

ANALYSIS OF ALTERNATIVE INSTITUTIONAL ARRANGEMENTS FOR REFORM OF U.S. AIR TRAFFIC CONTROL

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ABSTRACT: *A considerable amount of New Public Management-oriented research investigates alternative institutional arrangements for provision of services to the public. Some of this work argues in support of service delivery through an increase in outsourcing or by privatization of existing government functions. Air traffic control is provided to aircraft operators using airports and airspace all over the world. This article studies institutional arrangements of provision of air traffic control employing a comparative analysis of six nations: Australia, Canada, New Zealand, Switzerland, the United Kingdom, and the United States. The objective of the study is to determine whether a modification of the governance of the U.S. air traffic control system is appropriate and, if so, what alternatives seem most appropriate to replace the current system.*

Conclusions based upon the analysis suggest that air traffic control is most effectively provided on a not-for-profit basis, with indirect participation by stakeholders including airlines and airport operators in the governance of the air traffic control provider. For reasons related to safety, national security, and international obligations, governments remain ultimately responsible for providing this essential service. However, a strong argument may be made that the U.S. system should be reformed.

Attributes of New Public Management (NPM) reforms include disaggregation and decentralization of public services, as well as an emphasis on the adoption of private-sector management practices within the public sector (Osborne and McLaughlin 2002). Accordingly, the NPM literature often addresses establishment of alternative forms of service delivery, including outsourcing or privatization of government functions (Borins 2002). It has been argued that where changes in institutional arrangements for service delivery are designed to give organizations specific mandates to focus on

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providing greater benefits to specific groups of users, responsiveness and the quality of service should improve (Aucoin 1998). In addition, it has been asserted that reductions in information costs have led to an increase in the effectiveness of process-oriented structures, such as independent organizations with focused service delivery responsibilities relative to functional structures with a wide scope of responsibilities, e.g., a large government department (Jones and Thompson 1999, 29).

Advocates of NPM also have leveraged the concept of the minimalist state, where government arranges for specific services but does not necessarily provide them (Jones and Thompson 1999, 18; Savas 2000, 65; Pollitt 2002). In contrast to traditional public administration, NPM also is concerned with implementation rather than solely with policy prescriptions (Kelman 2003). The focus is therefore more on the operation of management systems and techniques, and associated outcomes. Often these approaches cannot be decided upon or implemented unilaterally, but require some type of cooperative relationship between stakeholders (Jones 2003, 9-16).

Among the traditional functions of government, air traffic control (ATC) is provided for the purpose of preventing collisions between aircraft in the air and between aircraft and obstructions on the ground, as well as expediting and maintaining an orderly flow of air traffic. In addition to ATC, the effective management of air traffic requires associated services such as meteorology, search and rescue, and telecommunications, as well as the provision of aeronautical information such as charts. When grouped with ATC, these ancillary functions are termed air navigation services (ANS) (International Civil Aviation Organization [ICAO] 1997, 83). ANS is therefore a broader term and describes the range of services provided somewhat more accurately than ATC, but the latter label is better known. Therefore, ATC is used in this article to describe the services under consideration. An additional factor in this regard is that most of the world's nations place meteorological services and search and rescue provision, both of which are included under the definition of ANS, under other organizations rather than assigning them to the ATC provider.

The first section of this article describes the institutional context for ATC. We then move to an explanation of our motivation for choosing the delivery arrangements of six nations for comparative analysis. This is followed by an analysis of the key features of the ATC providers in each country. The next section compares and contrasts nation-specific characteristics, with a goal of making a preliminary determination of what the elements of a successful approach might be for reforming the U.S. ATC system. We examine evidence that suggests reform of the U.S. system is needed. Our analysis indicates the type of reform the U.S. should adopt and why change should be a high policy priority. We explore issues that must be addressed should reform be attempted, and suggest topics related to provision of ATC services that require further research.

THE CONTEXT OF AIR TRAFFIC CONTROL REFORM

The provision by governments of ATC reflects the responsibility of the state for safety, international relations, and indirectly, the macroeconomic benefits of ensuring a sound infrastructure for aviation. ATC is a public good provided to all aircraft using a country's airfields and airspace (Weimer and Vining 1991; Lieberman and Hall 2000).

However, ATC also represents a service that directly benefits only a limited number of users, notably aircraft owners and operators.

The idea that the users of the system, rather than the taxpaying public, should incur the costs associated with ATC provision is inherent in the commercialization process (Poole and Butler 2002). However, the International Civil Aviation Organization (ICAO) sets out broad principles for the establishment of user charges, which member states are expected to comply with. The core ICAO policy on user charges states that only distance flown and aircraft weights are acceptable parameters for use in a charging system (ICAO 1997, 59). These two factors are considered to be easy to measure, bear a reasonable relationship to the value of service received, and do not discriminate due to factors such as where the flight originated or the nation of aircraft registration.

From the private-sector perspective, investors find ATC assets of interest because “they have a vital role to play in the economy, and there is little or no chance that the companies involved could go bankrupt and the equipment left unused” (Asset Finance International 2003, 1). Therefore ATC services, within the NPM framework, represent a viable candidate for studying alternative means of service delivery.

The central document governing the global organization of ATC is the *Convention on International Civil Aviation*, commonly referred to as the Chicago Convention, whose original version was signed in that city in 1944 (ICAO 2000). In the convention, contracting states agreed to ensure the minimum standards of ATC established by ICAO, a specialized United Nations agency created by the convention.

Emanating from obligations under the Chicago Convention, ATC has traditionally been provided by line agencies of national governments. However, there is a widespread trend toward transferring delivery of ATC services out of line departments of national governments to independent agencies or corporations. The Civil Air Navigation Services Organisation (CANSO), which is the trade association for independent ATC providers, currently counts thirty-one members (CANSO 2003a). However, whatever delivery mechanism is chosen, national governments remain ultimately responsible for ensuring that adequate ATC services are available (ICAO 1997, 7).

ICAO has developed three broad categories to describe the organizational forms of ATC providers: government departments, autonomous public-sector organizations, and private-sector organizations. In a 1997 document, ICAO noted that there were no known examples of private-sector ATC provision (8-9). However, the 2001 partial privatization of National Air Traffic Services Ltd. (NATS) in the United Kingdom now provides a case of a private-sector, for-profit ATC enterprise (Shaoul 2003).

Jones (2003, 14) has commented that public management researchers “want to know how their findings on cases in one institutional, governance, and socio-economic and cultural setting related to findings and dynamics in other systems, nations, levels of government, etc.” Similarly, as explained by Borins (1998) in an early yet prescient comparative review of NPM in commonwealth nations, what works in one public-sector context may not work in another political, economic, or social setting.

While there are comparative studies of airline and airport privatization (Advani and Borins 2001; Backx, Carney, and Gedajlovic 2002; Doganis 2002; Staniland 2003), we were unable to locate a comparative analysis of ATC reform. The literature on changes to the governance of ATC (Goodliffe 2002; Lovink 1999; Shaoul 2003) has focused

mostly on the experience of individual nations in transforming their ATC services. Charles and Newman (1995) briefly discussed the experience of New Zealand in their review of the proposals for ATC reform in the U.S. Golaszewski (2002) provided a brief review of the differences between ATC provision in the U.S. and Europe, but focused on air traffic management issues (such as congestion and delay) rather than governance or organizational form.

While the U.S. has yet to undertake any significant change in how ATC is delivered, the experience of other nations is relevant to the design of any eventual U.S. reforms. We have, therefore, chosen five additional countries with a view towards examining their experiences with the reform of ATC provision. Our choice of nations was motivated as follows. First, we selected Australia, New Zealand, and the United Kingdom, which Barzelay considers “benchmark cases of NPM,” a view supported by Aucoin in his study of reforms in Canada (Barzelay 2001, 55; Aucoin 1995). Additionally, all three of those countries have moved ATC delivery out of the line department structure into independent organizations.

We then added Canada, also a member of the commonwealth, and the U.S.’ largest trading partner, which shares a 7,065-mile border with the U.S. (Cody 2003). Airline traffic between the U.S. and Canada also represents the largest international air traffic market in the world, and Canadian ATC directs a great deal of traffic between the U.S. and third nations (Pustay 1999). We also added Switzerland to our selection, in order to include a nation outside the Anglo-American sphere. Switzerland is of particular interest as the first country to establish an independent not-for-profit corporation for ATC provision, Radio-Suisse (now called Skyguide), doing so in 1921 (CANSO 2002b). Finally, we will examine the current arrangements for ATC in the U.S. in order to contrast them with the five other nations studied. In doing so, we were inspired by the variation-finding approach to comparative case analysis undertaken in Barzelay’s examination of NPM in the U.S. and five other countries (Barzelay 2001, 55).

It should be pointed out that while one cannot deny ATC services to an aircraft operator, the regulation of aviation, through aircraft and airline registration and pilot licensing, means that nonrecovery of fees is not a significant issue for most ATC providers. However, there are significant costs associated with providing ATC services. Consistent with the trend toward user fees and cost recovery in many nations, there has been a gradual shift toward recovering a greater part of the costs of ATC provision from users, rather than taxpayers.

A focus on self-financing, whether from user charges or by obtaining debt on the commercial market, also has the benefit of disciplining ATC providers to control costs. However, the post-2001 decline in air traffic—and ATC providers’ revenue—has caused major difficulties for ATC providers, whose flexibility in controlling expenditures is limited by national and international safety obligations, and the fact that typically 70 to 80 percent of their expenditures are on personnel and essential recapitalization (Hayes 2003). The current state of affairs has been summarized in the following discussions:

For some months now air navigation service providers . . . and airlines have been on a collision course. Recent airline complaints about increases in air traffic control charges have hit a sensitive nerve among members of the Civil Air Navigation Services

Organisation (CANSO) which held its annual general meeting in early June. After all, one of the main *raison d'être* of corporatisation is to position service providers so they react flexibly to the needs of their customers. But instead of developing amicable partnerships with airlines around the world, corporatised service providers are now having to search for ways to bridge the growing divide between the two sides. “How does the market see us? Not capable enough of reacting to the current challenges—too slow, too inflexible,” according to CANSO chairman and DFS [Deutsche Flugsicherung, the German ATC provider] CEO Dieter Kaden. “You are somewhat fortunate in that the basis of your operations comprise full cost recovery and no economic risk. In contrast, we have to take the full economic risk,” says Dr Christopher Klingenberg of Lufthansa. “This has an impact on unit costs. The lower the traffic growth, the higher the growth in charges” (Ibid.).

Reform of ATC highlights two key relationships with central government functions held by all ATC providers. First, in traditional ATC provision, as in the case of the Federal Aviation Administration in the U.S., the agency that delivers ATC services also is responsible for regulating the safety of ATC operators. However, when ATC delivery is moved outside of core government functions, regulatory responsibilities for safety must be retained in-house. For example, when the United Kingdom spun off ATC provision to NATS, the responsibility for regulating that agency’s safety was assigned to the Civil Aviation Authority, which formerly had also provided ATC services. Given that ATC delivery is increasingly seen as an economic activity that a provider supplies for its own benefit, even on a not-for-profit basis, the sponsoring state must create a suitable regulatory regime to ensure compliance with safety requirements (CANSO 2003c).

Similar issues arise in terms of economic regulation. With ATC provision moved outside of the central machinery of government, the service provider sets rates independently, although there are generally governance or advisory mechanisms in place to ensure consultation with users. However, the state usually retains some degree of economic regulation, notably through the right to review user charges set by the board of the ATC provider. These powers must be used with restraint, given that the service provider bears the risk and liability for poor performance should revenues prove insufficient (CANSO 2003c).

For example, following the attacks of September 11, 2001, worldwide air traffic dropped significantly, forcing many ATC providers, including Nav Canada, to increase charges to be able to recover costs and maintain their capital investment plans. Under the Civil Air Navigation Services Commercialization Act, the Canadian Transportation Agency (CTA), a government regulatory body, was given the authority to review user charges set by Nav Canada when an appellant believed the charges were inconsistent with the charging principles set out in the act. Air Canada, in challenging rate increases set by Nav Canada effective 1 August 2003, alleged that the increased charges were inconsistent with the legislated charging principles, as they would generate revenues beyond the current and future needs of Nav Canada, and would threaten the financial health of the airline. The CTA disagreed, and let the increased charges set by Nav Canada stand (Canadian Transportation Agency 2003).

In a contrasting case, the Australian Competition and Consumer Commission blocked price increases proposed by Airservices Australia because they reflected only a short-term decline in air traffic and did not sufficiently consider longer-term prospects for recovery of the aviation industry. Additionally, the commission believed that the proposed rate increases would discourage Airservices Australia from innovating in order to minimize costs (Australian Competition and Consumer Commission 2003). Perhaps in anticipation of the vicious cycle caused by the attempt to maintain revenue levels when air traffic declines, the United Kingdom, in its privatization of NATS, limited annual rate increases to the retail price index minus a correction factor, which is a common regulatory device within European Union countries. However, this restriction proved problematic in the post-2001 environment, as we will discuss later in this article (UK National Audit Office 2002).

The second key relationship is that between ATC providers and the military. In each of the nations studied, some of the airspace is reserved by the military for operations and training. How the relationship between civilian and military ATC is managed, including who is responsible for what specific functions, varies by country. In addition to routine ATC, other activities, such as search and rescue, responding to terrorist threats, and the provision of flight information, also require cooperation between the ATC provider and the military.

Under the traditional assignment of civil ATC to a government department, relationships with the military could often be handled informally or through internal government arrangements. Reform of ATC, as inspired by NPM, leads to clearer accountability for performance and increased autonomy from government. These changes have usually resulted in the need to more formally define the respective responsibilities, both operational and financial, of the ATC provider and the military. As we will discuss below, ATC reform has often led the military to integrate its own ATC functions with those of the ATC provider.

Rather than arguing simply for privatization of ATC, we believe that the transition in how ATC services are being delivered has created an opportunity for dialogue. Goodliffe (2002) has emphasized that because of the differences between ATC and other types of public services, standard models of privatization do not necessarily apply, or at least require significant adaptation. The first group of differences includes the international obligations of the state to provide ATC and the corresponding authority of the state to collect charges. The second group of differences arises from the national security aspects of ATC, which include a need for close relationships with the military on an ongoing basis.

CHARACTERISTICS OF AIR TRAFFIC CONTROL IN SIX NATIONS

Table 1 presents an overview of the key characteristics of ATC providers in the six nations reviewed. We first describe the type of organization, its relative size measured by total operating expenses, as well as the legislation that established and governs the provider. We then summarize the funding strategy as well as relationships with the national government in the areas of safety and economic regulation.

TABLE 1
Key Features of Air Traffic Control Governance

<i>Country</i>	<i>Name of Provider</i>	<i>Organization Type</i>	<i>Total Operating Expenses for Air Traffic Services (Year)</i>	<i>Empowering Legislation and Date</i>	<i>Governance</i>	<i>Funding Strategy</i>	<i>Regulatory Authority –Safety</i>	<i>Regulatory Authority –Economic</i>
Australia	Airservices Australia	Government-owned authority	AUD 519,494,000 (2002-2003)	Air Services Act, 1995	Eight-member board of directors appointed by minister for transport and regional services	Charges based on return on equity approved by minister. May raise money on private capital market	Civil Aviation Safety Authority	Australian Competition and Consumer Commission
Canada	Nav Canada	Private, non-share, not-for-profit corporation	CAD 927,934,000 (2003)	Civil Air Navigation Services Commercialization Act, 1996	Board of directors: 10 named by govt and aviation Industry, four independent members plus president/CEO	Self-financing; original credit facility from banks	Department of Transport	Canadian Transportation Agency
New Zealand	Airways Corporation of New Zealand	Stated-owned enterprise	NZD 91,972,000 (2002-2003)	Incorporated in 1987 as a company under the Companies Act and the State Owned Enterprises Act	Seven-member board of directors appointed by minister for state-owned enterprises and minister of finance, each of whom has 50% of shares	ACNZ expected to make a return on operating capital; debt/equity structure to be maintained at 50/50	Civil Aviation Authority	New Zealand Commerce Commission

(table continues)

TABLE 1
CONTINUED

Switzerland	Skyguide	Not-for-profit, joint-stock corporation	CHF 285,586,000 (2002)	Federal Aviation Act and Federal Ordinance on Air Navigation Services, last amended 2001	Seven-member board of directors appointed by shareholders. Federal govt owns 99.85% of shares; aviation industry interests own 0.15%	Full cost recovery. Debt financed by private banks; debt not guaranteed by government	Federal Office for Civil Aviation	DETEC (federal department for environment, transport, energy, and communications). En route charges must be approved by EUROCONTROL, approach charges must be approved by DETEC
United Kingdom	National Air Traffic Services Ltd.	Public-private partnership between govt (48.87%), consortium of UK airlines (41.94%), BAA plc (4.19%), NATS staff (5%)	GBP 415,771,000 (2002-2003)	Transport Act, 2000	Board of directors with advisory stakeholder council. One executive director, one independent (nonexecutive) director, three govt directors, four airline industry directors	Regulated as a monopoly utility	Civil Aviation Authority	Civil Aviation Authority. En route charges must be approved by EUROCONTROL
United States	Federal Aviation Administration	Government agency	USD 5,764,000,000 (2003)	Federal Aviation Act of 1958	Administrator reports to secretary of transportation	Congressional appropriations, and fees set by regulation	Federal Aviation Administration	Federal Aviation Administration

Australia

ATC services in Australia are provided by Airservices Australia, a government-owned authority created by the Air Services Act 1995. The same legislation also created the Civil Aviation Safety Authority to separate the safety regulation function from the ATC provider. Airservices also is unique among the ATC providers reviewed in this article in that the organization also is responsible for airport firefighting services.

Since 1995, there has been some discussion of transforming Airservices into a corporation and opening up some ATC functions to competition, but no such changes have been introduced so far (CANSO 1999, 34-40; Airservices Australia 2001; Airservices Australia 2003). The minister for transport and regional services appoints all members of the Airservices board of directors. There are currently six independent directors plus the chief executive officer and the chief financial officer.

The relationship between Airservices and the Department of Defence is managed through a series of agreements (CANSO 1999, 35). The two organizations are working on integrating the management of Australia's airspace, as well as developing a model for cost recovery by Airservices of services provided to the Department of Defence, and vice versa (Airservices Australia 2002, 12, 30; AAP Newsfeed 2002).

Canada

The Canadian reform of ATC was significantly influenced by reforms in Australia and New Zealand. However, when Nav Canada was created in 1996 through the Civil Air Navigation Services Commercialization Act, Parliament did not follow the example of those two countries in creating an independent government agency. Rather, the legislation provided for a private sector, not-for-profit, non-share capital corporation, with a board of directors composed of stakeholder representatives. The result has been described as the world's first fully privatized air traffic control system (Baglolle 2001), and the stakeholder board is viewed as the most distinctive element of Nav Canada's governance structure (Poole and Butler 2002).

There are fifteen members on Nav Canada's board of directors; the Air Transport Association of Canada, which represents the nation's air carriers, appoints four. The Canadian Business Aircraft Association, representing corporate aviation users, names one board member; Nav Canada unions appoint two; and three members are appointed by the government. In turn, these ten individuals select an additional four independent directors. Together, the fourteen directors then name the president/chief executive officer.

The relationship between Nav Canada and the Department of National Defence is governed by a series of agreements. As in Australia, neither of the organizations charge the other for services provided in their respective airspace (CANSO 1999, 75). While the military operates its own ATC services, it is of interest that the Nav Canada Training Institute does all formal training of military ATC controllers. This arrangement precedes the creation of Nav Canada; previously, the Department of Transport trained all civilian and military controllers. Nav Canada has also provided contract training to controllers from twenty-five nations (Nav Canada 2004).

Nav Canada's autonomous structure has been suggested by one U.S. research organization as the model for eventual FAA reform (Poole and Butler 2001). A further point is that the government does not guarantee the company's debt, and any financing is obtained on the commercial market (CANSO 1999, 77). Initial funding to buy the ATC system from the government came from long-term bank loans and bond issues, with any surplus revenue reinvested in the company. Under government ownership, the Canadian ATC system had problems with obsolete equipment and undercapitalization similar to those of the FAA. In contrast, Canada now has what has been called the world's most modern air navigation system (Baglolle 2001).

Given Canada's distinctive strategy of placing the ATC provider outside the government, the question arises of how the public interest is to be ensured, particularly given that ATC is a monopsony. Lovink (1999) has explained that the enabling legislation incorporated the view that the public interest could be satisfied by

- requiring the company, as a nonprofit enterprise, to reinvest any surplus back into the business;
- as mentioned above, setting up a board composed of stakeholders in the aviation system;
- setting out principles for how user charges were to be developed, including a requirement to respect international obligations; and,
- allowing appeals by aircraft operators to the Canadian Transportation Agency, a government regulator, where it was believed that the above principles were not being respected.

Nav Canada encountered considerable success in its first few years. In the period from 1996 to 1999, productivity (measured in flights per employee) increased 32 percent, airline costs decreased 33 percent, controller salaries went up 33 percent, and the total number of employees declined 14 percent, although none of the positions eliminated were controllers or technicians (Wald 1999).

The reforms have not been without criticism, particularly in the post-2001 period. Unions have complained about being denied the right to refuse overtime, despite significant pay raises since privatization. One labor representative called Nav Canada a financial disaster, with \$176 million (Canadian) in debt and its largest customer, Air Canada, in bankruptcy proceedings. Even Nav Canada's president has termed the post-2001 downturn in air traffic a catastrophe (Carr 2003). As mentioned earlier, during 2003 Air Canada, which represents 28 percent of Nav Canada's revenue, unsuccessfully appealed an increase in user charges to the Canadian Transportation Agency. This was the first appeal to the agency since the creation of Nav Canada in 1996 (Airports 2003; Poole and Butler 2002). At the time Nav Canada announced the increased charges, an article entitled "Nav Can Ups Carrier Fees 7 Percent: Airlines Condemn Increases as Latest Shock to Sector," by I. Jack in the *National Post* (Toronto) on 22 July 2003, described the company's challenge as follows:

Nav Canada, the operator of the country's air traffic control system, is raising the fees it charges the financially ravaged airline industry by 7 percent as it combats a deficit of its own. The airlines condemned the move and said they will probably have to absorb the cost rather than pass it on to customers, a further blow in tough times for a beleaguered industry. "Nav Canada's rate increase is completely out of touch with reality. Canada's air industry is facing some of the worst economic circumstances that it has seen in its history," said Laura Cooke, Air Canada's spokeswoman.

"It's a blow any time costs rise, and it's the airlines that have to come up with the money in this environment," said Warren Everson, vice-president of the Air Transport Association of Canada. WestJet Airlines Ltd. complained part of Nav Canada's deficit comes from money that Air Canada has not paid. "It's disappointing that the industry is having to pay for that [Air Canada deficit] and, more importantly, that the customers are having to pay for it," said Siobhan Vinish, spokeswoman for Calgary-based WestJet. Nav Canada, a non-profit company, took a \$22 million charge in the quarter for fees not paid by Air Canada. The carrier, which is in bankruptcy protection, owes Nav Canada \$45 million.

In its appeal, Air Canada had alleged that the financial health of the airline industry was material to Nav Canada in setting user charges (Canadian Transportation Agency 2003). Also, general aviation (corporate and recreational aircraft) users claim they are being asked to pay a disproportionate share of costs compared to airlines (Baglolle 2001; Lovink 1999). Despite the downturn in user charges, Nav Canada has maintained a high AA credit rating with Standard & Poor's. While Air Canada has been reducing its fleet size, competing airlines were viewed by S&P as likely to at least partially replace any cuts in Air Canada service. Also, a restructured Air Canada could emerge from the current bankruptcy proceedings with a stronger and more stable traffic base. S&P did acknowledge that Nav Canada's ability to raise rates beyond the 6.9 percent increase announced in 2003 could be limited (Airports 2003).

New Zealand

For many students of NPM, New Zealand represents the first nation with the Westminster system of government to undertake fundamental reforms in the structure of government and in the policymaking process. These changes can be traced back to the 1983 victory of the Labour Party. At the time, New Zealand was facing a severe fiscal crisis, and as explained by Barzelay (2001, 73), the situation "provided an ideal context for economic policy to spill over into public management." Reform in New Zealand has been facilitated by the country's small population of only four million, unitary form of government, and single-chamber legislature (Organisation for Economic Cooperation and Development 1999).

Immediately before being restructured in 1987, ATC provision cost the government more than NZ\$10 million a year. The Airways Corporation of New Zealand, now a state-owned enterprise, claims "air navigation services return to the Government shareholder more than \$10 million in dividends and taxes every year" (Airways Corporation of New Zealand 2003a). Airways also provides all military ATC services through a contract with the Ministry of Defence (CANSO 1999, 41).

Airways has been described as the most autonomous of the reformed ATC organizations that remain part of their national government. This is consistent with the principles underlying reform of the public sector in New Zealand, which include the provision that commercial functions remaining the responsibility of the state should operate as in the private sector as corporations, with independent boards of directors, and paying taxes and dividends (Organisation for Economic Cooperation and Development 1999).

Airways' board, while named by the two responsible cabinet ministers, is expected to set policies in accordance with the government's role as a rational shareholder (Poole and Butler 2001). The firm's capital structure is based on a debt/equity ratio of approximately 50/50; the government does not guarantee Airways' debt (CANSO 1999, 41).

While Airways is not required to consult with users in setting charges, it has chosen to do so through a memorandum of understanding with its major airline customers. The company has also chosen to self-regulate its returns based on economic value added (EVA); excess revenues beyond EVA are used to reduce user charges in subsequent years.¹ Although there is no formal regulatory process for rate setting, charges can be appealed to the New Zealand Commerce Commission (Poole and Butler 2002). The International Air Transport Association, the trade group for the world's major airlines, has praised Airways for containing costs, minimizing its increases in user charges despite the post-2001 downturn in air traffic (International Air Transport Association 2003).

One note of discord concerned Airways' participation in a consortium that unsuccessfully bid on the United Kingdom's 2001 privatization of NATS, which is discussed below in our summary of the UK ATC reforms. There were allegations that members of the Airways board who were involved in the preparation of the consortium bid for NATS would stand to gain positions in NATS if the UK government accepted the bid. An investigation by the New Zealand Controller and Auditor General found that while three Airways board members were in a potential conflict of interest situation, proper reports were filed with the board, and appropriate controls were in place to protect the public interest (New Zealand Controller and Auditor General 2000).

Switzerland

Of the six nations reviewed, Switzerland's ATC arrangements are indeed unique. Since the inception of air navigation services in 1921, an independent federal corporation has provided ATC services. The firm was originally known as Radio-Suisse, but changed its name to Swisscontrol in 1987, then to Skyguide in 2001. The company's shares are held almost entirely by the government, with a very small portion (0.15 percent) held by the aviation industry (airports, aircraft operators, aviation-related organizations, and labor groups).

Skyguide has a seven-member board, consisting of an independent chairman who is currently a private attorney, a vice chairman who represents the military (currently the deputy commander-in-chief of the Swiss air force), and five other directors. These are currently the deputy director of the Federal Office of Finance, a union representative, an independent professional engineer, and the heads of Aerosuisse (the aviation

industry trade association) and Swissport Switzerland (the private franchise that operates Switzerland's three major airports at Zurich, Geneva, and Basel) (Skyguide 2004).

The government does not fund Skyguide, and debt financing must be obtained entirely on the private market; the government does not back Skyguide debt. Like Nav Canada, Skyguide can be viewed as a user cooperative, where it is presumed that the shared interests of the stakeholders will prevent monopsonistic behavior toward users. However, unlike Nav Canada, Skyguide is effectively controlled by the Swiss government (Poole and Butler 2002).

Similar to the arrangement in New Zealand, in 2001 the Swiss military delegated all responsibility for ATC in military airspace to Skyguide, and as of 2003 all military controllers were integrated into the company's operations. Skyguide claims that the Swiss model represents a greater degree of integration of civil and military ATC than that of any other nation (CANSO 2002b; Skyguide 2003).

In addition to being governed by ICAO regulations and safety and economic regulation by the Swiss government, Skyguide, like the United Kingdom's NATS, must comply with economic and safety rules set by the European Organisation for the Safety of Air Navigation (EUROCONTROL), a 41-member organization established in 1960. EUROCONTROL's main objectives include the integrated management of European air space and the harmonization of national ATC practices. EUROCONTROL is independent of, but supported by, the European Union (ICAO 1997, 94; EUROCONTROL 2003). A key initiative of the organization is the creation of the "single European sky," with upper-level airspace management being provided on a regional, rather than a national, basis.

A mid-air collision on 1 July 2002 was a defining moment for Skyguide. On that day, a DHL Boeing 757 freighter hit a Tupolev 154 flown by Russia's Bashkirian Airlines over southern Germany, in Skyguide-controlled airspace. The causes of the collision were found to be conflicting directions issued to the two pilots by controllers and by both aircrafts' onboard traffic collision avoidance systems (TCAS). Also, understaffing by Skyguide, which had only a single controller on duty to cover the area at the time, was determined to be a contributing factor, in addition to communication difficulties between Skyguide and the German ATC provider (Thomas 2002; Bowcott 2002).

The collision raised systemic issues about the relationship between the various national ATC providers, EUROCONTROL, and automated instructions generated by the TCAS installed onboard aircraft. The British firm Jane's commented that as a result of the collision and the financial collapse of Swissair, "the blow to national self-esteem has been considerable, more than the events themselves might seem to justify" (Jane's Sentinel Security Assessment 2003). Since the collision, Skyguide has been under intense scrutiny and has undertaken a number of reforms in partnership with EUROCONTROL (Thomas 2002; Jane's Airport Review 2002; Bowcott 2002).

United Kingdom

Of the six nations reviewed in this article, the evolution and current governance of ATC in the United Kingdom are the most complex. There are two key reasons. First,

the UK government is the only one of those reviewed to have established ATC as a for-profit activity. Second, the UK is also the sole known example of the creation of a share-capital public-private partnership (PPP) for ATC. In the UK, the ATC provider, the government, the nation's largest airport operator (BAA plc), and a consortium of seven British airlines jointly own the ATC provider, NATS. The NATS Employee Sharetrust Ltd. also owns 5 percent of NATS' parent company, NATS Holdings Ltd. (UK National Audit Office 2004, 6).

Further adding to the complexity is that NATS is composed of two wholly owned subsidiaries: NATS (En Route) plc, or NERP, and NATS Services Ltd. (NSL). NERP is a franchise that is licensed and regulated by the UK Civil Aviation Authority (CAA) as the sole enroute ATC provider in that country (Savas 2000, 79-80; NATS [En Route] Ltd. 2003). In contrast, NSL is an unregulated company that competes for contracts to provide ATC in airport towers (which are not within the scope of NERP's mandate), and also engages in training and consulting on a contract basis in both the UK and abroad (UK National Audit Office 2002). The separation of ATC providers between those managing airport towers and those responsible for enroute traffic control facilities is another unique characteristic of the British system. All the other countries reviewed have a single provider for both tower and enroute ATC, with the exception of the limited FAA contract tower program discussed in the U.S. section below.

NATS was originally established in 1962 as an independent government agency responsible for both civil and military ATC. In 1972, the agency became part of the CAA, but was also made responsible to both the chairman of the CAA and the chief of the air staff within the Ministry of Defence (MOD). In 1996, NATS was incorporated under the Companies Act, with 100 percent ownership by the CAA, in preparation for privatization. At the same time, responsibility for military ATC was transferred back to the MOD. Also, safety regulation of ATC was specifically assigned to the Directorate of Airspace Policy within the downsized CAA (Goodliffe 2002).

The license issued by the CAA to NATS (En Route) plc also requires the company to cooperate with the MOD. To support coordination, the Joint Air Navigation Services Council, created in 1996, was continued under the Transport Act, 2000 to integrate the efforts of NATS and MOD; the CAA is also represented on the council (UK House of Commons Library 1999). Additionally, MOD has chosen to integrate much of its ATC infrastructure with that of NATS. For example, military controllers now operate alongside their civilian colleagues at NATS' new Swanwick Centre, which oversees the airspace in England and Wales (CANSO 2002a; UK Ministry of Defence 2002; UK Department of the Environment, Transport and the Regions 1999).

The partial privatization of NATS, which was authorized by the Transport Act, 2000, represents a unique exception to the practice of public ownership and not-for-profit structure of ATC providers in other nations. The approach taken by the UK government must, however, be seen in the context of the widespread use of PPPs in the UK. These partnerships are closely associated with the private finance initiative (PFI), originally launched by the Conservative government in 1992 but continued under the current Labour administration. While the Conservative interest in PPPs was strongly influenced by ideological considerations, the Labour government has taken a pragmatic approach, viewing partnerships as a way of dealing with fiscal constraints. PPPs are, therefore, a means of getting private investment to substitute for public funding

(Falconer and McLaughlin 2000; Pollitt 2003, 59; Wettenhall 2003). As of 2003, the PFI had led to some 450 contracts underway or completed, with a total value of £50 billion (Broadbent and Laughlin 2003).

The choice of a PPP as a way of managing ATC followed an extensive review and consultation process with all stakeholders, including the Ministry of Defence (CANSO 2002a; UK Department of the Environment, Transport and the Regions 1999). Other PPPs in the UK transportation sector include the Channel Tunnel Rail Link, the London Underground, and design, build, finance, and operate (DBFO) contracts for several motorways (Shaoul 2003).

The report resulting from the consultation process mentioned above did acknowledge that, while a PPP was the preferred option of the government, no government had yet privatized its ATC provider. A key issue raised included the motivation of profit maximization and cost minimization that would drive a for-profit ATC provider. The government also acknowledged that a PPP was not required to raise capital, as demonstrated by the restructuring of ATC in Canada and New Zealand. Finally, operating ATC with a profit motive would give the CAA an even more important role as safety regulator, similar to that which the CAA played over the commercial airline industry. Overall, the consultation process did not result in a consensus in favor of a PPP; there was more support for the Canada/New Zealand model of an independent, nonprofit entity (UK Department of the Environment, Transport and the Regions 1999).

As established by the Transport Act, 2000, NATS had the following structure. Like other reformed ATC providers, the firm was designed to be owned by stakeholders. The government retained a 49 percent share of the company, although it was deemed to be a golden share constituting majority control. NATS employees were assigned 5 percent of the firm through a trust. The government then requested bids from the private sector for the remaining 46 percent. As mentioned above, the government selected the Airline Group, a consortium of seven British carriers (British Airways, bmi British Midland, Virgin Atlantic, Britannia, Monarch, easyJet, and Airtours), as the successful bidders during 2001. The Airline Group consortium also received merger clearance from the European Commission (CANSO 2002a).

Given that NATS was organized as a for-profit corporation, economic regulation was deemed necessary. Furthermore, NATS En Route Ltd. (now NATS (En Route) plc) was, as the sole UK holder of an enroute ATC license from the CAA, a monopoly. The degree of economic regulation, therefore, exceeded that imposed by the other nations reviewed on their ATC providers which operate not-for-profit systems. The act mandated the CAA to administer a price cap based on the retail price index minus an adjustment factor, a regime known as RPI - x . Any increase in user charges beyond the price cap required approval from the CAA through a lengthy regulatory process.

However, like any other ATC provider, NATS is vulnerable to declines in revenue should air traffic drop, as it did after the attacks of September 11, 2001. NATS is heavily dependent on enroute charges, which account for 75 percent of the firm's revenues. Contract ATC services provided at the towers of fourteen UK airports represented only 13 percent of earnings, while services performed for the Ministry of Defence and international organizations accounts for the remaining 12 percent (Shaoul 2003; CANSO 2002a). The post-2001 drop in revenues from enroute charges sent

NATS into a tailspin, particularly since it could do little to reduce the cost of its unionized workforce and was in the midst of construction of a number of new enroute centers that would eventually manage all UK airspace.

NATS had estimated a need for £100 million of capital investment over the period 1997–2007. The cost of paying the government for the proceeds of the sale of NATS led to the firm's debt rise to £733 million by 2002. The CAA would not authorize increased charges sufficient to offset the decline in traffic, and neither of the firm's shareholders (the UK government and the Airline Group) was in a position to make new equity capital available. Ironically, the Airline Group's member firms were in financial turmoil due to the same decline in air traffic that was causing difficulties for NATS. Debt servicing had also become challenging for NATS, and the government did not wish to take back the firm, which would have led to the PPP being branded a failure (UK National Audit Office 2002; Humphreys, Francis, and Ison 2003; Majumdar and Ochieng 2003).

In these circumstances, and with a unilateral injection from the government ruled out for fiscal and policy reasons (such action would undermine the very concept of a PPP), the only solution was to find equity funding from a new source. The government did provide some short-term financing to NATS while looking for a new investor during 2002. Finally, in March 2003 a restructuring was announced. NATS, the government, the Airline Group, and the CAA had undertaken a major refinancing exercise that examined a wide range of options, including creating a not-for-profit organization on the Nav Canada model. The approach chosen, dubbed the composite solution by NATS, preserved key features of the PPP while attracting a new investment of £5 million in share capital and £60 million in loans from BAA plc (UK National Audit Office 2004, 1-4).

BAA owns and operates seven airports in the UK: London's Heathrow, Gatwick, and Stansted Airports, and the airports serving Glasgow, Edinburgh, Aberdeen and Southampton. The firm, which evolved from the 1987 privatization of the British Airports Authority, had 2003 revenues of £1,933 million. BAA is therefore heavily involved in the aviation industry, and is one of NATS' clients, hiring NATS Services Ltd. to perform tower ATC at its UK airports. BAA also holds partial ownership or management contracts in a number of overseas airports, including Indianapolis, Boston, and Pittsburgh (BAA plc 2004). The government matched BAA's investment, also contributing £5 million in share capital and £60 million in loans (Dunn 2003; Woodman 2003).

With the new capital infusion, the distribution of the parent firm (NATS Holdings Ltd.) shares was modified as follows. BAA now has 4.19 percent, the UK government's ownership dropped from 49 percent to 48.87 percent, the Airline Group's shares went from 46 percent to 41.94 percent, and the NATS Employees Sharetrust remains at 5 percent of shares. The National Audit Office (NAO), having examined the new capital structure, believed that NATS is now in a more robust financial condition, and that adequate conflict of interest measures continue to be in place to protect the interests of all parties. The NAO also noted that the new financial structure "has been tested by modelling a wider range of exacting scenarios than those used when setting up the PPP," and that the restructured NATS should be able to withstand almost any foreseeable downturn in air traffic (UK National Audit Office 2004, 1-4). Finally, the

CAA agreed to a more flexible approach to regulating NATS user charges, while introducing higher penalties for flight delays caused by factors under NATS control. Also, any financial risk due to a decline in air traffic is now divided equally between NATS and its customers (Dunn 2003; Euroweek 2003).

The composition of the board of the parent company, NATS Holdings Ltd., was modified slightly by the addition of two directors from BAA plc. The other members now include three directors named by the government and ten who represent the Airline Group, with that owner allowed to appoint an additional two directors' positions currently vacant. The NATS Employee Sharetrust, which owns 5 percent of NATS, is not entitled to appoint directors (UK National Audit Office 2004, 6).

In summary, the evolution of NATS represents a lesson learned in terms of the conceptualization and design of PPPs. Despite the guaranteed need for ATC services, privatization did lead to considerable financial risk. This risk, which the government originally desired to transfer to the private owners of NATS through the PPP, ended up being borne by the government itself. The entry of BAA plc as a white knight has at least temporarily eliminated the possibility of bankruptcy or a government takeover, and the politically important principle of preserving NATS as a PPP has been respected. But there is also a clear message in the NATS experience for those nations wishing to privatize their ATC services (Humphreys, Francis, and Ison 2003; Linder 2000; Edwards and Shaoul 2003).

United States

In contrast to the other nations analyzed, the U.S. stands out for continuing to both regulate and deliver ATC services through the Federal Aviation Administration (FAA), a bureau of the U.S. Department of Transportation. The FAA is the direct descendant of the Aeronautics Branch of the U.S. Department of Commerce, created in 1926 (U.S. Federal Aviation Administration 2004a). However, the FAA does benefit from a somewhat greater degree of flexibility in personnel management and procurement than other U.S. government agencies (U.S. General Accounting Office 2003a). Also, private firms operate a small number of towers (currently 69) at low-volume airfields. Adversaries of the contract towers program view it as a harbinger of widespread privatization of the FAA (Hughes 2003; Keane 2003; Poole and Butler 2001, 14).

The FAA's challenges in modernizing its infrastructure have been a key driver of proposals for reform. Antiquated and unreliable equipment, an aging workforce, and resistance to change have been cited as the key barriers to effective FAA performance of the ATC function (U.S. General Accounting Office 1995). Additionally, the FAA has a poor track record in managing large capital projects (U.S. General Accounting Office 2003a; Mead 2003). Prior to the creation of Nav Canada, the same situation prevailed with the management of large-scale ATC projects by Canada's Department of Transport. Indeed, improved management of technology has been cited as one of the key accomplishments of Nav Canada since its creation in 1996 (CANSO 1999, 72).

Restructuring of ATC in the United States was first proposed in 1993 as part of the National Performance Review (Poole and Butler 2001, 6). Reform has not been possible, despite unsuccessful attempts in 1995 and 1998 by the Clinton administration to promote legislation creating a government corporation somewhat like those in

Australia and New Zealand, an option known as corporatization (United States General Accounting Office 1995; Treanor 1998). Since then, there has been little discussion of restructuring of ATC services in the U.S. along the lines of the other nations reviewed in this article, with the exception of a study funded by the conservative Reason Public Policy Institute. The study suggested creating a stakeholder-controlled corporation based on the Nav Canada model (Poole and Butler 2001). U.S. attempts at reform have been described as follows in a 23 October 1999 article by M.L. Wald in the *New York Times* entitled "Sale of Air Traffic System Has Led to Technical Advances": "The Clinton Administration has repeatedly tried to tinker with the structure of the F.A.A., and three years ago freed the agency from many Federal constraints on personnel and procurement policy. Last year, the Administration proposed making the F.A.A. a 'performance-based organization' like the Patent and Trademark Office, which sets its own fees and controls its revenues, but Congress did not agree. Members of Congress enjoy their leverage over the F.A.A., bringing home bacon to their constituents in the form of instrument landing systems, new runways and the like."

However, during 2003, the FAA did announce an internal reorganization that groups the major functions that support ATC (such as procurement and financial management) under an air traffic organization, rather than having them scattered throughout the FAA. This reorganization is consistent with the 1997 recommendations of the National Civil Aviation Review Commission, which proposed a performance-based organization within the FAA to manage ATC. However, the reorganization announced in 2003 does not incorporate one of the key recommendations of the Commission report, the creation of a board to manage the new organization. The concept of a stakeholder board was also the key Nav Canada innovation that the Reason Public Policy Institute recommended for the U.S. (Poole and Butler 2001). The reorganization announced by the FAA in 2003 is also intended to foster a greater sense of accountability for performance and productivity in the delivery of air traffic services (Bond 2003; National Civil Aviation Review Commission 1997; U.S. Federal Aviation Administration 2003a, 2003b). Given the size and complexity of ATC operations in the U.S., the close relationship of ATC to other national security functions, and opposition from unions and members of Congress, significant changes to the governance of ATC functions are unlikely.

The relationship between the FAA and the U.S. Department of Defense (DOD) is extremely complex, and beyond the scope of this article. Part of the challenge in documenting this relationship is the FAA's current organizational structure as described above, which does not separate ATC from other FAA functions such as aircraft registration, pilot licensing, and safety regulation. Another is the sheer size and complexity of DOD, which dwarfs the defense organizations of the other nations reviewed in this article (Thompson and Jones 1994; United States General Accounting Office 2003b). In brief, the FAA is responsible for managing an integrated system of civil and military ATC throughout the U.S., while the military provides ATC to cover airfields and airspace directly under military jurisdiction. DOD provides about 20 percent of air traffic services in the U.S. (MITRE 2000).

The attacks of September 11, 2001 provoked a major reexamination of FAA's relationship with DOD. The FAA is currently developing a national plan for the nation's airspace through 2025, in cooperation with DOD, the Department of

Homeland Security, the National Aeronautics and Space Administration, and the Department of Commerce (U.S. Federal Aviation Administration 2004b). The creation of U.S. Northern Command as a coordinating body for the military's support to homeland security has also provided a central DOD point of contact for liaison with other federal agencies, including the FAA (Reuters 2003; United States Northern Command 2004; McHale 2003).

COMPARATIVE ANALYSIS OF THE DELIVERY OF AIR TRAFFIC CONTROL

The reforms to ATC in the six nations reviewed above have led to a diversity of approaches toward service delivery. Within that context, institutional arrangements can be viewed as existing along three different axes, as illustrated in figure 1. We show traditional government operation of ATC on the far right, with the U.S. as an example. The opposite end of the spectrum is the UK, the only known country to have attempted to provide ATC on a for-profit basis. However, it is significant that the UK government has retained a controlling interest in the shares of the ATC provider. We will review the developments in the five nations that have restructured ATC provision first, and in the next section discuss implications for potential U.S. reforms.

Located in between the U.S. and the UK in figure 1 are four countries that represent an interesting diversity of approaches. As emphasized by Jones and Kettl (2003, 9), "even relatively similar nations, such as the United Kingdom, Canada, Australia, and New Zealand, have produced markedly different strategies" for public management reform. Australia has created an independent government agency with its own board, although a cabinet minister names its members. New Zealand's arrangements are slightly bolder than those of Australia, with the ATC provider assuming a corporate structure. In a similar approach to Australia, a cabinet minister names the board as well. However, both Airservices Australia and the Airways Corporation of New Zealand

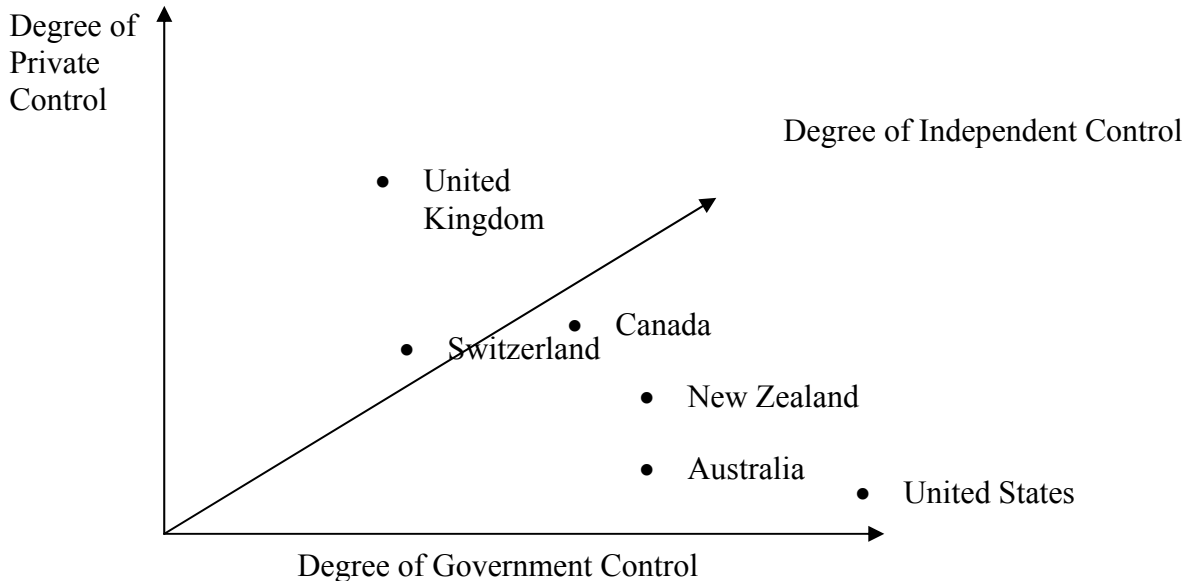


FIGURE 1. Responsibility for the Delivery of Air Traffic Control Services

have been successful at raising capital on the private market, even though their debt is not backed by their respective governments.

Nav Canada stands out for its unique governance and structure. The corporation has no share capital, and its board is made up of stakeholders represented either directly (in the case of the government and the Nav Canada unions) or indirectly through associations (with respect to the airline industry and general aviation). Unlike its UK counterpart, Nav Canada is a not-for-profit firm. Like its counterparts in the UK, Australia, and New Zealand, Nav Canada obtains its capital from the open market without a government guarantee of debt. Interestingly, the UK's legislative auditor has on two occasions recommended the Nav Canada model as a possible solution for the challenges faced by NATS (UK National Audit Office 2002, 2004). The Canadian approach has also been suggested as a potential model for U.S. reform of ATC (Poole and Butler 2001).

As students of public management might expect, the Swiss approach to the delivery of ATC is unique. Since the inception of ATC in 1921, Switzerland has provided ATC through a government-owned corporation. Recent reforms have placed a very small percentage of the shares of Skyguide (0.15% of total capital) in the hands of the nation's aviation industry association (Aerosuisse) and the largest airport operator (Swissport, a private firm). One senses that the goal of the share issue was to allow for participation by the stakeholders without compromising government control of Skyguide. Although the company remains entirely outside the line structure of the Swiss government, the majority of its board is government appointed.

The appropriate placement of Switzerland on the axes in figure 1 is somewhat problematic. On the surface, Skyguide would seem more like Nav Canada (due to its stakeholder board) or the UK National Air Traffic Services, due to private-sector ownership of share capital. But one could also argue that with the government having almost total ownership of Skyguide's shares, the company is in effect a government corporation more like that of New Zealand.

Finally, the UK stands out not only for its bold, if somewhat ideological, approach to ATC in creating a public-private partnership, inspired by the UK's well-known private finance initiative. No other example exists of ATC being provided on a for-profit basis. Furthermore, the ownership of 41.94 percent of NATS stock by the Airline Group, a consortium of seven UK carriers, is also unique. While Nav Canada has airlines represented on its board, their voice is heard collectively, through an officer of the Air Transport Association of Canada, and Nav Canada, unlike NATS, has no share capital. In Switzerland, Aerosuisse and Swissport jointly hold the tiny amount of share capital of Skyguide that is in the private sector, and Aerosuisse is a nonprofit trade association similar to the Air Transport Association of Canada. In contrast, the UK arrangement provides for substantial participation in NATS' governance by the Airline Group, even if a controlling interest remains with the government.

From the above analysis, several points emerge. First, even among the four Westminster countries, a range of approaches exists in the institutional arrangements for ATC. The UK approach is perhaps described as adventurous, with Australia and New Zealand following a more conservative but practical approach to reform. Canada has been somewhat bolder, but even then, the Nav Canada model recognizes the importance of involving stakeholders while keeping them at arm's length.

Second, whatever the reforms adopted, national governments remain ultimately responsible for ensuring that adequate and reasonably priced ATC services are provided. This responsibility derives directly from the role of governments in ensuring public safety, providing basic transportation infrastructure, and supporting economic development. The government's role in ATC is also directly related to national defense. Also, international obligations, whether bilateral or multilateral, require governments to provide ATC to aircraft of other nations entering their airspace.

In each of the five nations that have reformed ATC delivery, institutional changes have led to a careful examination of the relationship between the ATC provider and the military. As well, reform has resulted in further integration of military and civil ATC infrastructure and personnel. These changes have also benefited defense ministries, which have been able to reduce their own expenditures by outsourcing certain functions to the ATC provider.

Finally, in light of the UK experience, one might argue that institutional arrangements for ATC should have a not-for-profit orientation. While efficiency and effectiveness (including safety) are key goals of any ATC provider, there is no indication that the pursuit of profit, or direct ownership by private-sector entities, is necessary to the success of ATC delivery. Further anchoring this point is that ATC is an essential, monopsonistic service that is ultimately the government's responsibility.

IMPLICATIONS OF REFORMS ELSEWHERE FOR ATC IN THE U.S.

The U.S. model of in-house operation by the FAA, a bureau of the Department of Transportation, is also the traditional approach that continues to be followed by most of the world's nations. The U.S. has done the least of the nations reviewed in this article to change its institutional arrangements for the delivery of ATC. As we discussed above, the inability of the current structure of the FAA to respond to changes in the marketplace impedes growth, makes capital investment difficult, and probably has a negative impact on safety (U.S. General Accounting Office 2003a; Transportation Research Board 1999). While this situation is somewhat ironic, particularly given the size and economic impact of aviation in the U.S., the inertia also reflects the adversarial nature of U.S. politics and concerns about national security.

What are some of the potential implications of the reforms abroad on eventual changes to delivery of ATC in the U.S.? The question is difficult to answer. In conducting this research, we were struck by the relatively cooperative approaches that the five non-U.S. governments (in both their executive and legislative branches) and industry stakeholders took in developing and implementing new institutional arrangements for ATC delivery. This seems to contrast with the U.S. debate on potential reforms to ATC, which is much more partisan, places the various stakeholders in opposing camps, and reflects a much less cooperative approach to ensuring the delivery of ATC.

For example, the Aircraft Owners and Pilots Association (AOPA), a 400,000-member organization that represents the general aviation (small aircraft) sector in the U.S., is staunchly opposed to any initiative to move ATC outside the federal government. A key AOPA concern is that a restructured, independent ATC provider will be governed by and designed for the airlines exclusively. For example, user

charges for small aircraft could be raised to an amount that makes recreational flying unaffordable (AOPA 2003). In this context, it is worthy of note that Nav Canada has made a special concession to small aircraft, for example, charging a flat annual fee of between 60 and 200 Canadian dollars for single-engine piston aircraft (Poole and Butler 2002).

In contrast, our research could find no policy statements on the subject of FAA restructuring by the Air Transport Association, which represents the major U.S. airlines. The British firm Jane's has also noted this absence of advocacy. The silence is somewhat ironic, given the importance of ATC to major carriers (Jane's Airport Review 2000). However, the chief executives of American Airlines, Northwest Airlines, and Continental Airlines did support the 1995 corporatization proposals made by the Clinton administration, suggesting that Nav Canada serve as a model for U.S. reforms (Aviation Daily 1997).

The issue of labor relations and employee morale also is important in considering any major changes to U.S. ATC institutional arrangements. The National Air Traffic Controllers Association is firmly opposed to any restructuring of U.S. ATC along corporate lines, referring to any such shift as privatization (Sclar 2003). Nav Canada downsized significantly during its first three years, but facilitated the transfer of employees back to the Canadian government, provided early departure incentives, and continued collective bargaining rights. Nav Canada employees are now represented on the corporation's board. Finally, the company has also adopted a nonpunitive approach to operational errors, which has helped to improve employee morale significantly (Poole and Butler 2002).

In the U.S. context, there also appears to be a preference for defining entities as in either the public sector (through inclusion in a line department) or in the private sector (through outsourcing) rather than accepting the blurring of boundaries that is associated with NPM. These national characteristics would also help to explain the relative rarity of public-private partnerships in the U.S., particularly at the federal level (Borins 2002; Moulton and Anheier 2000).

Two aspects of Nav Canada's governance therefore appear particularly relevant to any contemplated restructuring of U.S. ATC. First, Nav Canada is a private firm, although incorporated by special legislation and without share capital. Unlike its counterparts in Australia and New Zealand, Nav Canada is not a government agency or corporation. Also, both Airservices Australia and the Airways Corporation of New Zealand have boards that are entirely named by cabinet ministers. Switzerland's Skyguide allocates 0.15 percent of shares, and two of seven directors, to the aviation industry. However, with the Swiss government appointing the other five directors and owning 99.85 percent of the stock, the private sector role in managing Skyguide is really more of a consultative one. The Canadian approach avoids effective government control (as in Australia, New Zealand, and Switzerland) while also escaping the pitfalls of being required to attract equity capital or earn a profit (as in the UK). Finally, Nav Canada's lack of share capital also helps preserve the notion of ATC as a public good.

Adding to the challenge of moving ATC outside the mainstream machinery of the U.S. government is the increasingly critical relationship between the FAA and other federal agencies involved in national security. The images of F-15s and F-16s flying alongside commercial aircraft in U.S. airspace reinforce the importance of this

relationship, and the stakes involved. While other countries with significant concerns about terrorism, such as the UK, have not seen national security as a barrier to reform of the ATC provider, the point remains a sensitive one in the U.S. in the wake of the terrorist attacks of September 11, 2001.

Any significant restructuring of ATC in the U.S. would raise significant implementation challenges. The UK experience has emphasized the need for a viable financial model that can withstand downturns in traffic. At the heart of a new corporation's structure would be decisions on the proportions of revenue provided by the different stakeholders (airlines, general aviation, airports, the government). In turn, each stakeholder group may expect to participate in the governance of the new organization. In reviewing the 1995 Clinton administration proposal to create an ATC corporation, the General Accounting Office explained the challenge as follows: "A corporation—created and charged to operate like a business—may have little incentive to provide equipment and services to users of the system whose financial contributions to the system are proportionately less than the value they receive. Included among these users are general aviation and small airports. An important issue facing the Congress in establishing the corporation will be how it accommodates the needs of such users" (U.S. General Accounting Office 1995, 2).

At the same time, any new U.S. ATC corporation would need to be isolated from the uncertainties of the government's annual budget-making process. Such measures would allow the new organization to take a long-term approach to investing in capital and personnel, goals that the FAA has had difficulty reaching. Another factor will be freedom to manage personnel effectively while treating organized labor in an equitable manner. Finally, separate new agencies will need to be established for safety and economic regulation; the former might reside within the downsized FAA, while the latter might be better placed within the Office of the Secretary of Transportation (Poole and Butler 2001, 13).

In the above context, it is difficult to assess the implications of reforms abroad for ATC delivery in the U.S. The public, as well as stakeholders such as FAA unions and the financially troubled domestic airline industry, may prefer to advocate maintaining the status quo so as to avoid assuming any of the risk or responsibility for delivery of this crucial service (Sclar 2003). The tradeoff could be a certain degree of inefficiency compared to other ATC providers, notably in the area of personnel management and capital investment. The FAA did announce a major reorganization in late 2003, which seeks to better focus ATC services within a single division of the agency. The impact of this restructuring, as well as the degree to which the announced changes incorporate lessons learned from other nations, remain to be seen.

CONCLUSIONS

This article provides a comparative analysis of the institutional forms and arrangements that have been chosen by six nations for the delivery of air traffic control. As with the airline industry, ATC providers are very vulnerable to the financial impact of a decline in traffic. Unlike the airlines, ATC providers do not have the option of shutting down significant parts of their operations or degrading service when revenues drop.

In the post-2001 economic environment, allegations of understaffing by the Swiss ATC provider Skyguide following a midair collision, and an increase in near misses in UK airspace due to alleged understaffing and low morale in NATS, further support the view that ATC is an essential part of a nation's infrastructure that must be maintained regardless of the adequacy of revenues (Jane's Sentinel Security Assessment 2003; Thomas 2002; Nordwall 2001; Shaoul 2003). The limited ability of ATC providers to reduce fixed costs, and many variable costs such as unionized personnel, in times of traffic decline is a source of concern. However, operation of ATC by a government or other not-for-profit entity does not necessarily translate into inefficiency.

In this article, we have not attempted to evaluate the different institutional arrangements for ATC from the perspective of performance. We have undertaken additional research to accomplish this task. In this regard, a significant factor to be considered is the impact of the type of mechanisms for increased stakeholder involvement on the performance of the ATC provider. The performance of ATC is not easy to evaluate, for a number of reasons. Safety is a paramount issue and can be measured using a range of criteria, including incidents (crashes, near misses, etc.) per thousand flights. Safety also is difficult to evaluate on a comparative basis because of factors such as traffic density, type of aircraft, weather, terrain, number and type of airfields, instrumentation, and relationships with and impacts of adjoining airspace.

The economic performance of the ATC provider also is a significant issue. Should ATC be organized to make a profit, or simply cover its costs? Given primary concern for safety, what degree of congestion and delay is acceptable from an economic perspective? Other issues that must be considered include: (a) What is a sufficient level of capital investment in ATC? (b) Should the provider seek out additional sources of revenue, such as consulting or operating contracts with foreign countries? (c) What is the financial relationship (including cost recovery in either direction) with the military? (d) If a provider's board exists, should its members be motivated by some type of an incentive structure, and if so, what is it? (e) What social objectives, some requiring additional expenditures or foregoing of revenue, are inherent to the provision of ATC? (f) To what extent should the government subsidize ATC provision to promote the airline industry, tourism, and economic development? (g) Alternatively, should the provider depend primarily on user charges, augmented by capital investment from the market? (h) How should user charges be allocated among the different user classes?

All of the above questions are important, and the separation of ATC providers from the line departments of governments has made them even more so. Certainly, any contemplated reforms to the governance of ATC in the U.S. will have to consider these issues. As the experiences of the six nations reviewed in this article demonstrate, the determination of the appropriate institutional arrangement for ATC is not a straightforward task. Each country has chosen its own path to government reform, incorporating concepts of NPM in a unique manner.

In contrast, aviation has become a truly global industry, and one where consistency in safety and efficient service delivery are expected. How each nation undertakes to deliver ATC, and the comparative analysis of these efforts, is indeed a fruitful area for further research. The U.S. now has a broad range of models to choose from in evaluating the options for a fundamental restructuring of ATC, as well as a wealth of lessons learned. However, the political decision-making process in the U.S., the size of

its aviation system, as well as unique security concerns, will also be key factors affecting the likelihood of any significant restructuring.

In addition to providing a better understanding of ATC service provision across a selected number of nations, the purpose of this article has been to assess alternatives for reform of ATC in the U.S. Based on our analysis of alternative institutional arrangements for the supply of ATC, we recommend that U.S. policymakers seriously consider reforming the U.S. system using the Canadian approach as a model to guide policy choice and implementation.

NOTE

1. According to the Airways Corporation of New Zealand, EVA measures the extent to which a business is performing above or below expectation. Therefore, a positive EVA means the business is adding value after allowing for a market return to the providers of the capital. The Airways Corporation of New Zealand calculates EVA as the difference between the net operating profit after tax (NOPAT) and the cost of the capital employed to produce NOPAT (Airways Corporation of New Zealand 2003b, 22).

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