
July 2005

AIR TRAFFIC CONTROL

Characteristics and Performance of Selected International Air Navigation Service Providers and Lessons Learned from Their Commercialization



Highlights of [GAO-05-769](#), a report to congressional requesters

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Why GAO Did This Study

In the past, governments worldwide owned, operated, and regulated air navigation services, viewing air traffic control as a governmental function. But as nations faced increasing financial strains, many governments decided to shift the responsibility to an independent air navigation service provider (ANSP) that operates as a business. As of March 2005, 38 nations worldwide had commercialized their air navigation services, fundamentally shifting the operational and financial responsibility for providing these services from the national government to an independent commercial authority.

GAO selected five ANSPs—in Australia, Canada, Germany, New Zealand, and the United Kingdom—to develop, as requested, a descriptive analysis of commercialized ANSPs that illustrated similarities and differences in ownership, length of experience with commercialization, and size and scope of operations.

This report addresses the following questions: (1) What are common characteristics of commercialized ANSPs in selected foreign countries? (2) What do available data show about how the safety, cost, and efficiency of air navigation services have changed since commercialization? (3) What are some key lessons learned about the commercialization of air navigation services?

www.gao.gov/cgi-bin/getrpt?GAO-05-769

To view the full product, including the scope and methodology, click on the link above. For more information, contact Gerald L. Dillingham, (202) 512-2834, dillingham@gao.gov.

What GAO Found

The five commercialized ANSPs that GAO selected have a number of common characteristics: All five have the safe movement of aircraft as their primary goal and are subject to some external safety regulation. All five operate as businesses, making and carrying out their own strategic, operational, and financial decisions. As businesses, all five are self-financing, assessing fees on users of air navigation services (e.g., major commercial air carriers; regional air carriers; and, in some cases, general aviation operators) and, as necessary, borrowing funds from capital markets. Finally, all five are largely monopoly providers of air navigation services and undergo some form of constraint in setting prices, such as economic review or procedural guidelines.

Available data from the five ANSPs indicate that since commercialization, the safety of air navigation services has remained the same or improved; each ANSP has taken steps to control costs; and each ANSP has reportedly lowered costs and improved efficiency through investments in new technologies and equipment. Despite concerns about the possibility that commercialization could potentially compromise safety, data from all five indicate that safety has not eroded. For example, data from New Zealand and Canada show fewer incidents involving loss of separation (the required distance between aircraft). All five ANSPs have taken steps to control their operating costs, whether by eliminating some administrative positions or by consolidating facilities. All five ANSPs have also invested in new technologies and equipment, which the ANSPs say have lowered their costs by increasing controllers' productivity and produced operating efficiencies, such as fewer or shorter delays. However, the ANSPs have also increased fees for general aviation operators.

GAO's research points to a number of lessons. For example, commercialized ANSPs must be prepared to mitigate the effects of an industry downturn, whether through reserves, higher fees, cost-cutting, or other measures. Involving stakeholders in modernizing (i.e., upgrading or replacing) ANSP facilities and equipment can benefit both the ANSP and the stakeholders. Special measures may be needed to protect service to small or remote communities. Finally, when a government sells an ANSP's assets, appropriate valuation is necessary to protect taxpayers' interests.

Montreal Tower Control



Source: NAV CANADA.

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Abbreviations

ACCC	Australian Competition and Consumer Commission
ANSP	air navigation service provider
CAA	Civil Aviation Authority
CANSO	Civil Air Navigation Services Organization
CTA	Canadian Transportation Agency
DFS	Deutsche Flugsicherung GmbH
EVA	economic value added
EXCDS	Extended Computer Display System
ICAO	International Civil Aviation Organization
NATS	National Air Traffic Services, Ltd.
OAG	Office of the Auditor General
PBO	performance-based organization
SARS	Severe Acute Respiratory Syndrome
TAATS	The Australian Advanced Air Traffic System
UK	United Kingdom

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**United States Government Accountability Office
Washington, D.C. 20548**

July 29, 2005

The Honorable Ted Stevens
Chairman
The Honorable Daniel Inouye
Co-Chairman
Committee on Commerce, Science,
and Transportation
United States Senate

The Honorable Conrad Burns
Chairman
The Honorable John D. Rockefeller, IV
Ranking Minority Member
Subcommittee on Aviation
Committee on Commerce, Science,
and Transportation
United States Senate

The Honorable John McCain
United States Senate

The Honorable Trent Lott
United States Senate

Since 1987, 38 nations have commercialized¹ their air navigation services, fundamentally shifting the responsibility for providing these services from the national government to an independent air navigation service provider (ANSP) that operates as a business and is designed as a performance-based

¹According to the International Civil Aviation Organization, “commercialization” is the ability of an organization to operate like a commercial business. In discussions about air navigation services, the term is often used interchangeably with other terms, including restructuring, privatization, outsourcing, and corporatization. For this report, we use the term “commercialization.”

organization.² In the past, governments worldwide owned, operated, and regulated air navigation services, viewing them as a governmental function. But as nations were faced with increasing congestion, outdated equipment and facilities, and financial strains, many governments reevaluated their structures for providing air navigation services. Some nations decided that shifting the responsibility for operating and, in some cases, owning the services to an independent commercial authority could produce efficiencies that would benefit both users and the government. In general, the responsibility for regulating the safety of the services is independent of the ANSP and is still considered a governmental function.

You asked that we develop a descriptive analysis of selected foreign countries' commercialized, performance-based air navigation service organizations. To do so, we asked the following research questions:

- What are common characteristics of commercialized ANSPs in selected foreign countries?
- What do available data show about how the safety, cost, and efficiency of air navigation services have changed since commercialization?
- What are some key lessons learned about the commercialization of air navigation services?

To address these questions, we reviewed the characteristics and performance of five commercialized ANSPs, which we selected as illustrative of similarities and differences in ownership, length of experience with commercialization, and size and scope of operations. These ANSPs—Australia's Airservices Australia; Canada's NAV CANADA; Germany's Deutsche Flugsicherung GmbH (DFS); New Zealand's Airways Corporation of New Zealand, Ltd.; and the United Kingdom's (UK) National Air Traffic Services, Ltd. (NATS)—were commercialized between 1987 and 2001 and have been operating since then as performance-based

²A performance-based organization (PBO) is a discrete management unit with strong incentives to manage for results. In the 1990s, Congress recognized the need to restructure federal agencies and to hold them accountable for achieving program results. To this end, Congress legislated the establishment of PBOs, modeled after the United Kingdom's executive agencies. As designed in statute, PBOs were to commit to clear management objectives and specific targets for improved performance. These clearly defined performance goals, coupled with direct ties between the achievement of the goals and the pay and tenure of the head of the PBO and other senior managers, were intended to lead to improved performance.

organizations. Because we selected these ANSPs to illustrate certain characteristics, our results cannot be generalized to all commercialized ANSPs.³

A performance-based organization develops strategies, goals, and measures and gathers and reports data to demonstrate its performance.⁴ The five ANSPs that we reviewed have been gathering and reporting data since commercialization, but their predecessor organizations did not necessarily gather or publicly report comparable data. Consequently, assessments of each ANSP's performance since commercialization are possible, but comparisons of performance before and after commercialization are generally not feasible. Additionally, opportunities for comparing performance across commercialized ANSPs are limited to the extent that the ANSPs define their measures of safety, cost, and performance differently. We determined that the financial and safety data from each country were sufficiently reliable for our purposes. For additional information on our scope and methodology, see appendix I. We performed our work in accordance with generally accepted government auditing standards from August 2004 through July 2005.

Results in Brief

The five commercialized ANSPs that we selected for review have a number of common characteristics: All five have the safe movement of aircraft as their primary goal and are subject to some external safety regulation by an arm's-length government regulatory authority. All five operate as businesses rather than as government organizations, making and carrying out their own strategic, operational, and financial decisions. As businesses, all five are self-financing, assessing fees on users of air navigation services (e.g., major commercial air carriers; regional air carriers; and, in some cases, general aviation operators) and, as necessary, borrowing funds from capital markets, instead of receiving annual appropriations from the

³Because we selected the five ANSPs in our sample to illustrate similarities and differences in specific characteristics, our sample is a nonprobability sample, and the results from such a sample cannot be used to make inferences about the ANSPs we did not review.

⁴For additional information on performance-based organizations, see GAO, *Federal Student Aid: Additional Management Improvements Would Clarify Strategic Direction and Enhance Accountability*, GAO-02-255 (Washington, D.C.: Apr. 30, 2002); *Performance-Based Organizations: Lessons From the British Next Steps Initiative*, GAO/T-GGD-97-151 (Washington, D.C.: July 8, 1997); and *Performance-Based Organizations: Issues for the Saint Lawrence Seaway Development Corporation Proposal*, GAO/GGD-97-74 (Washington, D.C.: May 15, 1997).

government. Finally, all five are largely monopoly providers of air navigation services and are constrained in the price-setting process by some form of economic review or procedural guidelines.

Available data from the five ANSPs we reviewed indicate that since commercialization, the safety of air navigation services has remained the same or improved; each ANSP has taken steps to control costs; and each ANSP has reportedly lowered costs and improved efficiency through modernization—that is, through investments in new technologies and equipment. Despite concerns about the possibility that commercialization could compromise safety, data from all five indicate that safety has not eroded. For example, data from Canada, Germany, and New Zealand show fewer incidents involving loss of separation (the required distance between aircraft). Additionally, stakeholders told us that safety regulation improved when the regulator was separated organizationally from the ANSP. All five ANSPs have taken steps to control their operating costs, whether by eliminating some administrative and middle management positions or by consolidating facilities. Furthermore, all five ANSPs have invested in and benefited from new technologies and equipment, which the ANSPs say have lowered their costs by increasing controllers' productivity, and have produced operating efficiencies, such as fewer or shorter delays. As a result, some ANSPs have been able to lower the prices they charge the airlines for certain services. However, the ANSPs have also instituted or increased fees for general aviation operators, and some ANSPs have increased or plan to increase the costs of service to small or remote locations.

We derived a number of lessons from our research on commercialized ANSPs. First, commercialized ANSPs must be prepared to mitigate the effects of an industry downturn through such measures as establishing a reserve fund, implementing a revenue-generating alternative to user fees, or cutting costs. Second, involving stakeholders in efforts to modernize (i.e., upgrade or replace) ANSP facilities and equipment can help to ensure mutually beneficial results. Third, the conflict between an ANSP's need to recover its costs and the inability of some users (e.g., regional air carriers) to pay the full costs of service to small or remote communities may mean that special measures are needed to protect service to such communities. Fourth, when a government sells its interest in an ANSP to private investors as part of the commercialization, the ANSP's assets have to be appropriately valued to protect taxpayers' interests and create a basis for sound financial decision making. Fifth, maintaining and attracting sufficient personnel, with the skills and expertise needed to ensure that the

regulator can provide uninterrupted safety regulation is important when operations are separated from regulation during commercialization.

Finally, developing baseline safety, cost, and efficiency measures prior to commercialization will allow the ANSP and others to assess the progress the ANSP is making toward its goals and evaluate the results of commercialization.

Background

Before commercialization, air navigation services under government control faced increasing strains. Many were underfunded, as evidenced by freezes on air traffic controllers' wages and insufficient funds to replace aging technologies. Technology replacement programs often cost more, took longer, and delivered less than promised, and stakeholders complained about performance and customer service. In some instances, the country as a whole faced widespread fiscal problems and the commercialization of air navigation services was simply part of a larger movement to reform government enterprises. For instance, the New Zealand government established 14 state-owned enterprises in 1987, including air navigation services, rail services, and postal services. The government also reformed electricity as a state-owned enterprise in 1994 and telecommunications in 2004.

Although fiscal problems often drove the commercialization of air navigation services, commercialization was generally intended not only to relieve the government of a fiscal responsibility but also to free the ANSP from some governmental constraints. According to the International Civil Aviation Organization (ICAO),⁵ a commercialized ANSP, whether wholly or partly owned by the government or fully privatized, should function as an autonomous body and, compared with a government organization, should have greater freedom from the government in conducting its financial affairs and developing infrastructure funding. In addition, it should be self-financing, subject to the usual business taxes, and required to seek a return

⁵ICAO is an advisory organization affiliated with the United Nations that aims to promote the establishment of international civil aviation standards and recommended practices and procedures.

on capital. According to ICAO, the government⁶ should still regulate the safety of the ANSP's operations, but the ANSP should be encouraged to be as competitive, efficient, and cost-effective as any other commercial business.

In the five countries whose air navigation services we reviewed, the ANSP continued to provide nationwide services after commercialization and, with limited exceptions, remained the sole provider of air navigation services. Table 1 summarizes information on the size and scope of the five ANSPs in our review.

Table 1: Summary Information on the Five Commercialized ANSPs That We Reviewed

Country	ANSP name	Year of commercialization	ANSP ownership	Approximate number of employees (controllers)	Approximate number of movements handled (year)
Australia	Airservices Australia	1988	Wholly government owned	2,900 (1,100)	2,723,828 (2004)
Canada	NAV CANADA	1996	Privately owned company	5,400 (2,300)	6,000,000 (2003)
Germany	Deutsche Flugsicherung GmbH	1993	Wholly government owned	5,400 (2,098)	2,720,000 (2004)
New Zealand	Airways Corporation of New Zealand, Ltd.	1987	Wholly government owned	650 (340)	1,004,161 (2004)
United Kingdom	National Air Traffic Services, Ltd.	2001	Partially government owned	3,758 (1,380)	2,000,000 (2004)

Source: GAO presentation of ANSP data.

Each ANSP generally offers en route, approach control, and terminal (or aerodrome control) air traffic services. Although definitions of these terms may vary slightly among ANSPs, the terms generally signify the same broad functions. Specifically, en route services guide an aircraft while it is operating at cruising elevations and outside terminal airspace. Approach control services apply during departure—immediately after the aircraft has

⁶In the UK and Australia, safety and economic regulators are “statutorily independent within the government.” A statutory authority is a public sector entity, established by legislation, which has the legal status of a corporate body. The reference to “independent” reflects an intended degree of independence from the Minister, whereby the director of the entity is responsible for its day-to-day operations but is accountable for its performance to the Minister.

taken off and while it is climbing from the origination airport—and during arrival—when the aircraft is descending to the destination airport toward the end of the flight. Terminal or aerodrome control services are provided while the aircraft is close to the airport from which it is arriving or departing. However, in some countries, the ANSP may not be the sole provider of approach control and terminal services.⁷ All but Germany's DFS also offer oceanic air navigation services.⁸ All five ANSPs are responsible for providing air navigation services to both civil and military aviation. In addition, the ANSPs may offer other air navigation-related services, such as meteorological, training, and consulting services, and charge for these services.⁹

The five commercialized ANSPs are affiliated with one or more international aviation-related organizations. The governments of all five ANSPs are members of ICAO and, therefore, all five ANSPs adhere to ICAO principles. All five ANSPs are also members of the Civil Air Navigation Services Organization (CANSO), a voluntary international trade organization whose mission is to represent the interests of commercialized ANSPs. In addition, the UK and Germany are members of EUROCONTROL, a European organization responsible for regulating the safety of air navigation, monitoring the performance of air traffic management systems, and developing a seamless air traffic management system in Europe. EUROCONTROL is mandated to develop implementing rules for the European Union's "Single European Sky" initiative, a legislative package approved by the European Parliament in January 2004.¹⁰ One of these implementing rules specifies that each member state is to develop an independent safety and economic regulatory authority to oversee its ANSP.

⁷Although technical definitions may vary slightly among ANSPs, these services broadly correspond to the services provided in U.S. air traffic centers, approach control centers, and towers.

⁸Oceanic services are analogous to en route services, except that the aircraft is flying over the ocean, where fewer communication, navigation, and surveillance capabilities are available than over land.

⁹NATS and NAV CANADA include charges for meteorological services in their basic service charges.

¹⁰This initiative consists of four regulations that address (1) the framework for the creation of a single European sky, (2) the provision of air navigation services in the single European sky, (3) the organization and use of the airspace in the single European sky, and (4) the interoperability of the European Air Traffic Management network.

The UK established such an authority before commercialization, and Germany is planning to develop one.

Common Characteristics of the Five Selected Commercialized ANSPs

The five commercialized ANSPs that we reviewed have a number of common characteristics: First, all focus on safely moving aircraft. Second, despite differences in ownership structures, all operate as businesses rather than as government organizations and are self-financing. Third, all are largely monopoly providers that are subject to some form of price-setting constraint achieved through economic review or procedural guidelines.

The Five Commercialized ANSPs Continue to Focus on Safely Moving Aircraft

For all five commercialized ANSPs, the safe movement of aircraft remains the primary goal. In some instances, government policy requires that the ANSP consider safety in any and all decisions affecting operations and service. For example, according to DFS officials, German legislation requires DFS to observe ICAO's standards and recommended safety practices, as well as adhere to the objectives and policies of international organizations in which the German government participates, such as EUROCONTROL. Similarly, in Canada, legislation requires NAV CANADA to maintain a fixed level of safe operations. According to Transport Canada, the safety regulator, the Minister of Transport has the authority to direct NAV CANADA to maintain or increase levels of service in the interest of safety. Although NAV CANADA can alter operations in accordance with business principles, it must demonstrate that the changes meet the required level of safety through an aeronautical risk assessment.

All five ANSPs are subject to external safety regulation. A separate authority conducts safety regulation and issues relevant certificates or licenses to air traffic controllers and technicians. In New Zealand, for example, the Civil Aviation Authority (CAA) is an independent regulatory authority that, among other things, establishes civil aviation safety and security standards and monitors adherence to those standards. CAA carries out accident and incident investigations and uses information from these investigations to establish an industrywide safety picture and develop safety initiatives ranging from educational campaigns to increased monitoring and regulatory action. In Australia, the Civil Aviation Safety Authority regulates and promotes aviation safety, and the Australian Transport Safety Bureau investigates aircraft accidents, incidents, and safety deficiencies within the aviation system, according to Airservices

Australia. In Canada, NAV CANADA and the government, through Transport Canada, share responsibility for the safety of the national civil air navigation system. Under a performance-based approach to safety regulation, known as the relations management approach, Transport Canada, as the regulator, establishes the requirements in law and standards, and NAV CANADA, as the operator, must demonstrate compliance by measuring and reporting on program results. Transport Canada, among other things, conducts audits, adjudicates safety issues raised by stakeholders, and licenses air traffic controllers.

All five selected ANSPs have also established formal safety programs. For example, DFS and NATS apply a systematic Safety Management System,¹¹ in accordance with EUROCONTROL's safety requirements, to all of their operational activities. This system forms the basis for risk assessment, safety assurance, safety control, and safety monitoring through standards that comply with national and international obligations. DFS's Safety Management System was also certified by the German Ministry of Transport in 2004. Similarly, Airservices Australia employs a systemic Safety Management System that complies with national and international requirements. To promote safety, the system requires activities such as operational risk assessments, surveillance, audits, and incident investigations.

Although the Degree of Government Ownership Varies, the Five Commercialized ANSPs Operate as Businesses, Making Their Own Decisions and Generating Their Own Revenue

The five commercialized ANSPs vary in the extent to which they are owned by the government—wholly, partially, or not at all. (See table 2.) Three of these ANSPs—Airservices Australia; Airways Corporation of New Zealand, Ltd.; and DFS—are state-owned corporations (i.e., companies wholly owned by the government). The UK's NATS is a public-private partnership (i.e., a cooperative venture between the public and private sectors that is designed to meet defined public needs) with the risks and rewards divided between both parties. The government holds the largest share of NATS (49 percent), and the remaining shares are divided among a consortium of seven UK airlines (42 percent), NATS staff (5 percent), and a private airport

¹¹The Safety Management System is a systematic and explicit approach defining the activities by which an ANSP undertakes safety management to achieve acceptable or tolerable safety levels. It is a system to ensure that the ANSP has identified, assessed, and satisfactorily mitigated all safety risks, including establishing procedures for reporting and assessing safety occurrences in air traffic control and for assessing and mitigating risks.

company¹² (4 percent). By 2006, Germany plans to change the ownership of DFS, selling 74.9 percent of its equity to private investors and reorganizing it as a public-private partnership, along the lines followed in the UK. NAV CANADA is a nonshare capital, private corporation—that is, it has “members” instead of shareholders. The corporation has 4 members representing government, airlines, noncommercial users, and the unions. These 4 members appoint 10 of the 15 board directors: 4 are appointed by the airline industry, 3 by the government, 2 by employees such as air traffic controllers and engineers, and 1 by general and business aviation. These 10 directors appoint another 4 based on expertise and the chief executive officer.

Table 2: Ownership of the Five Selected Commercialized ANSPs

ANSP	State-owned corporation	Public-private partnership	Private
Airservices Australia	✓		
Airways Corporation of New Zealand, Ltd.	✓		
Deutsche Flugsicherung GmbH (Germany)		✓	
National Air Traffic Services, Ltd. (United Kingdom)			✓
NAV CANADA			✓

Source: CANSO.

Before commercialization, members of the two ANSPs that are not wholly owned by their government, NATS and NAV CANADA, “purchased” some or all of the ANSP assets from the government. Although the UK government retained the largest share of NATS, the second-largest owner, the consortium of seven UK airlines known as “The Airline Group,” provided approximately \$1.4 billion, according to information from the National Audit Office, including about \$112.2 million from the group’s own resources and the remainder from a loan taken out with a consortium led

¹²This private company, BAA, plc., owns 7 UK airports, including London’s Heathrow, Gatwick, and Stansted, and has interests at 13 airports overseas.

by four major banks.¹³ The group used this sum to acquire NATS and meet associated transaction costs, leaving cash assets of approximately \$6.0 million in the business. In total, the government received an estimated \$1.3 billion in cash proceeds from the transaction.¹⁴ NAV CANADA purchased all of the ANSP assets from the Canadian government. Instead of going through a formal competitive bidding process, it negotiated a selling price with the government, and purchased the air navigation system in 1996 for about \$1.5 billion, using a \$2.9 billion line of credit provided by a syndicate of banks at the time of the purchase. NAV CANADA uses the remaining funds for capital investment and as working capital, as required.

The ANSPs Make and Execute Their Own Decisions, Involve Stakeholders, and Follow Corporate Practices

Each ANSP makes and carries out its own strategic, operating, and financial decisions. A supervisory board oversees policy making and operations and, when applicable, has fiduciary responsibilities to shareholders. The members of this board may represent key stakeholders, such as the airlines, employees, general aviation, and the national government. For example, in the UK, government appointees, the airlines, and BAA (the airport consortium) are represented on NATS's board of directors, while in Germany, DFS employees, government ministries, and the private sector are represented on a supervisory board. As in a corporation, an executive officer implements the ANSP board's policies and is, in turn, accountable to the board. Individual business units within the ANSP report to the chief executive officer and are directly responsible for various aspects of the ANSP's day-to-day operations. For example, Airservices Australia is structured around three market-oriented business groups—the Air Traffic Management, Airport Services, and Infrastructure Support Services groups. A Corporate Services group and a small Head Office support and lead the business groups. The managers of these five groups form the Executive Committee and work with the chief executive officer to advise the board as well as carry out the board's policies.

While the supervisory board and its executive officers have decision-making responsibility, stakeholders—including employees, the airlines, general aviation operators, airports, the government, the public, and others—may be involved in and provide input to their ANSP through a

¹³Unless otherwise noted, all financial amounts have been converted to U.S. dollars from each country's local currency and adjusted for inflation.

¹⁴National Audit Office, *The Public Private Partnership for National Air Traffic Services Ltd.*, report by the Comptroller and Auditor General, HC 1096, Session 2001-2002, July 24, 2002.

variety of mechanisms. For example, DFS has developed a Customer Relationship Management System to organize hearings for customers and involve them in working groups. This approach to involving stakeholders is consistent with a Single European Sky directive that member states establish a mechanism for consulting with stakeholders. In Australia, the aviation community (i.e., the airports, airlines, safety authorities, and others) participates in Airservices' strategic investment decision-making process through the Australian Strategic Air Traffic Management Group. In Canada, NAV CANADA's stakeholders (i.e., associations, unions, and airports, including international and U.S. representatives) are involved in the NAV CANADA Advisory Committee, which provides a vehicle for stakeholders who are not on the board of directors to raise issues and concerns with NAV CANADA.

As commercial organizations, the ANSPs follow corporate practices. Each ANSP has established performance measures and gathers and reports financial and other performance data. Each ANSP also publishes an annual report, which makes financial information available to the public to ensure transparency. Financial statements are typically subject to audits by independent third parties to ensure that adequate accounting records have been maintained, and that internal controls have prevented or detected any fraud and error in the accounting policies and estimates.¹⁵ In addition, the UK and Germany report their data to EUROCONTROL, whose Performance Review Commission collects data for benchmarking and publishes comparative studies of members' performance.

The ANSPs Generate Revenue and Have Borrowing Authority

All five commercialized ANSPs rely on user charges as their primary source of revenue and on capital markets for additional funding. Before commercialization, governments funded air navigation services through annual appropriations.

Since commercialization, each ANSP collects and manages its own revenues, charging fees for services. The air navigation service fees are based on ICAO's cost recovery principles, which call for recovering the

¹⁵As a publicly traded corporation, NAV CANADA is subject to the equivalent in Canada of the U.S. Sarbanes-Oxley Act, which requires independent auditors to attest to and report on internal control of the organization.

ANSP's operating costs.¹⁶ Despite some variation across ANSPs, the fees are generally as follows:

- The air navigation fees cover operating and capital costs associated with both en route and approach control services. These charges are based on a weight-distance formula.¹⁷ If applicable, ANSPs also levy charges for oceanic control.
- The ANSPs may also charge for terminal-related services. However, not all ANSPs are the sole providers of terminal services. In the UK and Germany, for example, private firms may provide terminal services. These terminal charges are distinct from the landing fees typically charged by airports, which are usually weight-based.
- The ANSPs may charge general aviation operators a flat fee for services or additional fees in particular circumstances, rather than charging the weight-distance fees typically assessed to larger air carriers.
- The ANSPs may also exempt charges for some services. According to ICAO policies, the ANSPs may choose to recover less than the full costs of some services in recognition of local, regional, or national benefits. For example, in Canada, aircraft or flights dedicated to search and rescue, air ambulance operations, and firefighting services are all exempt from air navigation service charges.

The five ANSPs vary in their treatment of any operating profits or losses. If an ANSP generates revenues from charges in excess of its costs (i.e., operating profits), it may rebate them to the users, lower the charges for the next year, pay some form of dividend to shareholders, or retain the revenues in reserve to protect against future losses. If costs exceed revenues, ANSPs use different strategies to meet those shortfalls. For example, NAV CANADA established a “rate stabilization fund,” which it used to store revenues when the aviation industry was healthy. The fund could then be used to cover costs and keep rates stabilized when the industry was ailing. The fund was capitalized by operating profits earned

¹⁶Fees for the European ANSPs also include a contribution to cover the expenses of EUROCONTROL.

¹⁷The standard weight-distance formula is a single charge per flight for en route services based on the distance flown by the aircraft within a defined area and the aircraft's weight. This formula is based on ICAO's policies on charges for air navigation services.

before September 11, 2001, but depleted during the economic downturn caused by the events of September 11 and the Severe Acute Respiratory Syndrome (SARS) outbreak of 2003.¹⁸

To pay for capital projects, the five ANSPs can either use current operating revenues or borrow funds. Before commercialization, the ANSPs relied on annual appropriations for capital projects; now, all five can borrow funds through access to debt financing and private capital. For example, NAV CANADA obtains all of its financing in the public debt markets. NAV CANADA has a borrowing capacity of about \$2.4 billion, of which \$1.8 billion is currently drawn.¹⁹ In Germany, DFS mainly finances its capital expenditures by drawing on a capital market program, which issues short-, medium-, or long-term notes (i.e., debt issuance and commercial paper), each amounting to approximately \$546.4 million for a total of almost \$1.1 billion, to private investors in the market. DFS can also draw on an annual credit line of around \$175.9 million from its bank.

The ANSPs Generate Revenues from Other Services

The ANSPs may also charge fees, as applicable, for other services, such as aeronautical information, consulting, and training. For example, a DFS business unit offers consulting services in air traffic system design and implementation, feasibility studies, operational planning, air traffic system evaluation, and safety management systems. In 2003, DFS's consulting service generated revenue of about \$2.8 million. In the UK, NATS competes with other service providers to provide terminal services at UK airports. In addition, NATS, like DFS, consults and offers training for other ANSPs worldwide in implementing safety management systems, solving airspace capacity problems, and commercializing ANSPs. From this business unit, NATS generated profits of about \$11.7 million in 2003 and about \$14.8 million in 2004.

Besides offering air navigation services in its own country, an ANSP may provide services and technology to other regions of the world to generate revenue. For example, Airservices Australia manages the upper airspace in

¹⁸Concerns about the in-flight transmission of SARS, a highly contagious respiratory disease that appears to be transmitted by close personal contact, affected passenger traffic on international flights to and from Asia, compounding the economic downturn in the aviation industry that began in 2000.

¹⁹The amount here does not include adjustments for inflation because it refers to the current 2005 year. The foreign exchange rate as of June 17, 2005 (1 U.S. dollar = 1.23 Canadian dollars), was used to convert to U.S. dollars.

the Solomon Islands. NAV CANADA recently signed a contract with NATS to install the Extended Computer Display System (EXCDS)²⁰ in three London-area airports, Stansted, Gatwick, and Heathrow, as well as to provide NATS with its oceanic system. While NAV CANADA prefers commercial off-the-shelf products, it also invests in developing in-house technologies. Many of the technology products developed by NAV CANADA are available to outside organizations, such as NATS, enabling them to reduce their costs and avoid development risks.

The Five Commercialized ANSPs Undergo Some Form of Economic Review or Follow Price-Setting Process Guidelines

Each of the five commercialized ANSPs is its country's sole provider of en route services and, as such, functions as a monopoly. Moreover, except in the UK, the ANSP is the sole provider of approach control services.²¹ With no alternative provider, operators cannot seek lower prices by changing routes and must pay whatever fees the ANSP charges. Since user fees constitute the ANSP's primary source of revenue, economic monitoring and regulation by an independent third party can protect users and ensure a fair pricing process.

ICAO recognizes the need for an independent mechanism to provide economic regulation of air navigation services. According to ICAO, the objectives of economic regulation should include the following:

- Ensure nondiscrimination in the application of charges.
- Ensure that there is no overcharging or other anticompetitive practice.
- Ensure the transparency and availability of all financial data used to determine the basis for charges.
- Assess and encourage efficiency and efficacy in the operation of providers.
- Establish standards for reviewing the quality and level of services.

²⁰EXCDS is an advanced flight data processing system developed by NAV CANADA that allows controllers to manage electronic flight data online using mouse-based or touch-sensitive display screens.

²¹In the UK, terminal services are open to competition. NATS competed for and won the opportunity to provide terminal services for 14 UK airports, including its largest airports, Heathrow and Gatwick.

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- Monitor and encourage investments to meet future demand.
 - Ensure user views are adequately taken into account.

The five countries whose ANSPs we reviewed have taken different approaches to reviewing their ANSP's user charges and price-setting process, but all five ANSPs are subject to some form of economic review or price-setting process guidelines:

- In Australia, the Australian Competition and Consumer Commission (ACCC)²² oversees Airservices Australia's process of setting user fees for air traffic services. Airservices must notify the commission whenever it wants to raise fees. The commission then evaluates Airservices' pricing proposal and decides to accept or reject the price change. If the commission rejects the proposed price, it can set a lower price. ACCC rejected one of two proposals by Airservices for a temporary fee increase to address the revenue losses that followed September 11 and the SARS outbreak, as well as the collapse of Australia's second largest airline. ACCC accepted Airservices' first proposal for a temporary fee increase for a year following the September 11 and SARS outbreak. However, ACCC rejected Airservices' second proposed fee increase. The airline industry had objected to the second set of proposed increases, citing a need for longer term price certainty. The ACCC ultimately decided that a longer term arrangement should be considered. ACCC directed Airservices to focus on 5-year pricing plans to encourage long-term planning, emphasizing that the robustness of the airlines should be taken into account when a price is set.

²²This independent Commonwealth authority monitors primarily monopolistic public and private service industries, including Airservices Australia.

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- The Canadian Transportation Agency (CTA) reviews the price-setting process against an established set of statutory principles. Appeals may be made to CTA by the users as to whether NAV CANADA has observed the charging principles in establishing its rates.²³ The charging principles do not allow NAV CANADA to make a profit and, as a nonshare capital corporation, surpluses are reinvested in the business or used to lower charges to customers.
 - Airways Corporation of New Zealand, Ltd., operates under a memorandum of understanding with its airline users. Under this memorandum, Airways uses the principle of “economic value added” (EVA) to self-regulate its pricing. EVA is the difference between the net operating profit after taxes and the cost of capital. A portion of any EVA above a certain level is returned to users in the form of a rebate. For example, in its 2004 Annual Report, Airways reported its net operating profit after taxes as about \$8.3 million. After subtracting the cost of capital (\$4.4 million), the resulting EVA was approximately \$3.9 million. Of this amount, \$1.8 million was returned to customers in the form of a rebate, since any profits above a certain level will ultimately be returned to the airlines. According to the aviation industry, the EVA mechanism has been key in making pricing of user fees more transparent.
 - In the UK, CAA exercises economic regulation over NATS. CAA’s Economic Regulation Group sets price caps for 5-year periods, basing them generally on the retail price index²⁴ and the group’s own analyses of allowances for NATS’s estimated operating and capital costs.
 - The German Transport Ministry reviews and approves any changes in user fees, but it does not independently evaluate the price-setting process or pricing changes. According to the Transport Ministry,

²³NAV CANADA’s board of directors, which includes air carrier representatives, is the main venue for the industry to express any grievances over pricing issues after a required open and transparent consultation process. However, according to Air Canada, its input on the board is limited and, because the public has comparable representation on the board, the public—with three government and two employee representatives—and the industry—with four representatives—cancel out each other’s input. As previously noted, when NAV CANADA raised prices after its rate stabilization fund was exhausted during the economic downturn, aviation industry representatives argued that this move further disrupted their business cycles during a time of financial strain.

²⁴The retail price index is the average measure of change in the prices of goods and services bought for consumption by the vast majority of households in the UK.

Germany plans to create an independent economic regulatory authority by 2006 to comply with the requirements of the Single European Sky initiative.

Since Commercialization, the Five ANSPs Have Maintained Safety, Controlled Operating Costs, and Achieved Efficiencies

According to information from each of the ANSPs we reviewed, air navigation safety has not declined since commercialization, and all five ANSPs have taken steps to control costs. In addition, the ANSPs have improved the efficiency of their operations by implementing new technologies and equipment. The ANSPs maintain that some of these outcomes would not have been feasible in a government organization.

Safety Performance Has Not Been Compromised Since Commercialization

At a minimum, safety has not eroded since commercialization, according to the available data from most of the ANSPs.²⁵ For example, data from DFS show a decrease in the number of aircraft proximity²⁶ incidents in Germany, from 23 in 1995 to 8 in 2003, 3 of which were attributed to DFS. In the UK, the number of the riskiest air proximity incidents for NATS declined from 9 in 2001 to 2 in 2003 and 1 in 2004. Similarly, data from Airways Corporation of New Zealand indicate a downward trend in incidents involving loss of separation²⁷ for the years following commercialization. NAV CANADA's annual report for 2004 also cites a decrease in the rate of loss-of-separation incidents, from an average of 0.96 incidents per 100,000 movements for 1999/2000 to an average of 0.79 incidents for 2003/2004. Officials at Transport Canada, the safety regulator, confirm an overall decline in aviation incidents since commercialization.

²⁵Since aviation accidents are rare and may be attributable to causes outside their control, ANSPs gather data on incidents that could pose hazards and may be within their control. Rates for these incidents are proxy measures for safety.

²⁶An aircraft proximity incident occurs when the pilot or air traffic controller deems the safety of the aircraft involved to be endangered, whether because of speed or nonadherence to minimal standards for separation between aircraft.

²⁷A loss of separation is an occurrence or operation that results in less than the prescribed separation between an aircraft and another aircraft; a land barrier, such as high terrain; or a vehicle on the runways of airports.

Additionally, stakeholders have told us they believe the air navigation system is as safe as it was when the government provided air navigation services. According to some, the separation of operating and regulatory functions has strengthened safety regulation and diminished any potential conflict of interest between promoting the financial interests of aviation operators and protecting safety.

As improved technology and system upgrades have allowed individual controllers to handle increasing levels of air traffic, concerns have arisen about the potential for controllers' fatigue to compromise safety. Data are not available to assess this potential, but some ANSPs have taken steps to limit and monitor controllers' workload. For example, the UK's CAA has regulated the hours of civil air traffic controllers, and its Safety Regulation Group must be notified of any breach by NATS or by controllers. In New Zealand, as air traffic has increased, some airspace sectors have been subdivided so that controllers are responsible for a smaller piece of airspace. DFS, in cooperation with its controllers' association, has undertaken a comprehensive study of controllers' stress and strain, which has led to internal regulations on the maximum working hours allowed at individual sectors, according to DFS.

The Five Commercialized ANSPs Have Taken Steps to Reduce Operating Costs

To lower their personnel costs, all five ANSPs have reduced their administrative staff or flattened their management organizations. For example, NAV CANADA closed most of its regional administrative offices and centralized corporate functions to its headquarters, reducing mostly administrative staff by 1,100 people (17 percent of the workforce). Airways Corporation of New Zealand also reportedly reduced its personnel costs by eliminating some middle management and administrative positions. In general, the ANSPs have not reduced their air traffic controller staffs.

To lower their facility operating costs, all five ANSPs have closed, relocated, or consolidated facilities. For example, Airways Corporation of New Zealand reported consolidating four radar centers into two over 8 years and is planning to consolidate these two radar centers into a single center by 2006. DFS has also integrated operations and consolidated facilities, moving 17 approach units from airports and integrating them into four air traffic control centers. DFS also relocated the Dusseldorf control center to the Langen control center in 2002 (see fig. 1), a year earlier than planned, and transferred and consolidated its headquarters from Offenbach to Langen. DFS reports that because its supervisory board, rather than a parliamentary committee, now makes major investment decisions, it has

been able to make key strategic decisions that would have been politically difficult when DFS was under government control.

Figure 1: Langen Control Center, Langen, Germany



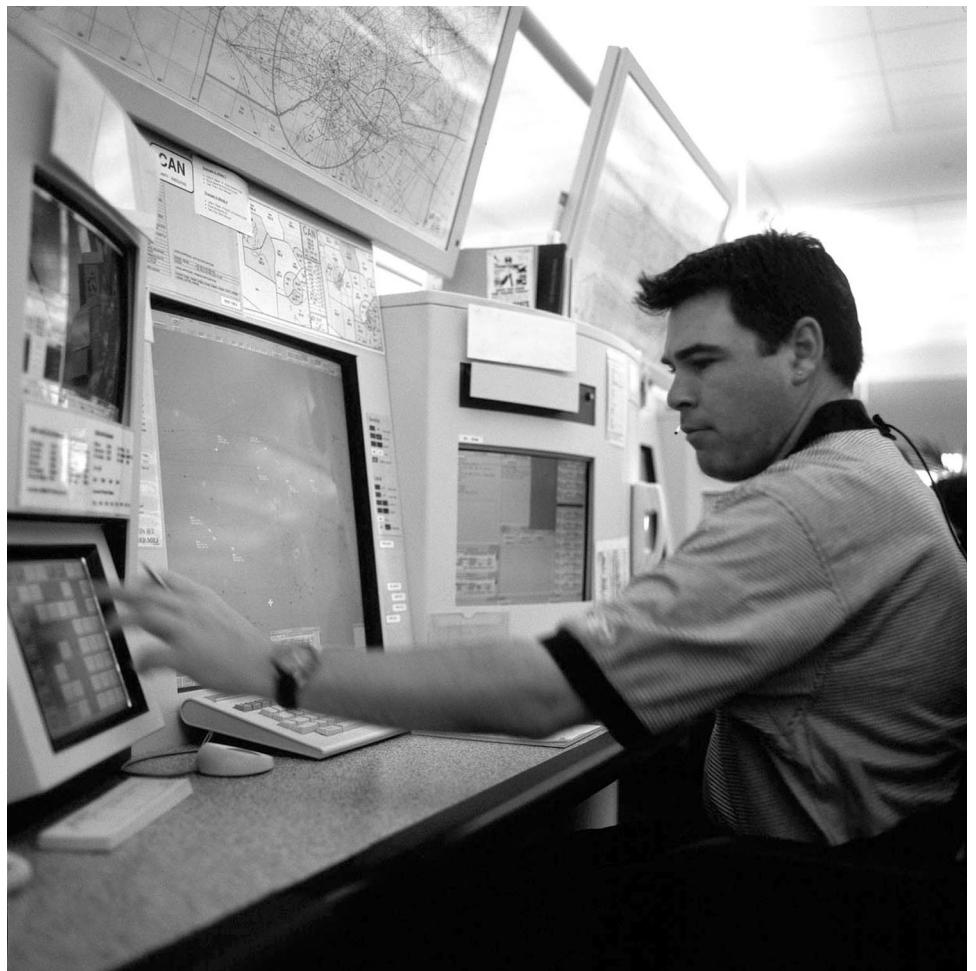
Source: Deutsche Flugsicherung GmbH.

In the UK, NATS reduced its net operating costs by almost \$161 million from 2002 through 2004, in part through direct management actions, according to its audited financial statement. For example, it consolidated two operations into one at a new air navigation services center, called the Swanwick Center. According to NATS, after placing this new center in service, it reduced its staff costs by nearly \$20.1 million and its costs for services and materials by about \$18.5 million between 2002 and 2003. Between 2003 and 2004, NATS reported, it reduced its operating costs for air traffic services by another \$21.4 million through cost control measures.

The Five ANSPs Said They Have Improved Efficiency through Modernization

All five ANSPs said they have improved productivity through modernization—that is, through investments in upgrading or replacing air navigation facilities and equipment. For example, Airservices Australia reported increases in controllers' productivity following the introduction of the Australian Advanced Air Traffic System (TAAATS) (see fig. 2). This system replaced conventional radar screens with more advanced computer screens that display data from a range of sources, including ground-based surveillance equipment and satellite-linked navigational equipment on aircraft, among others. TAAATS replaced handwritten, paper flight progress strips with screen-based information that is updated automatically. DFS is also eliminating systems that depend on paper strips and expects productivity gains and cost savings to follow. In New Zealand, according to the union that represents air traffic controllers, individual controllers are now able to handle much more flight activity because of improved technology.

Figure 2: The Australian Advanced Air Traffic System



Source: Airservices Australia.

Besides improving productivity, modernization—together with airspace redesign²⁸—has produced operational efficiencies, including fewer and shorter delays, according to the ANSPs. NATS, for example, reduced its average delay per flight from 2.7 minutes in 2002 to 0.74 minutes in calendar year 2003, while handling almost 2.1 million flights.

²⁸Airspace redesign is a reconfiguration of the established routes that aircraft fly to maintain standard separation from other aircraft when arriving at or departing from airports.

Access to Cash Flow and Borrowed Funds Has Facilitated Modernization

Commercialization has allowed the ANSPs to implement modernization projects more efficiently. Formerly, the uncertainty associated with the annual appropriations from national governments made it difficult to plan over multiple years. According to the ANSPs, access to cash flow and borrowed funds has allowed them to plan and execute projects more efficiently and has improved their ability to deliver projects on time, within budget, and to specification. For example, Airways Corporation of New Zealand deployed its new oceanic system, FANS1, in less than a year. The management of NAV CANADA estimates that it is producing new technology faster than the government once did and at half the cost.

Some of the commercialized ANSPs maintain that they have achieved the benefits of modernization faster and at less cost by purchasing commercially available systems and upgrades or by modifying off-the-shelf technologies to meet their needs, rather than developing their own systems from the ground up. NATS purchased its oceanic system and automated tower/terminal control system from NAV CANADA. To achieve further purchasing efficiencies, some commercialized European ANSPs have developed an alliance to procure systems. For instance, Germany has developed a strategic alliance with Switzerland and the Netherlands for the joint procurement of a new radar system.

Focus on Cost Control and Operational Efficiency Has Affected User Charges

Through their cost control initiatives and modernization efforts, some of the ANSPs have been able to lower their unit costs and, in turn, lower their charges to major commercial airlines, which pay the largest proportion of user fees and therefore are the primary users served by the ANSPs. Airservices Australia, for example, reported lower unit costs resulting from the increases in controllers' productivity that followed the introduction of TAAATS. NAV CANADA estimates that it is saving the airlines approximately \$80.3 million annually in reduced aircraft operating costs. According to NAV CANADA, the airlines are now paying 20 percent less in user fees than they formerly paid in ticket taxes when the government provided air navigation services.²⁹ In Germany, Lufthansa stated that except in business years 2001 through 2003, the airline paid less in user fees than it paid during the initial commercialization of Germany's air navigation service in 1993. According to Airways Corporation of New Zealand, it

²⁹While Australia, Canada, and New Zealand collect both en route and terminal fees themselves, Germany and the UK collect terminal fees themselves and receive en route fees collected for them by EUROCONTROL.

reduced en route charges by 22 percent in 1995 and by another 13 percent since 1997, resulting in an overall reduction of more than 30 percent.

For general aviation operators, however, commercialization has sometimes meant an increase in fees. Before commercialization, many only paid taxes on fuel. Some countries, such as Canada and New Zealand, have tried to make the fees affordable for small operators by charging a flat fee. NAV CANADA, for instance, charges general aviation operators a flat annual fee of \$58.³⁰ According to the Aircraft Owners and Pilots Association—New Zealand, Airways Corporation of New Zealand charges general aviation operators a fee of \$68 for 50 landings. In addition, Airways eliminated the en route charge for light aircraft.

Some governments have provided for air navigation services at small, remote general aviation and regional airports, viewing such services as a public good. Australia, for instance, subsidizes service to some regional areas under the Location-Specific Tower Subsidy Program and, according to Transport Canada, NAV CANADA is legislatively required to maintain service to remote locations in the northern region. In addition, NAV CANADA charges the same price for services to remote locations as for services to the rest of the country. The price is based on a formula that considers weight and distance.

Lessons Learned about the Commercialization of Air Navigation Services

We have derived a number of lessons from our research on the commercialization of air navigation services in the five countries we selected. The following paragraphs summarize these lessons.

The Commercialized ANSPs Must Be Prepared to Mitigate the Effects of an Industry Downturn

Because commercialized ANSPs rely primarily on user fees to cover their costs, an industry downturn presents a fundamental financial risk for such ANSPs that they must be prepared to mitigate, whether through a reserve fund, cost-cutting measures, user fee increases, additional borrowing, restructuring, or some combination of these or other options that will be

³⁰This amount does not include adjustments for inflation because the fee is established for the current 2005 year. The foreign exchange rate as of June 17, 2005 (1 U.S. dollar = 1.23 Canadian dollars), was used to convert to U.S. dollars.

sufficient to offset the decline in air traffic and the concomitant decline in revenue. The industry downturn that began in about 2000 and intensified after the events of September 11, 2001, and the SARS outbreak of 2003 brought this lesson home to at least four of the five commercialized ANSPs we selected for review. After commercialization and before the downturn, these four—Airservices, DFS, NATS, and NAV CANADA—had been able to cover their costs through user fees and borrowing. However, during the downturn, they had to take additional steps to address the revenue losses. NATS, with the greatest debt load, was the most vulnerable, but even NAV CANADA, with a multimillion-dollar contingency fund, eventually had to take extraordinary measures.

Besides being burdened with debt, NATS was vulnerable to the industry downturns because nearly all of its costs (95 percent) were fixed, limiting its ability to cut costs, and its revenues depended heavily on North American air traffic. Specifically, North American flights accounted for 14 percent of its flights and 44 percent of its revenues. When transatlantic traffic declined after September 11, NATS's revenues declined 15 percent. To avoid insolvency, NATS first obtained an estimated \$104.2 million in short-term loan credit from its lending banks and then refinanced, bringing in a new equity partner (BAA, plc).³¹ However, the combination of lost business and increased debt threatened NATS with insolvency in early 2002, leading it to implement operational cost savings, obtain a temporary loan credit, refinance its debts, renegotiate prices for users through a new regulatory structure, and obtain additional funds from the government and private shareholders.

Under its new regulatory structure, NATS now has a system in place to mitigate the effects of an industry downturn through automatic price increases that are triggered by reductions in air traffic. These price increases go into effect when traffic falls below a benchmark level, limiting NATS's revenue loss to 50 percent of the revenue that would have been generated if the benchmark level of traffic had been reached. If traffic falls below this 50 percent benchmark, as it might in a severe crisis, NATS's revenue loss is limited to 20 percent of the projected revenue. In effect, this automatic trigger mechanism spreads the risk of traffic downturns between NATS and its airline customers. Without this trigger, the prices set by CAA,

³¹Total new investment made in NATS as part of the refinancing arrangement was approximately \$225.7 million—about \$112.8 million from BAA, plc, matched by an additional \$112.8 million from the UK's Department for Transport.

the economic regulatory body, would remain fixed until the next regularly scheduled review when prices may be adjusted, upward or downward, and benchmark levels set.

In Germany, DFS also lost revenue during the industry downturn, but to a lesser degree. DFS reported a loss of more than \$36.4 million in 2001, when air traffic declined by 0.9 percent over the previous year. In 2002, it sustained a loss of more than \$23.2 million, when air traffic levels fell 2.9 percent below 2001 levels. To address these deficits, DFS modified investments, canceled projects, and ultimately raised fees, thereby increasing financial pressures on the airlines. However, when air traffic increased again in 2003, DFS recorded an operating profit of more than \$87.4 million and reduced its 2005 fees for en route services by 19.5 percent and for approach control services by 28 percent. DFS has begun to consider the benefits of a reserve fund, but German legislation governing air navigation service charges must be changed before DFS can develop such a reserve.

Before September 11, NAV CANADA banked up to \$66.3 million in its rate stabilization fund to protect against future losses. However, with the industry downturn, this fund was quickly exhausted and, after the SARS outbreak in 2003, the fund reached a cumulative deficit of about \$96.9 million. To maintain operations, NAV CANADA cut costs and raised its service fees, consulting with users as required. By the end of 2004, it reduced the deficit to approximately \$26.0 million, according to its 2004 annual report. However, as aviation industry representatives have noted, the fee increases had the inadvertent effect of disrupting the business cycles of air carriers, which faced the same difficult economic circumstances. Moreover, because NAV CANADA's price-setting process is limited only by statutory charging principles, NAV CANADA was able to raise its fees unilaterally, without having to negotiate increases with representatives of the airlines or other interests. Its board approved the fee increases to balance revenues and expenses as required by legislation. The CTA rejected an appeal of the increases brought by certain operators.

Involving Stakeholders in Modernization Efforts Can Help Ensure Mutually Beneficial Results

According to the ANSPs, involving stakeholders in efforts to design, acquire, and deploy new technologies can be beneficial. For example, Airways Corporation of New Zealand noted that its investment decisions are very much driven by customers' needs. Airways said it consults closely with the airlines before deciding to acquire new systems and to implement technology upgrades. According to Airways, if the airlines say they do not

want to make a particular investment and the investment adds no value for the customer, Airways will not spend the money. For example, the airlines have reported that they are not currently interested in Automatic Dependent Surveillance-Broadcast,³² so Airways has no immediate plans to invest in the technology. DFS has also reported that consulting with its customers before investing in any modernization efforts has been beneficial. According to DFS, before commercialization, the German government did not consult with users and other stakeholders when it acquired and deployed new air navigation technologies.

Once an initial investment decision has been made, ANSPs have further reported, it is beneficial to involve stakeholders throughout the design and acquisition process. For example, Airservices Australia reported that, since commercialization, air traffic controllers play a much larger role in the acquisitions process and have come to understand the linkage between service delivery costs and the costs of new equipment. Similarly, Airways Corporation of New Zealand noted that it has found it essential to involve the same controllers throughout the design process to ensure consistency in requirements and to maintain a thorough understanding of the project's ongoing specifications. In Airways' experience, it is essential for controllers, manufacturers, and the ANSP to reach agreement in order to establish realistic expectations for system design from the very beginning.

Steps May Be Needed to Balance Business and Small Community Interests

In some instances, an ANSP's need to recover its costs may be at odds with a small or remote community's need for scheduled air service. Providing air navigation services for such communities may not be commercially viable because it typically generates less revenue than providing services for larger communities. Even though the minimum cost of an air navigation service is the same, regardless of the location, the cost per plane is often higher at small or remote locations because the cost of the service is spread among fewer operators, usually with smaller planes.

In the past and in some countries today, the ANSPs charged the same fee for air navigation services at every airport, regardless of its size or location. Under this arrangement, called network pricing, services at heavily used

³²Automatic Dependent Surveillance-Broadcast is a system that allows pilots and air traffic controllers to "see" the location of nearby aircraft and engage in collaborative decision making. It broadcasts aircraft position data from an onboard navigation system, such as the global navigation satellite system.

airports subsidize services at small or remote airports. However, two of our five ANSPs, Airservices Australia and Airways Corporation of New Zealand, have adopted an alternative pricing scheme, called location-specific pricing, under which the fee for some service matches the cost of providing that service to a specific location.³³ Once this scheme is fully implemented, formerly subsidized air navigation services to small or remote locations may likely cost more. If an airline decides that it does not want to pay the increased fees, it may discontinue service to the location. However, air service may be the only means of public transportation to some small or remote locations. Continuing to provide air navigation services to small or remote locations may require special efforts to balance community needs and business interests.

Airservices Australia has reported that it plans to phase in location-specific pricing to ease the transition from network pricing. According to Airservices, it will increase charges over the next 5 years at general aviation and regional airports and the increased charges have been approved by the regulator. Although the increases will be gradual, the plan has raised concerns about further price increases and any future need to close or reduce services at these locations. Some fear that needed air services to remote bush locations will be lost, while others fear that secondary services, such as flight school training, which are typically provided at smaller airports, will be affected.

The impact of location-specific pricing on remote communities and small operators is difficult to predict. Costs may go up, but charges may not necessarily be prohibitive. When legislation calls for service to remote communities, an ANSP may ultimately be forced to take a financial loss if it is not able to fully recover its costs. Airservices Australia is seeking to control costs at some locations by deploying new lower cost technologies to serve remote communities. For example, Airservices Australia is planning to install Automatic Dependent Surveillance-Broadcast ground stations, which will allow air traffic surveillance services over remote regions of Australia where no surveillance currently exists and where the introduction of radar would not be cost-effective.

³³NATS has not implemented location-specific pricing. However, airport services are provided through a competitive process in the UK, and the prices for these services may therefore vary by location.

Appropriately Assessing the Value of Assets Is Essential for Sound Pricing and Cost Accounting

To protect taxpayers' interests, Canada and the UK needed to have an appropriate valuation of their facilities and equipment before wholly or partially selling these assets to their newly established ANSP. According to its Office of the Auditor General (OAG), Canada did not properly value its ANSP assets and infrastructures. The approximately \$1.5 billion value that the government negotiated with NAV CANADA in 1996 fell short of the \$2.3 billion to \$2.4 billion estimate developed in 1995 by a third party. NAV CANADA reported, however, that both it and Transport Canada disagreed with the OAG's estimate and its underlying assumptions. In a study of the NATS reorganization, the National Audit Office found that the UK government raised some \$1.3 billion from the sale of the ANSP to a consortium of seven UK-based airlines. However, these proceeds were realized by increasing the level of NATS's bank debt. As a result of this debt, NATS was extremely vulnerable to the decline in air traffic after September 11. DFS is currently undergoing a valuation of its key assets in preparation for selling 74.9 percent of its equity to private investors in a formal competitive bidding process.

Maintaining Staff Levels and Expertise during Commercialization Can Prevent Disruptions in Regulatory Functions

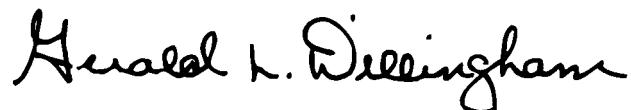
Some countries that commercialized their ANSP had difficulty retaining a sufficient number of staff to carry out safety regulation. For example, in Canada, many of the safety staff moved to the newly established NAV CANADA after commercialization, leaving the government regulator, Transport Canada, with insufficient staff to carry out timely safety inspections during the first 6 months after commercialization. Germany faces a similar challenge as the government prepares to develop a safety regulatory authority in accordance with the Single European Sky initiative by the end of this year. According to the Transport Ministry, it may be difficult for the government to recruit safety staff at a civil service salary when the private sector is paying higher salaries for safety inspectors to develop safety standards and procedures. CAA managers with responsibilities for regulating the safety of NATS's operations also raised concerns about recruiting staff. According to these officials, regulators need the highly skilled expertise of air traffic controllers. However, the high salaries of air traffic controllers of the ANSPs make it difficult to recruit them for regulatory positions.

Developing Baseline Measures before Commercialization Can Enhance Performance Measurement

Obtaining baseline measures before commercializing a country's air navigation services will allow the government and others to assess the new ANSP's performance in the areas of safety, cost, and efficiency. Some of the countries whose ANSPs we reviewed did not collect baseline data or measure performance as extensively as the commercialized ANSPs have since done. As businesses, commercialized ANSPs must assess the performance they are making toward their goals to access private funding and, therefore, they need extensive performance data. However, lack of baseline measures before commercialization makes it difficult to gauge its development before and after commercialization. For instance, the Canadian OAG considered the assets of NAV CANADA to be undervalued, due to the absence of good financial information before commercialization. In addition, international organizations that support commercialized ANSPs have emphasized the importance of developing performance measures and benchmarks. ICAO, for example, stresses the importance of having transparent financial data available for economic oversight, and CANSO and EUROCONTROL are working to standardize performance measures and compare ANSPs across dimensions such as safety, cost, and efficiency.

We are sending copies of this report to interested congressional committees; the Secretary of Transportation; the Administrator, FAA; and the chief executive officers of the ANSPs in our sample. We will also make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

Please call me at (202) 512-2834 if you or your staff have any questions about this report. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Major contributors to this report are listed in appendix II.



Gerald L. Dillingham, Ph.D.
Director, Physical Infrastructure Issues

Scope and Methodology

We developed a descriptive analysis of selected foreign countries' commercialized, performance-based air navigation services providers (ANSP) by reviewing the characteristics and performance of five such organizations, which we selected as illustrative of similarities and differences in ownership, length of experience with commercialization, and size and scope of operations. We then analyzed the information we had gathered to identify lessons learned about the commercialization of air navigation services. Our review included site visits, agency interviews, and analyses of documents provided during our site visits and obtained through our own research. The ANSPs—Australia's Airservices Australia; Canada's NAV CANADA; Germany's Deutsche Flugsicherung GmbH (DFS); New Zealand's Airways Corporation of New Zealand, Ltd.; and the United Kingdom's (UK) National Air Traffic Services, Ltd. (NATS)—were commercialized between 1987 and 2001 and have been operating since then as performance-based organizations. Because we selected these ANSPs to illustrate specific characteristics, our results cannot be generalized to all commercialized ANSPs.

To describe common characteristics of commercialized air navigation services in the selected countries, we conducted a computer search on key elements of each ANSP and conducted interviews in each country. We collected information on the size and scope of air traffic (e.g., number of aircraft movements and number of air traffic controllers); the ownership, management, and funding structures of each country's ANSP; and institutional mechanisms for stakeholder input. We interviewed government officials, ANSP executives and representatives, union officials, and representatives of aviation stakeholders in each country to synthesize information on how air navigation services were delivered before commercialization and the key elements and characteristics of commercialized ANSPs.

To describe how the safety, cost, and efficiency of foreign air navigation services have changed since commercialization, we conducted interviews and reviewed documents obtained during our site visits. We also gathered information through our own computer research. We interviewed government officials, ANSP executives and representatives, national audit officials, union officials, and representatives of aviation stakeholders to obtain their views on how safety, cost, and efficiency have changed since air navigation services were commercialized. In addition, we interviewed officials from the International Civil Aviation Organization (ICAO), the Civil Air Navigation Services Organization (CANSO), EUROCONTROL, and the European Commission to obtain their perspectives on these issues. Finally,

through our computer research and analysis of documents obtained during our site visits, we obtained additional information on the performance of each ANSP, including its safety, costs, and efficiencies, since commercialization.

To identify lessons learned about the commercialization of air navigation services, we conducted interviews and reviewed literature on commercializing air navigation services and implementing performance-based air traffic organizations. In each country, we interviewed government officials, ANSP executives and representatives, union officials, and representatives of aviation stakeholders, asking them about the lessons they had derived from commercialization. We also reviewed literature from academics and experts on commercializing air navigation services and synthesized information from our interviews with information from the literature to arrive at some general lessons on the commercialization of the five air navigation service providers we reviewed.

Unless otherwise noted, we converted the local currencies of each country into U.S. dollars using the Organization for Economic Cooperation and Development's purchasing power parity historical series for each country in the relevant years for the currency. We adjusted for inflation using the Gross Domestic Product price index of the Congressional Budget Office's economic projection for 2005 to obtain the estimated value of each country's currency in 2005 U.S. dollars.

We did not compare performance before and after commercialization or across countries. Such comparisons are generally not feasible because data for assessing performance are typically unavailable for the time before commercialization, or the measures have changed in the years following commercialization. Furthermore, comparisons between or among ANSPs are difficult because each ANSP may define its measures of cost, safety, and performance differently.

We determined from our review of the independently audited financial reports of each ANSP that the financial data we obtained and used for our engagement were sufficiently reliable for our purposes. An independent audit was conducted on the annual financial reports of each of the five ANSPs in accordance with the applicable country's accounting standards and practices. The independent auditors for each ANSP found that the annual financial statements were unqualified and fairly presented, in all material respects, the financial condition and position of the ANSP.

Appendix I
Scope and Methodology

To identify any changes in safety since commercialization, we collected and analyzed information provided by each ANSP and by its independent safety regulator. We interviewed officials from these regulators, and we relied on safety data from the ANSPs and their audited annual financial reports, which had been independently reviewed and evaluated. To assess the reliability of these data, we (1) interviewed the officials from each ANSP and its independent safety regulatory authority who were responsible for compiling these data and (2) corroborated the data through comparison with other sources of information. We determined that the data from each country were sufficiently reliable to identify any major changes in safety since each ANSP was commercialized.

GAO Contact and Staff Acknowledgments

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