The *Acela Express*

R. Clifford Black

Amtrak's *Acela Express* high-speed trains have helped the National Railroad Passenger Corporation (Amtrak) capture more than half the combined air-and-rail market between the terminal cities of Washington DC and New York. If intermediate cities such as Baltimore and Philadelphia are included, Amtrak's share of the air and rail markets is about 75%. Between New York City and Boston, *Acela Express* has increased Amtrak's share from 18% to 40%. The popular trains carry more than 2 million passengers annually, or more than 10% of Amtrak's 24 million passengers, accounting for about 25% of Amtrak's annual ticket revenue of more than $1 billion.

Amtrak began operating *Acela Express*, the first regularly scheduled high-speed passenger train service in the USA, between Washington DC, New York City and Boston in December 2000. However, the idea of significantly increasing passenger train speeds in the most densely populated region of the country had been a goal of city planners and railway presidents since the 19th century.

During the late 19th and early 20th centuries, the USA led the world in railway building and operation. At one time, the US railway industry was the largest business enterprise in the fastest growing economy in the world. At its peak, it employed more than 1 million people, and spanned 400,000 km of lines. It is not an exaggeration to say that US railways helped build the new nation and define its culture. While the federal government offered land and tax incentives for railways to build new lines, for the most part, railway companies remained commercial entities not funded by government.

Standard Railroad

The Pennsylvania Railroad was among the large and powerful companies that emerged from the American railway boom. For a time, it adopted the advertising slogan, 'The Standard Railroad of the World' implying that it was the very best and that all others should emulate it. Whether or not it was the best, the 'Pennsy' (as it was nicknamed) was innovative and forward-looking. During the 1930s, it undertook one of the nation's most ambitious public works projects of the time—to install catenary for electric locomotives between New York City and Washington DC. This could be considered as the first step in laying the groundwork for the commencement of *Acela Express* operations some 60 years later.

The electrification of the Pennsylvania Railway's main line between New York and Washington DC as well as several suburban commuter lines radiating from Philadelphia permitted faster schedules and higher train frequencies on busy passenger and freight routes in the most congested region of the north-eastern US. The railway's many tunnels under the Hudson and East rivers provided access to its monumental Pennsylvania Station in Manhattan and had been fitted with a 650-V dc third rail during construction in 1910s. However, until the 11,000-Vac catenary system was built in the 1930s, steam locomotives took over at Manhattan Transfer just 10 km from Pennsylvania Station. No significant changes were made to passenger train operations until the mid-1960s when Congress and others noted the advances in rail technology in France and Japan. Sleek shinkansen on the Tokyo–Osaka route were making big news around the world with their time-shrinking cruising speeds of more than 200 km/h. On America's only significant electrified railway, trains hauled by then-30-year-old locomotives were still cruising at 144 km/h, and were having to slow down over more sections as tracks and other infrastructure deteriorated because of deferred maintenance.

High Speed Ground Transportation Act

Partially in response to these international developments, Congress passed the High Speed Ground Transportation Act of 1965, creating the Office of High Speed Ground Transportation and appropriating $90 million for R&D in the field of faster

Artist's impression of *Acela Express* (Amtrak) ground-based transportation. Part of the funding was invested in a new railway test facility in Pueblo, Colorado, which is still busy today as the Transportation Technology Center, Inc., (TTCI) operated by the Association of American Railways. The only facility of its kind in the world, many foreign rail operators and manufacturers use the TTCI for various speed and reliability tests on both passenger and freight train equipment.

But back in the 1960s, significant advances in US railway technology were still a long way off. One experiment in 1966 involved installing twin jet aeroplane engines on the roof of an old DMU railcar. The project, which ended almost as soon as it began, turned out to be more of a stunt than a test programme. The M-497 test vehicle attained a respectable speed of 293 km/h on its only run in northern Ohio on the New York Central Railroad. While the M-497 never ran again and was soon scrapped, it still holds the all-time North American railway speed record.

Metroliner

Meanwhile, the US Department of Transportation was working on a more practical approach—a train that became known as the *Metroliner*. A consortium of Westinghouse, General Electric, The Budd Company, and the Pennsylvania Railroad, combined their efforts to create a fleet of 50 stainless-steel EMU units. A modified train set using these units attained a speed of 267 km/h in tests on a specially prepared section in New Jersey. Regular *Metroliner* services from January 1969 reached speeds of 176 km/h. In 1983, the *Metroliner* speed was raised to 200 km/h using more conventional electric locomotive-hauled coaches.

US passenger rail service was in decline during the 1960s as a direct result of two sources of tremendous competitive pressure. The federal government had committed billions of dollars to a comprehensive, national Interstate highway system and commercial aviation was turning to jet aircraft in ever-increasing numbers, serving government-backed airports and using government-backed air traffic control. Facing this kind of subsidized competition, and receiving virtually no federal support, the private US railway industry was in desperate financial condition and needed to be relieved of its loss-making passenger business. To meet this wish, Congress created the National Railroad Passenger Corporation by passing the Rail Passenger Service Act of 1970. The new passenger rail company was named Amtrak—a contraction of 'American travel on track' and services started on 1 May 1971.

The *Metroliner* was among the trains operated by the fledgling Amtrak on that first day. They were considered the most successful passenger trains in the US because they were relatively fast, ran on a fairly frequent schedule and enjoyed a niche market between their terminal cities of New York City and Washington DC. The main competition for the largely business-travel clientele was 'shuttle' flights operated by Eastern Airlines between Washington's then National Airport and New York's LaGuardia Airport. Already the most densely populated region of the US, the Northeast Corridor (NEC) between Washington DC, New York, and Boston was experiencing growing congestion on the ground and in the air, and the term gridlock came into common usage to describe the mobility crisis. Clearly, there was need for more and better transportation options. The Northeast High Speed Rail Improvement Project (NEHRIP) was to be part of the solution.

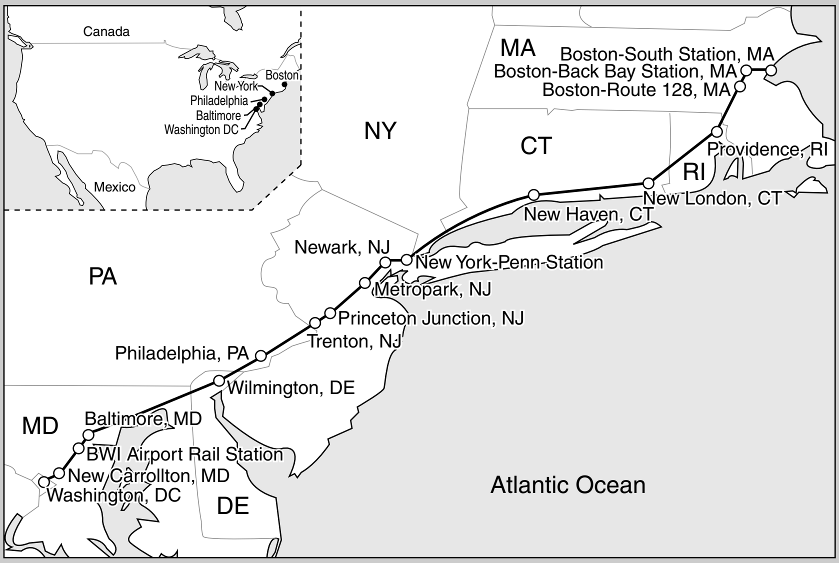
The busiest railway in the western hemisphere, Amtrak's NEC between Washington and Boston had been the only major AC-electrified passenger line in the US since the 1930s. In addition to a tortuous right-of-way engineered in the 19th century, another major technical shortcoming was the termination of the electrification at New Haven, Connecticut, not quite a third of the way from New York to Boston. The electric services changed to steam (and later diesel) at New Haven until the 1910s when the New York–New Haven section was electrified. The remaining non-electrified section had been frequently seen as a candidate for installing catenary, but fundiing had always blocked these proposals. Clearly, to improve speeds, cut running times and provide efficient service, the electrification had to be extended east and north beyond New Haven. This need was finally met by the NEHRIP.

In the early 1990s, the late W. Graham Claytor, Jr., Amtrak's President, Chairman and CEO urged members of Congress to give Amtrak money to extend electrification from New Haven to Boston and to upgrade signals, track and other infrastructure in the process. In 1992, he held a press conference in New York City's Pennsylvania Station with US Senator Frank Lautenberg, Chairman of the Senate Appropriations Committee. They announced the NEHRIP plan which would invest $1.2 billion of federal money in infrastructure improvements to the Boston line. But more than just infrastructure improvements, what Lautenberg and Claytor wanted was a programme of study and engineering that would lead to the acquisition of the *Acela Express* high-speed train sets some 7 years later. (Unfortunately, Claytor died in 1994 before his dream was realized.)

Visits by Foreign Rolling Stock

Later in 1992, in a series of talks with the representatives of the Swedish State Railways, Claytor arranged to test Sweden's popular new X2000 tilting train on the NEC. It was both a publicity stunt

***Acela Express* Route Map**



Source: Amtrak

to draw attention to modern passenger rail technology being used in other industrialized nations as well as a method of collecting engineering data to help Amtrak write specifications for its own, specialized high-speed train set. To demonstrate the public acceptance of such new technology, ABB (the builder) arranged with Amtrak to have the train tour the US, even in regions outside the electrified NEC, pulled and pushed by Amtrak diesel and gas turbine locomotives. It was a popular success, drawing thousands of spectators wherever it went. For more than a year, the X2000 periodically operated in regular service between Washington DC, New York and New Haven. During the X2000's visit, Siemens and Amtrak agreed to test the new German high-speed ICE. Both the X2000 and the ICE train were tested on the NEC—the X2000 at 248 km/h and the ICE at 265 km/h. In 1993, the ICE also operated for several months in regular service between Washington DC and New York. These tests with Swedish- and German-built trains were extremely useful in gauging public response to modern trains, and all the while they were undergoing tests, Amtrak's Engineering department was studying the new equipment to help Amtrak write specifications for when the company was ready to advertise bids to build a uniquely American high-speed train.

New Specifications

In 1993, when Amtrak asked for bids to build its new, as-yet unnamed high-speed trains, three organizations emerged as qualified bidders: ABB, Siemens, and a consortium of Bombardier and Alstom.

While there were similarities with existing trains, the specification package differed from all other train sets worldwide. They were to have bi-directional capability with operating controls at both ends, superior acceleration and braking, and the ability to negotiate the numerous curves on the NEC at higher speeds than conventional equipment. This latter specification would require tilting capability. But the requirement that set these trains apart from all others was the need to meet crash-resistance standards far above anything else in the world with a buffer strength requirement in the driver's cab as high as 544,310 kg, or about twice the international standard.

In March 1996, Amtrak President Thomas M. Downs was joined by Al Gore, the Vice President of the US, and other dignitaries at Washington DC's Union Station to announce the selection of the Bombardier–Alstom consortium as the builder of Amtrak's new high-speed trains. It was a gala occasion attended by railway industry executives, government officials and the press. The consortium was to produce 18 high-speed train sets (later increased to 20) and 15 high-horsepower conventional electric locomotives for delivery beginning in 1999. Construction of three special maintenance facilities for the trains in Washington DC, New York, and Boston was included. It was a tall order to design, build and test high-speed trains designed exclusively for the existing US railway environment. The deal was sealed by a consortium loan to Amtrak that provided the approximately $850 million needed to finance the trains and maintenance facilities.

A major difference between Amtrak's *Acela Express* and some of the comprehensive high-speed systems in other industrialized countries is that the *Acela Express* was envisioned and designed as an incremental improvement over existing conventional trains. In contrast to Europe and Japan, without a clear federal policy on high-speed rail, this choice was made out of necessity driven by economics and practicality. The economics resulted from long-term US public policy that favoured building Interstate highways for fast and easy travel by private automobile between cities. The highway trust fund, financed by relatively low taxes on petroleum and diesel fuels, could not be touched for construction of intercity passenger railway lines. From a practical standpoint, even if money was available, the process of building a new right-of-way though the most densely populated region of the US would require acquisition of billions of dollars worth of real estate and litigation with the potential for decades of delay.

Consequently, the *Acela Express* would

have to be able to operate over a 19th century alignment that could not support a dedicated track, such as that used by the French TGV or Japanese shinkansen. Nonetheless, the track, signals and power supply had to be upgraded and well maintained in order to realize the benefits of the new train's high-performance capabilities. Concrete ties and continuously welded rail had already been installed on some NEC sections during the 1980s, but more needed to be done. The NEHRIP project to electrify and upgrade the route from New Haven to Boston was proceeding as quickly as possible while the consortium started construction of the *Acela Express* carriage shells in La Pocatiere, Canada, and final assembly of carriages in Barre, Vermont, and locomotives in Plattsburgh, NY. It was a race to complete the track upgrade and deliver sufficient train sets to begin operating *Acela Express* services by the goal of 1999.

Despite the 1999 goal, it wasn't until March 2000 that George Warrington, Amtrak President and CEO, announced to a crowd of front-line Amtrak employees in New York City that the new trains would be named *Acela* based on a combination of the words acceleration and excellence. A large screen showed the first view of the new train as it rolled slowly from the workshop in Vermont. The media hailed the event, but the *Acela* did not become world news until November that year when the train made its inaugural run from Washington DC to Boston. At last, the US had a high-technology, high-speed train of which it could be proud, and in which Amtrak invested a great deal of hope for its future as a major force in one of the busiest and most competitive travel markets in the world. It turned out that those hopes were well placed.

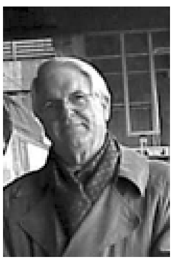
Successful Service Start

The few infrequent *Acela* services between Washington DC, New York and Boston from December 2000, drew large, admiring crowds. With two sleek, 6000-hp (4474-kW), aerodynamic power cars sandwiching six passenger carriages between them, the trains were like nothing seen in the USA before, even taking into account the earlier visits by the X2000 and ICE. Four business-class cars, one first-class car and one café car provided a total of 304 seats. Some features that immediately impressed passengers were the large windows; improved interior lighting; spacious, attractive restrooms; electrical outlets at each seat; at-seat food service in first class; and the smooth, quiet ride at speeds up to 240 km/h.

As the consortium delivered more train sets, customers flocked to *Acela Express* and its market penetration became so significant that competitor airlines published critical newspaper advertisements—the ultimate expression of flattery for any marketing department! Thanks to these popular new trains, Amtrak's market share continues to climb in the northeast. After 1999, Amtrak's market share between New York and Washington DC grew from 36% to 53% while the airlines' share dropped from 64% to 47%. Amtrak's share grew even more dramatically from 18% to 40% on the New York–Boston section. Of the total 4.767 million or so combined air and rail passenger trips in the NEC in the first quarter of FY2004, fully 2.928 million (61%) were on Amtrak trains.

Under Amtrak's President and CEO, David L. Gunn, Amtrak is embarked on major infrastructure projects that had been deferred and whose delay had threatened the continued reliability of *Acela Express* schedules. New concrete ties, welded rail, ballast-deck bridges, signal systems and catenary hardware are being installed incrementally in this busiest and fastest railway in the NEC, where more than 1000 trains operate each day. With improved reliability and shorter journey times, Amtrak is considering increasing the number of *Acela* train sets in regular weekday operation. Currently, 15 train sets provide 46 weekday departures from Washington DC, New York, and Boston. The remaining five sets are assigned to back-up or programmed maintenance. Amtrak is studying changing this 15/5 arrangement to 16/4 operation soon.

With the success of *Acela,* the inevitable question is when similar services will be started in other markets around North America. At present, other projects are still in planning. As always, costs are a major consideration and sometimes a stumbling block. Nevertheless, a broad range of proposals remains in the concept stage, including incremental speed increases in the Midwest and Pacific Northwest and possible dedicated-right-of-way, high-speed services in California. The markets are clearly ripe for the US to expand improved passenger rail services and the *Acela Express* has whetted America's appetite. ■



R. Clifford Black

Mr Black is Director of Media Relations at Amtrak.