King Computer


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A phlethora of computer systems is being installed or developed at CN, North America's most technologically advanced railroad. There are so many computerized control systems that the proverbial monkey at a typewriter, er keyboard, that is, would stand a good chance of coming up with an acronym for one of them on his very first try. The acronyms abound: TRACS, WIN, YIS, TMOS, and so forth. And only fitting for a bilingual country, there's even one that happens to mean something in French (AMIS, for Automotive Management Information System, happens to mean "friends").

But by and large, the extent of CN's computer applications to railroad controls and management systems is more overwhelming than friendly, at least to an outsider looking in.

At the center of them all stands Traffic Reporting and Control System (TRACS), which maintains real-time information on the movement and status of all cars, locomotives and trains. As the master, online inventory, it is the source of the statistics and information used to run the railroad.

The Yard Inventory System (YIS) reports directly to TRACS and monitors car movements in yards and terminals. The information stored in these two systems is used to prepare and record waybills through the Waybill Information Network (WIN). WIN has an important repetitive function that eliminates about 2/3 of the keystroking required by a clerk preparing a waybill for a regular customer, which makes up about 75 percent of CN's waybilling. And through the CARLOC information system, customers can obtain information on car location and shipment status, with direct access via Telex, TWX or phone.

These systems, on-line for several years, make up the base on which


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Coal may still be king for many railroads, but computers are the thing at CN.


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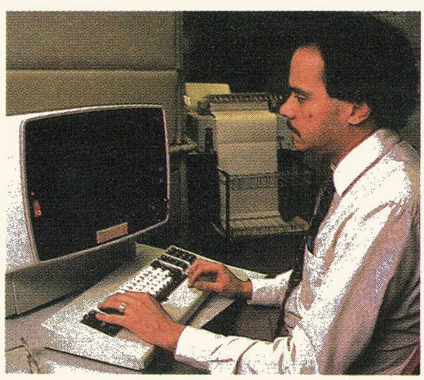
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CN is adding layer after layer of computerized control systems. "We've put a great deal into the development and application of technology to improving productivity," said J.A. Clark, chief of transportation. "The impact of such new technologies will escalate greatly in the next five to ten years."

One of CN's current priorities is continuing to bring on-line the transportation manpower operating system (TMOS). By the end of the year, it promises computerized dispatching of all running trades employees, fitting each person to the particular job according to his right to work and personal qualifications.

Also, TMOS is making significant strides towards its goal of a fully automated running-trades payroll system. "By 1987, TMOS will produce the payroll from train control and operations data, thereby eliminating the time ticket and the big problem of controlling the quality of time claims," Clark said.

REIS improves controls

The first step in developing this automated payroll was the installation of electronic outer switch timers, which monitor the arrival and departure of trains at terminals. The timers generate the following data: site and track number, subdivision and mileage, time and date, speed, wheel count, and inbound or outbound indication. Each site that is

1) Computers touch every aspect of railroading at CN.
2) The Hump Yard Improvement Program will track the progress of each car through the yard on color monitors, which are to be operational by this summer.
3) The Transportation Manpower Operating System promises computerized dispatching of all running trades employees by the end of the year and, eventually, a fully automated running trades payroll system.
4) Rail Train Control operator in Edmonton. RTC applies computer technology to train controls in CTC territory and has a new computerized train sheet component being implemented in 1986.

equiped with the devices has wheel sensors and a micro computer that transmits the information to CN's central computers.

CN is upgrading this system by replacing some of the outer switch timers with its Railway Electronic Identification System (REIS), which gives the same information but with the addition of the car's unit number. REIS, manufactured by EID Systems, includes track-side interrogators which activate car-mounted transponders. At 60 miles per hour, the transponder can respond about 15 times in the period of time it takes the train to go by, resulting in a high degree of accuracy.

The first REIS models, tested about four years ago, had to be redesigned due to moisture getting into the units. During 1985, 43 interrogation sites in the Mountain Region were installed with the new units as a pilot project. All the locomotives (about 1000) which pass through that region have been equipped with the transponders. A few cars that are limited to unit train service have been equiped, also.

Comparing information from the interrogators with running trades time returns began in December. J.H. Hughes, manager traffic systems, operations, expects REIS and the outer switch timers to lead to a reduction in terminal and final time payments of at least 4 percent due to improved verification of reporting accuracy.

"This could ultimately lead to automatic train reporting, with exception reporting, if necessary, which would reduce considerably the amount of work done manually at car-load centers," he said.

"At the yard, for example, the train is reported in, every car is worked, there are pick ups and set offs.... You could do all that automatically with a simple reading device like REIS. An unexpected benefit of the outer switch timers and REIS is the ability to monitor train speeds."

Upgrading hot box detectors

Another project aimed at improving trackside detection capabilities is called wayside automated inspection stations (WAIS) and involves the conversion of error-prone analog hotbox detectors to digital data transmission systems. During 1986, 38 detector sites will be upgraded, bringing the number of digital hot box detectors up to 75 percent of CN's total.

A new add-on feature, the hot box detector analyzer, will be tested in 1986 and promises to eliminate about 90 percent of the hot box detection tapes that are currently scanned manually. Data from the digital hot box detectors will be sent to a central computer in the dispatching office. The computer analyzes the data and prints a tape for the operator only when an anomaly is detected.

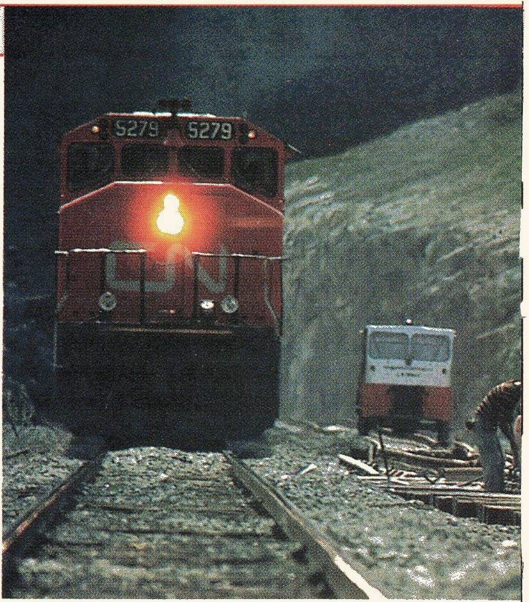
Microelectronics affords the possibility of building data processing capabilites into these more and more sophisticated wayside detection systems, thereby making them increasingly multifunctional. WAIS provides the flexibility needed to incorporate other inspection devices into the existing hot box detection system, including hot wheel and flat wheel detectors, overload and shifted load detectors, and even sniffers and sound detectors.

Staying ahead of ATCS

While many railroads await the developments of the Advanced Train Control System, CN is designing and installing many of its own advanced control systems. "We're developing some of the same things in-house, but even so, we'll benefit tremendously from ATCS because it will permit uniformity on the North American continent, thus lowering the cost of train control systems," said Frank Bartunek, asst. chief of transportation, technological development.

"We can't plow all these advances because its too expensive, but we are working on a few that are dear to us." Rail Traffic Control (RTC) and Computer-Aided Manual Block System (CAMBS) are two of those systems dear to CN.

"RTC and CAMBS could be considered as a first step in the same direction as ATCS," Bartunek said. "But will they sustain the technological drive propelled by ATCS? For example, they've started working on cab signaling, which we haven't gotten into.

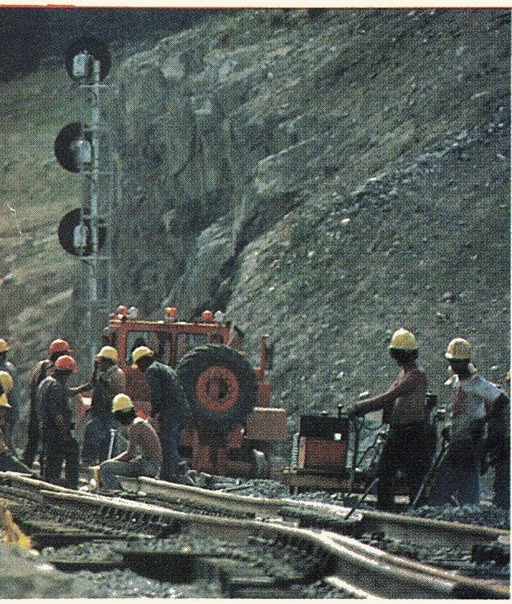


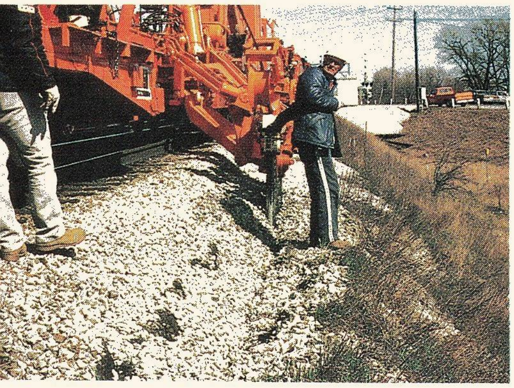
Double tracking and expansion in western Canada has facilitated the introduction of fiber optics, which is being installed for both communications and train controls. Lines from Edmonton to Vancouver and Montreal to Toronto represent an investment of $(C)100 million.

"Since ATCS is taking a modular approach, their building blocks will probably be complementary with ours, although we might have used certain features that will turn out to be incompatible." Meshing ATCS with any in-house control systems will be a chore for the coming decade, Bartunek added with a sigh of relief.

RTC applies computer technology to train controls in CTC territory. It monitors train movements and controls switches and signals at meeting points. Introduced on the Prairie Region in 1978, RTC is fully implemented on CTC territory in the Mountain Region and will be installed in the Great Lakes Region starting in 1986.

Computerized train sheets, a new component of RTC, will be implemented in the Mountain Region in 1986. By eliminating the effort involved in manually maintaining the train sheet, this component will significantly reduce dispatcher workload and reduce verbal radio traffic by about 40 percent.





CAMBS will cover dispatching in "dark" or nonsignalized territories, replacing manual block systems and train orders as the method of train control. It will virtually eliminate the possibility of errors by providing the dispatcher with instant access to train location and track occupancy information. CAMBS will be implemented in three stages.

Phase I, to be tested in 1986 and installed next year, will provide computer interlocking protection for movement authorities, automatically preventing overlapping authorities from being issued and thus improving the safety. Phase II, to be designed in 1986, will eliminate a large part of the dispatcher's paper work, and Phase III will interface CAMBS with other computerized systems such as RTC and TRACS.

Hump yard efficiency doubles

One of CN's more ambitious projects is the Hump Yard Improvement Program (HYIP). In the late 1970's, it appeared that several of CN's hump yards would soon reach the limits of their capacity. Although overall traffic levels didn't grow as fast as anticipated, some of yards, such as Symington Yard in Winnipeg, are used to their limits and suffer from an occassional backup of cars to be classified. On a busy day at Symington, 40 trains can arrive, with about 3300 cars, of which 2400 cars are humped.

An analysis of the situation showed that the major bottleneck in such yards occurred in the hump area itself and were due to slow humping speeds, excessive trimming requirements and problems keeping the hump fed because of congestion in the pull back area. Such delays are costly; each one hour reduction in through-put times that HYIP will gain promises to save approximately $(C)1 million a year.

CN set out to turn the hump yards into a true pipeline operation, including unmanned automated hump engines. HYIP will increase Symington Yard's capacity up to 100 percent by the time it is completed in 1988.

The Process Control System is the first of HYIP's three major computerized and integegrated systems to be developed. It should be in place by this summer. The system will improve the control of cars being humped by routing each car to the appropriate class track, with the progress of each car displayed on a color computer monitor. It will also adjust the speed of cars or cuts of cars as they pass through the retarders, taking into account car weight, rolling resistance, wind direction and other factors.

The next system to be implemented is the Signal Control System, which will set up protected routes for the unmanned hump locomotives, as well as improve control over train and yard movements and allow faster train entry/exit speeds.

The most futuristic component of HYIP, the Locomotive Control System, will allow continuous operation of the hump through the use of robot hump locomotives. The robot locomotives will move between the pull back area and the receiving tracks of the yard, coupling automatically to cars in the receiving yards under the control of the LCS computer. A later phase will add field control, allowing the robots to be controlled by a crewman on the ground.

"We never imagined how complex this project would be when we began, but every major railroad will have to go through the same experience in the next ten years," Bartunek said. "Even if they buy a ready-made system, they'll still need a cadre of people who understand the technologies involved.

"Several components of these systems will have applications outside of what they were specifically designed for," he said. "The field control box, for example, could complement advanced train controls. With ATCS, the engineer will be the only person on the train, but ATCS won't help him with a bad order that has to be set off. With the field control box, he could pull out the bad order, doing the switching himself, but this is many years off."

Fibers replace pole lines

CN is also preparing for the future by installing high capacity fiber optics lines that will be used for signaling as well as communications needs. The two lines will represent an investment of $(C)100 million and will serve the communication needs of both CN and CNCP Telecommunications.

One of the cables was laid last year between Montreal and Toronto, with a spur to Ottawa, and this summer CN will begin installing its own electronic equipment to control communication over the three pairs of fibers it will use.

The other fiber optics line is between Edmonton and Vancouver, and CN will use it to operate train controls along that corridor. "This line was initiated by the railroad in conjunction with the double tracking program," said Roy Shintani, system manager, communications expansion, S&C.

"There wasn't enough room to replace the existing pole line. Besides, we needed more reliable trackside circuits. Everything that was on the pole line will go on the fiber optics cable, including hot box detectors, REIS, radio controls and signaling circuits."

CN will save about $(C)20 million by not having to reconstruct the pole line between Edmonton and Vancouver during the double-tracking work as well as about $(C)9.5 million per year from the elimination of pole line maintenance and the need to lease circuits from telecommunication companies.

Safety still first

New control systems and operating procedures such as those described above, improve the safety of the railroad, but only with thorough training and vigilant adherence to safe operating practices. CN has long emphasized safety, and for the past ten years has ranked in the top five safest Class I railroads as measured by the Federal Railroad Administration. It was the third safest during the first nine months of 1985, with 3.90 accidents per million train miles, compared with 5.35 in 1983.

This years safety record is not as good, however. On February 8, 26 persons died in a headon collision of a nine-car VIA Rail passenger train and a 114-car freight train. Both trains were operated by CN crews. The westbound freight, which was on a double-track section, ran through a switch aligned against it and entered a single-track section where it hit the eastbound VIA Rail train.

CN's internal investigation determined that both the CTC on the territory and the freight train's brake system were functioning correctly. Therefore, it concluded, the accident is attributable to human error.

The CN investigation is continuing, and two other investigations are being conducted. One is by the Canadian Transport Commission and the other is a judicial inquiry directed by the Federal Minister of Transport.

Just one week after this accident, an 86-car freight train derailed on CN's transcontinental mainline, 25 miles east of Vancouver. No one was injured, but 19 cars were derailed and 86,000 (imperial) gallons of dangerous commodities were spilled. No evacuation was necessary because it was an unpopulated area. A loose wheel is the suspected cause of the accident, according to an internal investigation.

Referring to the accident involving the passenger train, R.E. Lawless, president and chief operating officer said, "While it's unfortunate this accident took place, it's easy to take this out of contect. We run about 350 freight trains and close to 500 passenger and commuter trains a day. That's a lot of wheels turning and there are naturally a lot of risks involved. We can only hope that, through good management, training and operating practices, we keep the risks to a minimum. And on a comparative basis, I think that we do."□