IC's MICROWAVE: PLANNED FOR PROFIT

COMPUTER MAIN CENTRAL

▲ 1050 PICL TERMINAL
⬡ TELETYPE PICL TERMINALS
● TELETYPE REPORTING TERMINALS
--- AUTHORIZED MICROWAVE
— PLANNED MICROWAVE
— POLE LINE

SUFA
CKEE
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BHME
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IC's microwave system is planned for profit

Annual savings from the road's $15½-million management-information system will top $5 million.
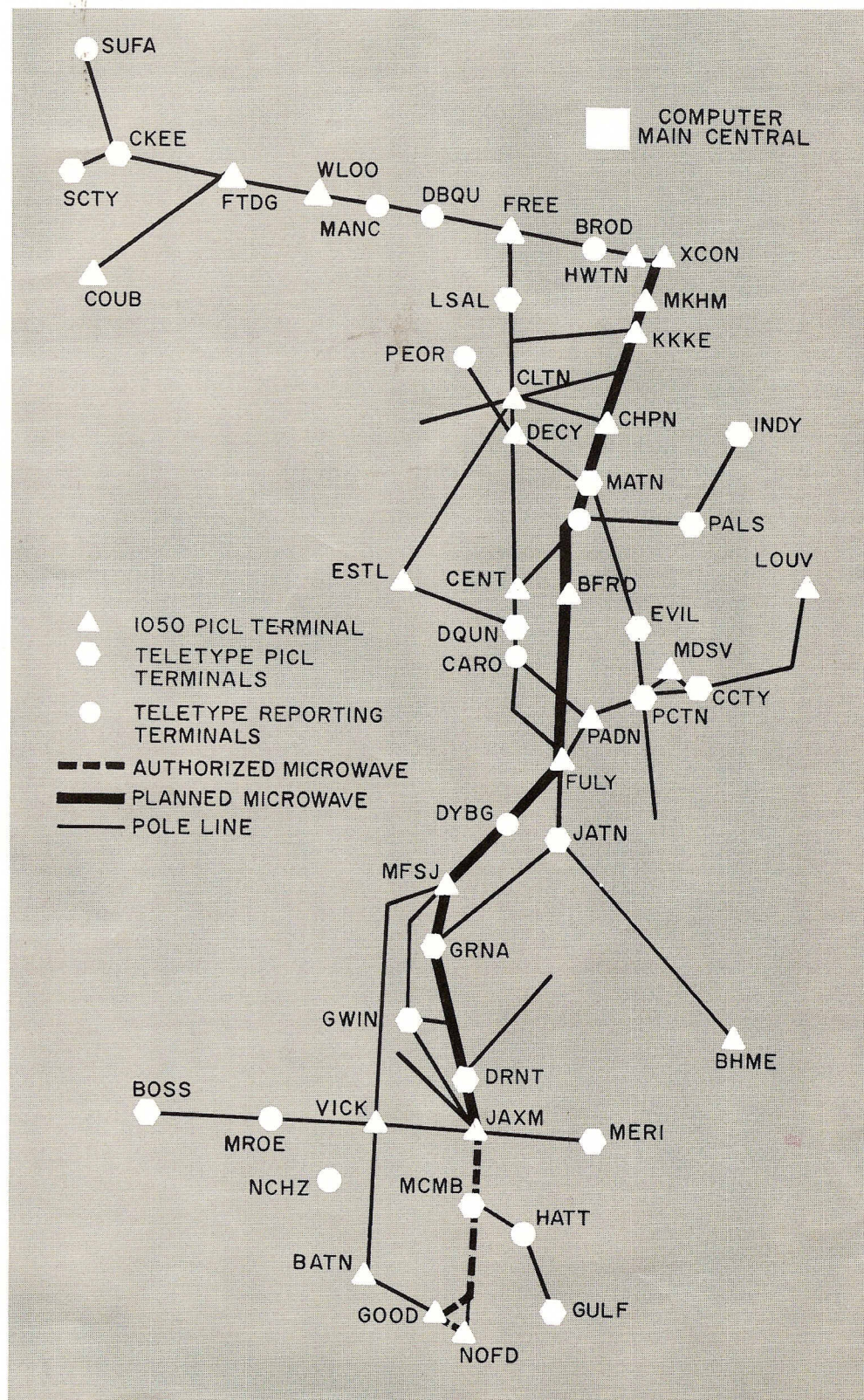
When Illinois Central announced plans for 180 miles of microwave last June, the news attracted little attention: many roads had substantial microwave mileage already in operation.

When, early last December, IC said it planned to build a $15½-million electronic management-information system called MAIN (for Mid-America Information Network), the news was still pretty ho-hum stuff: Such systems are already working or a-building on a dozen-or-so U.S. railroads.

But, here and there, the news got a second look. Long-time observers of what goes on at IC's fortress-like headquarters on the Chicago lakefront took notice: they were astonished at the sudden lurch-forward in MAIN's planning that the announcement implied. Some computer experts in the industry (many of whom had been talking to IC's planning people since the MAIN study began in 1964) were surprised by MAIN's simple structure and matter-of-fact schedule. A few security analysts began to thoughtfully weigh IC's decision to invest a good year's net income in a mixture of men, microwave equipment, computers, training programs and yard car-inventory systems.

● **The stakes are big.** Of course, the blockbuster figures weren't all on the investment side of IC's decision. IC insiders estimate the road's MAIN system will be one of the most profitable investments ever made by a railroad. MAIN will be paying its own way by the end of '68. Beyond protection of IC's competitive service and the road's position in the transportation marketplace, easily identified dollar-savings annually captured by MAIN should top $4,000,000 in 1969. By 1970, annual savings will top $5,000,000. In addition, the MAIN system when fully operational will provide the equivalent of up to 5,000 additional freight cars—equal to capital investment of $50 million.

And those sums reflect only the readily-spotted economies that MAIN will effect within the revenue limits

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of traffic presently carried by the road. A continuation of the traffic trends that have steadily raised tonnage on U.S. railroads during most of the sixties could well make IC's investment in MAIN much better. Many experts predict the industry will handle much more than a trillion ton-miles of traffic by 1975. If IC were to just hold on to its share of that, MAIN's contribution to IC net income would increase—at a much greater rate than would a contribution from any other kind of capital investment.

● **Multi-level task.** IC is already pushing work on MAIN at many levels. Crews are already working on three of the four legs of microwave that will parallel the road's entire north-south main line. Talks with union officials concerned with the changes ahead in work and manpower because of MAIN have been held. More than 475 men in IC yards and terminals have been trained in IC's leased training car, with more than 1,000 to go. Recruiting programs for highly qualified and experienced manpower are in high gear. Adjacent to IC's lakefront headquarters, a building is being rebuilt from the walls out to house the MAIN nerve-center. The structure will receive an IBM 360-30 this month, a 360-50 in mid-year and another at the end of this year.

Design work and programming for the teleprocessing system and for revenue, disbursement and car accounting systems is already under way and scheduled for completion by year's end or by early next year. MAIN's operations and traffic reporting systems will become operational during the fourth quarter of this year.

IC's investment in MAIN is mounting fast. After starting with one-time and recurring expenditures of $336,398 in the final months of '66 (along with a modest outlay of $97,667 in capital expenditures), IC's MAIN investment will top $2,000,000 in one-time and recurring outlays plus $2,900,000 in capital expenditures by the end of this year. By the end of '68, when MAIN investment will start slacking off, IC's investment in the two accounts will pass the $9,000,000 mark—about half for one-time and recurring expense and half for capital investment. IC's outlays for MAIN will reach $15.5 million by the end of 1970.

MAIN's microwave network will serve as an arterial pipeline through which data will funnel from the system to IC's computer at Chicago—and back.
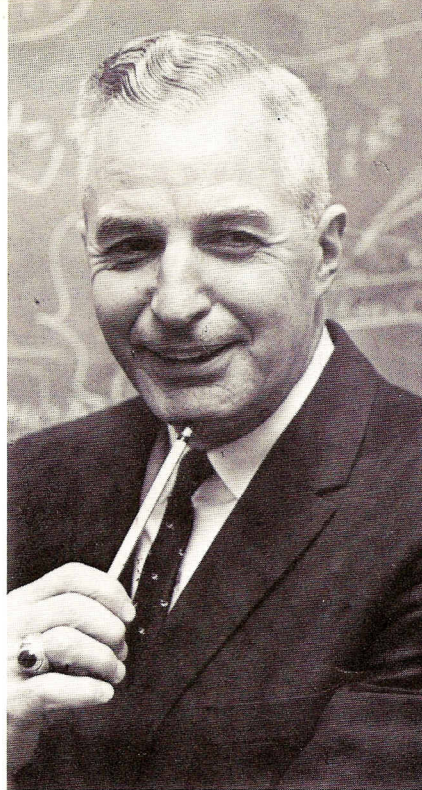
He heads the MAIN project
Richard P. de Camara

● **Planning preliminaries.** Two years of study and analysis preceded IC's decision to begin work on MAIN last December.

In 1964, IC's then-president Wayne A. Johnston appointed a four-man team to investigate the opportunities in computer management-information systems. The four men, representing operating, communications, accounting and traffic were L. T. Coyle (staff assistant) Frank Moran (assistant general freight agent), L. E. Johnson (director machine procedures) and George Pipas (general superintendent communications & signalling). They traveled extensively, visiting railroads already deep in work aimed at management-information systems. By late 1965, the group's ideas were shaping up. They held two briefing sessions for IC's staff. The staff liked what the group had in mind and they began working on plans for MAIN.

Then, dramatically, the project became just one of many folders on the desk of William B. Johnson, who took over as president of IC on May 1 of last year.

Wayne A. Johnston—who was elected chairman of IC's board the same day that W. B. Johnson was elected president and chief executive officer—had delivered quite a railroad to his successor. What one financial writer called "IC's splendid solvency" owed much to his leadership of the road for two decades.

A strong road with deep economic roots in the Mississippi Valley's indus-

trial, agricultural, forestry and mining tonnage, IC's cash position was—and is—strong. Johnston had kept IC in good shape and also whittled away a substantial part of IC's long-term debt. The new president, on the other hand, was an ex-PRR lawyer whose entire career had been spent in companies nowhere near so fortunate as IC. W. B. Johnson's reputation as a corporate activist, in fact, was made after he took over the all-but-moribund REA Express and made a moneymaker of it—until the Post Office changed the ground rules for REA Express last year.

Industry wiseacres made poor puns about the "Johnson & Johnston medicine" afflicting the digestive habits of IC's brass. The uncertainty and fear that washes through a large organization whose leadership suddenly changes looked like a good bet to kill or seriously delay the MAIN project. Rail veterans know that tradition dies hard in the industry and that the life of a manager with change on his mind is hardly ever easy. Experienced observers have watched many such managers become dismayed by institutional hostility buried under deep layers of apparent agreement, action committees and hierarchical hanky-panky.

It didn't work out that way at IC. Insiders agree that Johnson—with help from Chairman Johnston—worked with consummate skill around the road's institutional barriers to change.

● **Promotion and piracy.** Taking maximum advantage of the cadre of enterprising officers whom Wayne Johnston had brought along toward staff rank in recent years, Johnson judiciously promoted promising men and added key men from the outside. He successfully avoided the kind of corporate bloodshed that often accompanies major change in management—and saved IC the many months of shocked inaction that usually follows. Some IC men even cheerfully describe the new men IC has recruited from other roads as a "return" for the men who left IC in years past to fill important posts in industry organizations and on other railroads.

Now, a year after the Johnson administration began at IC, spirits are high on the railroad. The successful marriage of IC's old virtues and its new drive sparked some complex decisions and fast implementation schedules for MAIN.

Quickly after W. B. Johnson's arrival at IC, MAIN's original four-man group resumed planning at an accelerated pace. They reviewed the entire

IC drew on the experience of other railroads

project with an outside consulting firm and then presented a final briefing to IC's new president and the road's staff. MAIN's mechanics were direct, its objectives attainable and its return-on-investment overpowering. Seven months after taking over at IC, Johnson and the IC board gave a green light to the MAIN project.

● **First, a new set-up.** IC created a new department to build and operate MAIN. Johnson turned to the Frisco for a man to head up the project. Richard P. de Camara was elected vice president—information and controls systems for the IC Nov. 1.

The new vice president organized the MAIN department into five sub-departments, each to be headed by a director responsible for building and, later, managing, a vital sector of MAIN. De Camara appointed two of IC's original four-man planning group as directors and a third man from the group as number two man to another director. George Pipas was named director of communications. Lou Johnson was named director of data processing and "Rit" Coyle was named assistant director of data control.

Vice President de Camara went to the outside to fill the remaining directorships. "There just weren't men on the property with the special kind of expertise MAIN requires," he recalls.

He got two of his directors from the Louisville & Nashville—a road that is in the front rank of railroads with successful management-information systems already operating. W. H. Thompson was named director of data control. A. K. McKechnie was named director of methods, systems design and programming. Both men had played key roles in the development of L&N's computer system.

The fifth director for MAIN was hired from Melpar, Inc. As director of service evaluation R. Waldner is charged with the responsibility for giving IC the same watchdog capability via MAIN that enabled Frisco to dramatically improve car-mile and utilization ratios.

● **Adaption, not invention.** Somewhat surprisingly in an era when many railroad officers pant for recognition as innovators, MAIN's leaders cheerfully admit that MAIN's antecedents can be spotted on a dozen other roads. They remind you of the obvious: IC's original quartet of researchers looked at the systems of a dozen other roads. Further, the men putting MAIN together reflect many man-years of experience on roads that led the way into the
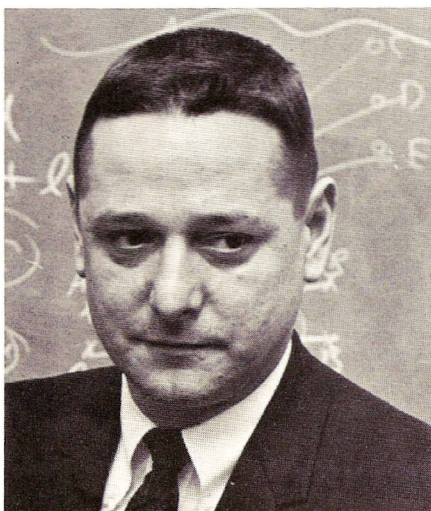

Director of Data Control
W.H. Thompson
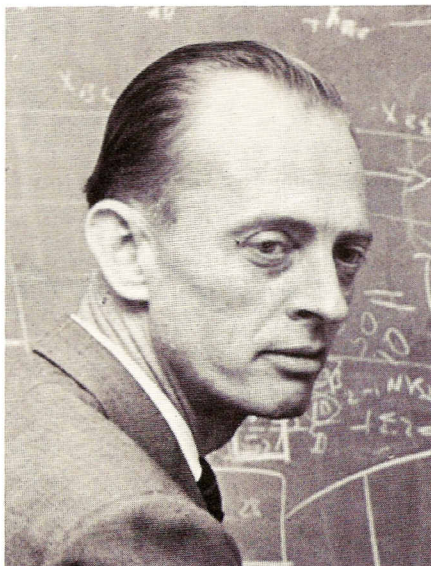
Director of Methods
A.K. McKechnie

Director of Data Processing
L.E. Johnson

systems era. And de Camara is quick to note that IC can "take advantage of the information clearing house that is beginning to exist in the Data Systems Division at the AAR—something that didn't even exist when a few roads began pioneering in this area in the early sixties."

● **Total involvement?** When MAIN is completed, the system will directly touch the work of almost a third of IC's total employment. A steady stream of IC's top officers have been going to computer cram courses. Director of data control Thompson estimates that about 6,000 employees will become involved in MAIN training of one sort or another. "They fall into two groups —roughly 3,000 ops and 3,000 non-ops. We're not only involved in the training of people directly involved in computer work and communications work, but also in the training of the round-the-clock shifts of men who will operate PICL yard systems and all the other men and women whose jobs will change because of MAIN."

What about IC's brass? De Camara makes an interesting point about the head of steam behind MAIN. "Middle-managers are coming around very quickly, as MAIN's usefulness becomes more and more apparent. And, of course, this is absolutely necessary— because they, by and large, are the ones who will use MAIN.

"Above the middle managers? There you'll find a unique situation at IC. Both the operating vice president and the comptroller were agitating for a system like MAIN. The topside environment makes it possible for things to get done with dispatch. IC's departmental barriers are lower than they are on any railroad I know of.

"We're making quick progress because we were able to take advantage of what has been already accomplished on other roads and can thus avoid the expensive, time-consuming pitfalls that complicated the progress of the pioneers in the field. We're also able to move quickly because we planned well. Not that we have avoided all mistakes. We've had some lulus—but we've learned from them."

Organization is probably the most original aspect of MAIN, says de Camara. "Consider what Bill Thompson does—outside the operating department. Only the Denver & Rio Grande Western has had its top communications officer in the computer department. Communications is more vital to and less separable from computers than it

ever was to railway signalling. Communications is a function of management while signalling may more properly belong to the maintenance of way department than be paired with communications. Railroads have not fully married the disciplines and technologies that go into successful management-information systems. We are trying to do that here."

● **All systems on time.** MAIN's directors report on-schedule or ahead-of-schedule status for all projects.

Director of data control Bill Thompson says, "We started meetings between MAIN people and labor relations people very early in the work. We met with union representatives and outlined our plans and requirements. We're encouraged by the sessions where we've told them while they may lose some jobs, others will be substantially upgraded.

Director of Communications Pipas says that IC needs and will get more technicians and professional people. "We plan to maintain our own communications network. We need communications engineers who can become expert in dealing with the interface problems between communications media and computers. The entire spectrum of communications media, from microwave to telephone, is being geared for MAIN's maximum effectiveness as an operational tool and as an extension of management's ability to make decisions and manage—in time to meaningfully influence results.

Built-in flexibility

"Examination of coaxial cables for imput to the computer from certain locations, a test for optical scanning equipment made to read hand-written numbers and other such work is proceeding in parallel with MAIN as promulgated in original planning.

"If some new technique or hardware is proved out at any point in the project, we'll switch without a moment's hesitation."

A. K. McKechnie, director of methods, systems design and programming, has most of his staff already hired. "We plan to have 45 systems analysts—and we already have 42." Director of Data Processing Lou Johnson feels that a great plus for MAIN will come when IC's computer building is completed—and the directors and their staffs move into close proximity with one another and with IC headquarters staff generally.

MAIN's new headquarters is a four-story building. The available space prompted a recent visitor to ask if provision wasn't being made for the possibility that MAIN's basic structure

might have to be changed from a terminal-oriented imput to a central-input system at a future date. For example, if qualified manpower is too hard to get and keep out on the railroad and/or if imput quality is too difficult to maintain from so many different imput points.

IC's MAIN officers agree the new facility has the space and environment to switch to a Southern-style imput—a roomful of IBM 1050s operating directly from waybills sent to the computer by microwave facsimile transmission.

The IC's new microwave network will also have capacity enough to handle facsimile transmission. IC has even provided for the possibility of direct data input via cathode-ray tubes with typewriter keyboards. This would permit visual checking of input and instantaneous computer editing.

Does this mean IC is not sure of its philosophical alignment on the side of the railroads that feel such imput ought to be generated in yards and terminals?

"No," says de Camara. "We feel that this is best for IC—both philosophically and practically. With this kind of set-up, our divisions can be as informed as our system. Such knowledge, we feel, is valuable to operations."

Bill Thompson, whose work keeps him out on the IC for weeks at a time, makes a further point: "The interaction of people doing railroad work and MAIN work is often productive. We can't know everything. The people who'll make MAIN work will probably have as much to contribute to MAIN as the system managers will."

Adds de Camara: "Also, MAIN will tend to produce a new kind of middle-management. We haven't gone to the 'war-room' kind of system because it doesn't seem to be best for IC—even though by location and intent MAIN will offer the general superintendent of transportation swift control and decision power over most of the system. We do, however, have options built into the basic system. We feel that we'll have the best operations-control and management-information system in the industry when we're through."

Judging from the magnitude of IC's profit expectations from MAIN, de Camara's superlative could be justified. Many experts feel the "identifiable" items that make up that figure amount to less money than will result from increased business attracted by better service and the more competitively priced services that will ensue. IC shareholders could do some happy arithmetic about MAIN: The system could add something close to $1 per share in earnings to IC common stock.

IC's MICROWAVE:

Costs get cut all along the line

Yearly communications savings are expected to top $500,000.

George Pipas, IC's director of communications, says a practical fusion of communication and computer capability is a must—if a management-information system is to be effective.

As one of the five directors of IC's MAIN team in the Information and Control Systems department, Pipas is already deep in the planning of a microwave nerve system for the Mid-America Information Network. IC's director of communications (formerly the road's general superintendent of signals and communications) was a member of the four-man study group that prepared the original recommendations for a railroad system-wide information network.

The essential combination of communications and the computer were early discerned by the study team. The communications function is a major factor of information acquisition, says Pipas. Reduced to essentials, the function of the new information network, he says, is to collect data from all over the railroad and transmit it to a central computer headquarters in Chicago. There, the data is processed into meaningful reports, which are transmitted to appropriate supervisory personnel at key offices along IC's 6,000 miles of line. Also, included in the communications planning, is the determination of off-line requirements to service 47 traffic offices in the U.S., Canada and Mexico.

● **Car moves vital.** As might be expected, car location information requirements bulk large in MAIN's scheme of things. To determine communications requirements for handling this information, car counts were taken at yards where cars are waybilled or received in interchange. This information was developed by computer runs covering several months to provide typical average figures. Addition-
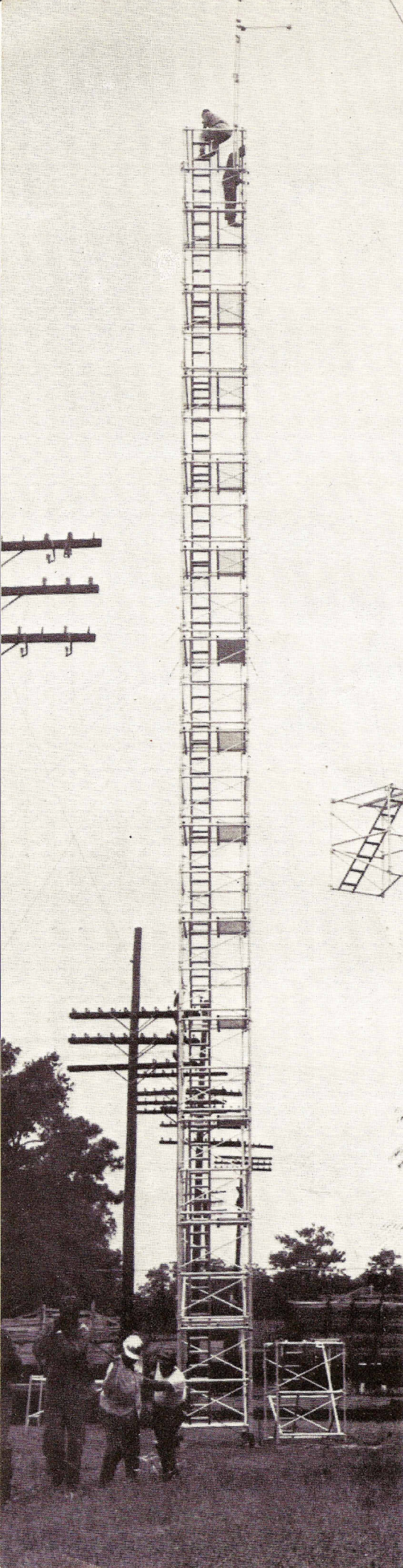
Director of Communications
George Pipas

ally, samples of present traffic were analyzed (with the help of the computer) to determine the number of lines of data transmitted. For example, all cars move on a consist/movement card (about 1 line of data), and all loaded cars have a second card (waybill/traffic) of data. Data transmitted as expected, closely parallel car volumes handled at the various terminals.

From these studies, the following communications equipment guidelines were established:

—Teletype reporting terminal would be one that handles less than 200 cars per day in and out (double count).

—IBM 1912 (paper tape transmission) yards would handle 200 to 400 cars daily, in and out.

—IBM 1050 (punched card transmission) yard will handle more than 400 cars daily, in and out.

As now planned, IC will have 11 Teletype reporting terminals, 18 IBM 1912 yards and 26 IBM 1050 equipped yards.

● **150 words per minute.** The punched card transmission units, IBM 1050's, will be operated on a 150-band circuit at 150 words per minute. IC is conservatively planning to work four 1050's on one microwave voice channel, although up to seven can be so accommodated.

The communications input/output devices at the various yards and terminals will be terminated on an IBM 2703 communications control unit in front of an IBM 360/50 computer at Chicago A predetermined pattern of polling of these devices will be programmed.

At the larger terminals, where there is considerable waybilling and interchange of cars (more than 400 cars daily), 1050 units will be directly connected to the computer via assigned circuits. For example, of the six 1050's at Memphis, two will be on individually assigned circuits to the Chicago computer. The other four units will be paired on two party-line circuits. Partylining will be typical where volumes do not justify individual circuit assignments.

Similar arrangements are made for the yards having Teletype or IBM 1912 paper tape transmission units.

● **Administrative messages.** Traffic studies were also made of the volume of administrative messages handled over the railroad.

Concerning voice traffic, studies were made of present requirements as well as of the expansion in traffic expected when the entire railroad will be completely equipped with DDD (direct distance dialing) service. On Oct. 1, 1967, dial equipment will go into service to serve the Chicago general office.

From these studies, determinations were made of the present and estimates of future requirements for voice and data. Also, IC's communications plans call for complete train - to - wayside radio coverage along mainlines. Wayside radio stations are to be remotely controlled, enabling direct contact with moving trains, as well as M/W crews and others along the right-of-way.

All these circuit requirements indicated that "big pipe" communications was the logical answer to handle IC's requirements along its mainline. Accordingly, Pipas' group added microwave planning to their communications efforts.

Preliminary microwave station sites and path routes were determined by the communications department from an analysis of topographic maps. Where possible, sites were chosen on IC property. For the few locations (about 50%) that are off IC property, the necessary land has been purchased.

To insure that line-of-sight transmission is possible, the communications department used two portable aluminum towers (102 feet high). Starting at New Orleans and working northward, towers were set up at adjacent sites. Men climbed to the top of the towers and after establishing radio contact, used a special signaling mirror to flash sunlight to each other. When working at night, a white revolving light was used. The observer noted the flash of sunlight or the white light. The signalman and the observer would

climb down their respective towers until they lost sight of the light or sunlight flash. Their elevations were carefully noted. Resorting to graphical techniques, formulas, and adequate clearances, tower height for a clear path for the microwave signal was determined.

- **Microwave under construction.** The New Orleans-Jackson, Miss., 176-mile microwave system is nearing the construction stage. The contract for this section is being handled by Lenkurt Electric Co., Inc. Also, Lenkurt is making path surveys and checking a preliminary routing for microwave between Jackson and Chicago. Contract for the towers for this first link will soon be let. Armadillo Mfg. Co. is installing the microwave equipment, wiring and power supplies in fiberglass housings, which will be hauled to the station sites and set in place atop concrete foundations.

The New Orleans-Jackson microwave link is to go into service later this year. Planning will continue on the rest of the system, which is now scheduled for a late 1968 or early 1969 cut-in date.

Until the IBM 360/50 computer goes into service (due Nov. 1, 1967), the car movement data will be handled by Teletype equipment. Beginning about Sept. 1, 1050 units will be placed in service, operating initially on leased circuits. The present microwave is planned for 420 voice channel capacity, but it can be expanded to 600 voice channels.

- **Savings, too.** There will be savings as a result of installing the switching computer, microwave and its associated communications network for the MAIN system. For example, there will be reduced telegraph relay office expense. There will be considerable retirement of copper line wire now serving through communications circuits. Present planning calls for open wire circuits to remain for message, dispatchers' and other local communications circuits after the microwave system is in service. Present plans call for microwave from New Orleans to Chicago. However, studies will be made as to the economics and advantages of some stub systems to key points such as St. Louis and Council Bluffs.

Plans are also under way for consolidating dispatcher locations and moving CTC machines to central locations. Another improvement is anticipated from installation of dial switchboards with the changeover to direct distance dialing. Total savings in the communications area alone are estimated to be well over $1 million through 1969. Annual savings of at least $500,000 are anticipated after that date.

IC's MICROWAVE:

Better car utilization will be assured

When fully operational, Illinois Central's Mid-America Information Network will contain 44 Perpetual-Inventory-for-Car-Location yards. Locations handling at least 200 cars daily in and out will have such systems.

- **Punched card file.** Each of the 44 yards will maintain a punched card file of cars in the yard. When a car comes on line or is waybilled, a car is keypunched at the first location with a punched card input device. The car initial, number and other information, either contained in the waybill or required to move the car, will be keypunched. Generally, a loaded car will require two cards: a consist/movement card and a waybill/traffic card. An empty car will normally require only the consist/movement card.

Each PICL yard will create cards for cars received in interchange at the locations, or for cars entering the yards from a nearby interchange point not equipped with keypunch equipment. Also, a PICL yard will create cards for cars waybilled at non-PICL yards. PICL yards will receive punched cards from other yards concerning cars moving to them.

Thus, at each PICL yard, there will be at least one punched card for each car in the yard. A PICL file will be established at these yards with cards filed in sequence as the actual freight cars are located on the tracks in the yard. Initially, the PICL file will pertain to yard tracks, but as the system becomes fully operational, industry switch runs will be included.

As cars are moved, say from a yard track to an industry siding, the PICL file will be updated.

- **Accuracy is important.** To assure that yard clerks and other yard personnel (such as telegraphers) prepare the car data as accurately as possible, IC is providing special training. A remodeled passenger car ("Main 19") has been equipped with IBM 1050 and Teletype units as well as other IBM

KEEPING TABS on freight cars via punch cards are (l. to r.) Richard P. de Camara, Illinois Central vice president—information and controls systems, and W.H. Thompson, the road's director of data control.

equipment that will be used at PICL yards. This special car has been and is being spotted at PICL yards for training of yard personnel. A two-man instruction team is used on the car. The two men instruct the yard personnel on the use of the new equipment.

Some of the equipment, particularly the IBM 1050 units, will be new to the yard clerks. However, these units have electric typewriters as the keyboard unit. Clerks are required to type at least 30 words per minute. For smaller PICL yards, under 400 cars per day, in and out, teletypewriter units will be used for data input to the computer.

In addition to training in the special Main 19 car, teams of five or six men will visit PICL yards to implement the program.

- **Equipment already on-line.** Even as personnel training has been mounting, IC is installing IBM equipment at PICL yards. A task force under W. H. Thompson, director of data control, has been supervising this phase of the PICL program, as well as the training of yard personnel.

Target date for placing PICL yards in service is August 7 of this year.

IC will have 30 major terminals using IBM 1050 units for data input. These will be PICL yards. An additional 18 PICL terminals will use IBM 1912 or similar input devices.

- **PICL payoff is big.** The PICL system is expected to improve terminal operations, provide service evaluation data, and reduce car detention. By knowing where cars are in a more exact sense (empty in yard or empty but waiting for load at shipper's dock), IC anticipates much better utilization of its freight car fleet. ∎

We're taking the wraps off our new symbol by putting it on 52 million dollars worth of new freight cars
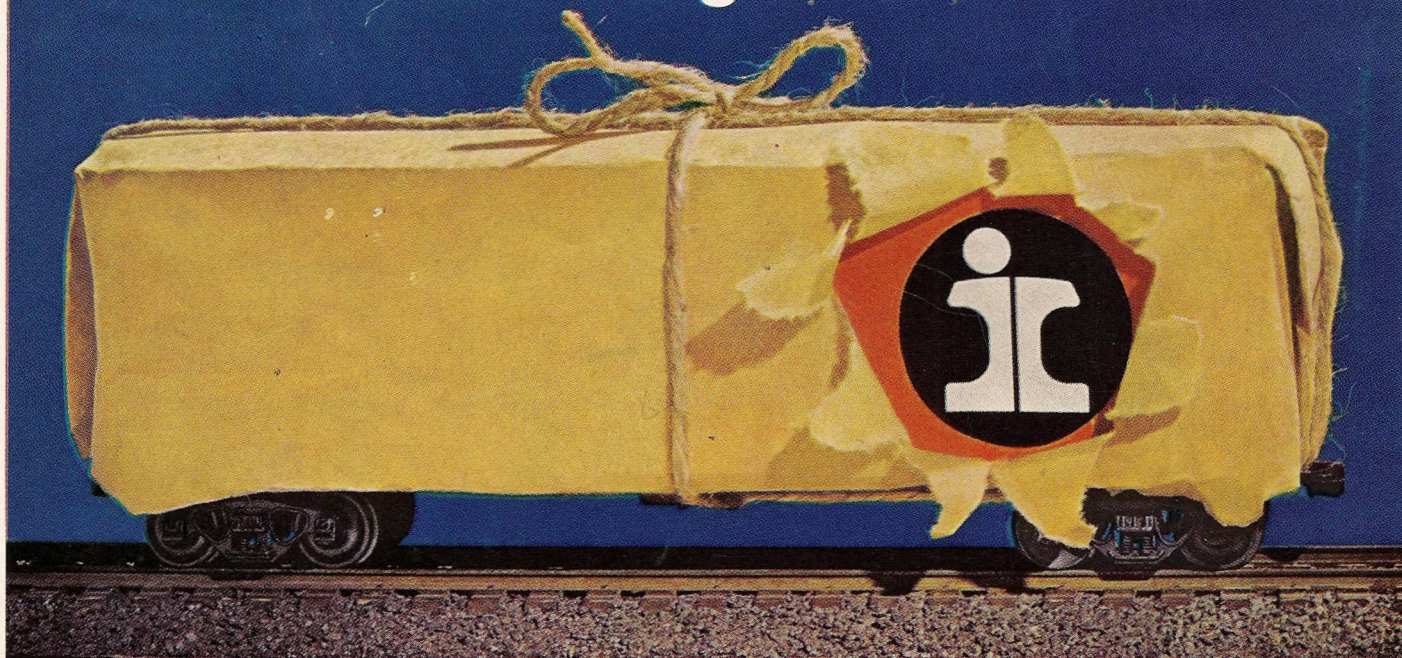
What better way to show our friends and shippers our new corporate symbol than to put it on the biggest package of new freight cars ever delivered to this railroad! The symbol appears on 16 types of new cars, including jumbo cars, fast-loading cars, damage-free cars, specialty cars.

Altogether, we're spending $87 million this year for improvements that will benefit our customers. Example: our new communications network and computer information system that will help us move our freight cars and locomotives to the right places at the right time for our shippers.

What can our new symbol mean to you? Ask your nearest Illinois Central sales representative, or write or call: Howard Powell, Traffic Vice President, 135 East Eleventh Place, Chicago, Illinois 60605. Phone (312) 922-4811.

Main Line of Mid-America **ILLINOIS CENTRAL**

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