



The Centre for
Sustainable Transportation

Le Centre pour un
transport durable

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ISSUE ON TRANSPORTATION, TERRORISM, AND SUSTAINABILITY

On September 11, “night fell on different world”, as President George Bush reminded the American people some days later.[†] This was true for the United States and for Canada, and perhaps more true for transportation than for other kinds of human activity. This issue of the *Monitor* discusses how transportation and transport-related issues are changing in what the *Toronto Globe and Mail* describes as “The New Order”. The perspective is that of interest in securing progress towards sustainable transportation.

The direct effects of safety and security concerns on transportation, particularly aviation, are the first matter considered here. Links between what is happening with respect to aviation security and two matters discussed in the earlier issues of the *Monitor*—aviation’s global impacts and energy use—are noted, with a comment on military aviation. Also considered are options under discussion for improving transport safety and perceptions of safety in all passenger and modes.

A later section deals with potential indirect effects of the events of September 11 on transportation: those that could result from changes in how land is developed.

A concluding section discusses some of the longer-term implications of the September 11 events for sustainable transportation.

Because the events of September 11 are so recent, firm data and established trends are still hard to find. This issue of the *Monitor* relies on anecdotal evidence and media sources more than previous issues. Data are included here that have a less than a satisfactory level of confirmation, and may well change with further review. Nevertheless, the potential importance for the future of transportation of what has happened and is happening warrants some analysis at this point from a sustainability perspective.

Some of the immediate changes—such as reduced aviation activity—may be in a direction consistent with sustainable transportation. Others—such as cancelled plans for large buildings—may not be. The convulsive events of September 11 were truly epochal, and it is appropriate to examine the features of the new order and even to attempt to guide them towards desired goals.

Box 1. The Centre’s definition of sustainable transportation

A sustainable transport system is one that:

- allows the basic access and development needs of individuals, companies and societies to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations;
- is affordable, operates fairly and efficiently, offers choice of transport mode, and supports a competitive economy, as well as balanced regional development;
- limits emissions and waste within the planet’s ability to absorb them, uses renewable resources at or below their rates of generation, and uses non-renewable resources at or below the rates of development of renewable substitutes, while minimizing the impact on the use of land and the generation of noise.

Centre for Sustainable Transportation
158 Panorama Hills Close NW
Calgary, Alberta T3K 5J4

Phone (403) 663-0652
Fax (403) 547-5857
E-mail transport@cstctd.org
Web site www.cstctd.org

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The Centre's perspective is embodied in its definition of sustainable transportation, which with minor changes has been adopted by the 15 countries of the European Union (see Box 1).²

SAFETY AND SECURITY

Moving people and goods usually entails risks, but the risks must be acceptably low or else the transport system will not be used and will thus not function to support economic and social activity.

Much attention has been paid to ensuring safety in the use of all modes. The focuses have been on reducing operator error, avoiding catastrophic equipment malfunction, and keeping unwanted objects out of the path of moving vehicles. Avoidance of sabotage has always been a priority, enhanced in recent years for what may be the most vulnerable mode, aviation.³ The focus has usually been on protecting the occupants of transportation vehicles and people in places where these vehicles concentrate (e.g., airports, train stations, and major road intersections).

What seems new after September 11 is widespread awareness of the potential for commercial aircraft to serve as enormously destructive guided missiles, especially large jetliners with full fuel tanks.⁴ The idea of aircraft serving as missiles is not new. Best known are the Japanese suicide (kamikaze) pilots in World War II, who sometimes loaded their planes with extra gasoline tanks to achieve greater destructive effect.⁵ A more recent example may be the December 1994 hijacking of an Air France airliner with the possible intention of exploding it over Paris, France.⁶

The use of other transport vehicles as guided bombs—notably cars and trucks—has become an often-used terrorist weapon inside the U.S. (e.g., at the World Trade Center in February 1993⁷ and at the Murrah Federal Building in Oklahoma City in May 1995), as well as abroad. Indeed, of the 17 major terrorist incidents recorded worldwide between 1983 and 2000, ten involved car or truck bombs, including the two just mentioned.⁸ Damage to the Pentagon from the hijacked plane that crashed into it on September 11 was said to have been

“minimized” by renovations designed to fortify the structure against a truck-bomb explosion.⁹

The use of road vehicles as guided weapons has triggered significant changes in automotive access to sensitive areas, notably London, UK, where the licence plate of every road vehicle entering the financial district is checked electronically at a security perimeter.¹⁰

The use of aircraft as guided weapons of mass destruction is more likely to involve suicide missions on the part of their operators than use of road vehicles or marine craft.¹¹ Although incidents of international terrorism have declined over recent years, the propensity for terrorists to engage in suicide missions may have increased.¹²

Thus, in mid-2001, there could well have been heightened awareness of the possible use of aircraft as guided missiles. Nevertheless, a Nuclear Regulatory Agency representative is reported to have said that before September 11 there were no appropriate contingency plans concerning the 103 nuclear reactors in the U.S. because “it was never considered credible that suicidal terrorists would hijack a large commercial airliner and deliberately crash it into a nuclear power plant.”¹³

Since September 11, there are clearly two new safety and security aspects to aviation. One is the fear of being on a plane that is hijacked for a suicide mission. Previously, aircraft hijacking was usually associated with mostly harmless although inconvenient diversion to an unwanted destination and only occasional harm to on-board hostages. This new fear may contribute to the decline in air travel discussed below.

The other aspect concerns the wisdom of having large airborne concentrations of navigable explosive material routinely within range of population concentrations and strategic targets. This concern has not been prominent in recent discussions, but it may loom larger in debates about commercial aviation's future.

CHANGES IN AVIATION ACTIVITY

The events of September 11 caused a sharp decline in air travel that is still being felt early in 2002. In the U.S., boardings of scheduled domestic and international flights were down 22 and 33 per cent, respectively, in October 2001 compared with a year earlier. In February 2002, the comparable year-on-year declines were 13 and 8 per cent (i.e., international travel was depressed more, but has recovered more quickly).¹⁴ Worldwide, 120,000 airline industry workers are said to have lost their jobs as a result of the September 11 attack.¹⁵ In Canada, individual airlines have reported increased traffic, but this was in part the result of absorption of passengers from the Canada 3000 carrier, which went out of business in November; overall traffic may be down.¹⁶

The general picture seems to be that of a sharp decline passenger traffic in September followed by gradual recovery, with the extent of the decline being greater and the pace of the recovery being slower in the U.S. than elsewhere.¹⁷ The last such sharp decline occurred in late 1990 and early 1991, the result of the Gulf War and events leading to it, with the major impact being outside North America. Then, full resumption of earlier trends took six or more months. Analysis of that period is compounded by a continuing economic recession that had reduced passenger traffic for 18 months before the events in Iraq.¹⁸

Dramatic changes had also been happening in the industry before September 11, 2001. For example, revenue per passenger-kilometre in the U.S. had declined by 19 per cent between February and August, and declined by only a further two percentage points in September. The pre-September lost revenue was attributed not so much to an overall fall in traffic, but to a decline in the purchase of non-discounted fares (i.e., first, business, and full-fare economy classes), which had fallen off steeply and by August 2001 was down 30 per cent compared with August 2000.¹⁹

The relative success of ‘no-frills’ operations reinforce the view that the recent woes of the airline industry may be in



part a continuation of what was happening before September 11. Southwest Airlines was the only major U.S. airline to have returned to 2000 passenger levels by the end of 2001. In Canada, WestJet posted a 55-per-cent increase in passenger traffic in December 2001 compared with December 2000. Air Canada's corresponding increase for its domestic business was two per cent. Europe's largest no-frills airline, Ryanair, posted a 50-per-cent increase in traffic in January 2002 over January 2001. Europe's largest airline, British Airways, reported continuing ridership losses.²⁰ Thus, what may be affecting air travel is not fear of flying so much as 'fare fright'.

Air freight traffic has followed similar trends to those for passenger traffic, also suggesting that the aviation industry's woes may have more to do with economic conditions than with concerns for safety.²¹ As with passenger services, a decline in revenue began well before September 11. In the case of air freight within the U.S., the decline was perhaps as much in response to competition from trucking as to overall economic conditions. Several airlines had dropped their two-day domestic service during the previous 12 months, saying that "inroads by truckers had taken too great a toll".²²

Indicative of the longer-term trends in the industry are the order books of the major aircraft manufacturers. Gross orders for 2001 for the two major manufacturers of large commercial jets were down by about a quarter from 2000 (from about 1100 to about 840 aircraft), with Boeing suffering most of the loss, and Airbus moving ahead to be the leading manufacturer.²³ Much of this decline occurred before September 11. However, a tenth of the world's commercial jet fleet has been put into storage or otherwise grounded since September 11.²⁴

After September 11, there were predictions that use of business jets would surge, so that company executives could avoid the uncertainties of scheduled air travel.²⁵ However, in January 2002, Montreal-based Bombardier, one of the largest producers of business jets, announced layoffs because this market had slumped, with deliveries expected to be down 21 per cent in 2002 compared with

2001. Sales of regional jets, on the other hand, are being sustained.²⁶

A more important deterrent to airline travel than fear of confinement within a guided weapon may be the increased inconvenience and unpredictability of travel caused by more stringent airport security. Business travellers are said to have reduced travel substantially because of this factor. According to one report, "... snarled security lines and angry passengers—no matter how much they pay for their tickets—pose one of the biggest customer-relations problems in the airline industry's history".²⁷

The U.S. Government, now responsible for airport security, appears to be responding by considering introduction of a national identification program that will expedite check-ins at airports. Homeland Security Director, Tom Ridge, is quoted as saying he favours "some kind of trusted flier program, biometric card, eye scan fingerprint" for frequent fliers and flight crews.²⁸

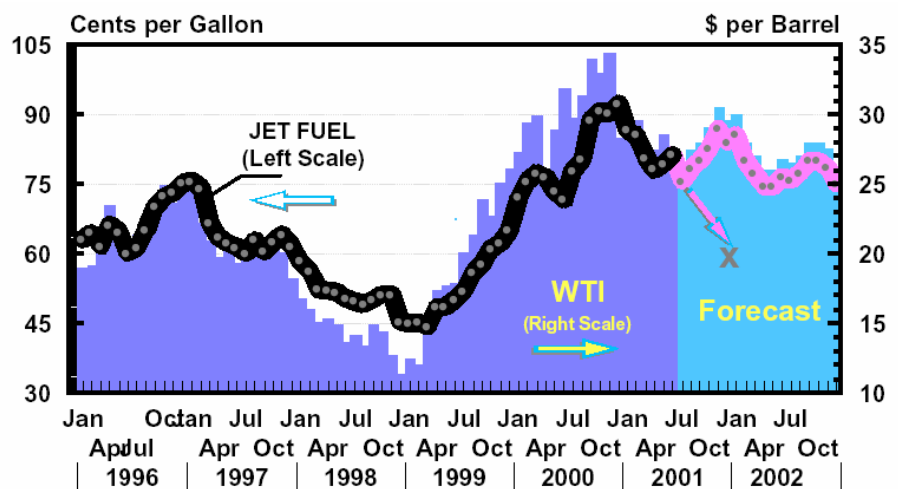
The matter is controversial. The alternative view is that available additional resources should be used to bolster existing practices, e.g., by improving luggage searches and being more vigilant about identity theft.²⁹ This approach could increase delays and intrusiveness at airports. Already, one frequent business

traveller from New York State has been quoted as saying, "Whenever I travel, I feel I am in a police state".³⁰

The longer-term impacts of such heightened security measures seem hard to predict. Tighter security can work in opposite directions. They can comfort travellers and they can also inconvenience them. Airlines may back off increased use of the 'hub-and-spoke' system to avoid further congestion at hub airports. Conversely, there could be greater use of hubs, because only they can afford the sophisticated equipment and personnel required for heightened security.³¹

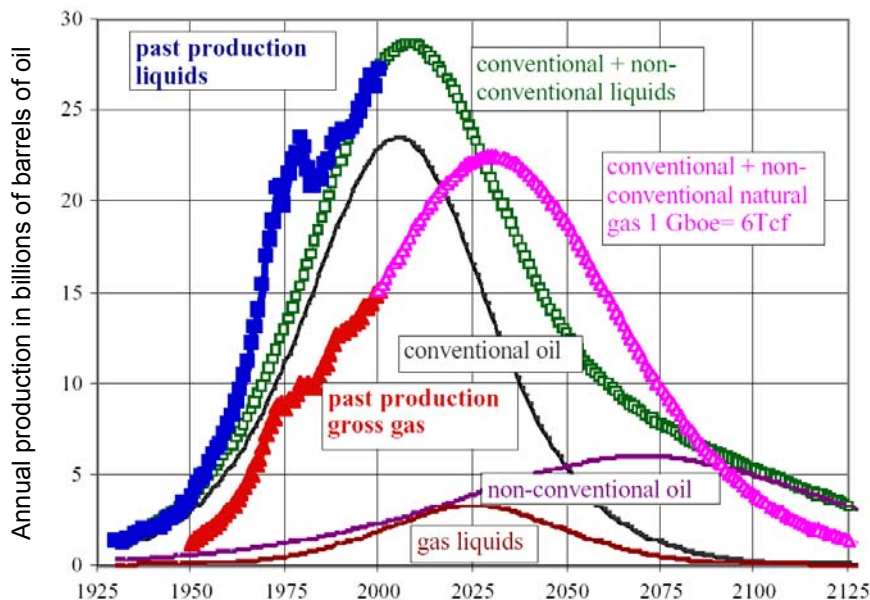
In summary, the events of September 11 depressed the airline business, particularly in the U.S.. Some recovery has occurred, but it may be many months before pre-September trends are restored. These were already reflecting depressed economic conditions as well as factors specific to the aviation industry, including concern about wide passenger-fare differentials and competition for freight from trucking. Full recovery to the hectic pace of aviation growth in the late 1990s could require restoration of that period's high rate of economic growth. More economic growth would likely mean more energy use, which in turn would bring to the fore aviation's considerable vulnerability to high energy prices, discussed below.

Box 2. Jet fuel price in relation to world oil price (West Texas Intermediate), January 1996 to mid-2001, and projection to the end of 2002



Source: Air Transport Association (U.S.)

Box 3. Actual and projected worldwide production of petroleum liquids and natural gas, 1925-2025



Source: Perrodon et al, *Petroleum Economist*

SUSTAINABILITY AND MILITARY AVIATION

Military aviation has unquestionably increased in intensity over the last few months as personnel and supplies are ferried to the Indian Ocean and Pakistan, air strikes continue on targets in Afghanistan, and air defences over North American cities remain at a post-Cold War peak. Is it possible that the increase in military aviation has offset the decline in civil aviation and thus that aviation's total environment and resource impacts are not diminished?

The simple answer to this question is 'probably not'. Data on military aviation activity occasionally appear in reliable sources. One of these sources suggested that worldwide in 1992 roughly 18 per cent of aviation fuel use was used for military purposes, i.e. about 26 million tonnes out of total use of about 139 million tonnes.³² For the U.S., the share seems to have been considerably higher, perhaps 30 per cent,³³ or about 17 out of 56 million tonnes.³⁴ (Thus, in 1992 the U.S. accounted for roughly 28 per cent of the world's fuel consumption for non-military aviation and 65 per cent for military aviation.)

The growth in civil aviation since 1992 has likely meant a general decline in the proportion of aviation fuel going to military use—at least until September 2001—perhaps to 14 per cent worldwide and to 23 per cent in the U.S.³⁵ It follows that it would take an approximately doubling of U.S. military aviation activity to offset a 10-per-cent decline in worldwide aviation fuel use.³⁶ How much recent military operations have increased aviation fuel use may not be known for years, if ever. Evidence from the Gulf War period suggests that operations then raised fuel use for U.S. military aviation by no more than about 25 per cent.³⁷

Thus, given that only a 10-per cent decline in worldwide aviation activity is being estimated for 2002,³⁸ it seems that the resulting decline in fuel consumption may not be offset by increases in fuel use for military aviation.

AVIATION AND ENERGY

In the background remains the major challenge posed by aviation's future energy requirements. Aviation is the most energy-intensive form of transportation. Moreover, as Box 2 shows, jet fuel

prices track crude oil prices with some precision.³⁹ This is because both markets are almost fully global in nature and are almost free from influence by taxation. (Where there is a high tax component in the consumer price—as in the case of road-vehicle fuel—swings in crude oil prices are of much less significance.)

Evidence that worldwide oil production may soon be constrained has become firmer since the matter was discussed in the February 1999 issue of the *Monitor*, and since aviation was discussed in the March 2000 issue.⁴⁰ Box 3 shows a recent assessment that points to a peak in oil production before 2010.⁴¹ Such assessments continue to be controversial, with criticism perhaps coming more from economists than geologists.⁴² However, the basic disagreement seems to be only as to whether the peak will occur in the decade before or the decade after 2010.

If demand for oil (i.e., potential use of it) were to continue to rise beyond the production peak—as seems likely—the inevitable result would be major oil price increases. Commercial aviation could become utterly transformed from what we know today. Taking a flight could once again become a luxury expenditure. The events of September 11 may have reduced oil consumption worldwide and thereby postponed the peak in worldwide oil production by several months or even a year.

IMPROVING AVIATION SAFETY AND SECURITY

Some effects of the efforts to secure North America's domestic transportation will take years to unfold, but the U.S. government's quick expansion of fiscal and administrative measures to assure responsibility for key transportation outcomes is an immediate phenomenon with potentially far-reaching consequences for sustainability. Before September 11, much of American and Canadian transportation policy was based on the premise that the continent's mobility means needed only minimal oversight by government. Private carriers and manufacturers were expected to lead in the setting of transportation priorities.



For example, aircraft were seen to be little different from ‘buses with wings’, a phrase that had been used to describe the airline industry’s competitive dynamics following deregulation.⁴³ In this paradigm, government intervention was focused on preventing accidents, something that could be assured through a discrete set of safety regulations and oversight by government inspectors while the rest of transportation policy was inspired by market forces. Competition among private carriers was presumed to maximize the efficiency by which goods and people could circulate, particularly within North America.

It is now apparent that this pre-September 11 transportation policy paradigm exposed North Americans to significant risks. Just as it is now obvious that buses could not have been transformed into the weapons of mass terror that hijacked aircraft became, it is also clear that market forces could not be expected to yield adequate protection against such a threat. American and other leaders responded by quickly setting the market-led policy paradigm aside and launching new spending and administrative initiatives.

On September 22, 2001, President Bush signed the *Air Transportation Safety and System Stability Act*, which granted \$5 billion to U.S. airlines and established a \$10 billion loan guarantee program. Following decades of deregulation, this legislation created an Air Transportation Stabilization Board to preside over loan guarantee applications, supervise airlines that obtained such guarantees, and ensure that government received an appropriate “participation in gains” that might subsequently be generated by an airline. This could include acquiring shares in the carrier, a radical departure from both the longstanding private ownership of U.S. airlines and the more recent trend toward privatization of other national air carriers, such as Air Canada.

On November 19, the *Aviation and Transportation Security Act* was signed into law, providing for the largest single expansion of the U.S. public service in decades. As many as 30,000 federal personnel will be hired within the next 12 months to assure the screening of air

travellers, cargo, and other transportation activities in all modes. The new Transportation Security Agency was allocated US\$4.8 billion in the President’s 2003 budget, of which approximately \$2.2 billion would be collected from users.⁴⁴ Such spending and public employment increases, the epitome of an era of ‘big government’ that was declared dead in the 1990s, make it likely that the turn of the millennium will be remembered as a low ebb of government involvement in the transportation sector.

In Canada, a new Crown corporation—the Canadian Air Transport Security Authority—was established on March 28, 2002, to be responsible for airport screening equipment, training and overseeing baggage- and passenger-screening personnel, installing high-technology bomb detectors, establishing security zones on airport tarmacs, supporting airport policing, and supervising armed, undercover police officers on board flights.

In several countries including Canada, governments began indemnifying airlines against risks that became commercially uninsurable as a result of the September 11 attack. In the European Union, this is deemed to be state aid of the industry and thus a breach of EU competition rules unless approved by the European Commission. Approval has been granted until late May to allow airlines to establish a self-insurance arrangement, perhaps managed by the Montreal-based International Civil Aviation Organization.⁴⁵

As a result of these various moves, the cost of flying will increase as additional charges are placed on carriers and users. Charges imposed on users include the recently imposed Passenger Civil Aviation Security Service Fees in the U.S.⁴⁶ and Canada’s Air Travellers Security Charge.⁴⁷ At least 120 airlines worldwide, including Canadian airlines, had already imposed surcharges to cover additional security and insurance costs being incurred since September 11.⁴⁸ Such charges could be significant factors in dampening demand for price-sensitive air travel.

IMPROVING THE SAFETY AND SECURITY OF OTHER MODES

Once the initial fiscal and administrative measures to secure aviation are in place, some thought could be given to long-term policy options that would yield a more robust and resilient transportation system. Such a system could offer greater redundancy, enabling travellers and freight to switch modes during times of heightened threat.⁴⁹

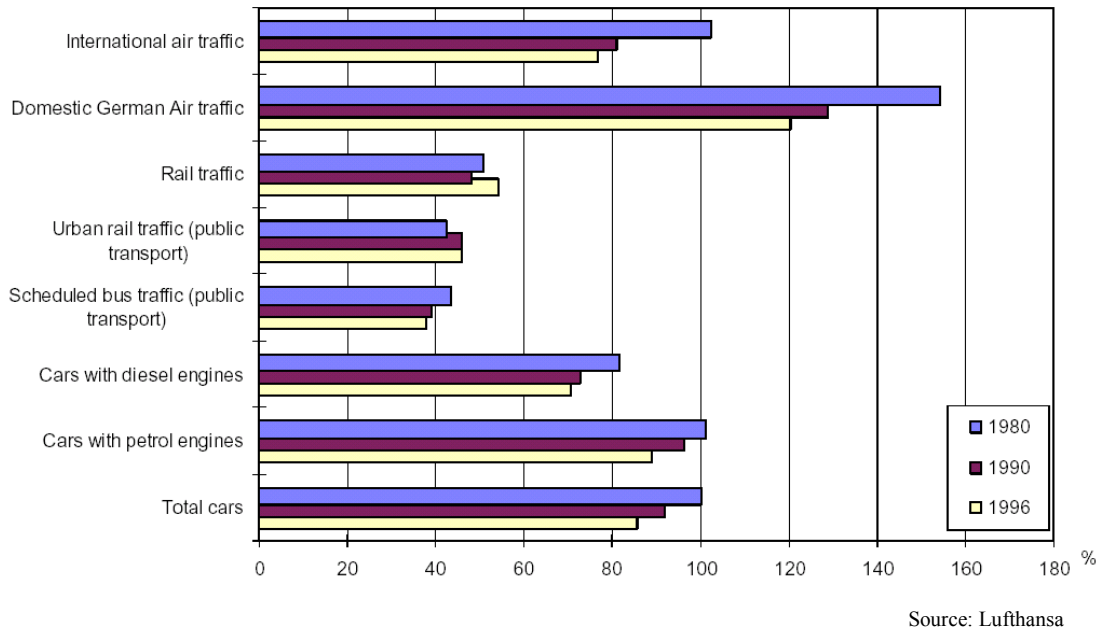
Resilience concerns only avoiding and surviving terrorist attacks, but also a system’s ability to respond to unexpected changes in travel demand however caused. Qualities composing resilience include having physically robust infrastructure, network redundancy, good information collection and management systems, diversity, flexibility, and efficiency. September 11 provided many opportunities for displays of resilience in public transit systems. In New York, in particular, transit played a major role in evacuating people from lower Manhattan. In Canada, transit systems helped move thousands of stranded airline passengers in St. John’s, Halifax, Edmonton, and Vancouver.

The rail mode is the most obvious candidate for enhanced development in inter-city passenger transportation. Passenger trains experienced an immediate spike during the grounding of civil aviation in Canada and the U.S., but perhaps the only service that has exhibited sustained ridership gains is Amtrak’s Acela Express, the most modern application of passenger rail technology in North America.⁵⁰

Acela Express, Amtrak’s high-speed train service in the 700-kilometre Boston-New York-Washington corridor, runs at up to 240 kilometres/hour. This service was introduced in December 2000, ran below Amtrak’s projections until September 11, but has since exceeded them by about nine per cent. About 25 Acela trains are operated in the corridor each day, with nine leaving Boston and ten leaving Washington. The Acela Express service carried about one million passengers in its first year, with a projected annual ridership of about four million passengers a year.⁵¹

Box 4. Estimates of relative energy intensity per person-kilometre of various passenger transport modes (Germany, 1999)

value of private car 1980 = 100% = 2,64 MJ/Pkm



In Europe, high-speed rail provides a proven substitute for flying between population centres less than 1,000 kilometers apart and increasingly feeds travelers to longer-haul air transportation in Zurich, Paris, Frankfurt, and other hubs.⁵² It represents progress towards sustainable transportation in that rail uses much less energy—and therefore results in fewer emissions—than short-haul aviation (see Box 4).⁵³

High-speed rail development has suffered numerous false starts in North America. The costs of deploying new technology and introducing new infrastructure have been judged too high in relation to meeting future mobility needs through expanding road and air options.⁵⁴ Proposed projects include the California High Speed Rail Authority's plan for a 1,100-kilometre system linking San Diego, Los Angeles, San Francisco, Sacramento.⁵⁵ This project is likely to be a bellwether for inter-city rail transport options in North America. Security concerns could tip a previously unfavorable balance of political and economic factors toward diversification of inter-city travel options.

Nevertheless, passenger rail is not without security concerns. According to the

director of maritime and land security for the U.S. government, baggage screening could soon be operating on U.S. trains as well as buses and cruise ships. All passenger security could be treated with the same intensity as aviation security.⁵⁶

Rail freight has yet to have the scrutiny given to other freight modes. The generally more orderly arrangements concerning rail, and the limited route-taking, suggest that rail freight could thrive in an era of heightened security.

For Canadians, the most important implications concern border crossings by road. In 1996, over five million trucks, 39 million cars, and 100 million people entered the U.S. by land from Canada, probably more in 2002. These totals vastly exceeded other modes on the passenger side and substantially exceeded them—in terms of value—on the freight side.⁵⁷ As noted above, trucks are well suited to delivery by terrorists of explosive materials to specific targets. They could serve equally to deliver chemical, biological, and nuclear weapons.

One strategy under discussion is use of an automated entry-exit system with some elements similar to what is being

discussed for aviation. For trucks, this could involve the use of 'secure' vehicles whose locations and contents are continuously monitored by remote surveillance systems and whose drivers require special clearance. An initial such proposal would 'pre-screen' for expedited crossing formalities at the U.S. border more than 7,000 Canadian trucks owned by major shippers and driven on regular routes.⁵⁸ The challenges of applying an automated tracking system for such a quantity of cross-border traffic—people, vehicles, and their contents—seem formidable. The alternative strategy of bolstering existing practices—

which is what has been done since September 11—will deter trade and other traffic.⁵⁹

Such measures would make freight transport more sustainable if they encouraged the replacement of partially loaded trucks with fewer, fully loaded, and well-monitored trucks. On the other hand, measures requiring secure loading points and the sealing of vehicles while en route could make it more difficult to consolidate loads from several origins.

Within Canada and particularly the U.S., we can expect further restrictions on traffic in sensitive areas (e.g., vehicle bans along Pennsylvania Avenue in Washington and Wall Street in New York). We can also expect more inter-city car traffic. One effect of increased aviation security appears to have been replacement of short-distance air travel by car travel.⁶⁰ Recently imposed security surcharges add proportionately higher burdens to short-haul flights, and could lead to replacement of short-haul flights by car or train journeys. Such trends would be in the direction of sustainability as flights by smaller aircraft over shorter distances can be particularly energy intensive (see Box 4).



It is too soon to tell what consequences of more secure trucking and marine operations will be for sustainable transportation. There seem certain to be significant impacts emerging with the implementation of new measures. In the meantime, long lines of idling trucks on both sides of the Canada-U.S. border are likely.

The U.S. government's assessment of what may be the greatest risk to homeland security now appears to have shifted from airports and aircraft to seaports and freight containers.⁶¹ A U.S. Department of Transportation study had reported in August 2000, that terrorists could smuggle in nuclear bomb components in a standard freight container.⁶² A 1996 report by the Washington-based

Centre for Strategic and International Studies had indicated that a complete weapon of mass destruction could be shipped in this way.⁶³

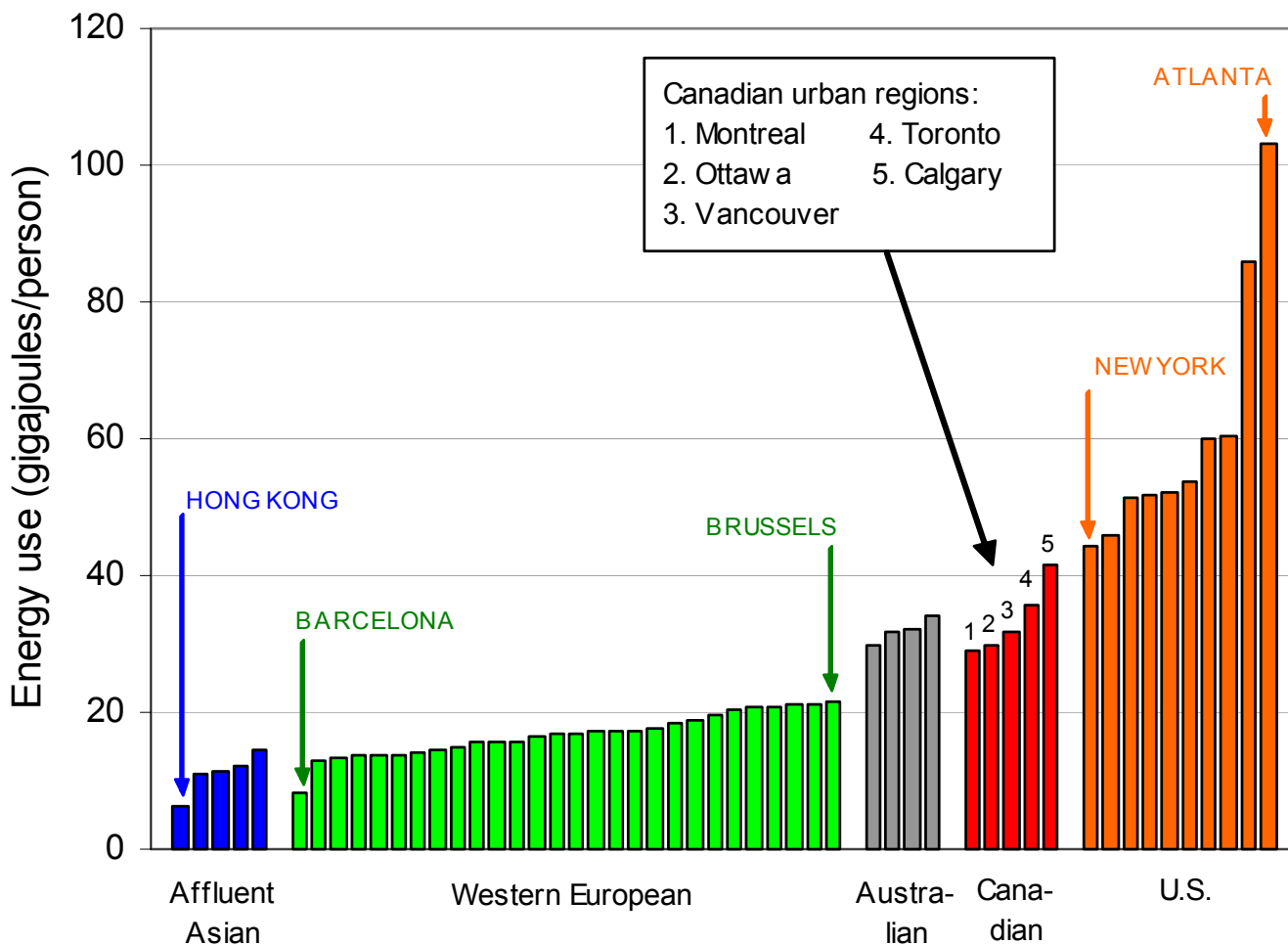
Only two per cent of the six million arriving annually in the U.S. are now inspected. The *Seaport Security Act*, which provides US\$750 million for improved screening, is now making its way through the U.S. Congress. However, the U.S. Commissioner of Customs recently said, "It's physically impossible to check every container without essentially stopping global commerce."⁶⁴

Measures under consideration would involve tagging, tracking and tamper-proofing every container as it moves across the world. The logistical chal-

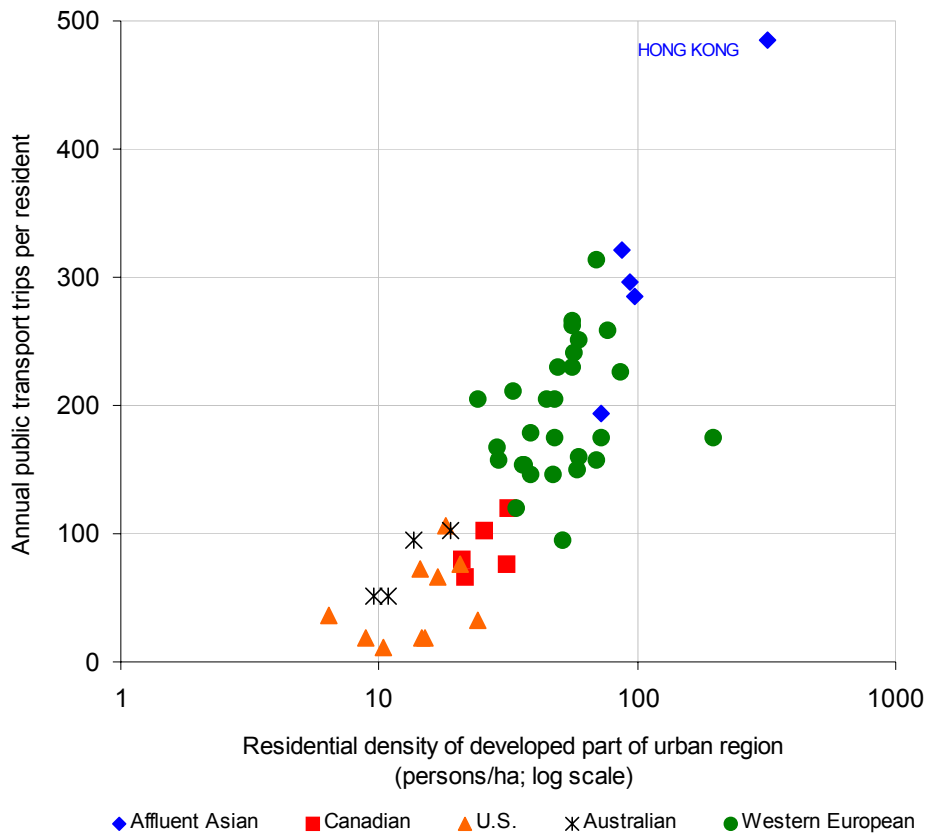
lenge would be huge. In 2001, the world's total movement in containers was between 72 million and 244 million TEUs (20-foot equivalent units).⁶⁵ The movement of each container can involve up to 25 different parties and require 30-40 separate documents, more if a container carries freight for several customers.

The U.S. has proposed installing its own security checks at numerous foreign ports, and using such ports as exclusive gateways to the U.S.⁶⁶ A more far-reaching proposal under discussion would have the U.S. extend its border controls to the point of origin, i.e., the factory or warehouse where the container is filled and sealed.⁶⁷ Such requirements could profoundly alter pat-

Box 5. Energy use for passenger transportation in 52 urban regions, 1995



Source: UITP (2001)

Box 6. Transit use and residential density, 52 urban regions, 1995

Source: UITP (2001)

terms of globalization, with uncertain effects on the sustainability of freight transport.

As threat assessments are more fully developed and acted upon, security surcharges could also become applied to marine-, rail-, and road-based transportation. The effects of these additional costs on transportation could be similar to the effects of increased fuel costs. There could be reduced amounts of traffic, by land, sea, and air. If such reduced traffic could be achieved without reductions in the flows of goods and people—i.e., transportation became more efficient—the result could be a trend towards more sustainable transportation.

IMPLICATIONS FOR URBANIZATION

The World Trade Center (WTC) was a key part of one of the most intensive focuses of human activity. Manhattan Is-

land has among the highest settlement and employment densities in the world, made possible by tall buildings and mass transit. Both factors may have come into disfavour as a result of the September 11 attacks.

Past attacks on cities seem to have done little to discourage the appeal of urban areas. Cities that were severely bombed in World War II—Berlin, London, and Tokyo, for example—have been rebuilt at similar or higher densities. Ever-present fears of terrorist attacks in European cities in the 1970s-1990s appeared to do little to discourage living and working in them.

Now, however, according to Anthony Vidler, dean of the Manhattan-based Cooper Union School of Architecture, “Dispersal rather than concentration is being talked about as the viable pattern of life and work, where monumental buildings will give way to camouflaged sheds, or entirely scattered to home of-

fices.”⁶⁸ The thought was reinforced in part by developer Donald Trump, who said he was disappointed that the WTC would likely be rebuilt much lower, perhaps in the form of four or five 60-storey buildings rather than the original two 110-storey towers. “I think you’d have a hard time with tenants at higher heights”, he said, noting that he had had to scale back a structure he is building in Chicago.⁶⁹

Thus, the attack on the WTC may be seen as an attack on a particular type of building, the extremely tall high-rise tower. (The WTC towers were 417 and 415 metres in height.) Of the 25 buildings more than 300 metres tall remaining in the world, ten are in the U.S. and seven are in Chinese cities (including three in the Special Administrative Region of Hong Kong and one in Taiwan). Seven of the remaining eight are in countries with Muslim majorities, including the two tallest buildings, each 452 metres, which are in Malaysia. There are 37 buildings between 250 and 300 metres high, including 21 in the U.S. and three in Canada.⁷⁰

A concentration of high-rise buildings, especially extremely tall high-rise buildings, contributes to high settlement and employment densities that in turn contribute to an area or region having low levels of energy use for transportation. In practice, this means low levels of low fossil fuel use and low rates of emission of pollutants. These are two essential features of sustainable transportation (see Box 1).

Separate data are not available for Manhattan, but they are available for Hong Kong, which may be the only affluent place in the world with a more intense concentration of activity than Manhattan. Hong Kong is an extraordinary urban region in several respects. Not the least is its extremely low per capita energy use for transportation, as illustrated in Box 5.⁷¹

The data in Box 5 are for *urban regions* and include all 6.3 million people in Hong Kong in 1995 and all 19.2 million people in the New York City region (i.e., not only the 1.5 million people who live



on Manhattan Island). If separate data were available for Manhattan, they would show this New York borough to be much more similar to Hong Kong than to rest of the New York region.

The extraordinarily low energy use for transport in Hong Kong reflects the high settlement densities and high level of transit use (Box 6) and also the corresponding low level of automobile use (Box 7).⁷² These appear to be features of life in Manhattan.

Conversely, reductions in density resulting from fear of being a target in the upper floors of an extremely tall building could result in increased car ownership, lower levels of transit use, and consequent higher levels of fossil fuel use and emissions of pollutants.

Another factor contributing to reduced transit use could be fear of being targeted while travelling. A notorious terrorist attack involved use of the deadly gas Sarin in the Tokyo subway system in 1995, hospitalizing nearly 1,000 people and killing 12.⁷³

It is too early to assess the impact of the September 11 events on transit ridership. In New York, there was a major decline during the final months of 2001. The paralysis in Lower Manhattan was a major factor, but there was more widespread economic impact that could have reduced ridership, as well as possible fear of using collective transport. A further factor was an ongoing decline in subway ridership; rides to and from Lower Manhattan were down four per cent in August 2001 compared with August 2000.⁷⁴ Overall, public transit in the New York region is expected to lose about four per cent of its ridership during the period October 2001 to December 2002 because of the WTC tragedy.⁷⁵

Across the U.S., transit rid-

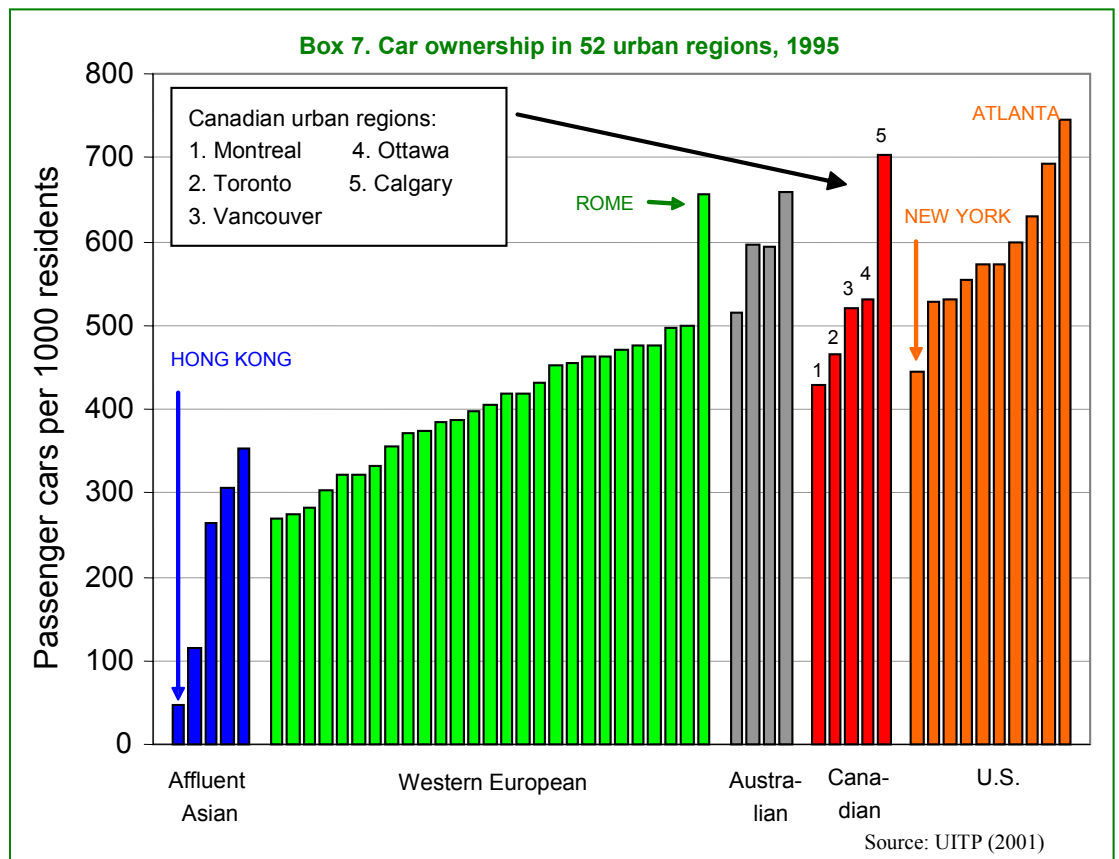
ership increased in every month of 2001 from January to August, compared with 2000, for an average of 2.4 per cent over this period. It then declined by 2.2 per cent in September.⁷⁶ Transit ridership in the New York region is about a third of all U.S. transit ridership.⁷⁷ Thus, it would have required a more than 20 per cent decline during the final 19 days of September to cause this turn-around, or a more than 30 per cent decline in Manhattan.⁷⁸ The New York declines in ridership seemed less than this, suggesting that the events of September 11 reduced public transit use elsewhere in the U.S.

In Canada, the few available data suggest that public transit ridership fell in every month from February to August 2001, compared with 2000.⁷⁹ The decline in September was less than the average decline during the previous seven months. Ridership in October and November was *higher* than in 2000, but was again below the 2000 level in December. Thus, if anything, the events of September 11 may have served to increase transit ridership in Canada. However, a recent report suggests the events served to reduce transit ridership in Toronto.⁸⁰

IMPLICATIONS FOR SUSTAINABLE TRANSPORTATION

The strongest implications concern aviation. The events of September 11 and subsequent actions in response to these events have added to the already enormous commercial challenges facing this industry. In several respects, aviation as a mode of mass transportation was living on borrowed time. Sooner or later, the profound security implications of mostly unregulated aviation or the sector's growing use of increasingly scarce petroleum resources—or both—had to become apparent. September 11 has brought several of these factors into sharper focus.

Next in importance may be the implications concerning railways. The opportunities for rail freight are clear. It is for railway companies to reap this advantage. Done well, the result should be progress towards sustainable transportation because, other things being equal, rail freight transport can use less energy and produce fewer emissions per tonne-kilometre than other land-based freight transport.



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The implications for rail passenger transport may be almost as clear. Much of what aviation does within North America, and elsewhere, could be done by rail. There would be much less energy use and much less risk of associated highly destructive terrorist activity. If high occupancy levels were maintained, well-used passenger rail could represent progress towards sustainable transportation. The challenge may be to convey the intrinsic safety and convenience of rail to potential customers who now contemplate only flying or driving as serious intercity mobility options.

Almost finally, there are the implications for road traffic, which in North America is responsible for almost all of the movement of people and much of the movement of freight. Every vehicle can be a guided weapon, and the tendency will be for vehicle use to become more restricted, or

at least more monitored. Security checks on driver and vehicle registration will become more stringent. Much more highway travel will be monitored. More areas will be off limits to vehicles that do not have prior permission. The net result could be a minor decline in use of road vehicles, but perhaps not enough to produce a serious shift towards sustainability.

The last word concerns data. Good knowledge of transportation systems and how they function may be a prerequisite for effective action to move them towards sustainability. Already there are voices being raised in the U.S. to reduce the availability of some aspects of transport data, for security reasons. This could impede progress toward sustainability. Fewer data are available in Canada, and so the impact of any restriction on data availability could be of lesser significance.

THE CENTRE FOR SUSTAINABLE TRANSPORTATION

The Centre is a federally chartered, non-profit organization.

It began work in 1996 with start-up funds from Environment Canada and Transport Canada. These departments of the Government of Canada continue to contribute support.

The Centre's mission is to provide leadership in achieving sustainable transportation in Canada by facilitating cooperative actions, and thus contributing to Canadian and global sustainability.

To achieve its mission the Centre provides reliable information, fills knowledge gaps through research, educates stakeholders and raises awareness among them, and offers strategic policy advice in selected areas.

The Centre's first publication was its *Definition and Vision of Sustainable Transportation*, published in mid 1997. You are reading the sixth issue of the *Sustainable Transportation Monitor*, published annually from 1998 to 2000 and now twice or more times a year. All issues of the *Monitor* are available at the Centre's Web site, as are the Centre's other publications (visit www.cstctd.org). The *Monitor* provides evaluation of progress towards or away from sustainable transportation and discussion of related matters.

This issue has been written by Richard Gilbert, the Centre's research director, and Anthony Perl, a member of the Centre's Board of Directors. The content has been endorsed by the Board of Directors acting as individuals rather than as representatives of the organizations with which they are affiliated (and not unanimously in every instance).

Comments on this issue of the *Monitor* and proposals as to what should be covered in coming issues are much appreciated. E-mail is the preferred mode of communication but feedback by any mode is welcome. **Please see Page 1 for our e-mail address, fax and phone number, and mailing address.** Contact the Centre to become a corporate or individual member of the Centre.



REFERENCE NOTES

1. The reminder was in the president's September 20, 2001, address to the U.S. people (Elisabeth Bumiller, *New York Times*, January 6, 2002).
2. The text in Box 1 is that adopted by the European Union Council of Ministers for Transport and Communications at its meeting in Luxembourg in April 2001.
3. The basis for considering aviation as the most vulnerable mode is this: The technical attributes of civil aviation—speed of vehicle, energy intensity of movement, lightweight material used in construction of the vehicle, proximity of airways and populated areas—combine to make aviation a highly vulnerable mode of transportation, both to the occupants of the vehicle and, as was shown (again) on September 11, to the inhabitants of areas where jetliners crash. Aircraft designers, avionics engineers, airport designers, and others concerned with aviation system design have lowered the inherent risks of high speed and energy intensity through many fail-safe systems, and redundancy of those systems. When those systems are defeated through sabotage, aviation remains vulnerable to catastrophic failure.
4. According to *Scientific American* (November 2001 issue, Page 15; see sources cited therein), the following amounts of energy release were associated with the September 11 attack on World Trade Center towers:

Kinetic energy of impact of the two planes	9 gigaJoules (GJ)
Fuel detonation at impact	900 GJ
Fuel burning after impact	5,000 GJ
Total	6,000 GJ

The fuel burning after impact, most of which would not have been present if short-haul aircraft had been used, likely caused the collapse of the towers (which released an additional 2,000 GJ). The energy release of about 6,000 GJ is equivalent to the energy involved in the detonation of 1,200 tonnes of TNT, the rating of a small tactical nuclear warhead. The estimate of the kinetic energy of impact may have to be revised upwards by about 25% in the light of evidence that the plane that hit the second tower was travelling at an extraordinarily high speed. (See Lipton E, Glanz J, "Sept. 11 jet's speed passed design limit", *International Herald Tribune*, February 25, 2002.) The increase, however, would only be in the order of 25% across both planes, leaving the overwhelming impact to be that of the fuel burning after impact.
5. See "Heroes of aviation" in the ThinkQuest Library at <library.thinkquest.org/26854/cgi-bin/printer.cgi?name= histh&v=2>.
6. See U.S. Federal Aviation Administration at <www.faa.gov/avr/arm/n97-13.pdf>.
7. See Williams D, The bombing of the World Trade Center in 1993, *International Criminal Police Review*, No. 469 (1998).
8. The major terrorist incidents are listed at the Web site of the Center for Nonproliferation Studies, Monterey Institute of International Studies (<cns.miis.edu/pubs/reports/convter.htm>).
9. Concerning the role of the pre-September 11 renovations to the Pentagon, see "From the ashes, a Pentagon reborn", *New York Times*, January 20, 2002.
10. For the City of London's 'Ring of Steel', see Ashworth J, "Big brother is watching you", *The Times (UK)*, May 7, 1999.
11. The key difference between suicidal acts in other modes and in aviation is the potential for mass destruction that can arise from such action in aircraft. When road vehicles have been used as weapons of mass destruction (e.g., the use of car bombs) the occupants/drivers have only sometimes stayed with the vehicles until detonation.
12. According to the U.S. State Department, international terrorist attacks declined from 539 per year during 1986-1990, to 425 per year during 1991-1995, and to 338 per year during 1996-2000 (see *Patterns of Global Terrorism* at <www.state.gov/s/ct/rls/pgtrpt/2000>). Suicide missions are not especially identified but the impression is of an increase, particularly since the 1993 Oslo Agreements, after which Palestinian terrorist organizations may have sent more than 70 suicide bombers on missions against Israeli targets (see Schuman E, *Israel Insider*, June 4, 2001 at <www.israelinsider.com/channels/security/articles/sec_0049.htm>).
13. For the quote see the Web site of Physicians for Social Responsibility at <www.psr.org/s11/plants.html#notes>. For information about nuclear reactors in the U.S., see the Web site of the Nuclear Energy Institute at <www.nei.org>. A proposal to adopt a *Nuclear Security Act* was introduced into the U.S. Congress in November 2001, with the aim of ensuring that reactors are protected against hits by fuel-heavy aircraft (<ens-news.com/ens/feb2002/ 2002L-02-01-04.html>). U.S. intelligence agencies are reported to have issued on January 23, 2002, an internal alert about a planned terrorist attack on a nuclear power plant by Islamic terrorist (see Smithson S, "How secure are U.S. nuclear power plants", March 26, 2002, at <www.gristmagazine.com>). On January 29, 2002, the U.S. president's State of the Union address suggested that diagrams of U.S. nuclear plants had been found in terrorist bases in Afghanistan, as well as detailed instructions for making chemical weapons and surveillance maps of U.S. cities (see <www.whitehouse.gov/news/releases/2002/01/20020129-11.html>).
14. Air Transport Association, *Monthly Passenger Traffic Report*, March 14, 2002 (at <www.airlines.org/public/industry/bin/traffic.pdf>).
15. This estimate was given on January 17, 2002, by Pete C. Garcia of Continental airlines (reported in *Trade Compass News*, at <www.tradecompass.com>).
16. McArthur K, "WestJet's traffic rises 54.7%", *Globe & Mail* (Toronto), January 10, 2002.
17. Nevertheless, U.S. airlines are recalling laid-off workers and restoring cut service, although in some cases at a smaller scale, using smaller aircraft. (See Peltz JF, "Cautious airline

- sector preparing for takeoff", *Los Angeles Times*, February 3, 2002.)
18. For data on passenger traffic before during and after the Gulf War, see the *September 2001 Industry Briefing* of the International Air Transport Association, available at <www.iata.org/pdf/iaf.pdf>.
 19. For the revenue decline before September 11 and its causes, see the November 14, 2001, presentation by Chief Economist of the Air Transport Association (at <www.air-transport.org>). For an analysis of the woes of one major carrier (United), see Lowenstein R, "Into Thin Air", *The New York Times Magazine*, pp. 40-45, February 17, 2002.
 20. For information about Southwest Airlines, see McKenna B, McArthur K, "Airline industry sees signs of recovery", *Globe & Mail* (Toronto), January 8, 2002, and also the company's January 17, 2002, press release. For WestJet, see the source detailed in Note 16. For Ryanair, see Jones L, "Booming Ryanair sees passenger count soar", *Financial Post* (Toronto), February 5, 2002. For British Airways, see the company's February 4, 2002, press release indicating that for the last three months of 2001 revenue passenger- and tonne-kilometres were down respectively 20% and 19% compared with a year earlier. See also the second source detailed in Note 19.
 21. See, for example, the British Airways data in Note 20.
 22. See Page P, "Dreams deferred", *Air Cargo World Online*, February 2002 (at <www.aircargoworld.com>). Also see this issue for air freight traffic during 2001.
 23. For aircraft order information see <surf.to/orders>; see also Fieweger K, "Boeing's jet orders down 45% in 2001", *National Post* (Toronto), January 10, 2002.
 24. Pigg S, "Wide-body graveyard: Swaths of desert hold the wreckage of a bleeding airline industry", *Toronto Star*, February 2, 2002.
 25. In October, Air Partner, the world's largest corporate jet broker, predicted a surge in its business, but by December this had not been reflected in the company's trading statement (see <www.airlondon.com>).
 26. See Motte B, "Bombardier chops 800 jobs", *Globe & Mail* (Toronto), January 10, 2002. See also, McArthur K, "Bombardier rehires 800 workers for regional jets", *Globe & Mail* (Toronto), March 27, 2002.
 27. The quote is from Sharkey J, "Class consciousness comes to airport security", *New York Times*, January 6, 2002. This article reported airline surveys to the effect that 25% of business travellers are cutting back on travel "not because of fear of flying, but because of the delays and annoyances at crowded, often tense airport security checkpoints".
 28. Woodyard C, "Security hassles deter many frequent fliers", *USA Today*, March 11, 2002.
 29. This is the conclusion of a recent brief discussion of the issues involved in a high-technology identification program (Grossman WN, I seek you: Are new security technologies worth the intrusion and the cost?, *Scientific American*, pp. 18-20, March 2002). In this article, James Wayman, director of the U.S. National Biometric Test Center (San Jose State University) was reported as saying that knowing that someone is going to be a terrorist when they get on a plane is beyond what science is capable of predicting.
 30. For this quote, see the source detailed in Note 28.
 31. Post-September 11 service cutbacks seemed to focus more on flights not involving hubs, but this may have been because they are less profitable rather than for considerations of congestion or security. (See Zuckerman L, "preserving hubs is the method behind the madness", *New York Times*, November 20, 2001.)
 32. The worldwide estimates of fuel use for military and all aviation purposes are from Table 9-4 of Intergovernmental Panel on Climate Change (IPCC), *Aviation and the Global Atmosphere*, (Penner JE et al, eds.), Cambridge University Press, 1999. Three estimates are given in the table. The authors of the report seem to prefer the NASA estimate (see Page 4 of the report), and that estimate is used here.
 33. The estimate that about 30% of fuel for U.S. aviation went for military purposes is based on the following. According to Table 2-8 of the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1997*, U.S. Environmental Protection Agency, April 1999 (available at <www.epa.gov/global_warming/publications/emissions/us1999/1999-inventory.pdf>), military vehicles used 26% of jet fuel in 1992. Factoring this up to allow for the 23% acquired directly from non-domestic sources and not included in the *Inventory* (see <www.eia.doe.gov/oiaf/1605/gg96rpt/appd/html>) gives the estimate of 31%. A high proportion of the military aviation fuel seems to be used for refuelling. According to the January 2001 report by the U.S. Defense Science Board Task, *More capable warfighting through reduced fuel burden*, in 1999 the U.S. Air Force used "approximately 85 per cent of its fuel budget to deliver, by airborne tankers, just 6 per cent of its annual jet fuel usage" (at <www.acq.osd.mil/dsb/fuel.pdf>). p. ES-1).
 34. The estimate of U.S. non-military use is from Table 4-5 of *National Transportation Statistics*, U.S. Bureau of Transportation Statistics, 2000 (at <www.bts.gov>).
 35. In the U.S., the military proportion with respect to the domestic *Inventory* (see Note 33) fell from 26% to 22% between 1992 and 1997, and by extrapolation would have been perhaps 19% in 2002. Assuming the same factor of 23% of direct acquisitions, the 19% becomes 23% of total U.S. aviation use in 2002 compared with 30% in 1992. A similar analysis estimates a decline from 19% to 14% in military aviation as a proportion of worldwide use.
 36. This 'back of the envelope' estimate assumes the U.S. proportions of aviation fuel use remain as indicated in the text.
 37. For fuel use across the Gulf War period, see the first two sources detailed in Note 33.
 38. This estimate was made in January 2002 by the deputy head of the World Travel and Tourism Council (see "WTTC sees 10% fall in air travel", *Financial Post* (Toronto), January 12, 2002).



39. Box 2 is from the source detailed in Note 19. Jet fuel prices are shown in the sources as “without taxes”. However, there are no taxes on fuel used for international flights and almost no other taxes on aviation fuel. For further information on aviation fuel taxes see <www.globalpolicy.org/soecon/glotax/aviation>.
40. Issues of the *Sustainable Transportation Monitor* are available at <www.cstctd.org>.
41. Box 3 is from a presentation by Jean Laherrère entitled *Forecasting future production from past discovery*, made at an OPEC conference entitled “OPEC and the global energy balance: Towards a sustainable energy future”, held in Vienna in September 2001, available at <www.oilcrisis.com/laherrere/opec2001.pdf>. The source cited for the chart is Perrodon A., J.H. Laherrere, C.J. Campbell, The world’s non-conventional oil and gas, *Petroleum Economist*, March 1998. The projections in the chart assume ultimately recoverable totals of 2,750 billion barrels (about 437 km³) of liquid and 12,500 trillion cubic feet (about 350,000 km³) of gas. Also see Deffeyes, KS, *Hubbert’s Peak: The Impending World Oil Shortage*, Princeton University Press, 2001. Deffeyes concluded, “This much is certain, no initiative put in place starting today can have a substantial effect on the peak production year. No Caspian Sea exploration, no drilling in the South China Sea, no SUV replacements, no renewable energy projects can be brought on at a sufficient rate to avoid a bidding war for the remaining oil. At least let’s hope that the war is waged with cash instead of with nuclear warheads. ... So when does world oil production peak and start downward? That’s the big enchilada. ... The mathematical peak falls at the year 2004.7; call it 2005. However, I’m not betting the farm that the actual year is 2005 and not 2003 or 2006. ... There is nothing plausible that could postpone the peak until 2009. Get used to it.” (pp. 149, 157-8). Also see Bentley RW, Global oil & gas depletion: an overview. *Energy Policy*, vol. 30, pp. 189-205, 2002. Among Bentley’s conclusions is the following: “The world contains large quantities of non-conventional oil, and various oil substitute. But the rapidity of the decline in the production of conventional oil makes it probable that these non-conventional sources cannot come on-stream fast enough to fully compensate. The result will be a sustained global oil shortage.”
42. See, for example, the article *Closed Coffin: Ending the Debate on ‘The End of Cheap Oil’*, A commentary by Michael Lynch, Chief Energy Economist at the economics consulting firm DRI-WEFA Inc. at <sepwww.stanford.edu/sep/jon/world-oil.dir/lynch2.html>.
43. The “buses with wings” phrase was put forward by those advocating deregulation, among them Prof. William Stanbury of the University of British Columbia, at a symposium on airline competition held in Calgary on May 30, 2000 and organized by the Van Horne Institute.
44. See U.S. Department of Transportation, *Fiscal 2003 Budget Reflects Funding for Transportation Security*, available at <www.dot.gov/affairs/dot01302.htm>.
45. Pomeroy R, “EC to let countries insure airlines”, *Financial Post* (Toronto), March 22, 2002.
46. The fee is US\$2.50 per enplanement, to a limit US\$5 per one-way trip and US \$10 per return trip (see <www.dot.gov/security/fedreg122801.html>).
47. The fee is \$12 per one-way journey originating in Canada; \$24 if the destination is other than Canada or the U.S. (see <www.fin.gc.ca/news02/data/02-013e-1.html>).
48. British Airways, *Flight Operations News*, February 2, 2002 (at <www.britishairways.com>).
49. The matter of the *resilience* of a transport system—its ability to handle unpredictable change—is discussed usefully in the section of the *Online TDM Encyclopedia* entitled Evaluating Transportation Resilience and Security (at <www.vtpi.org/tdm/tdm88.htm>).
50. In Canada, VIA Rail ridership increased system-wide by more than 40% immediately after September 11, but the continuing situation is unclear. Over the year, 2001 showed slightly higher ridership than 2000 for Economy class with a larger increase (6%) in VIA 1 passengers. (Source: VIA Rail press releases, November 21, 2001, January 10, 2002.)
51. These details about Amtrak and Acela are in a December 10, 2001, Associated Press report found at <cnn.com/travel>. The projected annual Acela ridership of four million is regarded as optimistic by the U.S. Government.
52. Patterson J, Perl A, The TGV effect: A potential opportunity for reconciling sustainability with aviation, *World Transport Policy and Practice*, vol. 5(1), pp. 39-45. See also the Lufthansa quote in Note 53. See also the Agence France-Press report, “Air France forced into fight for cut-price crowd”, *Financial Post* (Toronto), March 26, 2002. In this report it is noted that the recent high-speed rail service from Paris to Marseille has taken 60% of the market, that Air France has withdrawn from the Paris-Brussels market because it cannot compete with high-speed rail, and that it is losing out to rail in the Paris-London market.
53. On the high energy intensiveness of short-haul flights, see, for example, Figure 8-4 of the IPCC source detailed in Note 32. The German airline Lufthansa is particularly cognizant of the high energy intensity of short-haul flights and is seeking to reduce their number, as noted in the following from the Lufthansa Web site at <cms.lufthansa.com/de/dlh/en/focus/0,1774,0-0-181243,00.html>: “To improve the environmental performance of the domestic short-haul traffic, Lufthansa is counting on an intensified cooperation with the railways that applies each transport mode’s specific strengths. Lufthansa and Deutsche Bahn [German Railways] signed a declaration of intent that calls for a step-by-step shift of German domestic short-haul flights to the rails, while keeping ground travel times and passenger comfort levels comparable with those of air service.” Box 4 is taken from this Web site (specifically from <cms.lufthansa.com/LHe/images/MediaPool/main/mediafile75685.pdf>). The source of the information is given as “DRL-DVF, IFEU 1999”. IFEU is the Institute for Energy and Environmental Research, Heidelberg (see <www.ifeu.de/englisch/index.htm>).
54. See Chapter 4 entitled “False starts with high-speed rail” of Perl A, *New Departures: Rethinking Rail Passenger Policy in*

- the Twenty-First Century*, Lexington, Kentucky: University Press of Kentucky, 2002.
55. Details of California's high-speed rail plans can be found at <www.cahighspeedrail.ca.gov>.
 56. See the Associated Press report in the *International Herald Tribune*, March 27, 2002.
 57. Border crossing data for 1996 are from Tables 6-5a and 9-2a of *North American Transportation in Figures*, U.S. Bureau of Transportation Statistics (at <www.bts.gov>). Since 1996, the real value of U.S. Canada trade carried by truck has increased by about seven per cent (derived from information in *Transportation Indicators*, February 2002, U.S. Bureau of Transportation Statistics, at <www.bts.gov>).
 58. See "Pre-screen the trucks", *Globe & Mail* (Toronto), February 2, 2002, and Brinkley J, "Canada wants some trucks exempt from border inspection", *New York Times*, February 1, 2002 (web edition).
 59. For a discussion of the potential impact of U.S. actions on Canadian border traffic, see McKenna B, "Plans for a 'modernized' border will hit Canada like a freight train", *Globe & Mail*, March 22, 2002.
 60. For reports of decreases in short-haul trips by air, see the *USA Today* article detailed in Note 27. In this article, three airlines report driving shorter distances instead of flying as a major reason for reduced patronage.
 61. See "The Trojan Box," *The Economist*, February 7, 2002.
 62. Reported in the source detailed in Note 61.
 63. See Cordesman AH, *Terrorism and the threat from weapons of mass destruction in the Middle East*, Center for Strategic and International Studies, October 1996 (available at <www.csis.org/stratassessment/reports/terror.html>).
 65. The quote is from an interview during the television program *60 Minutes* on March 24, 2002 (see <www.cbsnews.com/stories/2002/03/21/60minutes/main504318.shtml>).
 66. Containers are increasingly 40 feet (13 metres) long, but the TEU is the standard unit. The wide range of estimates of container traffic depends on what is counted as container traffic. However, even the low end estimate of 72 million TEUs presents an extraordinary monitoring challenge. (See "When trade and security clash", *The Economist*, April 4, 2002.)
 67. Reported in the source detailed in Note 61. Arrangements for mutual prescreening of freight moving by water between the U.S. and Canada already appear to be being implemented.
 68. See the source detailed in Note 65.
 69. The quote is from Vidler A, "Aftermath; A city transformed: designing 'defensible space'", *New York Times*, September 23, 2001.
 70. The quote by and comments concerning Donald Trump are from Marr G, "Builders lowering heights, Trump says", *National Post* (Toronto), November 30, 2001.
 71. Data on the world's tallest buildings are from <www.infoplease.com/ipa/A0001338.html>.
 71. Box 5 is from Kenworthy J, Laube F, *The Millennium Cities Database for Sustainable Transport*, Union Internationale des transports publics (UITP), Brussels, Belgium, 2001 (CD-ROM). Data have been used from only 52 of the 60 affluent urban regions in the database. The five regions with populations less than 500,000 were excluded, as were three urban regions with unusually large numbers of missing data points.
 72. Box 6 and Box 7 are from the source detailed in Note 71.
 73. See Olson KB, Shinrikyo A, Once and Future Threat?, *Emerging Infectious Diseases*, vol. 5(4) (1999), available at <www.cdc.gov/ncidod/EID/vol5no4/olson.htm>. This incident is not among the 17 serious incidents listed in Note 8 because of the low number of deaths. Had the perpetrators been better prepared and organized, this incident could have resulted in more deaths than all of the 17 together, plus the events of September 11.
 74. The subway ridership data are in McCall HC, *The impact of the World Trade Center tragedy on the Metropolitan Transportation Authority*, at <www.osc.state.ny.us/osdc/rpt902.pdf>. See also the internal analysis by New Jersey Transit summarized at <www.transoptions.org/nj_commutingshift.htm>.
 75. See the source in Note 74 in relation to other MTA budget material at <www.ibo.nyc.ny.us/newsfax/Insidethebudget81.pdf>. Specifically, the estimated revenue loss for the 15-month period is US\$99.6 million and the total revenue in 2000 was US\$2.1 billion.
 76. Information is from the Web site of the American Public Transit Association at <www.apta.com>.
 77. This is the estimate by New York's Metropolitan Transit Authority (at <www.mta.nyc.ny.us/mta/network.htm>), which is approximately confirmed by the data at the source in Note 76.
 78. Perhaps half to two-thirds of MTA transit journeys touch Manhattan, meaning that about one fifth of U.S. transit trips start, end or both start and end on Manhattan Island.
 79. These data are from APTA (see Note 76), which provides limited reporting on Canadian systems. Transit properties providing data to APTA include Calgary and Vancouver, where there were labour disputes involving transit workers early in 2001. A more accurate account of transit ridership in Canada during 2001 will have to wait on the compilation of 2001 data to be produced by the Canadian Urban Transit Association.
 80. See Lewington J, "TTC user slowdown may lead to fare hike", *Globe & Mail*, March 19, 2002.

