holding company with several subsidiaries. NATS En Route Ltd (NERL) is responsible for en route and oceanic air traffic services, while NATS Services Ltd would be responsible for airport air traffic services and business development.

## Financial Structure and Regulation

NATS' main source of income is regulated charges to airlines and airports. En route charges, which constitute about 75 percent of revenues, are based on an internationally agreed, cost-based formula taking into account aircraft weight and distance flown.[28]

Under the PPP, en route charges are subject to price-cap regulation by the CAA using the RPI-X method. This approach sets prices at the level of retail price inflation (RPI) less a factor to account for productivity (X). The larger the X factor, the greater the productivity improvements expected and the more the real price decline. For the first five years, X was set for 2001 at 2.2 percent, for 2002 at 4 percent, and for 2003 and 2004 at 5 percent.[29] Thus, after an initial adjustment, NATS was expected to meet progressive efficiency gains. NATS' management recognized the efficiency gains that would be required and felt that they could be achieved without detriment to operations or to the initially proposed £1 billion 10-year investment plan.

Regulations also provided an RPI-X structure for oceanic services, with an initial X setting of 2 percent for the initial five-year period. Thus, the regulatory structure placed more pressure on NATS to achieve efficiency gains in en route services. These hoped-for improvements were supplemented by a delay incentive provision, which would reduce (increase) NATS revenues if en route delays were worse (better) than in 1999, subject to an overall cap of between £2 million and £5.7 million per year over the first five-year period. No delay provision was established for oceanic services.

## Sale and Initial Ownership/ Management Structure

The Transport Act included requirements for both the 49 percent government share and for a 5 percent stake to be held by NATS employees. The remaining 46 percent was put out for bids. Three consortia qualified for the next round of bidding: Nimbus (which included facilities and airport services group Serco), Novares, and the Airline Group (composed of British Airways, bmi British Midland, Virgin Atlantic, Britannia, Monarch, easyJet, and Airtours). The government had stated its intention to pick a single partner consortium.

After continuing discussions, on March 27, 2001, the government announced it had selected the Airline Group as NATS' "strategic partner." Both Nimbus and the Airline Group bids were very similar in safety, security, and operations, but there were other differences on which the decision turned. The Nimbus proposal was seen as having a stronger financial structure, but with slightly lower sale proceeds to the government. There also was more support for the Airline Group's bid from other airlines (which believed there would be more customer focus to their benefit) and from the employees (who believed that jobs and conditions would be more secure).

Initially, the Airline Group's bid was worth about £95 million more in sale proceeds than Nimbus' offer. The main reason for the difference was that the Airline Group had assumed a higher rate of growth in NATS' traffic and revenue. After their selection, however, the Airline Group told the government that traffic declines in 2000 and early 2001 meant that they could not afford the price they had bid. The deal signed in July 2001 reduced initial proceeds by £87 million to £758 million. (This was still slightly more than the original Nimbus offer.) There also was a provision for deferred proceeds at later dates, worth (at most) an additional £21 million. The partnership became effective in July 2001 after getting merger clearance from the European Commission. Day-to-day operation was to be handled by a senior executive team, reporting to a non-executive board from the Airline Group, the director of the International Air Transport Association (IATA), and three partnership directors appointed by the government.

The net £765 million sale was completed in July 2001. The sale proceeds were financed overwhelmingly through borrowing by the Airline Group on behalf of NATS. Equity investment from the Airline Group was only £50 million, or about 6 percent of the total acquisition funding. NATS' initial financial structure saw NATS' debt rise to £733 million to cover the agreed sale proceeds. NATS' pre-existing debt capital of £355 million was refinanced with a new £733 million loan. This loan was secured by NATS' future revenues, not against the Airline Group as shareholders—as would have been expected if this was a conventional financial structure. In effect, the transaction was very similar to a project finance structure in which the equity participants paid in

only minimal equity, and where the overwhelming share of funding was from borrowing by NATS itself. The structure was quite similar to a leveraged buyout of NATS.

Despite warnings from NATS and the CAA about this level of gearing (leverage), the government concluded that these fears were misplaced. The government's financial advisors noted that any reduction in the amount of debt was likely to reduce sale proceeds pound for pound. After the transfer, in addition to the acquisition borrowing, the Airline Group negotiated additional credit facilities of £690 million for capital programs, and an additional £30 million facility for working capital. Prior to the events of September 11, NATS was expected to borrow almost £1.5 billion. The government's financial advisors concluded that this structure was adequate, and that it would be better for the shareholders to respond to additional needs if required.

## NATS' Financial Difficulties After September 11

As discussed above, the UK government's desire to maximize sale proceeds and the resulting highly geared financial position of NATS was vulnerable even to modest industry declines, which were starting to occur as early as 2000. The severe downturn in traffic after the September 11 terrorist attacks made NATS' financial structure non-sustainable and in need of immediate and dramatic restructuring. The attacks came so soon after the start of the PPP that there had been no opportunity to build any reserves. This restructuring took the better part of two years, and it was not until 2004 that NATS' position was strong enough to again look to managing for the future.

NATS' en route revenues were about 14 percent below forecast in the six months following September 11. In addition, since en route services had much higher margin than terminal area services, NATS' profits were reduced by approximately one-third compared to forecast. These declines were severe enough to put NATS at risk of violating the terms of credit facilities. NATS was forced to limit its borrowings under the credit line to only £24 million of the £690 million line. In effect, this put the entire £1 billion capital program on hold. Operating cash surpluses also were reduced, with some concerns that NATS would be unable to pay debt service on existing debt by early 2002.

While equity investors are commonly expected to bear business risks, the downturn after September 11 left the members of the Airline Group exposed to the same financial stress as NATS. They were unwilling and unable to infuse additional equity funds. The government also was unwilling to supply additional equity capital without extended review. The government's position was made more difficult in the context of the October 2001 decision to place Railtrack (the country's rail infrastructure company) into receivership. Between Railtrack and NATS, the result was tense relations between the government and financial institutions, as well as much public criticism of various privatization initiatives. In short, existing equity investors were unwilling or unable to serve a risk-bearing role.

Given the fragility of NATS' structure and the severity of the industry downturn, the need for a comprehensive solution was soon apparent. In such a setting, this financial distress can be resolved only through a mix of raising revenues, cutting costs, restructuring debt, and raising additional capital. Reflecting contributions from all stakeholders, NATS' restructuring has been described as NATS' "Composite Solution."

### Revenues

NATS' regulated pricing structure could not be changed without CAA regulatory approval. This proved to be a major challenge, because NATS charges had already been among the highest in Europe, and because the airline users were themselves in financial difficulty. However, as the severity of the downturn became apparent, the CAA agreed to revise NATS' RPI-X structure to a constant RPI-2, which is 2 to 3 percent more than originally agreed. With the RPI running about 3 percent, this was much less than the 12 percent average nominal increase put in place by European air traffic system providers in 2002. This pricing change was expected to cost airlines £100 million more over the 2003–2010 period.

In addition, the regulator put in place a traffic-volume risk-sharing mechanism that allows NATS to raise its charges automatically to recover half or more of lost revenue, should traffic fall below the level forecast by NATS in its regulatory submissions.

### Cost Reductions

While it is generally felt that air traffic control costs are largely fixed (at least in the short run), the magnitude of traffic declines forced NATS to rethink its cost structure. NATS reduced support costs and deferred both pension contributions and capital expenditures. Overall, NATS reduced costs by approximately £170 million over four years, representing about 10 percent of total costs.

### Additional Capital Funding

After internal cost reductions and the relaxation of regulatory price caps by the CAA, NATS proposed an additional £130 million of equity investment, made up of £65 million on equal terms from the government and a new investment from BAA plc, the operator of London's main airports. The government had required that any additional investment on its part be matched by private sector shareholder capital.

The introduction of a new shareholder resulted in a new ownership structure, with the government retaining its 49 percent share, the employees their 5 percent share, BAA plc with a 4 percent share, and the Airline Group's stake reduced to 42 percent. This new shareholding structure is quite remarkable, given that both the government and BAA's equity contribution exceeded that of the original £50 million from the Airline Group, yet BAA's shareholding is very small. This appears not to be the result of BAA's stronger financial position but a reluctance to allow the major UK airports to have a major governance role in air traffic services. The contribution by BAA looks somewhat similar to supplier or customer financing.

The proceeds were used to reduce the debt financing from the original £733 million (plus subsequent borrowings of £24 million) to approximately £600 million. Once these additional funds were secured, NATS' credit ratings were strengthened, and the company was able to replace the £600 million of bank debt with a bond issue that provided a much cheaper source of long-term finance with fewer restrictions on company operations and investments. The result was a balance sheet that was still highly leveraged but much less so than before. In addition, the infusion of shareholder funds moved the basic financial structure of NATS away from project finance precepts to a more conventional corporate finance structure.

## NATS' Situation and Outlook

NATS' financial structure was much improved by late 2003, but the volume and mix of traffic remained a challenge. The company lost £109 million in 2002–2003, and barely broke even in 2004. The advent and growth of low-fare carriers caused more discussion of the level of NATS charges compared to Europe. In addition, a major outage in summer 2004 caused traffic disruptions and delays, although without safety performance being affected. NATS brought in a new senior management team with private sector backgrounds involving large-scale capital programs.

By the end of 2004, traffic had recovered to pre-September 11 levels, with a 2005 traffic growth of almost 5 percent. This revenue growth enabled NATS to report its first significant pre-tax profit of £69 million for the year ended March 2005, and enabled it to declare its first ever dividend. Operationally, NATS handled record traffic of over 2.2 million flights, with fewer delays and consistent safety performance. The stabilized industry and company environment has enabled NATS to finally move forward on its £1 billion investment program and to undertake significant partnerships with the Irish Aviation Authority, to take on joint projects with Spain for next-generation air traffic systems, and to work with and utilize NAV CANADA technologies for electronic flight data systems.

## Lessons from NATS

**Lesson 1:** The transition from government to commercial status was strongly conditioned by government's preference to use a particular model for commercialization (public-private partnership). This preference led to a series of choices and compromises in implementation that placed NATS in a weak position at the outset.

**Lesson 2:** The government's desire to maximize sale proceeds overrode the objective of an improved ANS operation. This encouraged optimistic growth forecasts, inadequate risk assessment, and extreme gearing.

**Lesson 3:** The role of the Airline Group as strategic partner was compromised by the project finance structure put in place. NATS was too highly leveraged, and the security structures for the financing looked only to NATS' cash flows rather than equity holders as risk-bearing entities. The initial unwillingness and subsequent inability of the Airline Group to make larger equity investments meant that equity holders bore only minimal risk in the initial structure.

**Lesson 4:** The regulatory environment proved to be challenging and contentious, given the financial problems faced by both NATS and users. The management process struggled to respond to the financial crisis, in part because of concerns about the viability of the entire enterprise and the conflicting incentives of shareholders.

# Lessons and Conclusions

In many countries, most notably Canada and the United Kingdom, air traffic control is being provided by autonomous authorities operating on market-based principles with considerable managerial discretion and funded by fees collected for the services they provide. In the United States, the ATO within FAA provides air traffic control as a civil aviation department operated with annual budget appropriations from the central government. Table 5 summarizes the basic characteristics of FAA, NAV CANADA, and NATS. FAA faces serious problems both in operating the air traffic control system and particularly in making the long-term capital investments necessary for that system to accommodate the anticipated growth in aviation.

The problems facing FAA are not new, but have been recurring themes for decades. For nearly 20 years, a series of special commissions have called for reforms in how FAA is funded, organized, and managed. While the most far-reaching of these reforms have not been enacted, there have been important changes including a fixed five-year term for the FAA administrator and more flexible personnel and procurement systems. Most recently, both the air traffic control operations and the investment in facilities and equipment portions of FAA have been brought together in a single branch of FAA called the Air Traffic Organization. Some important changes have been brought about by the ATO, including the development of performance metrics and the setting of operational goals based on those metrics, as well as the continuing development of a cost accounting system.

While the ATO may be an important step in improving air traffic control in the United States, the formation of the ATO did not respond to three fundamental challenges that, unless addressed, will severely hinder both management of the air traffic control system and efforts to modernize it to keep pace with the anticipated growth in aviation:

- Air traffic control funding has a fundamental disconnect between the factors that drive the

**Table 5: Summary of Characteristics**

| **Country** | United States | Canada | United Kingdom |
|---|---|---|---|
| **Organization** | FAA/ATO | NAV CANADA | NATS |
| **Type of Organization** | Government agency | Nonprofit corporation | Public-private partnership |
| **Budget** | Government budget process | Autonomous | Autonomous |
| **Primary Funding Source** | Taxes | User fees | User fees |
| **Fees or Taxes Set By** | Congress through the legislative process | Board of directors with possibility of appeal to government | RPI-X, with X set by Civil Aviation Authority |
| **Safety Regulator** | Self-regulated | Transport Canada | Civil Aviation Authority |
| **Access to Private Financial Markets** | Some leasing | Full access | Full access |

costs of providing the services and the factors that drive the revenues used to provide the financial support.

- FAA's air traffic control modernization programs continue to be hampered by the poor performance and high costs of capital investment programs.
- Air traffic control lacks organizational independence, which prevents resources from being used in the most effective ways and which also results in self-regulation of the air traffic control system.

One challenge is that FAA's funding continues to have a disconnect between factors that drive the costs of the system and the factors that drive the revenues used to provide most of the financial support for the system. This disconnect hampers FAA's ability to manage its resources effectively and leaves FAA's funding vulnerable to structural changes in the aviation industry.

A second challenge is the continuing poor performance and high costs of FAA's capital investment programs. One cause of this problem is diffused accountability. Diffused accountability can result in inadequate incentives for financial discipline, which is one of the most striking differences between FAA and both NAV CANADA and NATS. With NAV CANADA and NATS, financial discipline comes primarily from the role of users, aircraft operators, in approving and overseeing capital investment decisions. Users see and judge the "worth" of investments in very tangible terms: Does what they are going to get justify the cost in terms of the impact on future user charges? With FAA, the accountability is diffused among the FAA, Congress, and the administration; financial discipline is inadequate; and the history of FAA's ATC modernization projects has been a pattern of projects being over budget, under performing, and late.

The final challenge is FAA's lack of organizational independence, which prevents FAA from using its resources in ways that would be most effective in managing the air traffic control system. Congress often intervenes in FAA decision making to prevent improved efficiency through facilities consolidation because of local concerns about possible job loss. Because FAA is both the provider of air traffic control services and the regulator of those services, FAA, in effect, self-regulates rather than having arm's-length regulation of air traffic control as it has with airline operations, aircraft design and manufacture, and virtually every other aspect of aviation.

NAV CANADA and NATS are examples of two different types of autonomous authorities operating on market-based principles with considerable managerial discretion and funded by fees collected for the services they provide. NAV CANADA was the first private sector company in the world to use a non-share capital structure to commercialize a government service. Governance and management is in the hands of a stakeholder cooperative with a board designed to represent various constituencies—airlines, government, passengers, labor unions, general aviation, and airports. NAV CANADA's revenue comes from the fees it charges users for these services. The company's safety performance is regulated by Transport Canada.

NATS is a public-private partnership between the Airline Group, a consortium of seven UK airlines that together hold 42 percent of the ownership; NATS employees, who hold 5 percent; the UK airport operator BAA plc, which holds 4 percent; and the British government, which holds 49 percent and a "golden share," giving it a super-majority on major decisions. Its revenues come from fees charged users for these services. The Civil Aviation Authority of Britain has responsibility for both economic and safety regulation, and must approve most changes in fees, services, and financing.

While these two organizational forms were quite different, they shared the characteristic that both have overcome the fundamental challenges that remain with FAA. Both NAV CANADA and NATS started out with highly leveraged financial structures, although for different reasons and with some important differences. Both were severely affected by the airline industry downturn that started in 2001. NAV CANADA saw its rate stabilization account go into deficit and increased its charges. NATS had to restructure its debt and raise additional equity investment.

Both NAV CANADA and NATS have emerged from the 2001–2004 period as financially solid organizations that are both well positioned not only to modernize to meet the growing needs of their own airspace, but also to extend their provision of various air traffic management services to other parts of the world. So long as these fundamental challenges remain for FAA, it doesn't seem well positioned to do either of these things. For FAA to move ahead in a similar fashion, the fundamental challenges outlined here must be addressed.

# Acknowledgments

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# Appendix: How Does the Air Traffic Control System Work?

Perhaps the easiest way to describe how the air traffic control system works in the United States is to follow a typical passenger airline flight from beginning to end. A commercial airline flight will have a flight profile that includes the following steps:

- **Preflight:** This portion of the flight starts on the ground and includes loading the aircraft, flight checks, push-back from the gate, and taxi to the runway.
- **Takeoff:** The pilot powers up the aircraft and speeds down the runway.
- **Departure:** The plane lifts off the ground and climbs to a cruising altitude.
- **En route:** The aircraft travels across the country at cruising altitude and nears the destination airport.
- **Descent:** The pilot descends and maneuvers the aircraft toward the destination airport.
- **Approach:** The pilot aligns the aircraft with the designated landing runway.
- **Landing:** The aircraft lands on the designated runway, taxis to the destination gate, parks at the terminal, and the aircraft is unloaded.

## Preflight

Prior to the flight, while passengers, baggage, and any cargo are being loaded on the aircraft, the pilot does the final walk-around inspection of the aircraft and files a flight plan with the tower. Passenger airline flights follow instrument flight rules and are equipped to fly in a wide variety of weather. The flight plan the pilot, or the airline's dispatch office, files with the air traffic control tower contains the airline name and flight number, the type of aircraft, the intended airspeed and cruising altitude, and the route of flight including the departure and destination airports. A controller in the tower enters the flight plan information into the FAA host computer. The computer, in turn, generates a flight progress strip, which contains all the necessary information for the flight and which will be transmitted from controller to controller until the plane reaches its final destination.

Once the flight plan has been approved, the pilot is given clearance and the flight progress strip is passed to the ground controller in the tower. All air traffic control is overseen by the Air Traffic Control System Command Center, which monitors the entire system, including weather conditions. In some cases, perhaps due to weather or other reasons, the flight may be held on the ground and delayed from taking off. These ground holds are used to make sure that no part of the air traffic control system is overloaded beyond its capacity. Holding an aircraft on the ground prior to takeoff is preferred to having that aircraft have to circle in the air at the destination airport, waiting for the congestion to ease so that the plane may land.

The ground controller is responsible for all ground traffic, including aircraft taxiing from the gate to the takeoff runway and from the landing runway to the gate. When the ground controller has determined that it is safe, the pilot is directed to push back from the gate. If a tug is used to push the airplane back from the gate, that tug is usually operated by airline personnel. The aircraft then taxis to the runway under the direction of the ground controller. When the plane reaches the designated takeoff runway, the plane is "handed off," which means that the flight progress strip is passed, to the local tower controller.

## Takeoff

The local controller is responsible for making sure that aircraft taking off maintain a safe distance from one another. An airplane taking off or in flight leaves very turbulent air behind it, including a particular form of turbulence knows as wake vortex. If an aircraft flies too closely behind another aircraft, it can result in a very bumpy ride and in some cases a very dangerous condition. When the local controller determines that there will be sufficient distance between aircraft and that it's safe to take off, clearance is given to the pilot and the pilot may begin the takeoff run. A critical safety aspect is making sure that the active runway is clear of other aircraft. The local controller provides the pilot with the radio frequency on which the pilot can talk to the next controller, and hands the plane off (electronically) to the next controller, in this case the departure controller. The local controller will continue to monitor the plane until it is five miles from the airport.

## Departure

The departure controller, who has control of the aircraft now, is located in a Terminal Radar Approach Control Facility, known as a TRACON. Once the aircraft has taken off, the pilot turns on the plane's transponder. The transponder detects incoming radar signals and broadcasts back a radio signal that provides the air traffic control system with the aircraft's flight number, altitude, airspeed, and destination. This information is displayed on the radar screen of the air traffic controller and makes it much easier to keep track of multiple flights. The airspace controlled by a TRACON is a 50-mile radius area that may contain more than one airport. The TRACON airspace will have well-established air corridors for arriving and departing aircraft, and the departure controller will direct the plane to one of these corridors by giving the pilot the heading, speed, and rate of climb. The departure controller will use radar, in conjunction with transponders, to monitor the aircraft and maintain a safe distance between it and other aircraft. When the aircraft leaves the TRACON airspace, the departure controller hands off the aircraft to a center controller.

## En Route

The controllers responsible for the aircraft during the en route portion of flight are located in Air Route Traffic Control Centers, ARTCCs, sometimes just known as Centers. The airspace of the United States is divided into 21 different zones, each one controlled by a different ARTCC. Within each of these zones, the airspace is divided into sectors, and each sector is managed by at least two controllers. The radar associate controller received the flight plan information prior to the flight entering the sector and works with the radar controller to maintain safe separation between aircraft. This involves communicating via radio with the pilot and providing instructions as to altitude, heading, and speed. There are both high-altitude sectors (above 24,000 feet) and low-altitude sectors (below 24,000 feet). The controller will also provide updated weather information. In some cases, aircraft may be directed to alternative routings to avoid bad weather. These controllers will monitor the aircraft until it leaves their sector, at which point they will hand it off to the next sector's controller. Depending on the length and destination of the flight, it will pass through several sectors and several different Centers.

## Descent

As the plane nears its destination, the controllers will move it from the high-altitude sectors to low-altitude sectors and merge the aircraft approaching a particular airport from various directions into a single line, with sufficient spacing between the planes so that they can proceed to land. In order to merge planes into a single line, some may have to slow down, others may have to speed up, and still others may have to enter a holding pattern briefly. As the plane descends, it will get to within 50 miles of its destination airport and will enter airspace controlled by the destination TRACON.

## Approach

At the TRACON, the approach controller will direct the pilot to adjust the aircraft's heading and speed to line up with other aircraft along a designated approach corridor and align with the landing runway. When the plane is within 10 miles of the runway, the approach controller in the TRACON hands off the aircraft to the local controller in the tower.

## Landing

The local controller uses both visual information and surface radar to make sure that it is safe to land and then clears the aircraft to land. As with takeoffs, making sure that the runway is clear of other aircraft is a critical controller responsibility. The local

controller also provides the pilot with weather and runway condition information. Once the aircraft has landed, the local controller directs it to the appropriate taxiway and hands the plane off to the ground controller to direct the plane to the gate.

When described in simple terms, it all sounds easy; in fact, almost all flights are uneventful from an air traffic control standpoint. However, it's important to realize how many things must function properly for the air traffic control system to work. Not only must the radars and transponders work well to allow the controllers to monitor the location of each aircraft, but the radios must also work well on the different frequencies to allow the controllers and the pilots to communicate. Then the various computers must work well and communicate with one another to allow the handoffs from controller to controller. And, all of this must function 24 hours a day, 365 days a year, in all kinds of weather.

# Endnotes

1. See, for example, Air Traffic Control, FAA's Modernization Efforts—Past, Present, and Future, Statement of Gerald Dillingham before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives, October 30, 2003, GAO-04-227T; and Cost Control Issues for the Federal Aviation Administration's Operations and Modernization Accounts, Statement of The Honorable Kenneth M. Mead, Inspector General, U.S. Department of Transportation, Before the Committee on Appropriations, Subcommittee on Transportation, Treasury, and Independent Agencies, U.S. House of Representatives, April 9, 2003.

2. NAV CANADA, Level of Service Review, Summary Briefing Paper, October 2004.

3. See, for example, Air Traffic Control, FAA's Modernization Efforts—Past, Present, and Future, Statement of Gerald Dillingham before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives, October 30, 2003, GAO-04-227T; and Cost Control Issues for the Federal Aviation Administration's Operations and Modernization Accounts, Statement of The Honorable Kenneth M. Mead, Inspector General, U.S. Department of Transportation, Before the Committee on Appropriations, Subcommittee on Transportation, Treasury, and Independent Agencies, U.S. House of Representatives, April 9, 2003.

4. Air Traffic Control, FAA's Modernization Efforts—Past, Present, and Future, Statement of Gerald L. Dillingham, Director, Physical Infrastructure Issues, GAO-04-227T.

5. Status of FAA's Major Acquisitions: Cost Growth and Schedule Delays Continue to Stall Air Traffic Modernization, Federal Aviation Administration, Report Number AV-2005-061, date issued: May 26, 2005.

6. National Civil Aviation Review Commission, Executive Summary, December 11, 1997.

7. National Civil Aviation Review Commission, Section III, December 11, 1997.

8. One example was when President Clinton signed the Federal Workforce Restructuring Act of 1994. The act targeted a reduction of 272,900 federal employees between 1993 and 1999. Eventually, more than 3,000 FAA employees left the agency under this program.

9. National Airspace System, Experts' View on Improving the U.S. Air Traffic Control Modernization Program, GAO-05-333SP.

10. To date, only one appeal has been filed; it was denied by the government in 2003.

11. A little over 200 low-volume air traffic control towers and 58 automated flight service stations are operated by private sector companies under contract to FAA.

12. A domestic segment is a flight leg consisting of one takeoff and one landing by a flight.

13. As a point of comparison, the federal tax on gasoline for automotive use is $0.184 per gallon, in addition to state gasoline taxes that typically range from $0.10 to $0.33 per gallon.

14. As a point of reference, the Wright Brothers' first flight was on December 17, 1903.

15. For a more complete description of the origins of passenger air transportation, see John R. Meyer and Clinton V. Oster, Jr., *Airline Deregulation: The Early Experience* (Auburn House, 1981), Chapter 2.

16. National Airspace System, Experts' View on Improving the U.S. Air Traffic Control Modernization Program, GAO-05-333SP.

17. National Airspace System, Transformation Will Require Cultural Change, Balanced Funding Priorities, and Use of All Available Management Tools, GAO-06-154.

18. Perspectives on the Aviation Trust Fund and Financing the Federal Aviation Administration, Statement of the Honorable Kenneth M. Mead, Inspector General, U.S. Department of Transportation, Before the Committee on Transportation and Infrastructure, Subcommittee on Aviation, United States House of Representatives, May 4, 2005.

19. Air Traffic Control, FAA's Modernization Efforts—Past, Present, and Future, Statement of Gerald L. Dillingham, Director, Physical Infrastructure Issues, GAO-04-227T.

20. Status of FAA's Major Acquisitions: Cost Growth and Schedule Delays Continue to Stall Air Traffic Modernization, Federal Aviation Administration, Report Number AV-2005-061, date issued: May 26, 2005.

21. National Civil Aviation Review Commission, Executive Summary, December 11, 1997.

22. National Civil Aviation Review Commission, Section III, December 11, 1997.

23. National Airspace System, Experts' View on Improving the U.S. Air Traffic Control Modernization Program, GAO-05-333SP.

24. National Airspace System, Experts' View on Improving the U.S. Air Traffic Control Modernization Program, GAO-05-333SP.

25. *Aviation Safety Commission: Final Report and Recommendations* (Washington, DC: Government Printing Office, 1988), p. 25.

26. To date, only one appeal has been filed; it was denied by the government in 2003.

27. NAV CANADA had emphasized that its user-nominated governance structure provided strong efficiency incentives and a more applied focus to capital investment. They also noted that the nonprofit structure was not subject to economic regulation, thereby reducing regulatory risk and allowing them to borrow at lower cost than regulated utilities.

28. These are established by EUROCONTROL and collected on NATS' behalf by the EUROCONTROL Central Route Charges Office.

29. This profile of efficiency gains was expected to bring NATS' level of charges to the European average by the end of the five-year period.

30. National Airspace System, Experts' Views on Improving the U.S. Air Traffic Control Modernization Program, GAO-05-333SP.

# Bibliography

Annual Performance Report: Year One—Taking Flight, Air Traffic Organization, Federal Aviation Administration, 2004.

Civil Aviation Authority, Economic Regulation Group, "National Air Traffic Services Public Private Partnership: Setting the Charge Control for Enroute Services in UK Airspace for the First Five Years," Consultation Paper, April 2000.

Cordle, Vaughn and Robert Poole, Jr., "Resolving the Crisis in Air Traffic Control Funding," Policy Study 332, Reason Foundation, May 2005.

Department of Transportation, Office of the Inspector General, Status of FAA's Major Acquisitions, Federal Aviation Administration, Report Number: AV-2003-045, date issued: June 26, 2003.

Department of Transportation, Office of the Inspector General, Status Report on FAA's Operational Evolution Plan, Federal Aviation Administration, Report Number: AV-2003-048, date issued: July 23, 2003.

Department of Transportation, Office of the Inspector General, Status of FAA's Major Acquisitions: Cost Growth and Schedule Delays Continue to Stall Air Traffic Modernization, Federal Aviation Administration, Report Number: AV-2005-061, date issued: May 26, 2005.

Kahn, Alfred E., "Change, Challenge, and Competition: A Review of the Airline Commission Report," *Regulation: The Cato Review of Business & Government* (1993 #3).

McCulloch, R. A., "European and USA Operational Concepts for 2000–2010: A Framework for Comparison," 2nd USA/Europe Air Traffic Management R&D Seminar, Orlando, 1–4 December 1998.

National Air Traffic Services Limited, Financial Statements for the Year Ended 31 March 2004, Company Number 3155567, 2004.

National Civil Aviation Review Commission, Avoiding Aviation Gridlock and Reducing the Accident Rate, A Consensus for Change, December 1997.

NAV CANADA, Annual Report, 2002.

NAV CANADA, "Level of Service Review Results: Summary Briefing Paper," October 2004.

NAV CANADA, "Management's Discussion and Analysis on Form-51-102F2," July 13, 2005.

"NAV CANADA proves privatization works," *Air Transport World,* Volume 37, Number 10, October 2000.

United States General Accounting Office, Air Traffic Control: FAA Should Avoid Duplication in Procuring a Traffic Management System, Report to the Subcommittee on Transportation, Committee on Appropriations, House of Representatives, GAO/IMTEC-88-8, December 1987.

United States General Accounting Office, Air Traffic Control: Continued Improvements Needed in FAA's Management of the NAS Plan, Report to the Chairman, Subcommittee on Transportation, Committee on Appropriations, House of Representatives, GAO/RCED-89-7, November 1988.

United States General Accounting Office, Air Traffic Control: Analysis of Proposal to Create a Government Corporation, Statement of Kenneth M. Mead, Director, Transportation Issues, Resources, Community, and Economic Development Division, Testimony Before the Subcommittee on Transportation Committee on Appropriations, U.S. House of Representatives, March 15, 1995.

United States General Accounting Office, Air Traffic Control: Status of FAA's Modernization Program, Report to Congressional Requestors, GAO/RCED-99-25, December 1998.

United States General Accounting Office, Air Traffic Control: Role of FAA's Modernization Program in Reducing Delays and Congestion, Statement of Gerald L. Dillingham, Director, Physical Infrastructure Issues, Testimony Before the Subcommittee on Aviation, Committee on Commerce, Science, and Transportation, U.S. Senate, GAO-01-725T, May 10, 2001.

United States General Accounting Office, Air Traffic Control: FAA Needs to Better Prepare for Impending Wave of Controller Attrition, Report to the Chairman and Ranking Democratic Member of the Subcommittee on Aviation, House Committee on Transportation and Infrastructure, GAO-02-591, June 2002.

United States General Accounting Office, National Airspace System: Current Efforts and Proposed Changes to Improve Performance of FAA's Air Traffic Control System, Report to Congressional Committees, GAO-03-542, May 2003.

United States General Accounting Office, Air Traffic Control: FAA's Modernization Efforts—Past, Present, and Future, Statement of Gerald L. Dillingham, Director, Physical Infrastructure Issues, Testimony Before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives, GAO-04-227T, October 30, 2003.

United States General Accounting Office, Federal Aviation Administration: Plan Still Needed to Meet Challenges to Effectively Manage Air Traffic Controller Workforce, Statement of JayEtta Z. Hecker, Director Physical Infrastructure Team, Testimony Before the Subcommittee on Aviation, House Committee on Transportation and Infrastructure, GAO-04-887T, June 15, 2004.

United States Government Accountability Office, National Airspace System: Transformation Will Require Cultural Change, Balanced Funding Priorities, and Use of All Available Management Tools, GAO-06-154, October 2005.

United States Government Accountability Office, National Airspace System: Experts' View on Improving the U.S. Air Traffic Control Modernization Program, GAO Panel, GAO-05-333SP, April 2005.

United States Government Accountability Office, National Airspace System: Progress and Ongoing Challenges for the Air Traffic Organization, Statement of Gerald L. Dillingham, Director, Civil Aviation Issues, Testimony Before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives, GAO-05-485T, April 14, 2005.

White House Commission on Aviation Safety and Security, Final Report to President Clinton, February 12, 1997.

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