THE LITTLE ENGINE THAT CAN

There's a clear track ahead, as the Swedish locomotive hauls the eight-car Metroliner toward New York City at 193 km/h.

The Swedish Rc4a ASAE locomotive, on the right, is dwarfed by a General Electric E-60 unit in the Wilmington, Delaware, yards.

In the first gray light of a November morning, the undersized locomotive didn't inspire exclamations of wonder as it waited, coupled to eight sleek Amfleet cars, to make the high-speed run from Washington to New York City. Looking rather like an oversized streetcar, with portholes along its corrugated sheet-metal sides, it was dwarfed by conventional locomotives on adjacent tracks. But, like Charles Atlas' 97-pound weakling, it packs a powerful punch, as I was soon to find out.

The lightweight Rc4a locomotive, built by ASEA in Sweden, is currently under lease to AMTRAK for testing in the Northeast Corridor. The ASEA unit, which weighs only 81 650 kg (180 000 lb), about half the weight of the comparably powered General Electric E-60, arrived by ship in the United States on July 21, and is in regular service following exhaustive shakedowns and modifications to meet U.S. requirements. Experience with the ASEA locomotive, and with an additional French unit that will undergo tests early in 1977, will be valuable to AMTRAK in developing specifications for a new generation of high-speed locomotives that will be needed to upgrade the Northeast Corridor for 193-km/h (120-mph) speeds.

My invitation to ride the cab of the ASEA locomotive was hardly exclusive. Along with Jim Seamon, TRB's Railroad Specialist, were two representatives of the Swedish manufacturer, who were helping the three-man AMTRAK crew assess the performance of the locomotive, and sundry AMTRAK executives. Observers took turns riding in the front and rear cabs, connected by a narrow passage along impressive transformers, relays, panels, and other electrical gear.

Exactly at 7:00 a.m., when the train had filled up with an assortment of briefcased businessmen, military personnel, commuting college students, and women bent on early Christmas shopping, engineer J. W. Crow set a series of switches on the airplane type of console in the cab, and as he gradually turned the rheostat that controlled the power feed the train began to glide smoothly out of Washington's Union Station. No wheel slip, no chatter, no clanking of couplings—just a steady whine as the wheels took hold instantly.

Visibility was unparalleled; wide windows gave a 180-degree field of view to the engineer, who sat comfortably in a padded leather armchair, one foot on the "dead man" control, one hand controlling the speed, while he constantly monitored the instruments on the console. Dressed in a business suit and tie, his overcoat and hat hung neatly nearby, he wasn't exactly the traditional "Casey Jones" figure. As we passed through the Washington yards, picking up speed, I couldn't help making a comparison with my first ride on the footplate of a locomotive, some 35 years earlier.

The season of the year was the same, but there the comparison ended. The line was the old London and Northeastern, not AMTRAK. We rolled out of Berwick-on-Tweed early in the morning, with spray from the stormridden North Sea freezing on the tracks. The studded footplate of the engine was coated with

Transportation Research News editor, Hugh M. Gillespie, describes a ride from Washington, D.C., to New York City on an AMTRAK train pulled by a Swedish-built locomotive.

1 The 4476-KW locomotive is in wide use throughout Europe and is currently under exhaustive tests in the Northeast Corridor.

2 It's common sense in any country not to stick your hands or head out of the locomotive windows.

3 The intricate control console includes a four-panel loadmeter that indicates the individual load on each wheel motor.

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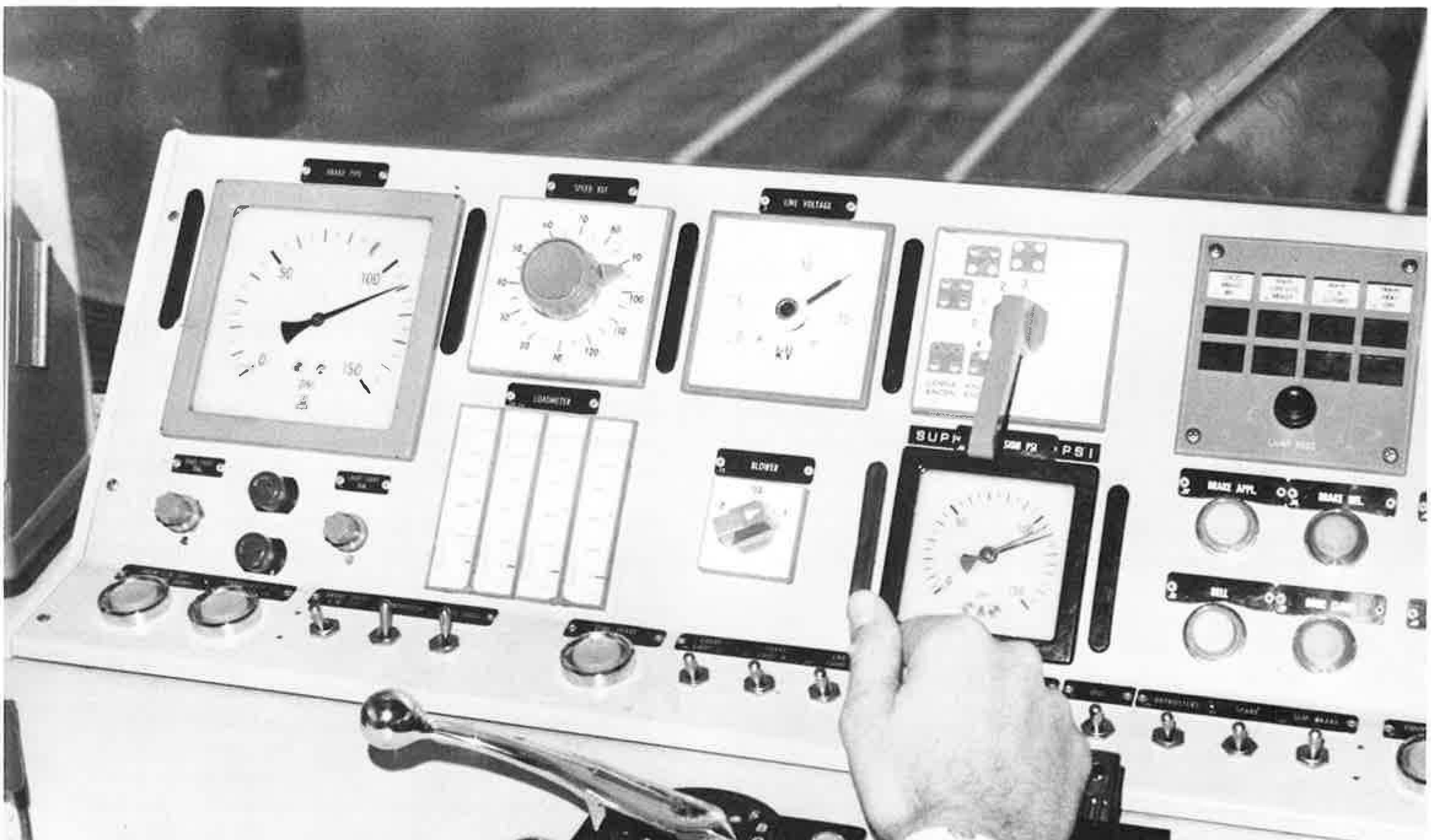

white frost, which gradually melted as the flames from the coal furnace licked their way round the edges of the ill-fitting furnace door. The driver, wrapped like an onion in layer after layer of coats and scarves, held the heavy brass regulator as he peered, with eyes streaming, through the clouds of smoke and cinders that streamed back from the funnel of the 50-year-old engine. Meanwhile, the fireman, soaked in sweat, swung his shovel from bunker to furnace, his boots striking sparks from the frozen footplate, striving to keep the train moving at its maximum 56 km/h (35 mph). And a certain 10-year-old boy, sitting on a dirty wooden box with blood congealing and chilblains complaining, decided against a career as an engine-driver.

Back in the present day, as we rolled smoothly through the Maryland countryside at a steady 193 km/h (120 mph), I asked ASEA representative P. E. Olsen what the secret of the Rc4a locomotive was. How can it pull away so smoothly and powerfully from a dead stop and accelerate so steadily, as compared to other locomotives?

The answer, it seems, lies in thyristor control, pioneered by ASEA as early as 1962, and steadily refined since by ASEA and others for railroad and transit applications. The thyristor control system provides completely stepless acceleration and incorporates an "early warning" wheel-slip control device that enables it to accelerate rapidly, with relatively heavy loads, to high speeds.

The application of thyristors also made it possible to use separately excited traction motors, resulting in the maximum traction from each individual axle. Says ASEA, "It is well known that separately excited motors exhibit great differences in load sharing when the slightest variation of speed occurs, a problem which is overcome with individual field control. On the other hand, the characteristics of the separately excited motor, is, of course, an advantage in coping with the hazard of slip or wheelspin because the motor which has a higher speed in relation to the other motors reduces its load rapidly when it is fed from the same voltage source."

The creep control system permits the maximum use of the available adhesion on every occasion, gives complete protection against slipping, and operates fully automatically. This means that the engineer doesn't need to take any action to stop slipping or to balance the traction of the various wheels.

ASEA's claim of adhesion equivalent to 33 percent of the Rc4a's weight, compared with less than 20 percent for any other locomotive, seemed to be borne out as we pulled away from the various stops on the way to New York City. Running at the maximum 193 km/h wherever track conditions permitted, the Swedish locomotive performed effortlessly and had the wholehearted approval of the train crew.

Before the unit was put in service in October, American couplers and pantographs were installed, and the electrical system was modified to work within the voltage limitations of the corridor. A pneumatic bell, along with a complete cab signal and train speed control system, were supplied by AMTRAK and installed by ASEA.

Four weeks of exhaustive testing were carried out in September. Not only were the trucks instrumented to test for oscillation, but the locomotive also was fitted with the specially instrumented wheels that directly measure the lateral forces exerted between the wheels and the rails. This allowed inspectors to measure lateral forces continuously while the train operated on the Northeast Corridor test track, which is a 32-km (20-mile) segment located between County and Millham interlockings in New Jersey. For the Rc4a tests, the test track was set up to induce the most extreme cases of dynamic interaction of wheels and rails that any locomotive could be expected to encounter in normal operation.

The Swedish locomotive, or a similar unit developed along the same lines, is expected to supplement the heavier locomotives now in use in the Northeast Corridor, giving AMTRAK both heavy duty and lighter duty flexibility.

Development and acquisition of rolling stock are only a part of the revitalization program for the Northeast Corridor, which extends almost 725 km (450 miles) from Washington to Boston via New York City. It crosses eight states having a population of 40 million people.

About 2090 km (1300 miles) of track must be improved; ties must be replaced and continuously welded rail installed on 675 km (420 miles). Alignment and surfacing are needed on more than 1290 km (800 miles) of track, and ditching and drainage work on another 200 km (125 miles).

Of the 855 bridges on the corridor, 190 were built before 1895, and four out of five of these must be replaced completely. More than half the bridges must be strengthened, and nearly all of them need some degree of repair. Movable-span bridges must be upgraded where the tracks cross navigable rivers.

Badly neglected tunnels in Baltimore and New York must be reworked to restore drainage and track subsystems and to increase clearance for 25-kV electrification.

The U.S. Congress has provided for a $1.9 billion program for improvements on the Boston-Washington line. At the end of 5 years, stations will have been modernized, electrification systems will have been upgraded from Washington to New Haven and extended to Boston, and tracks will be capable of carrying trains at a sustained speed of 193 km/h (120 mph).

The anticipated end result is a travel time of 2 hours and 40 minutes from Washington to New York, and 3 hours and 40 minutes from New York to Boston.

It seems particularly appropriate that a European locomotive is helping to spearhead the resurgence of passenger service in the identical area of the United States where the country began 200 years ago.