

## **REINVENTING AIR TRAFFIC CONTROL A New Blueprint for a Better System**

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### **EXECUTIVE SUMMARY**

Recent and pending congressional efforts to reform the Federal Aviation Administration (FAA) will fail to solve the underlying structural problems of air traffic control (ATC). Procurement and personnel reforms, while useful, are not likely to change the FAA's bureaucratic corporate culture. And they do not address the inherent problems of the ATC system being part of the federal budget process, subject to external micromanagement, and subject to a conflict of interest between safety regulation and ATC operations.

Canada has now joined 15 other countries in fundamentally restructuring its ATC system, by 1) divesting it to a newly created corporation, 2) funding it entirely by user fees, and 3) subjecting it to arms-length safety regulation. Data from other restructured ATC systems reveal major gains in efficiency, reduced flight delays, reductions in operating costs, and significant progress in technological upgrades.

Canada is selling its ATC system to a not-for-profit corporation (Nav Canada) set up and controlled by the major aviation stakeholders: airlines, business aircraft owners, pilots, air traffic controllers, and the government (which is also a user of the system). This was a consensus approach developed by the aviation community itself, as the best way to resolve the same set of structural problems that beset the U.S. ATC system. Their guiding principle has been "user pay means user say."

A U.S. adaptation of the Nav Canada model offers several advantages over current House and Senate FAA reform proposals, as well as moving beyond the Clinton Administration's failed government-corporation proposal. As an independent nonprofit corporation, it would give meaningful control of the system to its users, all of whom would be represented on its board of directors. Independent of government, it would develop a commercial corporate culture, like those of overseas ATC corporations. ATC funding would keep pace with the growth of aviation, no longer held hostage to the federal budget process. User fees would be reasonable, tempering cost-allocation with ability-to-pay. For example, a typical Learjet in business use would pay only a bit more or a bit less in annual user

fees than it used to pay in fuel taxes, which would be abolished. Air safety would be improved, thanks to both arms-length regulation by the FAA and the rapid modernization made possible by a revenue-bond funded modernization program. This approach would permit the abolition of the passenger ticket tax, with the remaining FAA functions funded by general federal revenues.

The United States should follow the example of Britain, Germany, Switzerland—and now Canada—in fundamentally restructuring air traffic control. A not-for-profit user-controlled, user-funded corporation is the best way to address the ATC system's fundamental problems.

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## I. THE NEED TO RESTRUCTURE ATC

There is widespread agreement that the U.S. air traffic control (ATC) system, owned and operated by the Federal Aviation Administration (FAA), needs major restructuring. The airline industry attributes \$3 billion in annual flight delay costs to ATC deficiencies—mostly wasted fuel and extra crew time.<sup>1</sup> Wasted passenger time is estimated at several billion dollars more. Because of obsolete and failure-prone equipment (such as 1960s IBM mainframe computers, equipment dependent on vacuum tubes, and radars between 20 and 30 years old), the FAA maintain safety margins by artificially increasing the spacing between flights, imposing ground holds, and using other techniques that reduce system capacity.

Most observers recognize five underlying problems which have produced today's dysfunctional ATC system. These problems are:

- **Procurement:** Costly and cumbersome federal procurement regulations (including costly appeals procedures) needlessly increase both the cost and the time of obtaining new systems. In an era when new generations of computers come along every 18-24 months, a procurement system that takes five to seven years for a major acquisition simply cannot provide state-of-the-art technology for ATC.



- **Personnel:** ATC is a 24-hour-a-day operation, with relatively high stress. It is simply incompatible with the rigidities of position and compensation inherent in the civil service system. The FAA's ATC system finds it very difficult to attract enough of the right kinds of people, especially to staff high-stress positions in high cost-of-living areas.



- **Budgetary:** Although the majority of its revenues are derived from aviation user taxes deposited into the Aviation Trust Fund, the FAA depends on annual appropriations via the federal budget process. Hence, its funding level in any given year depends upon the constraints of that process, rather than on the needs of aviation users and the rate of aviation growth. Moreover, FAA must fund all major capital expenditures on a pay-as-you-go basis (rather than being able to finance them via the capital markets), on the basis of somewhat unpredictable annual appropriations.



- **Micromanagement:** Because it is part of the federal budget process, the FAA is subject to detailed oversight by both Congress and the executive branch. Micromanagement not only tends to substitute the judgement of these external bodies for that of the agency's top management, but it also takes up large amounts of these managers' time.



- **Conflict of Interest:** The FAA serves as both the aviation safety regulator and as the operator of a major component of the aviation system—the ATC system. Thus, vis a vis airframe manufacturers and airlines, the FAA regulates safety at arms-length; but when it regulates ATC safety, it is essentially regulating itself. In addition, the FAA's charter calls for it to both promote the health of the aviation industry and regulate its safety—a charge given to no other safety regulatory agency.



These structural problems have been cited by in numerous reports over the past two decades by such bodies as the Aviation Safety Commission (1988), the Transportation Research Board (1991), the National Airline Commission (1993), Vice President Gore's National Performance Review (1993), and the U.S. DOT's Executive Oversight Committee (1994). Similar problems have been noted in the ATC systems of numerous other countries, as discussed below in Section III. As a result, fundamental restructuring of ATC is under way around the world.





## **II. U.S. ATC REFORM THUS FAR**



**A. Personnel & Procurement Reform, 1996**



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Two of the underlying problems discussed above have been the subject of legislation enacted in October 1995. Pursuant to this legislation, on March 28, 1996 the Administration announced the creation of new FAA personnel and procurement systems intended to address long-standing problems in those areas.



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The new personnel system replaces a foot-high stack of civil service rules with a 41-page document and consolidates 155,000 position descriptions into 2,000. The new system permits pay and shift differentials reflecting the need to attract qualified people to high-cost, high-stress locations.



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The new procurement system is intended to reflect private-sector practice, by exempting the FAA from a number of existing procurement laws. It reduces acquisition documents from 233 to under 50, and aims to cut various procurement time periods in half. It provides for a kind of binding dispute resolution in cases of protest of a contract award—but still permits appeals to the courts (which have been a major cost- and delay-inducing factor).



But the potential impact of these reforms is inherently limited. The FAA remains a part of the federal budget process and subject to detailed oversight (aka micromanagement) by both legislative and executive branches. Moreover, many observers, from the General Accounting Office<sup>1</sup> to *Aviation Week*<sup>1</sup> magazine, have concluded that the underlying problem is the FAA's bureaucratic corporate culture. A forthcoming study from the Institute of Public Policy at George Mason University further documents the underlying problem of the FAA's bureaucratic culture, which is the very opposite of being customer-driven; it concludes that accountability to aviation customers can only be achieved by changing the way the ATC system is financed and paid for—specifically by shifting to direct user payments.<sup>2</sup> Thus, while Congress's new procurement and personnel reforms are a step in the right direction, their potential is inherently limited.

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<sup>1</sup> Editorial, "FAA Needs 'Buck-Stops-Here' Management," *Aviation Week & Space Technology*, March 4, 1996.

<sup>2</sup> Roger Stough and Kingsley Haynes, unpublished draft, Institute of Public Policy (Fairfax, VA: George Mason University, May 1996).



**B. Failure of Government Corporation Idea**



A far more sweeping reform proposal was made by the Clinton Administration in 1995: divesting the ATC system to a government corporation, the U.S. Air Traffic Services corporation (USATS). USATS would have been created by legislation as a federally chartered, government-owned corporation, analogous to Amtrak, the Tennessee Valley Authority, and the U.S. Postal Service. It would have had a board of directors appointed by the President and confirmed by the Senate and was to be fully supported by user fees, instead of drawing appropriated funds from the Aviation Trust Fund and general revenues. Its revenue stream would have been bondable, and USATS was to have been authorized to borrow either from the Treasury or from the private capital markets. USATS was to have been regulated at arm's length by the remaining FAA, which would have retained the functions of aviation safety regulator and administrator of the airport grants program. To varying degrees, the USATS proposal was designed to address all five of the structural problems set forth in Section I. It would be outside the federal procurement and personnel system, outside the federal budget process and able to borrow for modernization, subject to much less micromanagement, and no longer subject to conflicting roles.



Reaction to the USATS proposal was mixed. While generally supported by airline and airport organizations and by the air traffic controllers' union, it faced strong opposition from business aircraft and recreational aircraft organizations, and most members of the aviation subcommittees of Congress—which doomed it to failure. Several House Republicans introduced an alternative measure calling for creation of a private, user-owned corporation, but that bill went no further than the USATS proposal.



The most common argument made for public consumption by opponents was that safety might be put at risk. Aviation safety expert Clinton V. Oster of Indiana University challenged this view in congressional testimony, noting:



“It has not been necessary for the FAA to build, operate, or maintain aircraft for them to fly safely. Instead, very high levels of safety have been achieved through regulatory oversight. Similarly, it should not be necessary for the FAA to build, operate, or maintain the air traffic control system for it to operate safely, either. Here again, very high levels of safety should be achievable through regulatory oversight.”<sup>iii</sup>



And policy analyst Robert Poole noted in congressional testimony that safety is inherently a function of technology, and that a corporatized system would make it far more likely that the ATC system could operate with state-of-the-art technology.<sup>3</sup>

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<sup>3</sup> Testimony of Robert W. Poole, Jr., Reason Foundation, before House Aviation Subcommittee,



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The underlying reason for general-aviation opposition to corporatization was the fear of losing the huge cross-subsidies built into the current user-tax method of funding ATC. While business and recreational aircraft currently pay just three percent of all such user taxes, they use 20 percent of all en-route ATC services and 59 percent of all control tower and TRACON services. Despite the Administration's proposal to permanently exempt business and recreational aircraft from user fees, these organizations steadfastly opposed the USATS plan.



**C. Why Restructuring Is Still Needed**



The 1996 reforms in personnel and procurement policies still leave the ATC system embedded within an FAA imbued with a bureaucratic corporate culture and subject to micromanaged oversight, uncertain year-to-year funding that does not match the growth in aviation, an inability to finance modernization in a businesslike manner, and inherent conflicts between operations and safety regulation. As noted by former Air Transport Association president James Landry in congressional testimony, “These problems are inextricably linked. Correcting just one single problem [or two] will not solve the FAA's overall problems and may even exacerbate the remaining ones.”<sup>iv</sup>



Since 1972, and especially in the past decade, at least 16 countries have fundamentally restructured their ATC systems (see Table 1). While several have converted their equivalent of the FAA into a free-standing corporation providing both ATC and safety regulation, the large majority have divested ATC alone, retaining safety regulation as an arms-length government function. All 16 have shifted from tax funding to direct user fees. These corporatizations (or “commercializations”) have all been carried out to solve the same structural problems that plague the U.S. ATC system.



<b>Table 1: Overseas ATC Corporations</b>				
Country	Corp. Name	Year	Functions	ATC Funding Source
Australia	CCA	1988	ATC <sup>1</sup> + reg.	Mostly user fees
Austria	Austria Control	1994	ATC + reg.	60% = user fees
Canada	Nav Canada	1996	ATC	100% user fees
Czech Rep.	ATC Admin.	1993	ATC	Mostly user fees
Germany	DFS	1993	ATC	100% user fees
Ireland	IAA	1994	ATC + reg.	100% user fees
Latvia	LGS	1993	ATC	100% user fees
New Zealand	Airways Corp.	1987	ATC	100% user fees
Portugal	ANA	1992	ATC + airports	100% user fees
Russia	Magadan Aero Control	1995	ATC	In transition
Singapore	CAA	n.a.	ATC + airports + reg.	100% user fees
South Africa	AT&NS Co.	1993	ATC	100% user fees
Switzerland <sup>2</sup>	Swiss Control	1988	ATC	100% user fees
Thailand <sup>2</sup>	AeroThai	1948	ATC	100% user fees
Ukraine	UK SATSE	1993	ATC	In transition
United Kingdom <sup>3</sup>	NATS	1972/1996	ATC	Mostly user fees

Footnotes:

1. Considering spin-off of ATC as separate corporation.

2. Partial user ownership

### 3. Considering sale of NATS





While many of these restructurings are quite recent, some major gains have been reported in several countries. For example, in its initial year of operation (1993), the corporatized German Air Navigation Services Ltd. (DFS) reduced ATC delays by 25 percent.<sup>4</sup> User-charge revenues in New Zealand have gone down by 30 percent in real (inflation-adjusted) terms since corporatization in 1987, and are 50 percent less than the government had projected they would be by this point, had the system remained unchanged. Charges in Australia have gone down by 15 percent in real terms. Reduced charges have resulted from substantial gains in efficiency.<sup>5</sup> Airways Corporation of New Zealand's total annual operating costs declined from NZ\$120 million in 1987 (the year of corporatization) to

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<sup>4</sup> "Delays Down in Germany," *Aviation Week & Space Technology*, January 10, 1994.

<sup>5</sup> Airways Consulting Service, "International Experience of ANS Commercialization," Discussion Paper No. 4, *The Study of the Commercialization of the Air Navigation System in Canada*, Ottawa: Transport Canada, 1995.

NZ\$80 million in 1993.<sup>6</sup>

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<sup>6</sup> Leonard Hill, "Doing it Right: New Zealand's 'Commercialized' ATC Proves that Performance Can







### **III. Nav Canada: A Different Corporate Approach**



## A. Introduction



On April 1, 1996 Canada's Transport Minister signed historic legislation authorizing the sale of his agency's ATC system to a newly created corporation, Nav Canada. This not-for-profit, stakeholder-controlled company was incorporated in 1995, as the outgrowth of a several-year process of research and consultation by the entire aviation community in Canada. By late-summer 1996, the financing is expected to be in place by which Nav Canada will purchase the system from Transport Canada (for \$1.1 billion) and formally take over the operation and all personnel of the ATC system. Canada's airline ticket tax and general aviation fuel tax will be phased out over a two-year period, to be replaced by user fees, which will provide the sole revenue source for Nav Canada.



The restructuring of ATC in Canada is a new departure in several ways. By most quantitative measures, it is the largest ATC corporatization to date (see Table 2)—a system that is between one-fifth and one-eighth as large as the U.S. ATC system. It also interacts directly with the U.S. system, which means that U.S. airlines and private aircraft will soon be paying direct user fees on their growing volume of flights to and from Canada. Third, Nav Canada is the first ATC corporation totally controlled by its users and operators. Fourth, it is the first case in which a government has sold (rather than merely transferred) its ATC operations to a new corporation.



How did Canada progress relatively smoothly to this dramatic restructuring of ATC?



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	United States	Canada	Australia	Germany	United Kingdom	Switzerland	New Zealand
Independent of Government	No	Yes	Yes	Yes	Yes	Yes	Yes
Starting Date	n/a	1996	1988	1993	1972	1988	1987
Govt. Safety Oversight	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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1994 Revenue:	\$4,275	\$429	\$432	\$913	\$778	\$143	\$59
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1994 Expenses	\$6,190	\$572	\$388	\$913	\$697	\$143	\$52
(\$ in millions)							

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Air Traffic Controllers	17,300	2,060	1,140	2,000	1,630	300	300
1994 Aircraft Movements (millions)	38	7.4	3.6	2	1.5	1.5	1.2
Commercial Aircraft	18,440	5,680	260	680	3,120	n/a	130
Commercial Pilots	117,430	20,500	8,700	9,000	12,540	n/a	2,960
General Aviation Aircraft	184,430	21,850	7,900	20,340	4,270	n/a	3,100
General Aviation Pilots	654,090	59,990	22,500	100,000	27,530	n/a	4,190
Weekly Domestic Departures	142,930	16,950	5,500	15,000	4,840	n/a	3,670
Weekly International Departures	8,240	2,660	670	15,000	6,030	n/a	530

Source: General Accounting Office







## **B. User-Led Reform**

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Canada faced the same underlying problems with its ATC system as does the United States: rigid personnel and procurement systems, micromanagement, budgetary constraints, and conflict of interest. In 1991 the Air Transport Association of Canada made a formal proposal to the government to corporatize the system along the lines of New Zealand's 1987 Airways Corporation (which had already made substantial improvements in that country). Presentations by Airways Corp. officials at aviation conferences sparked further interest in the concept and discussions among the various aviation interest groups.

In 1994 the Canadian government launched a major study of potential ATC commercialization. Transport Canada commissioned studies by Price Waterhouse (financial model), Burns Fry (financial aspects), Hickling Corp. (economic regulation), and Airways Consulting (international experience). In parallel, the Air Transport Association of Canada commissioned KPMG Peat Marwick to assess the implications for the airlines of the three commercialization options identified by Transport Canada: a Crown corporation (similar to USATS), a mixed enterprise (partly owned by government and partly by users) and a not-for-profit corporation. Transport Canada published a series of five discussion papers on various aspects of commercialization, reviewing both the general rationale for restructuring ATC and delving into specific issues such as governance and user charges.

By autumn 1994 the major aviation stakeholder groups had reached consensus that the not-for-profit private corporation was the way to go. They delivered a position paper<sup>v</sup> to the government firmly stating their opposition to a government corporation like USATS, identifying as drawbacks the following:



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- Continued political control (micromanagement);

- Board appointments by politicians, not users/stakeholders;

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- Corporate culture more like that of government than private enterprise; and

- Major modernization decisions subject to political influence.



By contrast, a not-for-profit private corporation would function as an entrepreneurial enterprise, avoid conflict of interest with regulatory authority, be responsive to its users, and apply best business practices. The document also set forth a mission statement and a suggested composition of a board of directors made up of stakeholders. And it called for 100 percent funding by user charges, based on “fair and equitable allocation of costs to all users.” This remarkable document was signed by the heads of the following organizations:



- Air Transport Association of Canada

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- Canadian Air Line Pilots Association

- Canadian Air Traffic Control Association

- Canadian Business Aircraft Association

- Canadian Owners & Pilots Association.



With the government's blessing, these groups drew up articles of incorporation and created Nav Canada on May 29, 1995. RBC Dominion Securities was selected as Nav Canada's financial advisor to develop the plan for financing the company's acquisition of the ATC system from Transport Canada. The legislation was introduced on April 1, 1996 and is expected to pass easily. Financial closing on the deal is expected by late-summer 1996, at which point the actual transfer of ownership will take place. The transaction price is expected to be \$1.1 billion (U.S.), though the financing will be for a larger sum to provide for reserve and investment funds. Nav Canada will be seeking investment-grade ratings for its financing from Moody's, Standard & Poor's, and the two main Canadian rating agencies.



The government agreed to provide generous severance payments to all 6,400 ATC employees. Nav Canada has agreed to accept the existing union contract until it expires at the end of 1997, meaning that all employees will retain their jobs with Nav Canada until at least that date.



**C. Structure and Control of Nav Canada**



Nav Canada will purchase the ATC assets from the Canadian government, becoming their owner. However, Nav Canada is, by design, a non-share capital corporation: there is no equity ownership. Its financing will be entirely via debt. Without shareholders, it will not seek to make a profit, only to cover its costs, and to keep those costs to a minimum, in the interests of its stakeholders.



This structure is designed to avoid the need for explicit government regulation of the monopoly service of air traffic control. Without the drive to earn profits, and with users having a major say in running the organization, the classic rationale for government regulation of a monopoly (protecting consumers from monopoly exploitation) disappears.



How will the stakeholders exercise control over Nav Canada? The corporate charter calls for a 15-member Board of Directors, whose composition is carefully prescribed to include all relevant stakeholders. Four are to be appointed by the airlines, one by the business-aircraft association, and three by the government (which is also a significant user of ATC services). Two members will be appointed by the unions, and another member will be the CEO (who is himself appointed by the board). The four remaining members will be appointed by the board as independent directors. The members will serve for staggered three-year terms, for a maximum of nine years (except for the CEO). Elected officials, government employees, and employees or directors of any significant supplier, user, or client of the corporation are ineligible to serve as directors.



Despite this careful balancing of stakeholder interests on the board, additional provisions are provided to protect users. Nav Canada is required to consult with appropriate parties prior to proposing any increases in fees and charges or reductions in facilities or services, and must give 60 days prior notice of such changes. There will also be an Advisory Committee consisting of persons “interested in aeronautics and furthering the objects of the Corporation.” Consisting of between 9 and 15 people, it will be appointed annually by the board and the corporation's Associate Members. These non-voting members can include consumer groups, regional aviation interests, aerospace firms, airport operators, and small-aircraft owners and pilots.



## **D. Funding and User Fees**



In order to ensure commercial independence, Nav Canada will be funded entirely from fees and charges paid by users. Needless to say, with a large general aviation community in Canada, the question of fees and charges raised the same kinds of concerns as in the United States. While the issue is not yet settled, all parties have agreed that the benefits of shifting ATC to a stakeholder-controlled organization are worth the difficulties of devising a fair and equitable fee structure. As Transport Canada's first discussion paper on commercialization points out, "with user pay should come greater user say."<sup>vi</sup>



Transport Canada's discussion document on user fees reviews the methods of charging in use in Europe and in other countries which have commercialized ATC. The two principal types of charges are:



- **En-route charges**, generally based on the distance flown multiplied by the square root of the aircraft's maximum take-off weight.



- **Landing charges**, generally based on some measure of the aircraft's maximum take-off weight (the weight itself, the square root of the weight, or some other function).



Using a weight-related measure is a departure from strict allocation of charges according to system costs; after all, it costs the ATC system about the same to guide a Beech Baron as it does a Boeing 747. Egalitarians would characterize this form of pricing as being based on ability to pay; free-marketers could consider it pricing according to the relative value of the service (charging what the market will bear). The net result is to keep the charges relatively low for smaller aircraft.



Another principle incorporated in the Canadian user charge discussion paper is to not charge directly for flight service station transactions. Flight service stations provide services such as flight-plan filing and weather briefings, principally to general aviation users. Concerns have been expressed in the United States that if direct fees were charged for these services, some users might forego using them, with detrimental safety consequences. Hence, the costs of FSS operations are assumed to be covered out of the terminal and en-route charges paid by all users.



Table 3 reproduces the results of one hypothetical set of Transport Canada user fee schedules, in terms of what fraction of total ATC costs would be borne by each segment of aviation users.<sup>7</sup> The user fees assumed in this analysis are at comparable levels to those charged in Europe and Australia. Note that, as in most of the other countries which have commercialized ATC, government aircraft are assumed to be paying their proportionate share, based on their use of the system; this even includes military aircraft in Britain, Germany, New Zealand, and South Africa. Table 4 compares Canada's proposed user charges to those actually in use in four other countries.

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<sup>7</sup> "Illustrative User Charges," Discussion Paper No. 5, *The Study of the Commercialization of the Air Navigation System in Canada* (Ottawa: Transport Canada, 1995).



<b>Table 3: Illustrative Nav Canada User-Fee Impact</b>				
	En-Route Charges	Terminal Charges		
		$\sqrt{\text{MTOW}}$	$0.9\sqrt{\text{MTOW}}$	MTOW
Airlines	82%	41%	61%	66%
Commuters/Taxis	8%	33%	27%	24%
Business/Commercial GA	6%	18%	8%	6%
Recreational GA	1%	4%	1%	1%
State & Military	<u>3%</u>	<u>4%</u>	<u>3%</u>	<u>3%</u>
	100%	100%	100%	100%

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Source: Transport Canada

	En-Route (per 100 km)		Terminal		
	A-320	Queen Air		A-320	Queen Air
Canada	\$22	\$5	$\sqrt{\text{MTOW}}$	\$278	\$65
			$0.9\sqrt{\text{MTOW}}$	373	27
			MTOW	386	21
Australia (Sydney)	36	na*	MTOW	266	15
France (Paris)	98	23	$0.9\sqrt{\text{MTOW}}$	320	24
Germany (Frankfort)	115	27	$\sqrt{\text{MTOW}}$	407	96
United Kingdom (Heathrow)	124	30	MTOW diff.	190	10

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\* Piston-engine aircraft pay fuel tax in lieu of en-route charge

Source: Transport Canada





**E. Financing Nav Canada**



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Because Nav Canada will be a private, non-government corporation, it will purchase the ATC assets (and the right to be the ATC provider) from the Canadian government. Because the new company will not have equity owners, the purchase price will be financed in the commercial debt market. The initial capital will be raised as bank loans (bridge financing), which will be replaced, over time, with commercial paper and revenue bonds.



To provide lenders with the required security, the financing plan developed by RBC Dominion Securities provides for three types of covenants.<sup>vii</sup> The rate covenant provides for Nav Canada to set fees at a level sufficient to cover debt service costs, with a safety margin, after all operating and maintenance costs have been paid. A reserve covenant requires Nav Canada to hold an amount of liquid assets to cover temporary downturns in revenue. Finally, an additional bonds covenant will limit Nav Canada's total borrowing to an amount that can be justified by its ability to service its debt with reasonable user fees.



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In addition to borrowing the amount of its purchase price plus reserves, Nav Canada will be able to leverage its revenue stream to borrow prudently for modernization programs. This will give it the ability to escape from current Transport Canada budget constraints and the need to finance all current modernization efforts on a pay-as-you-go basis.





## **IV. APPLYING THE CANADIAN MODEL TO THE UNITED STATES**



**A. A New Route to Consensus on Restructuring**



The fact that all of Canada's principal aviation groups reached consensus on the transfer of ATC to Nav Canada suggests that this approach—of a nongovernmental stakeholder-controlled company—may offer a new route toward consensus on ATC reform in the United States via such a not-for-profit corporation (NFPC).



To U.S. airlines, the NFPC approach offers essentially all the advantages of the corporatization proposals they have supported in the past. The controllers' union supported the Administration's USATS plan, but opposed "privatization," by which they meant a for-profit company. Assuming that their pay and benefits are protected in a transition to a NFPC (as in Canada), they are likely to support this approach. Many congressional Republicans were skeptical of the creation of another government corporation—as some termed it a "flying Amtrak." They should be more receptive to a user-controlled nongovernmental corporation. And the Administration, having seen USATS be rejected but still committed to fundamental restructuring of ATC, should welcome an alternative way of achieving its aims via the NFPC approach.



The major question mark is the general aviation (GA) community, represented by two principal groups: business/commercial GA, represented by the National Business Aircraft Association (NBAA) and recreational GA, represented by the Aircraft Owners & Pilots Association (AOPA). As a first approximation, the former group flies business jets, turboprops, and multi-engine piston aircraft, while the latter group flies mostly single-engine piston aircraft. Despite a provision in the USATS measure exempting them from user fees, these groups feared that a cost-based system of user fees would have severely negative consequences on their flight activities.



What might persuade NBAA and AOPA to do as their Canadian counterparts have done and embrace the NFPC approach? Two key factors might make the difference. The first is a guaranteed seat on the board for a representative of each group (in contrast to the USATS approach of a single GA board member, chosen not by them but by the President). The second is a Canadian-type user fee system, based more on ability to pay than on allocated costs. These points are discussed in more detail below.



## **B. Board and Management**



There is now a virtual consensus that the FAA's corporate culture—particularly that of its Air Traffic Services unit—must be dramatically transformed, from its current bureaucratic model to that of an entrepreneurial, customer-friendly entity. A non-governmental user-controlled NFPC offers a way to bring about that change in corporate culture.



There is legitimate concern that the monopoly nature of an ATC corporation combined with the absence of a profit motive might not provide sufficient incentive for the NFPC to develop a commercial corporate culture. This issue was addressed by the National Performance Review in its 1993 study of the case for an ATC corporation. Its version of a NFPC was termed a “competitive joint venture,” modeled after user cooperatives in oil and gas pipelines, electrical transmission, and deepwater port operations. As NPR's Wayne Leiss put it, “A competitive joint venture achieves the same efficiency as competition, but in a monopoly market. The fee-paying customers work through the board of directors. They have the same incentive to reduce costs as owners trying to make a profit.”<sup>viii</sup> As Leiss notes, “The key is the election of the board of directors by the fee-paying customers. They are the only ones with incentives for efficiency, as they are the ones paying for inefficiency. Politically appointed directors, while earnest in their intentions, do not share in these incentives.” And this corporate board, in turn would select (and can remove) the management team, giving them the means to create a commercial, user-responsive corporate culture.



Unlike the proposed USATS, where the board was to be politically selected (nominated by the President and confirmed by the Senate), the board of the NFPC would be selected by the key stakeholder groups themselves, in accordance with the provisions of the corporate charter approved by Congress in the enabling legislation. One such board-membership structure might be as follows:



- 4 seats air carriers (e.g., ATA)

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- 1 seat airline pilots (e.g., ALPA)

- 1 seat business/commercial GA (e.g., NBAA)

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- 1 seat recreational GA (e.g., AOPA)

- 1 seat air traffic controllers (e.g., NATCA)

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- 1 seat airports (e.g., AAAE, ACI)

- 2 seats U.S. government (DOD, DOT)



These 11 seats would represent all major users (airlines, GA, and government), two major aviation employee groups (airline pilots and controllers), and airport operators—in other words, all the major ATC stakeholders. As in Nav Canada, airlines would not have a numerical majority and could therefore not impose their version of user fees or other policies upon the GA segment. The board would select the CEO (who would also be a director) and they would together select three independent directors, for a total of 15. A board structured in this way is intended to foster the search for consensus on fee structures and other policies.



The CEO would hire the top-management team, with policy guidance from the other board members. Most likely this would lead to the creation of a largely new top level of management for ATC, drawing the best available people from the private sector and compensating them accordingly. Competitive management pay scales are especially critical in this case, since the company's not-for-profit status means that no form of compensation based on stock or stock options would be available.



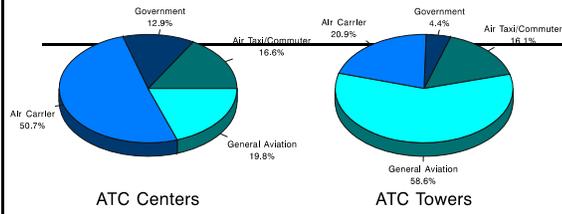
## C. User Fees



In exchange for a serious place at the table in the form of two board seats, GA users would be expected to contribute towards the cost of the NFPC's operations (user say means user pay). It is clearly in the GA community's long-term interest to be a paying member, to ensure that its interests continue to be taken seriously, in fact, in the NFPC board's policy decisions. This principle has been accepted by the GA community in Canada, New Zealand, and other countries where user fees have been introduced as part of ATC corporatization. As the GAO pointed out in comments on the USATS proposal, "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."<sup>ix</sup> Since GA operations account for over half of all control tower operations and some 20 percent of en-route center operations (see Figure 1), it is only fair that they pay some sort of fees for these considerable portions of the ATC system's workload.



Figure 1: Aircraft Handled by Air Traffic Control Centers and Operations Handled by Air Traffic Control Towers by User Group



Reason Foundation

Source: FAA's Air Traffic Activity report (FAA APO-94-10), Fiscal Year 1993.





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The question then becomes: How can a user fee system be constructed that realistically reflects GA usage of ATC services but 1) does not unrealistically burden GA with crippling cost increases and 2) does not have perverse impacts on safety (such as tempting some private pilots to forego weather briefings in order to avoid paying a fee)? The key principles employed by other countries with corporatized ATC systems are 1) to charge based on the relative value of the service rather than strictly on the underlying cost, and 2) to avoid direct charges for safety-related information services.



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The first of these points means adopting some variant of the internationally accepted practice of basing both terminal and en-route charges on some function of the weight of the aircraft, rather than on the proportion of system costs allocated to each type of user. This will lead to much lower charges for smaller (lighter) aircraft than would a fee system based on cost allocation. The second point means not charging directly for Flight Service Station activities. Instead, the NFPC's costs of providing those services will be recovered from all users, as part of the cost base to be recovered from en-route and terminal charges.



The Technical Appendix presents details on the computation of the user charges, using the maximum take-off weight (MTOW) as the basis for charging. Table 5 summarizes the results using MTOW approach, for a representative set of general aviation and commercial aircraft (along with assumptions about their annual flight operations). To take a representative business jet, the Lear 35, its total annual ATC charges would be \$23,696 (given the assumptions about flight activity set forth in the Appendix). That represents about 2.2 percent of its total operating cost (or 5.5 percent of its direct operating cost).



<b>Table 5: Conceptual Estimated Charges for Proposed System</b>								
Aircraft	Max T.O. Wt. (lbs.)	Landing s/Year	Avg. Distance (miles)	Terminal Charge	Enroute Charge	Annual Enroute Cost	Annual Terminal Cost	Total Annual Cost
Falcon 50	38,800	300	1,050	\$17.73	\$173.76	\$52,126.83	\$5,319.48	\$57,446.31
Falcon 20-5	29,100	321	750	\$13.30	\$93.08	\$29,879.84	\$4,268.88	\$34,148.73
Lear 35	18,300	462	550	\$8.36	\$42.93	\$19,832.38	\$3,863.75	\$23,696.13
Lear 24	13,500	346	550	\$6.17	\$31.67	\$10,957.00	\$2,134.65	\$13,091.65
King Air20	12,500	500	400	\$5.71	\$21.33	\$10,662.50	\$2,856.25	\$13,518.75
Baron	5,400	267	250	\$2.47	\$5.76	\$1,537.32	\$658.90	\$2,196.22
B747	776,000	700	2,500	\$354.63	\$8,274.10	\$5,791,870.00	\$248,242.40	\$6,040,112.40
B737	121,440	2,954	521	\$55.50	\$269.85	\$797,129.73	\$163,941.33	\$961,071.06
B757	332,000	1,400	1,500	\$151.72	\$2,123.97	\$2,973,558.00	\$212,413.60	\$3,185,971.60



Table 6 compares the user fee costs with the present user tax payments, for the same set of aircraft as in Table 5. As can be seen, the net impact of adding user charges and eliminating fuel taxes (for GA) and ticket taxes (for airlines) varies with the type of plane and the assumed flight activity. Table 7 looks more closely at the impact on general aviation.



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<b>Table 6: Current vs. Proposed User Costs</b>				
Aircraft	Current Annual User Tax*	Proposed User Fees	Proposed User Tax	Difference in Annual Cost
Falcon 50	\$39,812	\$57,446	\$0	\$17,634
Falcon 20-5	29,356	34,149	0	4,793
Lear 35	22,575	23,696	0	1,121
Lear 24	18,506	13,092	0	(4,964)
King Air	6,188	13,519	0	7,331
Baron	1,500	2,196	0	696
B747	10,416,000	6,040,112	0	(4,375,888)
B737	1,189,000	961,071	0	(227,929)
B757	3,906,000	3,185,972	0	(720,028)

\* Fuel tax for business aircraft, ticket tax for airlines.





**Table 7: GA Cost Impact Comparison**

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	Current Taxes	User Fees (Proposed System)
Aircraft		

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	Percent D.O.C.	Percent T.O.C.	Percent D.O.C.	Percent T.O.C.
Falcon 50	5.83%	2.19%	8.42%	3.16%
Falcon 20-5	6.02%	2.09%	6.70%	2.43%
Lear 35	5.23%	2.09%	5.49%	2.19%
Lear 24	4.84%	2.28%	3.42%	1.62%
King Air	2.81%	1.18%	6.14%	2.59%
Baron	2.50%	1.07%	3.66%	1.57%



As in Canada, GA fuel taxes would be *replaced* by the direct user charges for all GA flights filing flight plans (terminal charges) and flying IFR (en-route charges). No other types of GA operations would pay any charges—*or any fuel taxes*. As can be seen, even those types of corporate aircraft that would end up paying more would still be paying only a few percent of the total annual cost of owning and operating such an aircraft. The largest of these planes—the Falcon 50—would pay only 3.2 percent of its total annual cost as user fees—compared to 2.2 percent today.



The under-\$1 billion annual cost of the remaining FAA's safety regulation activities should continue to be met from general federal revenues (as are the costs of other safety regulatory agencies such as the FDA and OSHA). The airport grant program could be funded either from general revenues or by reduced air cargo and passenger ticket taxes at about one-quarter of previous levels—i.e., a passenger ticket tax of two percent. Table 8 looks more closely at the impact on airlines of ATC fees with and without a two percent ticket tax. With the tax, some aircraft will pay more than today, and others will pay less (again, depending on the actual amounts and types of flight activity). Without the two percent ticket tax, all types of airliners would clearly pay less than they do today.



<b>Table 8: Airline Cost Impact of a 2 Percent Ticket Tax</b>					
	Current 10% Tax	Proposed User Fee	Proposed 2% Tax	Difference with 2%	Difference without 2%
B747	\$10,416,000	6,040,112	2,083,200	(2,292,688)	(4,375,888)
B737	1,189,000	961,071	237,800	9,871	(227,929)
B757	3,906,000	3,185,972	787,200	67,172	(720,028)



**D. Purchase Price**



The Administration's USATS proposal assumed that the FAA's ATC assets would be transferred to the new corporation at no charge, on the grounds that these assets had already been paid for by users via the aviation user taxes deposited into the Aviation Trust Fund (and also on the implicit grounds that USATS would continue to be owned by the U.S. government, which would be paying itself if the assets were to be purchased). By contrast, Nav Canada is purchasing the ATC assets from Transport Canada for over \$1 billion. Should a new NFPC purchase the ATC assets from the federal government?



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Consider first the claim that users have “already paid for” these assets. Although user taxes have paid for a majority of FAA capital and operating costs, there is still approximately \$2 billion per year of general-fund support for FAA's \$8–9 billion budget. Hence, one could argue that only three-fourths of the costs of the system have actually been paid for by its users.



Second, the new NFPC (and its stakeholders) would be gaining something of great value in the transfer of ATC to themselves: control over the future of this essential system—something they do not have today. What they have “paid for” via user taxes is a dysfunctional system which they do not control. What they would be getting, via the NFPC, is a (potentially) modernized system which they do control. That ought to be worth paying for.



Third, it is also argued that because the Aviation Trust Fund has a multi-billion-dollar uncommitted balance, which aviation users have contributed but which would not be available to a new ATC corporation, the new corporation therefore should be able to receive the system's assets in exchange for giving up any claims on the Trust Fund balance. This argument may soon become moot. The principal source of user-tax revenue—the airline ticket tax—expired as of the first of this year and has not been reauthorized as of this writing. To keep the FAA in operation during the period since the expiration of the ticket tax, the FAA has been drawing down the unobligated balance in the Trust Fund. At the current rate of depletion, the balance will be close to zero by October 1996. It is highly unlikely that the ticket tax, if it were to be reinstated, would be applied retroactively. Hence, there may well be no Trust Fund balance which the ATC corporation would be “giving up” in exchange for not having to purchase the assets.



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If the assets are to be purchased by the NFPC, how much are they worth? According to the Administration's April 1995 briefing on the USATS proposal, the ATC asset value (net of accumulated depreciation) as of that date was \$5.9 billion<sup>x</sup>. This, of course, is the book value—not necessarily the market value. If a large fraction of those assets (radars, computers, landing aids, etc.) needs to be replaced within a few years, their real value may be far less than the book value (as the established telephone companies have discovered, since the advent of competition).



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Some kind of third-party valuation would have to be carried out to estimate the market value of the ATC system's assets. (Presumably, most of the real estate, control towers, and en-route centers would be valued at or above book value, in contrast to most of the electronic equipment.) We might guess that the net result will be in the \$3–4 billion range, substantially less than a single year's NFPC operating revenue and a sum readily financed in the capital markets (as is being done with Nav Canada).



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To recap, the benefits of having the NFPC actually purchase the ATC assets are as follows:



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- Payment by the NFPC for value received—i.e., for control of the ATC system's resources and the right to be the ATC provider.



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- Tangible demonstration of the shift from government to non-governmental, commercial operation of the system.



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- \$3–4 billion in asset-sale proceeds to the federal government.



**E. Financing the NFPC**



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There are two key questions to address with regard to financing of a stand-alone ATC corporation. Can a brand-new corporate entity without any operating history raise the capital to make a multi-billion-dollar purchase of the existing assets? And can such a corporation finance a multi-year modernization program?



The answer to both questions is yes. The summer of 1996 will see the capital markets providing up to \$2 billion to finance Nav Canada. The transaction is expected to begin with relatively short-term bank loans, to be replaced over time with longer-term commercial paper and revenue bonds. Although the U.S. ATC system is five to ten times larger than Canada's (depending on what measure of size is used—see again Table 2), its revenue stream is about 10 times as large as Canada's. In both cases, the new corporate entity would have either a de-facto or a de-jure exclusive franchise on providing essential ATC services, and the ability to set rates that ensure businesslike operations. Assuming it is well-run, it should be what the capital markets refer to as a good credit.



As far as financing a modernization program is concerned, the Department of Transportation commissioned a detailed financial feasibility analysis of its USATS proposal from Gellman Research Associates and Arthur Andersen & Co. As the report of DOT's Executive Oversight Committee concluded, "In all scenarios examined, USATS is financially viable with revenues sufficient to cover operating and investment costs." In addition, "USATS is also able to fund a portion of capital investment by using long-term debt which would be repaid when the benefits of these investments are realized by users. The accelerated investments [would] reduce USATS's ATC operating costs by \$0.9 billion. In addition, these investments would provide over \$10 billion in safety, delay reduction, and operating cost savings to users over the 1996 to 2005 time period."<sup>x<sup>i</sup></sup> The financial assumptions for a NFPC would be virtually the same as those used in these feasibility studies. Hence, its conclusions would apply equally to the proposed NFPC.





## V. CONCLUSION



A number of proposals have been made for reforming the ATC system to solve its problems of personnel, procurement, budget, micromanagement, and conflict of interest. Congress has made a constructive first step in exempting the FAA from some of the traditional civil service and procurement regulations. But without wholesale institutional change—creating a direct relationship between aviation activity and available ATC revenues, ending third-party micromanagement, strengthening arms-length safety regulation, and creating a businesslike, user-friendly corporate culture—the ATC system will remain inadequate to the task of meeting the needs of a growing aviation industry.



A Canadian-type not-for-profit corporation, controlled by the principal ATC stakeholders, offers an approach that would solve all of these problems in ways that should be acceptable to all of the stakeholder groups, including general aviation. By contrast, the reform proposals currently before Congress do not sufficiently address the underlying structural problems.



The House bill, making the entire FAA an independent government agency, would not change its corporate culture and would not match revenue growth with aviation activity, nor would it permit long-term financing of modernization programs. Moreover, it would leave in place the present conflict of interest between safety regulation and ATC operations—in contrast with the worldwide trend to separate these two functions.



The Senate bill has the great virtue of phasing in a shift from user taxes plus general revenues to true transaction-based user fees. But by leaving in place the ATC system's structure as part of a large government agency, it would not sufficiently address the corporate culture problem, and would not resolve the conflict of interest problem.



The Administration's government-corporation proposal had the virtues of separating ATC operations from safety regulation and of shifting ATC funding outside the budget process to direct user charges. But critics were understandably skeptical about a government corporation developing the kind of entrepreneurial corporate culture needed for an organization in desperate need of rapid modernization.



The lesson of Canada's ATC restructuring is that there is a third alternative besides a government corporation and a for-profit corporation. In this inherently monopolistic situation, a user co-op (NFPC) can offer the commercial corporate culture of private enterprise combined with the public-service mission of a government corporation. Because it represents all users, the NFPC can also be essentially self-regulating. But to prevent domination by the largest user group (in this case, the airlines), the governing board must be carefully designed to balance the potentially conflicting interest of all the various stakeholders.



Thus, a U.S. Airways Corporation modeled after Nav Canada offers a bold new approach to restructuring air traffic control in this country.





## **ABOUT THE AUTHORS**



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**TECHNICAL APPENDIX**



**A. Deriving the User Charges**



The proposed user fee system developed in this paper is based on the Nav Canada model currently being implemented. That model encompasses two types of ATC charges: terminal charges and en-route charges. The former are based on some function of aircraft weight, while the latter are based on weight and distance flown. The final details of the Canadian fee system have not yet been agreed upon, and will be decided by Nav Canada's stakeholder board during the initial transition year. But its general principles are set forth in the Transport Canada Discussion Paper No. 5, "Illustrative User Charges."



Transport Canada researchers spent considerable time developing a database of air traffic statistics (flight activity by type of aircraft, including weight, distance, landing frequency, etc.) so that precise charging formulas could be created. Comparably detailed U.S. data are not currently available; hence, this paper uses estimated flight frequencies and traffic mix derived from FAA statistics.



The basic concept is to begin with the total annual ATC revenue requirement, divide this into en-route and terminal components, and then establish a charging formula for each of those two components such that the aggregated flight transactions within that component, when plugged into the formula, produce the total revenue required of that component.



The first step is to derive the total revenue requirement. We begin by separating the ATC portion of the 1996 FAA budget, as follows:



Items to be transferred to ATC corporation: \$Millions

- ATC operations \$3,741 M

- Facilities & equipment 1,875

- Research

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TOTAL ATC

\$5,802 M



Remaining FAA functions

- Airport grants (AIP) \$1,450 M

- All other (safety reg., etc.)

902

TOTAL NEW FAA

\$2,352 M



TOTAL CURRENT FAA

\$8,154 M



Next, we devise a first-year budget for the new ATC corporation, assuming two changes from the above \$5.8 billion. First, the corporation will have annual debt-service costs from having financed an estimated \$3.5 billion purchase price. Assuming bond financing at 7.5 percent over 20 years produces annual debt-service charges of \$343 million. In addition, we have increased the facilities and equipment line-item to \$2 billion per year, constituting the annual debt service on a 10-year debt instrument to finance a revised technological upgrade of the ATC system. These changes produce an ATC corporation budget of the following:



ATC operations

\$3,741 M

Facilities & equipment

2,000

Research

186

Acquisition debt

343

TOTAL ATC CORP

\$6,270 M



This is the sum which must be obtained via the user-charge system. We have arbitrarily allocated this 60 percent to terminal charges and 40 percent to en-route charges. (Canada uses 60 percent en-route and 40 percent terminal, in view of its lower traffic density; this allocation has consequences for the ultimate impact of the user charges on different categories of user, and would be subject to negotiation among the ATC corporation's stakeholders.) Hence, we obtain the following:



Terminal charges

(60%) \$3,762 M

En-route charges

(40%) \$2,508 M



These are the annual sums that must be produced by these two types of charges. For the en-route portion, we also assume that the corporation would charge for international overflights of the United States (as many other countries already do). We estimate that revenue as \$40 million per year; that produces a revised revenue requirement of \$2,468 from domestic en-route charges.



To develop the charging formulas for en-route and terminal, we need information about flight activity in controlled airspace. Using aggregate FAA data, we begin with the following:



- Annual aircraft miles flown in controlled airspace: 9,805,250,000

- Annual (non-training) landings at towered airports: 90,000,000

- Estimated average weight of aircraft subject to charges: 60,000 lbs.

- Estimated average trip length for aircraft subject to charges: 1,000 mi.



For each type of charge, working backwards from the required annual revenue, we derive a charging factor to fit the following formula:



Enroute Revenue = (weight in tons) X (miles flown) X (e-factor)



Terminal Revenue = (weight in tons) X (landings) X (t-factor)



The e-factor works out to 0.00853 and the t-factor works out to 0.914.



This is equivalent to an average charge of \$27.42 per landing for recovery of the terminal portion of the budget and \$0.256 per mile flown to recover the enroute portion of the budget. The factor allows for deviation from average weight and average distance for each aircraft flown.



As noted in the main text, the 16 countries charging ATC fees all use some form of weight-based charging system, but whereas some use weight itself, others use the square root (or some other root) of weight. Nav Canada has not yet decided which function of weight to use. The example presented in this paper uses weight itself, but it would be up to the ATC corporation's board to assess the trade-offs involved (in terms of the resulting allocation of portions of the cost burden to different categories of user). This example is intended merely to be illustrative.



Table A-1 provides details on the assumed operating characteristics and costs of the representative general aviation aircraft used in this analysis.



Aircraft	Direct Op. Cost per Hour*	Total Cost per Hour**	Annual Flight Hrs.	Annual Direct Cost	Annual Total Operating Cost	Gallons per Hour	Annual Gallons	Fuel Tax	Annual Fuel Tax	Percent D.O.C.	Percent T.O.C.
Falcon 50	\$1,050	\$2,800	650	\$682,500	\$1,820,000	350	227,500	\$0.175	\$39,812.50	5.83%	2.19%
Falcon 20-5	800	2,300	610	\$488,000	\$1,403,000	275	167,750	\$0.175	\$29,356.25	6.02%	2.09%
Lear 35	720	1,800	600	\$432,000	\$1,080,000	215	129,000	\$0.175	\$22,575.00	5.23%	2.09%
Lear 24	850	1,800	450	\$382,500	\$810,000	235	105,750	\$0.175	\$18,506.25	4.84%	2.28%
King Air	400	950	550	\$220,000	\$522,500	75	41,250	\$0.150	\$6,187.50	2.81%	1.18%
Baron	150	350	400	\$60,000	\$140,000	25	10,000	\$0.150	\$1,500.00	2.50%	1.07%

\* D.O.C. = fuel, oil, fees, supplies

\*\* T.



**B. Funding the New FAA**



Spinning off ATC and making it self-supporting from user fees will leave the FAA with the following functions:



- Aviation regulation & certification

- Aviation standards

- Civil aviation security

- AIP administration



In recent years, the FAA's total budget has been funded about 70 percent by user taxes and 30 percent by general revenues and interest on the Aviation Trust Fund. These sources provided approximately \$2.6 billion in FY 1994. With the elimination of a large outstanding Trust Fund balance, interest will no longer be a significant source of annual revenue. How, then, should the \$2.3 billion in annual operating cost of the new FAA be covered?



We have proposed the elimination of the general aviation fuel tax (in exchange for GA paying ATC user fees). That leaves as possible funding sources 1) general revenues, 2) the existing international departure tax, 3) some reduced level of air cargo/waybill tax and passenger ticket tax.



A good case can be made for funding at least the \$902 million of FAA safety regulatory and related functions from general revenues, much as the comparable regulatory functions of such agencies as the FDA and OSHA are funded from general revenues. That leaves the airport grant (AIP) program, at about \$1.5 billion per year, still to be funded. The international departure tax produced \$267 million in 1994. Either general revenues or air cargo and passenger taxes could be used to make up the remainder; they would need to produce about \$1.2 billion. A two percent ticket tax would produce revenues within this range.

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- ii. "Issues Related to FAA Reform," Testimony of Kenneth M. Mead, General Accounting Office, Senate Aviation Subcommittee, August 2, 1995.
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- v. "A Not-for-Profit Private Corporation to Own and Operate the Canadian Air Navigation System," Air Transport Association of Canada, Canadian Air Line Pilots Association, Canadian Air Traffic Control Association, Canadian Business Aircraft Association, and Canadian Owners & Pilots Association, September 23, 1994.
- vi. "Principles and Options for Commercialization," Discussion Paper No. 1, *The Study of the Commercialization of the Air Navigation System in Canada* (Ottawa: Transport Canada, 1994).
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- viii. Wayne Leiss (National Performance Review), Presentation at Air Traffic Control Association Annual Meeting, October 26, 1993.
- ix. Testimony of Kenneth M. Mead, General Accounting Office, before the House Transportation Subcommittee, March 15, 1995.
- x. U.S. Department of Transportation, "Air Traffic Control Corporation Study: Financial Briefing to

Accompany USATS Legislation," April 1995, p. A-1.

<sup>xi.</sup> *Air Traffic Control: Analysis of Illustrative Corporate Financial Scenarios*, Technical report prepared by Corporation Assessment Task Force for the Executive Oversight Committee (Washington, D.C.: U.S. Department of Transportation, May 1994).