SPECTRUM

DECEMBER 1985 A SPECIAL EDITION
COMMEMORATING THE TWENTIETH ANNIVERSARY OF GENERAL ELECTRIC INFORMATION SERVICES COMPANY

20 YEARS OF EXCELLENCE

Contents

Acknowledgments

Many people contributed to creating this issue's commemoration of GE Information Services' twentieth anniversary. For its planning and execution, credit belongs to the individual and team efforts of Robin Carlson, Kathy Stevenson, Nancy Jamieson, Jackie Holtzman, Bill Backer, and Jim Doyle. The contributions of Dex Nilsson, John Watson, and Jim Rossini also deserve special recognition.

The dozens of individuals who gave so freely of their time for interviews and reviews are too numerous to list here. But to each of them, and particularly to Warner Sinback, we extend our sincerest appreciation. Finally, we thank Linda Handmaker for her extensive research and engaging presentation of the early history of General Electric Information Services.

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INFORMATION SERVICES
General Electric Information Services Company

SPECTRUM is published for employees by Employees Communication, General Electric Information Services Company, 401 N. Washington St. 01B, Rockville, Maryland 20850, U.S.A. For distribution changes QUIK-COMM: OLOS, publication number 0308.10.

GENERAL ELECTRIC
INFORMATION SERVICES
U.S.A.

General Electric Information Services Company

401 N. Washington Street, Rockville, Maryland 20850 (301) 340-4000

WALTER W. WILLIAMS
PRESIDENT

December, 1985

Dear Fellow Employees:

As you read this special anniversary issue of *SPECTRUM* which highlights "Twenty Years of Excellence" at GE Information Services, I hope you'll be impressed, as I was, by the range and caliber of our accomplishments as a company. Moreover—and perhaps more importantly—as I look to our past, I see the prologue to our future.

The history of GE Information Services is the story of creative and far-sighted people who encountered challenge after challenge and responded with solutions that frequently far exceeded the then-current state of the art. As we develop entrepreneurial strategies for the next 20 years, we are emphasizing our strengths, which stem from our roots:

- Our goals remain essentially the same: be number one or two in markets we pursue; maintain growth and profitability; produce high-quality products and services; and provide the top standard of dependable client services.
- We will modify products and services to take advantage of our strengths and to target the most profitable market niches. Just as we once anticipated future markets by moving from computer time-sharing to across-the-board services and products to information sharing, so have we recently moved to position ourselves to be the leader in markets in network-based services, EDI, consulting, software, and integrated communications.
- We will design our products and services to match end-user needs, essentially responding to the market's demands by specializing in inter-company and other applications in our areas of particular expertise. From our longstanding accounts, we are now choosing to focus on specialized services for industries such as banking, health care, international trade, office communications, claims and automated clearinghouse functions, payment services, and value-added services relying on application/industry expertise and application software.
- We will employ our worldwide networks and personnel to provide high-quality products and services. Two of our great strengths are GE Information Services' outstanding reputation for quality and reliability and our established international operations. Both constitute a basis for our projected success in narrowly focused markets and in potentially explosive international markets.

Where others have seen crises or impossible obstacles, GE Information Services historically has seen opportunities and seized them. As you read about—and take pride in—our last 20 Years of Excellence, I hope you'll also be thinking about ways to sustain and surpass our accomplishments in the 20 years to come.

Walt

Walter W. Williams
President

Chronicle of the Early Years

Ladies and gentlemen, I'd like to do a song now, that tells a little story, that makes a lot of sense . . . "Awopbopaloopbop — Alopbopalamboon! Tutti frutti! All rootie! Tutti frutti! All rootie!"

—Elvis Presley, 1956*

World War II and the Korean War had ended. Peace and the "baby boom" had settled in. It was 1956, a time of crew cuts and hula-hoops, 3-D movies and, yes, Elvis Presley. Barbeques in suburbia were becoming our goals; television our fascination. Sputnik 1 had reached outer space, and UFOs were appearing in the night. Everybody seemed to like Ike, especially Vice President Nixon. Polio was being eradicated, and cables had provided the first transatlantic telephone service. Building of the great interstate highway system had just commenced.

Corporations were dominating the economic scene, and technological developments were changing the face of American industry. A new industrial revolution had been launched in 1954 with the sale of the first commercial UNIVAC computer. And in 1956, in the arid land of Phoenix, Arizona, the General Electric Company pioneered in that revolution, forming a Computer Department to produce the ERMA system under contract with the Bank of America. That system led to full automation of the banking industry with its perfection of the Magnetic Ink Character Recognition method for reading coded characters along the lower edge of bank checks.

Shortly after its formation, the Computer Department set up a Scientific Applications Section to train personnel and provide programming support for hardware customers. Looking for a means to produce revenue, the section began selling various computing services, and between 1957 and 1959, it won three major contracts to provide computer-related personnel services. The contracts were with NASA in Huntsville, Alabama; with the United States Air Force in Falls Church, Virginia; and with Bell Laboratories in New Jersey, New Mexico, and on Kwajalein Island in the Pacific.

During this time, too, the component's name was changed to simply the Applications Section. But hardware sales remained the primary thrust of the department, and by 1962 its main product was the GE-225, a general purpose computer designed to do scientific and engineering calculations. That year, the Applications Section opened two computer centers in Chicago and Phoenix. Again the centers' major responsibilities were to support hardware sales: they conducted demonstrations, trained customers, and provided customer debugging and back-up services.

Computer sales boomed during the next three years, and the department opened additional centers in Bethesda, Schenectady, Dallas, New York, and Cleveland; in Richmond, California; and Wichita Falls, Texas. These were the early batch-processing days when people lined up to run their punched-card jobs or check processing on a computer. For those who didn't have in-house computers, the centers provided walk-in batch-processing services. The revolution was really underway, and the centers acquired more and more external business by offering programming services, package applications, and machine time. Little could anyone know at the time that these centers would be so essential to General Electric's success in the time-sharing business.

Genesis of an Industry
1964-1966

In the early and middle sixties we were emerging from our suburban cocoons. Elvis had lost some of his spotlight to four mop-topped Beatles from Liverpool. A preacher named Martin Luther King, Jr., had marched for blacks' civil rights in Selma, Alabama. A Catholic had defeated Nixon for the Presidency, then promised we'd beat the sputniks and be on the moon by decade's end. He didn't live to see it, and we sobbed.

Collegians were cramming for the Peace Corps instead of into Volkswagens and phone booths. And corporations were increasingly supporting the research and development taking place at universities and colleges. One such cooperative venture occurred between General Electric and Dartmouth College in Hanover, New Hampshire.

Two Dartmouth mathematics professors, John Kemeny and his assistant Thomas Kurtz, had been experimenting since 1959 with ways to get students to use computers more directly in their college work. Using LGP-30 computers, their undergraduate students were proving themselves quite adept at composing major programs and software systems.

The LGP-30, however, could accommodate only one student at a time on its

*The song itself was written by Little Richard.

console. And Kemeny soon realized that if he was to succeed in making computers an essential part of *all* students' education, two things would be needed—a less formidable programming language and some sort of "time-sharing" system. He needed a way to serve a multitude of students virtually simultaneously.

Conceiving the Idea

To the first point, Kemeny gathered a team of about six undergraduate students, and in an impressively short time, they invented a new programming language, the Beginners All-Purpose Symbolic Instruction Code—BASIC. But even though the language was successful, its mode of operation was still far from what Kemeny wanted.

About that time, in 1963, General Electric's Computer Department developed a new message switching system that could handle as many as 40 teletypewriters at once. Called the Datanet-30, or DN-30, the system was installed for the Chrysler Corporation in the eye of considerable publicity. It captured Professor Kemeny's fascination and inspired him to try a similar real-time system at Dartmouth: he would marry a GE-225 computer to a DN-30. The GE-225 would perform the actual computations, but it would operate as a "slave" to the DN-30 "master." The master would allocate the services of the slave among its several simultaneous users.

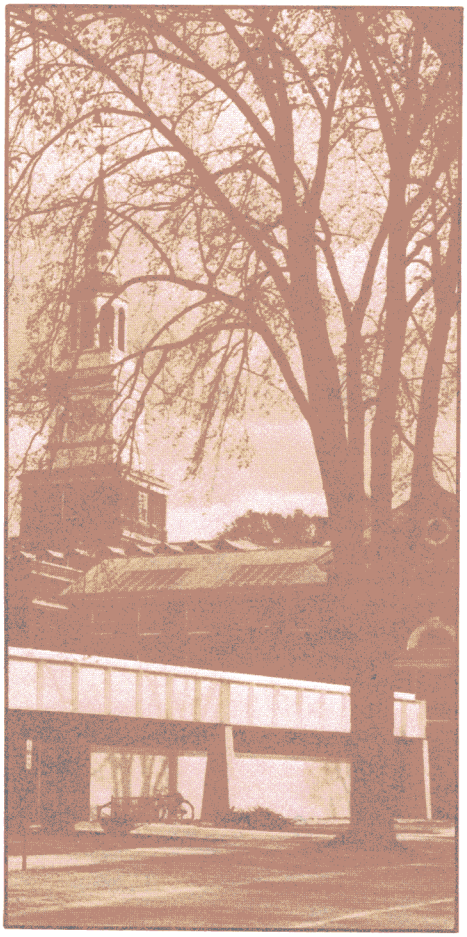
Convinced of Kemeny's insight, Dartmouth then obtained funding from the National Science Foundation, and in spring 1964, General Electric loaned the college one each of the GE-225 and DN-30 computers. Dartmouth students, under the direction of Professors Kemeny and Kurtz, began programming the system, and GE furnished a resident liaison to answer technical questions and observe.

On May 1, 1964, at four o'clock in the morning, the Dartmouth time-sharing system was born. By the following October, Dartmouth had coupled the DN-30 with the GE-235—a faster version of the 225—and had developed its software sufficiently to launch a freshman training program and to open the system for use by all interested students.

Founding a Business

Meanwhile, during Dartmouth's May-to-October development period, General Electric decided to gain its own knowledge of time-sharing by experimenting with a duplicate system in Phoenix. The Computer Department and the college worked closely through this time, keeping their two systems as similar as possible. And by October, with software improvements incorporated, the Phoenix system, too, was capable of serving multiple users. Later that month, the GE–Dartmouth time-sharing system was publicly demonstrated at the Fall Joint Computer Conference in San Francisco.

Eventually the system was opened to user's outside the Arizona plant. General Electric employees from across the country—including corporate headquarters—obtained teletypes and accessed the system through DIAL-COMM phone connections. Outside the company, several people were offered access to the system through long-distance phone calls. Soon more than 100 trial users nationwide were getting free computational service. GE, in turn, was getting valuable user feedback and the experience of operating the system under load.



Dartmouth College, home of the time-sharing concept.

Late in 1964, the Applications Section was given full profit and loss responsibilities. Its name was changed to the Information Processing Business (IPB); the computer centers became Information Processing Centers (IPCs); and Warner Sinback was appointed the IPB manager. The component was still, however, a part of the Computer Department, whose prime interest in time-sharing was its potential to support the sale of profitable *hardware* contracts.

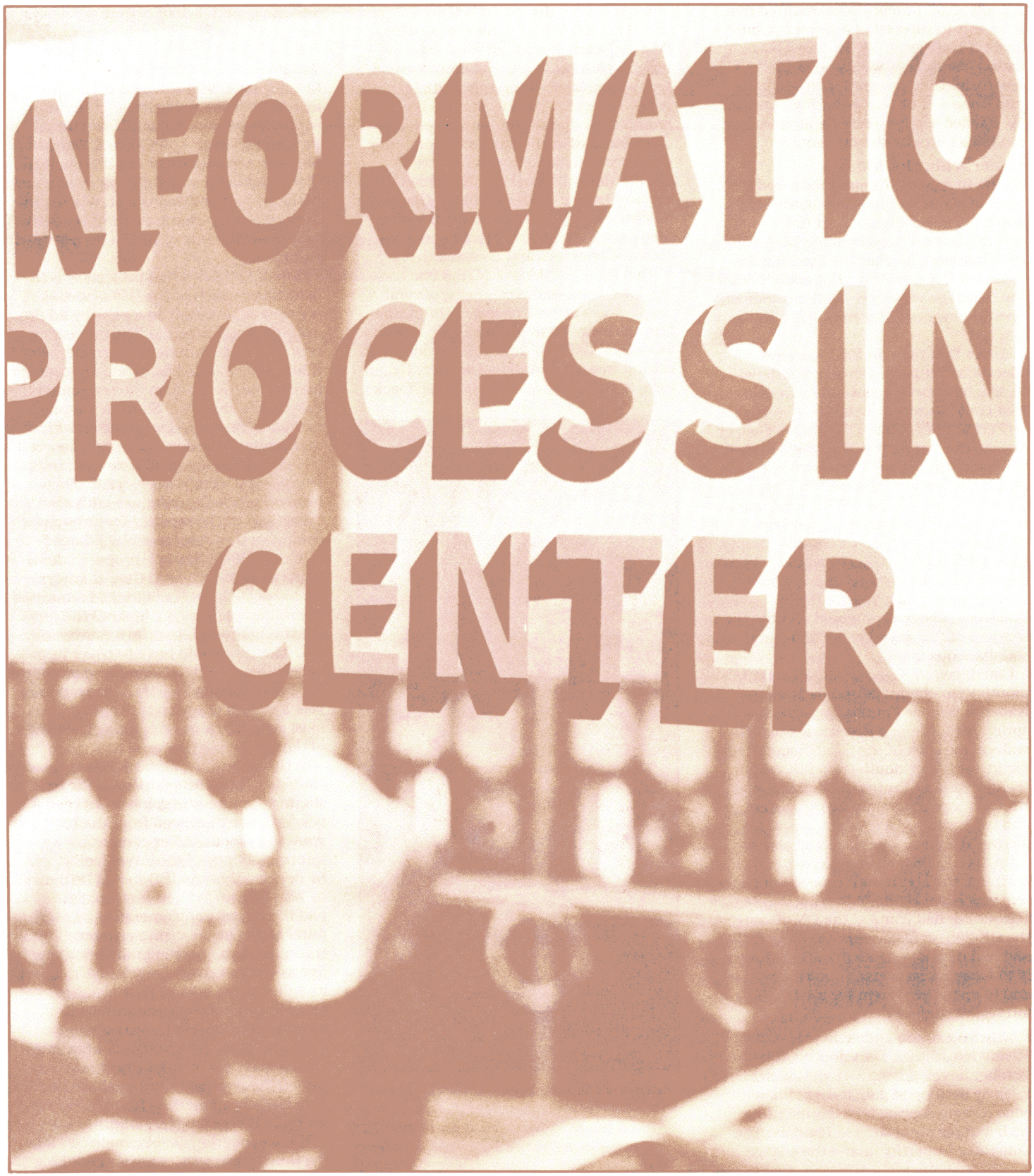
One of Sinback's first projects was to determine which of the IPB's existing services or potential new ones could produce the most revenue. The processing centers and government contracts were filling out his initial list when an engineer invited him downstairs "to see something called time-sharing." Sinback was immediately impressed with the powerful mechanism and soon was convinced that it had great commercial potential. But it was going to cost money—$208,000 in fact—to refine the software with such "niceties" as the security features and compilers that customers would need.

In early 1965, Sinback proposed developing a commercialized time-sharing service to his Division Manager and requested the funds for doing so. In April the project was approved, but the money was not. The IPB would have to cover its expenditures for time-sharing by generating $208,000 in unbudgeted new revenue by year's end—a criterion that would keep most projects from ever seeing the light of day.

In the meantime, Sinback had concluded early in the year that if the time-sharing venture was going to succeed it needed to be distanced from the hardware sales focus. After conducting an informal, "back of the envelope" study, he decided that the IPB should be moved to Washington, D.C. Its metropolitan area had the largest conglomeration of computer talent in the country. In terms of transportation, it was rapidly becoming just as convenient as New York City. And its cultural and educational facilities provided an excellent environment for the caliber of people he was seeking.

At first, most people thought Sinback's choice was "crazy." But eventually he gained the necessary approval, and in July 1965, headquarters for the IPB was set up in Bethesda, Maryland.

The engineering development work for the time-sharing system was still taking


NFORMATIO
PROCESSIN
CENTER

place in Phoenix, however. By August, security features were added to the software, and a customer invoicing system was developed. Contracts were devised, prices approved, customer manuals and sales literature written.

Finally, during Labor Day weekend 1965, the IPB installed a GE-235/DN-30 system (later known as the GE-265) in the Phoenix Information Processing Center. And the very next Tuesday, General Electric became the first company to offer commercial time-sharing services. Within four weeks the Phoenix system was overloaded with customers, many of them the early trial users. A second system was installed at the New York IPC in November, and within four more weeks it, too, was filled with customers.

Meanwhile, the project had attracted a great deal of attention in GE headquarters, and President and Chief Executive Officer Fred Borch had ordered a feasibility study of the information handling business arena. One excerpt from the study described the bold threshold that GE seemed historically suited to cross.

> Information Science and Technology are in about the same relative position today as were the Physical Sciences and Electric Power Technology . . . half a century ago. For the next several decades, a small group of hard working, creative, application oriented Information Scientists and Engineers will have the opportunity to do things that will lead to the same kind of leadership and profitable business ventures as did the Physical Scientists in the early days of General Electric.

As a result of this study, the funds were approved to launch a full-scale expansion of the commercial time-sharing service. And on January 1, 1966, the IPB finally separated from the Computer Department, becoming a separate company component, the Information Processing Centers Business (IPCB).

Before the era of supercenters, Time-Sharing Service in the United States was provided from Information Processing Centers located in various cities across the country.

Charting the Course

1966-1972

We were a rattled people as the last half of the sixties became the seventies. Draft-age collegians were crying out against a war we couldn't win; a generation of hippies was looking for its identity; and angry young blacks were rioting in the streets of Los Angeles, Cleveland, and Washington, D.C. Martin Luther King had been assassinated for his dreams; Bobby Kennedy for being a brother. President Johnson would not seek reelection, and Nixon made his comeback, promising we'd be out of Vietnam soon.

An official study finally decreed that UFOs were not from other planets. But humans were walking on the surface of the moon, and a new breed of communications satellites had been sent into orbit. Fervor pervaded the technological communities where the computer was king, and nowhere was the spirit more intense than at the IPCB. An entire new industry had been discovered, and people worked around the clock with unparalleled synergism to define the shape it would take.

One by one, the original IPCs were converted from batch to time-sharing equipment, giving General Electric an unmistakable head start in the industry race. Indeed, so successful were the initial conversions that on September 1, 1966—eight months after separating from the Computer Department—the IPCB was elevated to the Information Services Department (ISD), headed by Paul Leadley.

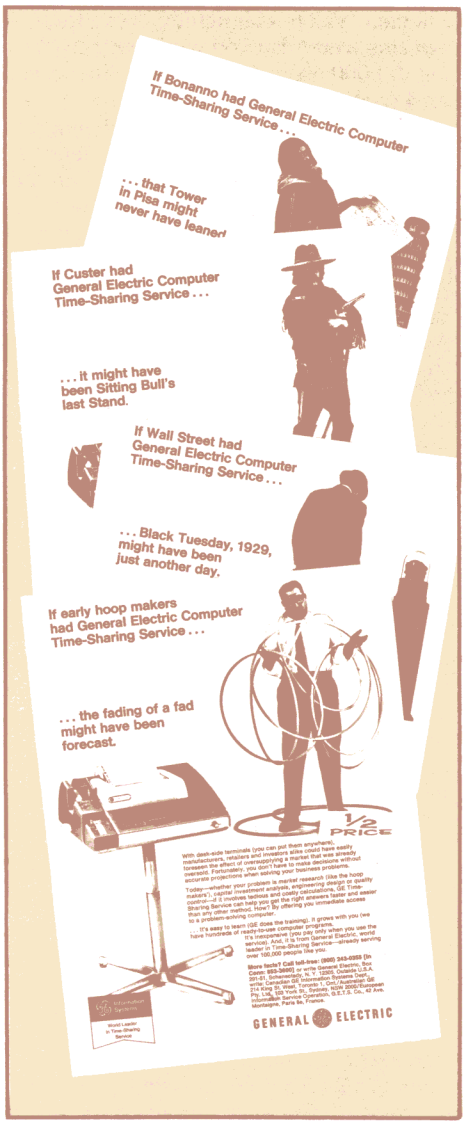
The growth accelerated, and between 1966 and 1968, time-sharing systems were installed at a rate of nearly one per month, and more than a dozen additional centers were opened in the U.S., including ones in Los Angeles; Teaneck, New Jersey; and Brook Park, Ohio. By the end of 1967, local time-sharing service had been introduced to Toronto and Montreal through a licensing agreement with Canadian General Electric, Ltd., and to London through a similar agreement with De La Rue Bull. In 1968, Bill Eaton was named General Manager of the Information Services Department, and Paul Leadley was charged with building the business internationally. Leadley then negotiated other distribution agreements that led to the opening of ten more centers in Europe and Australia that year. By the end of 1968, just three years after the Phoenix system's launching, more than 50 systems were installed worldwide, serving 100,000 users in 85 metropolitan areas on 4 continents.

GE Time-Sharing Service was being sold during this period as a powerful, dependable, easy-to-use tool, available when the customer wanted it and at a realistic price. No longer did people have to rely on outside vendors or an in-house data processor for access to the capabilities of a computer. A simple local phone call placed the nearest GE-265 at their fingertips. Most of all, however, time-sharing provided a quantum leap in a user's productivity. At GE's Small Aircraft Engine Department, for example, a standard analysis problem that once took a team of engineers 25 hours to solve now took only 15 minutes.

Used primarily for problem solving by engineers and scientists, the service's early customers included Hughes Aircraft, Shell Development, Chrysler and General Motors, Boeing Aircraft, Bechtel Corporation, and AT&T. Ironically, during the days before IPCB became a department, few personnel understood the requirements of this engineering and scientific market. Coming mostly from the banking and service activities of the Computer Department, they were more familiar instead with business types of applications.

Still under the organization's domain, however, were the government contracts with NASA, the Air Force, and Bell Laboratories. As each of these ended, beginning with the NASA contract in 1966, their designated personnel were reassigned throughout the time-sharing operations. And with them came a vast influx of scientific and engineering expertise—just exactly what was needed to support the new product in the marketplace.

Additionally, during the Computer Department's early explorations of time-sharing, another GE component also had been investigating the concept. The Missile and Space Division (MSD) in Valley Forge, Pennsylvania, also had acquired Dartmouth's software in 1964. MSD then installed FORTRAN in place of BASIC to support its own needs, and leading the implementation was John Watson. Like the Information Processing Business, MSD soon recognized the potential of time-sharing and established another commer-



A late-sixties advertising campaign cleverly promoted increased productivity for Time-Sharing Service users—with a touch of light-hearted name-dropping.

cial service, based on the GE-265, called the Desk Side Computer System (DSCS).

This dual entry into commercial time-sharing was consolidated in January 1967 with the transfer of more than 200 customers and three of MSD's 265 computers to the Information Services Department. Bob Hench and John Watson then led the joint development at Syracuse and Valley Forge of the second-generation DSCS II system, which used the GE-605 computer. Later, this system also was transferred to ISD, and the department offered the DSCS II service on two GE-605s, calling it MARK DELTA.

MARK II: The New and Improved Product

Meanwhile, for all the successes of the GE-265 time-sharing system, Warner Sinback had realized early in 1966 that the 200 series of computers was becoming obsolete. Supplanting it were GE's entirely new 400 and 600 series. Sinback was certain the 600 line would be the best next step. But developing a new time-sharing service on it would require nearly $2 million, and he knew no way to justify the entire expense.

Once again, Dartmouth College entered the picture. The General Electric Company was planning to donate a new 600 system to Dartmouth, but the project needed a "sort of patron saint" to carry it through. With images of another joint effort in mind, Sinback readily volunteered. He then suggested to the college that it select a small team of teachers and students to work with a special GE team on developing a new time-sharing offering for the 600 computers. Dartmouth agreed, and the chosen GE team moved to New Hampshire. Two other groups—in Phoenix and Falls Church—also worked on the new system's development. And the common goal of all was to have enough capacity to handle 200 simultaneous users; surely, they figured, that would be more than adequate for serving the country's entire remote processing needs.

Slightly more than a year later, in June 1967, the new time-sharing system was made available for free trial use by regular time-sharing customers. Called MOD EC for its expanded computing, control, capability, and core, the service was released commercially in the fall to customers in Philadelphia, Boston, Schenectady, and the New York area. Cleveland service was added soon thereafter. MOD EC's introduction was to be at a gradual pace; later its name would be changed, and a national publicity campaign would launch the new product. Thus, in April 1968, the greater productivity of the new GE-635 time-sharing service was announced to the world: its name was MARK II. Almost immediately, the original 265-based time-sharing service became known as MARK I.

MARK II had a more powerful BASIC language. It had program storage in object code, password control, more memory for larger problems, and faster problem solution. It also had a few problems of its own. The GE-635 had been built around the very latest hardware technology. But making MARK II the superior incarnation of MARK I that it was destined to be required significant changes in software. That technological challenge was compounded by the continuing improvements being made to MARK I; in other words, MARK II was aiming at a moving target.

Getting MARK II's hardware and software to run together in a reliable way was no small feat. Repeatedly the system would fail. Yet despite these hurdles, ISD's situation was not uncommon. Nearly every serious competitor at the time was attempting to introduce a more powerful, second-generation system, and every one of them faced troubles too. That summer, ISD hired a project manager named Ray Marshall from GE's Syracuse facility—the same company component that manufactured the 605 computers previously used by Hench at MSD. Under Marshall's direction at Brook Park, MARK II was brought to its full strength. And by October 1968, MARK II systems were successfully operating from the IPCs in Brook Park and Teaneck, and in a brand new facility in Los Angeles.

During 1968, too, ISD's marketing and sales began taking a broader approach to customers by initiating a National Agreement campaign. The objective was to get large corporations to sign an agreement approving the use of GE's time-sharing services by their branch offices. Representatives still had to sell the idea to each office, and each office could still access only its local system. But these National Agreement customers—including Arthur Anderson & Company, Ralston Purina, Allied Chemical, CONOCO, and others—would soon provide a major impetus for developing coast-to-coast access to one shared system.

Meanwhile, GE's time-sharing capabilities now comprised two separate services—MARK I and MARK II. In terms of sales, MARK I was recommended for file building and for running small programs requiring minimal computations. By and large, MARK I's initial customers were a loyal lot. They had "grown up" with the system, developed their programs on it, and could manipulate it with the ease of a skilled potter's fingers. Even though they could do the same work on MARK II for roughly half—and in some cases one-fourth—the cost, doing so required rethinking, rewriting, and re-implementing their now-familiar programs. So they tended to resist converting. Indeed, in the United States, it would be 1973 before the last program ran on the "obsolete" GE-265 system.

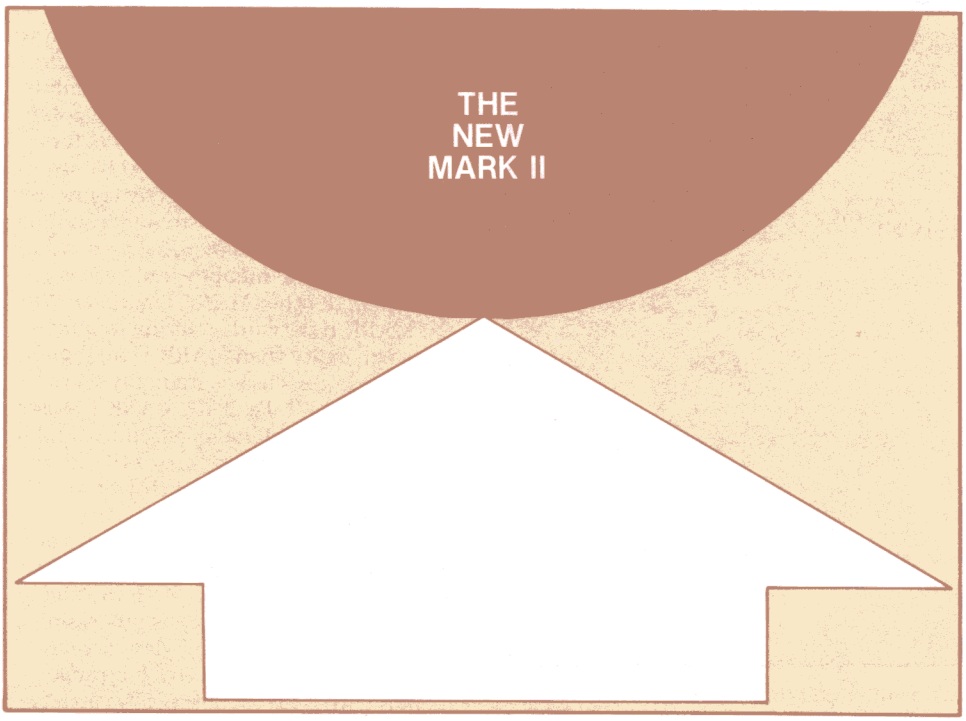
MARK II, on the other hand, was a

blockbuster. In addition to building files, it manipulated and stored them; instead of small programs with minimal computation, it ran large programs with lots of computation; and instead of 40 users at a sluggish pace, it handled 100 users at top speed. It provided what became known as "economy of scale"— the ability to do more, for more, and at a lower cost.

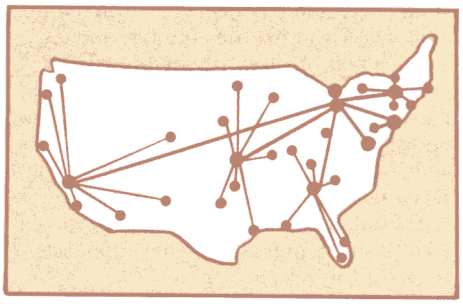
Operationally, MARK I had been designed to function as discrete systems. They were located in the IPCs of major cities, and separate local phone lines ran from each customer to the nearest system. As communications technology evolved, so did the ability to provide local phone calls to ever more distant areas. Consequently, some of the smaller IPCs became unnecessary: the New York center was then merged into the larger Teaneck facility, and the Cleveland center was merged into Brook Park. This coalescing led to the presence of three major facilities and 17 IPCs within the United States.

By contrast, the design of MARK II included a new twist to the original master-slave concept that significantly expanded the system's reach. The MARK II configuration used four Datanet-30s, one GE-635, and the communications technology of concentrator lines. Two of the DN-30s were co-located with the 635 computer, but the other two could be located anywhere; the concentrator lines then paired each remote DN-30 to a local one. This unique configuration meant it was no longer necessary to set up an entire system in a city, only a DN-30. Neither was it necessary to run individual phone lines all the way between each customer and a system location. Instead, lines needed to link only to the DN-30 serving that area. The DN-30 would then bundle customers' inputs and send them at high speed across the concentrator line to the partner DN-30, which would unbundle and forward the data to the computer. Outputs would be returned to customers following the same path in reverse.

Because of this larger capacity and reach, the MARK II systems were located in only the three big facilities, where they provided a regional-type service to the United States' East and West Coasts and to the Midwest. New customers were quick to grab for the built-in strengths and economy of MARK II. For National Agreement customers, many of their offices within certain regions now could share common data on a single system. But for any region's offices to use another region's data, the information had to be stored on each individual system. With their appetites whetted, it was only inevitable that these customers soon would want more.



Logo for the new and improved MARK II.



With Network I, remote concentrators located in Los Angeles, Kansas City, Atlanta, Cleveland, Teaneck, Schenectady, and Washington linked Brook Park's central computer complex to remote buffer units (multiplexers) in major metropolitan cities, from Seattle and San Diego to Boston and Miami.

The Network: Closing the Gap

By January 1, 1969, the Information Services Department had made such significant strides that it was named the Information Services Business Division (ISBD), with Paul Sage as general manager. At the time, the technical operations of the MARK I and II services were organized under the Information Networks Department (IND), headed by Dr. George Feeney. One of the initial DIAL-COMM users of the experimental Phoenix system, Feeney had been instantly possessed by the potentials of time-sharing. He often participated from his office at GE headquarters in the system's early developments. When he joined the Information Services Department in 1968, he transformed his experiences as a user into a knack for anticipating customers' needs—including their desire for one shared system that all their offices could access.

By now IND engineers had developed the successors to the Datanet-30 in MARK II's configuration. They had modified the hardware of a GE-PAC 4020 process computer and of a Honeywell 416 minicomputer, then developed the software to make them perform, respectively, as central and remote concentrators. Like the local DN-30, the 4020 tied into the GE-635 computer and directed incoming and outgoing data. But unlike its predecessor, the 4020 had no local service connections. All its links were to remote concentrators, and of these, it could be tied to as many as eight—located anywhere.

With this configuration in place, the next step was almost inevitable, and Feeney embarked on an experiment, which he called Network I. A single MARK II system, called MARK II-AX, was set aside at Brook Park. It then was

linked to remote concentrators in eight major cities across the country, and its service was offered to those customers who had been clamoring for common files. The initial testing of Network I was so successful that by June 1969, $34 million had been appropriated to establish a full nationwide computing network. By early fall, local-call service was available to customers in nearly 40 metropolitan areas of the United States.

Of course, some customers had offices in Europe, too. So in fall 1969, work began on an experimental COMSAT satellite link to a remote concentrator in London. In February 1970, the link passed its acceptance test at Brook Park, running for two weeks with an availability of at least 90 percent. It now was possible to have a genuine worldwide system, and on September 24, 1970, the Brook Park-based GE Information Services Network was officially announced to the public.

The development of a computing network that could reach across oceans and continents was, without overstatement, a monumental technological breakthrough. Yet part of what made these early achievements so remarkable was the period in which they occurred. It was a hard time.

Between 1965 and 1969, the time-sharing industry had grown like a boom town around a gold mine. Computer hardware companies, eager to sell their equipment, had initiated a variety of package deals that made it relatively simple for entrepreneurs to obtain financial backing and set up their own time-sharing service. By mid-1969, the market had become flooded with time-sharing capacity, and the growth rate, once predicted to spiral ever upward, suddenly dropped staggeringly. Attempting to stay alive, many of the smaller businesses began fighting price wars, and almost overnight the bottom fell out of the industry's price structure. Headlines were filled with the mergers, buyouts, and failures of time-sharing companies and with the news of a major shakeout in the industry. Most of the new companies never showed a profit before their demise, and even the profits of the leader, General Electric, began to slip. By the end of 1969, ISBD had lost millions of dollars.

Early in 1970, it fell to a new general manager, Arthur Peltosalo, to save ISBD. Always refusing to sacrifice any active development on which the future of the business depended, Peltosalo raised prices, cut costs, and took as many tax write-offs as possible. Yet when all was finally calculated, he was left with no choice but to implement the largest reduction in force in the business's history—then and now.

Concurrent with GE's development of the network, headlines in the computer world were filled with news of a shakeout in the time-sharing industry.

It was reported that time-sharing had passed through its first stage of growth. And while not without pain, ISBD had survived. The early Computer Department, on the other hand, had not. In 1970, deciding it was unlikely to achieve a top position in the hardware market, General Electric sold its computer manufacturing operations to Honeywell, Inc. Because of its market position and potential, ISBD was not seriously considered for inclusion in the sale. Instead, Honeywell became the official distributor for all GE information services in those countries where GE's computer manufacturing subsidiaries had been the distributors—primarily Europe and Australia. Possibly the network innovations had influenced the decision not to sell ISBD; most assuredly they had paved the transition to a new era in computing technology.

The process of developing *full* network capabilities spanned the years from 1970 to 1972. During this time, the Network I configuration was added to the Los Angeles and Teaneck facilities, which had now been dubbed "supercenters." Yet for all their individual reach, the supercenters' systems still could not talk to each other. Consequently, the next evolution in the network was the development of a switching technology that interconnected the three supercenters and allowed traffic to be routed from one computer to another, depending on the location of a customer's files.

During this time, also, the MARK I systems were progressively integrated into the network, and this led to the 17 Information Processing Centers being consolidated into the three early supercenters. MARK I access, however, could be obtained only through its directly connected central concentrator. Customers could use a network phone number to access MARK I service, but the number could not connect them to other MARK I systems. With the MARK II network offering so much more capability than MARK I could provide, the latter's usage gradually began to diminish in 1971. By 1973, MARK I's costs were far outweighing its revenues, and it finally became necessary to notify its last loyal users in the U.S. that the service was being discontinued.

Throughout this period in the network's development, the concept of a "super reliable" service prevailed. With the aim of giving customers continuous processing power 24 hours a day, 365 days a year, work began on a back-to-back arrangement of two 635 computers. The arrange-

ment would enable one processor to assume the work of the other in the event of a temporary failure. Furthermore, an Uninterruptible Power System (UPS) was installed at Brook Park. Constructed around massive batteries and diesel generators, the UPS isolated the network system from any power fluctuations and outages that could lead to equipment failure. And during this time, too, the tradition of daily system performance checks—Morning Call—was initiated, headed by Ray Marshall.

By the end of 1972, ISBD was again profitable. The General Electric information processing network involved 75 interconnected computers; more than 100,000 miles of communication lines; satellite and cable connections; and a diverse assortment of communications devices. The enhanced economy of scale provided by the network had now led to the merger of all the Los Angeles equipment into the Brook Park facility. In 1973, Teaneck's systems would be similarly merged, and the entire international network would be linked solely to the Brook Park supercenter. The service would continue being generated from this single site until the 1974 establishment of another supercenter in Rockville, Maryland.

Finally, of the many individuals who had worked and would continue to work on the network's technology, its overall software and architectural design can fairly be credited to Chris Brook. From the remote and central concentrators to the switching technology and more, Brook designed a network whose basic configuration still exists, because it also was designed to evolve with future technology. The future, meanwhile, was already waiting in the wings, and it was being billed as the "most significant advancement in variable-cost computing since time-sharing itself."

Era of Expanded Capability
1972-1977

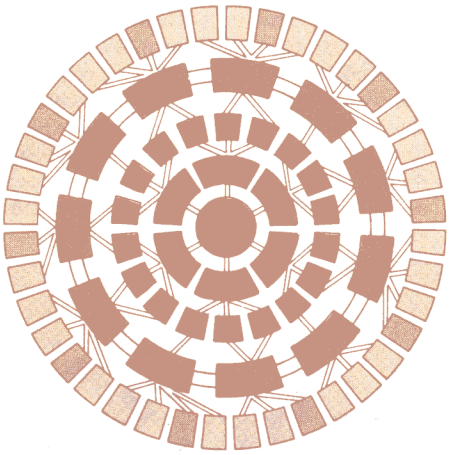
The vocabulary of our lives stretched the mind to near overload in the early and middle seventies. *Roots* grew from our televisions; acid rain poured from the skies; nuclear plants powered addictive video games. Only the most attentive of us could remember what OPEC stood for, but we all paid the price of its policies and carried the weight of a consequent recession. We parleyed detente with Russia, while we played ping-pong in China. Dodgers got amnesty; presidents got pardons, and American women were becoming priests and soldiers. Olympic athletes were murdered; airplanes were hijacked; the Beatles even disbanded.

The discerning mind had to think globally now. Communications technology had dropped the world in our laps, and Concordes crossed oceans in the time we spent buying groceries. As industrialism ebbed, service companies rode the crest of a sweeping new wave, and like so much else in our lives, nothing had the time to stand still.

MARK III®: The Full-Service System

While time-sharing and the network dominated developments during the sixties, ISBD's interest in batch-processing services—once a stronghold of the early computer centers—fell by the wayside. But the total computing power of all the time-sharing companies combined was only a small fraction of the power that existed in the world's in-house and service-bureau batch processing systems. Thus, in the early seventies, ISBD decided to increase its market scope by extending into the batch processing world.

The first approach was to use only the GCOS 3D system, a product of GE's early Computer Department, which by now was under Honeywell's ownership. Featuring batch, remote-batch, and time-sharing capabilities, the system was advanced in concept, but in reality it suffered from trying to be all things to all people. Its time-sharing capabilities, for example, were not as good as those of MARK II, where everything was geared to providing optimal response to the user. Yet the MARK II system wasn't designed to run big, routine data processing jobs. Payroll, accounts receivable, and similar



A well-known logo of the 1972–77 period, this mosaic depicts the configuration of MARK III. The outer ring of blocks represents remote concentrators that received data from up to 96 individual terminals on 96 telephone lines; they combined or concentrated the data for transmission on a pair of telephone lines. The lighter colored blocks represent concentrators used for transmission of high-speed data.

Each remote concentrator was linked to a GEPAC-4020 central concentrator, which further concentrated data. It also determined on which Foreground system a user's data was to be processed, and it directed the data to that system.

The third ring depicts Foreground systems, which then consisted of Honeywell 635s or 6000s. These systems performed on-line computations and served as the user's link to the Background systems.

Background systems, the next ring, performed batch processing and remote job entry work. And the central circle represents "future" massive storage devices. The essence of this configuration still exists today.

systems consumed a great deal of processing time, and this would have interfered with the response time for MARK II's interactive capabilities. Somehow, a connection was needed between the interactive capabilities of MARK II and the large remote batch capabilities of GCOS.

Thus, the second approach was to have MARK II act as a user-friendly front-end processor to the remote batch world. And in 1971, the project to develop a Foreground Background Interface (FBI) began. As both MARK II and GCOS used the GE 635 processor, a communication pipe was needed to connect the two systems. This led to the development of the bus adapter, a device that provides a hardware channel between the two operating systems so that both perform input and output functions in a manner similar to that of a tape or disk drive.

Conceptually, the FBI was a file-transfer mechanism that had inquiry and control capabilities. Users could submit a job to MARK II, where they could edit the data, specify the files to be transferred, then send the work to the job-entry stream of the Background GCOS system. Later, they could transfer all or part of the GCOS output back to the MARK II Foreground, where they could select which data should be transmitted to local high-speed print stations. When these capabilities were combined with the network, it also became possible for distributed users to enter data, and for the output to be returned to their multiple locations.

With the successful development of the Foreground Background Interface, ISBD renamed the MARK II product to reflect its new capabilities. And on November 13, 1972, MARK III Foreground, MARK III Background, and the MARK III Network were made available to all customers. Later, the product became simply MARK III Service.

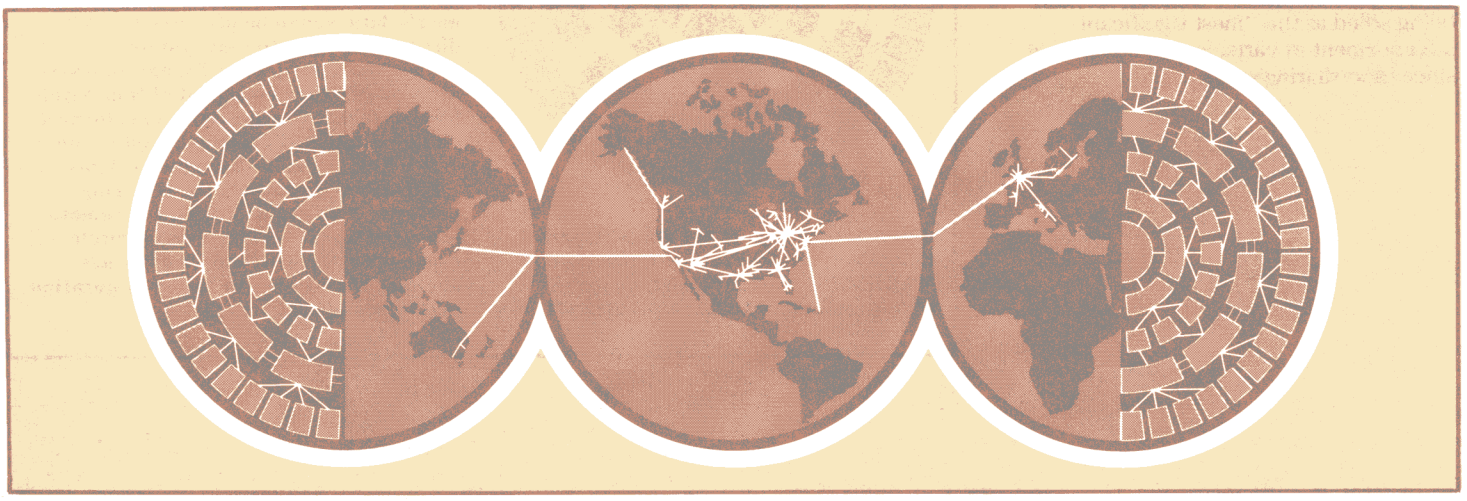
MARK III signalled the beginning of a long-term program to build a significant presence in the data processing market. For George Feeney, who had been named ISBD's general manager in 1971, it marked an approach to the information services industry that would drive the division for years to come. Simply expressed, Feeney believed in the concept of an information utility. He saw the data processing business evolving much like the early power-generation business had done at the turn of the century. Then, the prevailing logic held that every major manufacturer needed its own power station. And after that industry's first growth stage, nearly 50,000 small generating stations were supplying half of the country's electrical power, largely for their own internal needs. Just as the electrical industry became a utility provided to multitudes by only a few companies, so, too, did Feeney believe that a handful of information utility companies would provide full-scale computing services to the world.

In keeping with this concept, the full-scale utility could serve the remote batch processing market in two ways: it could either complement in-house data processing operations or totally replace them. And indeed, as the country experienced the severe recession of the early seventies, many companies looked at their in-house data processing operations—with its high costs, limited range, and rat race of upgrades—as a prime target for cutting expenses. In this environment, then, ISBD began addressing the replacement option by offering what it called Remote Facilities Management.

In 1973, General Electric's Switchgear Equipment Division in Philadelphia became the first user of the facility management service. Its in-house GE-635 was moved to Brook Park, and through the FBI system, Switchgear's batch processing was performed at the supercenter. Gradually, all of the division's data processing equipment, work, and 38-person operations staff were transferred to ISBD, until only high-speed remote printers and card equipment remained in Philadelphia. Later, similar facility management services were provided to GE's Transportation Systems Division in Erie, Pennsylvania; to the Mobile Communications Business Division in Lynchburg, Virginia; and to the Hospital Corporation of America (HCA).

Meanwhile, a second project was underway to add background capabilities for IBM batch processing systems by marrying the responsive MARK III front-end with an IBM 370/158 computer system. Its Single Virtual System (SVS) operating system possessed significant capabilities that MARK III did not have, including dedicated and removable disk packs, COBOL and PL1, and a batch processing system that allowed long-running applications to continue without being swapped out to share the processor. The project was completed and field tested in 1974, and the new service— called CRISP III/70 (for Conversational Remote job entry IBM Services Products)—was introduced commercially in 1975 to customers in Chicago and Houston.

CRISP III/70 led the way to a long-term



"Computer power for the global village" became the motto for GE's MARK III Information Service during the mid-seventies.

THROUGH 20 YEARS, THE ROAD HAS TAKEN MANY TURNS FOR GENERAL ELECTRIC INFORMATION SERVICES COMPANY. TURN THIS PAGE AND TRAVEL THROUGH TIME—WHERE WE'VE BEEN AND WHERE WE'RE GOING.

1. (1964) Time-sharing concept developed at Dartmouth College using GE-235 and DN-30 computers.

2. (1965) First commercial time-sharing service offered from systems in Phoenix and New York City.

3. (1965) Headquarters for Information Processing Business (IPB) established in Bethesda, Maryland.

4. (1966) IPB separates from Computer Department and becomes Information Processing Centers Business. Eight months later, becomes Information Services Department.

5. (1967) Local time-sharing service set up in London, Toronto, and Montreal.

6. (1968) MARK II Service introduced using GE-635s. Original GE-265 service becomes known as MARK I.

7. (1969) Information Services Department elevated to Information Services Business Division (ISBD).

8. (1969) Agreement signed making Honeywell distributor of ISBD products in most countries outside the U.S.

9. (1969) Datanet Software Services (DSS) established to offer programs written by outside industry experts. Becomes Network Software Services (NSS) in 1971.

10. (1969) Experimental Network I offers major U.S. cities from coast to coast access to one MARK II System in Brook Park, near Cleveland, Ohio.

11. (1970) Network link to London via COMSAT satellite successfully installed and tested in February.

12. (1970-72) GE Information Services Network established worldwide.

The world's first and still largest commercial teleprocessing computer network enabled people around the world to get timely business data rapidly using computer terminals and business telephones.

13. (1970) Seventeen IPC locations consolidated into three large "Supercenters" at Brook Park, Los Angeles, and Teaneck.

14. (1970) GE's computer manufacturing operations sold to Honeywell, Inc.

15. (1971) Uninterruptible Power System (UPS) installed at Brook Park.

16. (1971) GE time-sharing services reaches Japan through special MARK I licensing agreement with Dentsu Advertising Co., Ltd.

17. (1972-77) Era of expanded capability and powerful tools begins. Orientation moves from scientific problem solving to business applications and to building integrated systems.

18. (1972) Consolidation of Los Angeles and Teaneck centers begins, leading in 1973 to a one-site Supercenter at Brook Park.

19. (1972) MARK III® Service introduced along with Foreground/Background concept. Combines networking and interactive computing services of MARK II (Foreground) with the versatile batch processing capability of GCOS (Background).

20. (1972) Technical Services Operation (TSO) started. Leads eventually to Systems Development and Consulting (SDC) operation.

21. (1972) Profits begin to soar. Profitability continues through 1985.

22. (1974) Second Supercenter opened in Rockville, Maryland. Headquarters set up in same building, and 500 employees move in from Bethesda.

23. (1974) IBM Model 158 added to MARK III Network. Its background batch-processing capabilities were introduced as CRISP III/70 Service.

24. (1974) Database Management System (DMS) introduced. Now in its third generation, it provided an unprecedented friendly interface for managing files with the Hierarchical Indexed Sequential Access Method (HISAM).

25. (1974) Major sales campaign, IMPACT '75, rolls out at year's end.

26. (1975) Cluster System Technology debuts after two years of development work. A major technical breakthrough that significantly improved system load balancing, availability, and reliability.

27. (1975) Dentsu and ISBD form joint venture company, ISI-Dentsu, Ltd., for distributing MARK III Service in Japan.

28. (1975) Spain and Mexico hook up to MARK III Network. Now serving 18 countries on 4 continents.

29. (1975) International Training Center opens in Rockville.

30. (1975) Revenue passes $100,000,000 mark.

31. (1977) Amsterdam Supercenter opens.

32. (1978) San Diego hosts first Markmakers bash.

33. (1978) Worldwide network service extends to Hong Kong and Singapore.

34. (1978) Introduction of MARKLINK System provides the only distributed data processing available from a single source.

35. (1979) January 1: ISBD becomes the General Electric Information Services Company and enters joint venture with Honeywell.

36. (1979) European Marketing Operation opens in London to serve customers throughout Europe.

37. (1979) MARK III Service reaches Saudi Arabia and Venezuela. Now serving 24 countries on 5 continents.

38. (1979) MARK 3000™ Service arrives using the IBM 3033 central processor and the multiple virtual storage (MVS) operating system.

39. (1979) Mitrol, Inc., becomes General Electric Information Services' subsidiary, implementing Mitrol Industrial Management System (MIMS®) on MARK 3000 Service.

40. (1981) Commercialization of QUIK-COMM™ System, the global electronic mailbox service, marks entry into office automation arena.

41. (1981) MARK III Service becomes accessible in Bermuda, Bahrain, the Philippines, Portugal, and New Zealand. Marks first use of public data communications networks.

42. (1981) General Electric Information Services Company acquires four companies to better supply complete software services—Lambda Technology, Inc.; Energy Enterprises of Denver, Inc.; Banking Systems, Inc.; and Software International Corp.

43. (1981-82) Negotiations with Post, Telephone, & Telegraph (PT&T) operations extends QUIK-COMM System to Europe and elsewhere. WPXchange, PC Mailbox, and other office automation products introduced in 1984.

44. (1982) General Electric Information Services Company becomes wholly owned subsidiary of GE with corporate buyout of Honeywell's interest.

45. (1982) PC revolution leads to large purchase of IBM personal computers. Network now accessible by these, the Apple II Plus, and a myriad of other personal computers.

46. (1984) U.S. teleprocessing network unbundled to provide MARK*NET™ value-added network (VAN) service.

47. (1984) Agreements with three International Record Carriers provide expanded international access capabilities to nearly 60 countries.

48. (1984) Integrated Communication Services Operation (ICSO), for leasing and maintaining hardware, merged into General Electric Information Services Company.

49. (1984) Professional Services renamed General Electric Consulting (GECON).

50. (1984) Calwestern Automated Clearing House Association (CACHA) contracts for electronic funds transfer services among its 780-member banks, credit unions, and S&Ls. NACHA agreement follows.

51. (1984) ICSO enters Tenant Services business forming business relationships with MCI, InteCom, and Wang Laboratories, Inc.

52. (1984-85) Business relationships formed with Wang Laboratories, Inc., for office automation; with Apple Computer, Inc., on AppleLink and DealerTalk; and with NEC to link Japanese VAN with General Electric Information Services' network.

53. (1984-85) Electronic Data Interchange (EDI) developed and commercialized for computer-to-computer exchange of business documents.

54. (1985) General Electric Network for Information Exchange (GEnie) introduced—our first "mass market" product.

55. (1985) General Electric Information Services Company blazes the trail to the future with Manufacturing and Distribution EDI, International Trade, Medical Claims, Retail Systems, Information Providers, Applications Integration, Office and Corporate Systems, Dealer and Client Systems, Network Services, and more than the mind's eye can imagine.

strategy to connect every major computing system to the MARK III foreground. This not only would increase ISBD's ability to complement and eliminate in-house data processing activities, but it also would open the door for thousands of new customers to experience the interactive capabilities of MARK III Foreground.

The entire concept was snagged, however, when in 1976 IBM introduced its new Multiple Virtual Storage (MVS) operating system. Deciding that the modifications needed to upgrade the interface to this system were too extensive and costly, ISBD relaxed its promotion of the CRISP III/70 product, as well as its plans to add other systems to the background. And MARK III Service went forward, satisfied at least momentarily with the original marriage of MARK II and GCOS.

Software Technology: Tools and Applications for the Customer

To say that prior to the early seventies time-sharing had served only engineers and scientists would be untrue. As early as 1968, other people within customers' sites had started seeing the advantages of instant access. Personnel managers were keeping small files on the system; finance managers were using it for cash-flow and risk analyses. Marketeers employed it in research and forecasting, and sales managers found it could assist with new product introduction.

Even then, the business's orientation was shifting from being an electronic slide-rule to being a tool for business managers. As ISBD improved its ability to marry computing power with data bases, the shift to this orientation became complete. And by the early seventies, it wasn't computation that users were sharing, but rather *information*.

During and after this transition, software technology followed several paths. In 1969, for example, when most customers still were programming the machines themselves, ISBD introduced a new concept in software marketing, called Datanet Software Services (DSS). Through DSS, software packages written by outside industry experts were placed in a system catalog that all time-sharing users could access. The software remained the property of the author, who was responsible for all promotion, documentation, training, and consulting. ISBD, in turn, would place it on the system for general use, perform all billing, and collect the usage royalties for the author.

Among the first DSS authors were First National City Bank with its programs for the banking industry; Natural Gas Processors Association (NGPA), whose programs served the petrochemical industry; and Leap and Clary, which wrote for the construction industry. By the end of 1969, DSS had generated $150,000 in revenue; a year later, the figure was close to half a million.

The program was renamed Network Software Services (NSS) in 1971, and by this time, a new source of software authors was emerging. Similar to contemporary times with the writing of software for personal computers, the early seventies saw a surge of entrepreneurial companies writing software applications for the various time-sharing vendors. Thus, where the early authors of DSS programs had consisted largely of existing customers, the authors of NSS programs increasingly included these new, "third-party" companies. Among them were Structural Dynamics Research Corporation (SDRC), which provided a large package of mechanical engineering analysis and design programs, and Petroleum Software International (PSI), which wrote energy-related software. And NSS, by adding such third-party software to the system, became a major source of revenue for the Information Services Business Division for years to come.

Meanwhile, MARK III itself was changing as ISBD technologists created programs and routines that enabled the system to better address business problems. One change in programming was the subtle migration from the use of BASIC, which was superb for the ad hoc needs of a problem solver, to the use of FORTRAN, which was more capable of producing complex business reports and manipulating files. A second development, random binary files, provided the ability to randomly access data in a file rather than having to access it sequentially. Finally, programming developments also started concentrating on what was needed to manipulate fields of characters and to format reports rather than simply to get an answer.

Along with these developments came new tools for the business customer. FLEXIMIS, the Flexible Management Information System introduced in 1971, could gather a variety of data from sales, finance, marketing, and so on, and produce any type of information report required. In 1973, Financial Analysis Language, FAL, enabled financial analysts with limited computer skills to analyze data, perform calculations, make projections, *and* generate various reports. With the 1973 introduction of MAP, the Management Analysis and Projection system, users could access extensive data banks pertaining to the national economy, individual industries, and the top 1000 corporations. They then could use the data and the program's analysis and forecasting capabilities to discern trends and develop future business strategies.

As random access required that a user get to a point in a file and then identify the record desired, a series of capabilities was developed to assist in the programming of input and output to random binary files. First, the UREAD/UWRITE subroutines were developed so that whole pages could be read and written. Then came the Indexed Sequential Access Method (ISAM) system, which could find a record based on a character string key. Finally, in 1973, a Hierarchical Indexed Sequential Access Method (HISAM) was developed so that information could be stored and retrieved using a hierarchy of keys.

A highly sophisticated, flexible tool, HISAM enabled users to build, maintain, and access large business-oriented data bases. It also allowed them to manage several files as though they were one without disrupting any single file's physical format. But HISAM also required its users to do extensive, time-consuming programming in FORTRAN, which actually made their life harder rather than easier. And after all, the appeal of time-sharing had always been ease of use and increased productivity. Obviously, something was needed for the business customer that was as easy to use as BASIC had been for engineers and scientists.

In 1975, ISBD introduced that something, calling it the Data Base Management System, or DMS. DMS took HISAM one revolutionary step further by providing a conversational, nontechnical language for generalized data management. Instead of creating lengthy formal programs, users could produce reports by simply entering a few statements. And so greatly did it simplify the programming of structured data bases that they often were ready for use within days or weeks versus months. Indeed, DMS was probably the most significant programming innovation of the seventies for ISBD, enabling the business to penetrate the broad market that had relatively little programming expertise.

For all its capabilities, DMS and the many other programming developments were fundamentally tools—tools with which customers created their own appli-

cations to serve their own needs. But many companies were unable to support the in-house expertise needed to develop, implement, and maintain large-scale applications. Recognizing this fact, yet still desiring to provide full-scale utility service, Gary Mueller began an experiment that in its earliest days was playfully known as the "puppy farm."

Nickname aside, the puppy farm was a totally unique concept, unheard of in the days of the early seventies. It consisted of 12 of the best applications technologists that ISBD could find, who had agreed to leave their families and move into three townhouses near the division's Maryland headquarters. Operating on a schedule where they would work for several weeks then go home for a week, these technical giants underwent extensive training in the latest MARK II/MARK III technology until they were experts on the systems' operations. Once educated, they accompanied sales representatives on calls to major prospective customers, where they would evaluate the prospect's needs and propose an applied-system solution. When the solution was accepted, they would write the application for the customer then test, install, and implement it.

So successful was the first wave of 12 that ISBD quickly began training another dozen people. Then, in the opening months of 1972, the puppy farm emerged from its experimental phase fully recognized as the Technical Services Operation (TSO). And within two months the group had sparked $700,000 in new revenue. By 1974, TSO comprised 50 specialists located in seven U.S. cities; in 1975, it was renamed the System Development and Consulting (SDC) operation, and by 1977, the organization included approximately 300 people.

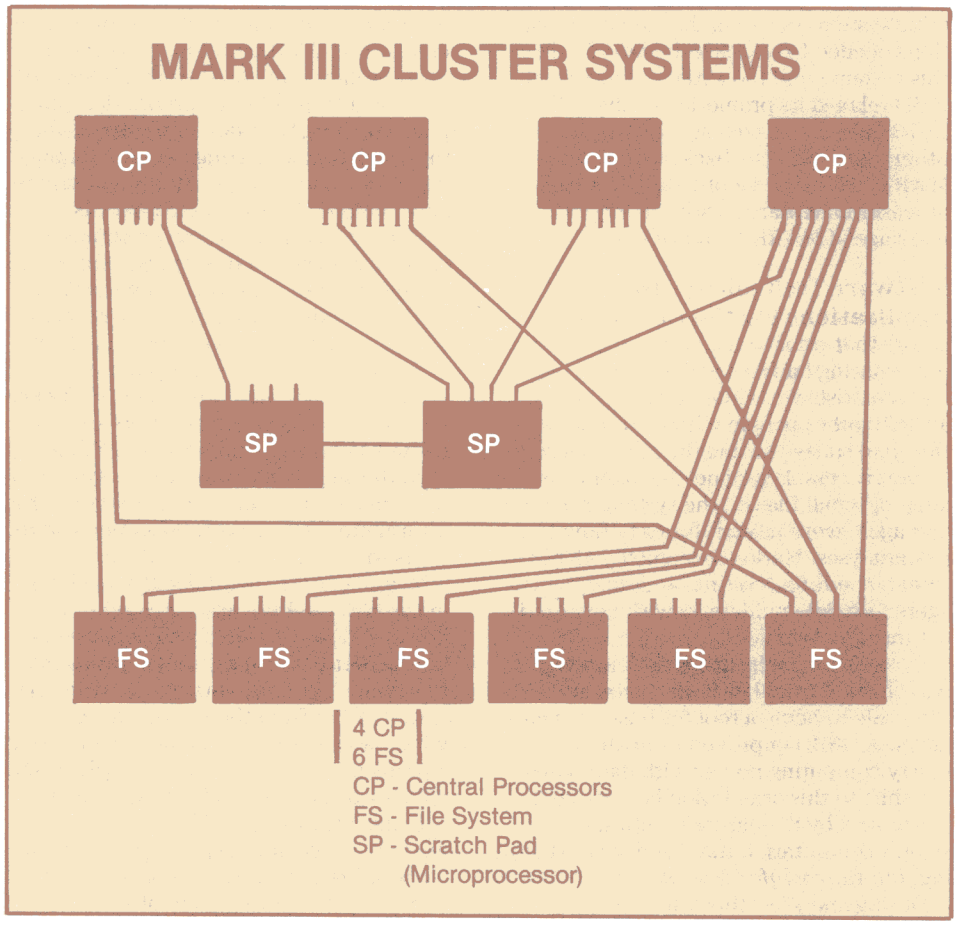
TSO represented a momentous breakthrough in the marriage of marketing and technology. It and then SDC were responsible for virtually every major customized application using GE's information processing services and tools, including those for Levi-Strauss & Co., General Telephone of Florida (GTF), Kodak, and many others. Indeed, during the early and middle seventies, the group generated approximately $20 million of new revenue every year.

Cluster Technology: Guaranteeing the Best Service

Meanwhile, the concept of a super-reliable service had continued to prevail, and indeed, MARK III's availability, reliability, and scope were considered hallmarks of the industry. But the shift to a business clientele was creating a different and much stronger demand for reliable service.

Scientific time-sharing users, for example, had not required a great deal in the way of dependability. If the system went down, they simply tried again five minutes later. They seldom kept old programs or data files, so by keeping a back-up copy of their current program they rarely lost more than a day's worth of changes.

Data processing applications, on the other hand, were quite different. Busi-



This 1975 illustration represents a MARK III Service four-by-six cluster file system. Four central processors were interconnected with six file systems by way of direct links to "scratch-pad" microprocessors.

ness data tends to be entered from multiple locations then consolidated upward in the organization. Many users access the information, and everything must be consistent. Thus, if a data base must be reverted and 100 clerks have to work overtime to resubmit yesterday's transactions, the reaction is anything but humorous. And of course, if a banker can't invest $10 million because the cash management system is unavailable, the day's interest is literally an opportunity lost forever.

Nonetheless, in the early seventies, when a MARK III processor went down—whether accidentally or for daily maintenance—its entire file system also went down and so did the customer. Additionally, the system's configuration was such that one processor could experience a very heavy load of users while another was having a relatively light load. For the users of the busier processor, this often meant slowed response times.

With the 1972 introduction of MARK III Service, ISBD recognized the need to rectify these problems caused by the configuration's one-file/one-processor dependence. But the recognition was much easier than the accomplishment, and more than two years passed before a solution was found.

Then, in January 1975, ISBD introduced its Cluster File System—a configuration that used specially designed microprocessors to interconnect three to six central processors with four to six file systems. This new design enabled the user load of a failing processor to be absorbed by the remaining processors in a cluster. Further, the design controlled the load that was assigned to each processor, thereby balancing use throughout the cluster. Now when a system went down, customers experienced only a momentary delay, then they could relogon to another processor. And with their use being evenly distributed across multiple processors, their response times became more consistent and their productivity could increase.

The brainchild of Bob Hench and George Feeney and the culmination of many engineers' efforts, clustered systems were another major technical breakthrough for ISBD. The division now was closer than ever to providing true 24-hour availability with optimum reliability. And customers with applications requiring nonstop accessibility could, for the first time, consider MARK III Service as their answer.

The Past as Prologue

As the era of expanded capability drew near an end, the reach of MARK III Service had extended to almost 20 countries on four continents. GE had formed a joint venture company with Dentsu Advertising, Ltd., to market MARK III in Japan, and the international demand was becoming so large that a third supercenter had been established near Amsterdam, The Netherlands.

For 12 years, the desire to provide computing power at vast economical scales had driven ISBD to develop a service whose quality and scope were unmatched by any competitor. Indeed, its leading-edge technologies provided a base that would withstand the test of changing times. And the times did change.

The distribution agreement with Honeywell continued until 1979, when GE and Honeywell formed a joint venture company called General Electric Information Services Company—GEISCO. Owned 84 percent by GE and 16 percent by Honeywell, this new business entity combined ISBD's service production capabilities with the sales, technical, and support capabilities of Honeywell in Europe and Australia. In January 1982, GE exercised its contract option to purchase Honeywell's minority interest in the company. And on December 31, 1983, GE Information Services Company became a wholly owned division of General Electric.

The information-utility concept was jolted in the late seventies with the advent of microcomputers and economical mainframes. And by 1983, when *Time* Magazine named the personal computer as "Man of the Year," even children in their homes were playing with computers. The market's need for remote raw computing power had diminished, and the business shifted its orientation more toward providing software and applications that could increase the capabilities of the market's own in-house power.

The possibilities for serving the market's needs were almost limitless. And as new competitors entered the service arena, it became apparent that the business simply could not provide solutions to all the information processing needs of the industry.

It could, however, provide the *best* solutions to those needs uniquely suited to its strengths. Where the market lacked the applications expertise or the third-party objectivity to develop intercompany solutions with its own computing power, who could better address the void than the company that had produced the TSO organization of applications builders? Where the market's computing power lacked interconnectability, who could better link its systems than the company that built the first commercial international network—a network that is still the largest commercially available teleprocessing network in the world? To date it serves approximately 6000 business and trade associations and simultaneously handles more than 6000 users—a far cry from the 200 once thought to be the most a system would ever need to handle.

With the strengths of the past as springboards to the future, GE Information Services entered 1985 with a view to network-intensive specialization. The sights of its Network-Based Services have focused on the emerging market for interorganizational systems—information systems that link manufacturers with suppliers and dealers, health care providers with insurers, member ACH banks with each other.

The company faces its future intent on moving beyond micro-integration into such specialized arenas as manufacturing and distribution EDI, international trade, health care, retail systems, office and corporate systems, dealer and client systems, as well as the products and delivery systems needed to support them.

And one past strength above all others will propel GE Information Services into this future—its solid foundation of talented and experienced people, people in the habit of pioneering.

I've seen early time-sharing books where the system was not called MARK I but rather the GE-265. Where did that name come from?
The first time-sharing system used the GE-235 process computer (6 microsecond memory) and the DATANET-30 communications processor. Adding the numbers together resulted in GE-265. The "service" was called Time-Sharing Service.

How much memory were users allowed in the GE-265 System?
Users could put in a total of 4166 characters, and that was it. The compiler and other run-time packages took up the rest.

Is it true that the first system did not have file input?
Yes. Data for a BASIC program was written at the end of the program, preceded by the word DATA. When the program needed data for operations, it would branch to those line numbers. The availability of file input in the GE-265 was a real boon, and users picked up on it quickly.

How many users could the GE-265 accommodate simultaneously?
Thirty-nine plus one port for the console operator. All communications lines came in through the DATANET-30 processor, which had 40 input ports at 110 baud.

Who were the early users of time-sharing that made the service take off?
They were engineers and scientists who wanted access to a computer without having to stand in line at their company's data processor, which was generally tied up doing business applications. They often faced the hassle of getting the data processing (DP) manager to assign them a coder who didn't understand the problem, and that would be followed by a series of batch runs (when available), error corrections, and reruns.

When engineers and scientists found they could have access to a computer through a terminal at their desk and that they could code their own problems in BASIC, they quickly signed up for the Time-Sharing Service—much to the dismay of the DP managers who viewed this as an erosion of their computer empires.

Was BASIC the only language available?
For a long time it was, but an ALGOL compiler was also available. It wasn't until April 1964 that a FORTRAN compiler became available. It filled a real need in the engineering/scientific computing community.

PAST

What were the logistics involved in getting the early Time-Sharing Service established so quickly in different cities?
Between 1962 and 1965, the Applications Section of GE's Computer Department opened computer centers in various cities around the country. The centers had GE-210 and GE-225 batch systems, which were used as back-up for the banking systems the department was selling. They also had staffs that sold and serviced batch computing.

When time-sharing caught on, GE-265 systems were moved into these existing facilities. Eventually, they replaced the batch equipment as the user load grew and more space was needed for additional systems. The service bureau staffs were converted to time-sharing staffs, and we had a jump on the market.

What terminals were first used to interface with MARK I Service?
Made by the Teletype Corporation, they were either the Model 33 or the Model 35, preferably with paper tape punch and reader, since it was a convenient way to enter and store data and programs. They operated at the blinding speed of ten characters per second.

Were portable terminals available in the early days?
If you can call an 80-pound suitcase with handles portable, then there were portable terminals. It was a Model 33 in a big plastic case, and the acoustic coupler was in an additional case that had to be carried to a client site for demonstrations. Account reps (ARs) devised small luggage carriers with wheels to move them about, but they were tough getting in and out of the trunk of a car. Female AR's were usually accompanied by a male AR or tech rep who could handle the "portable."

When did the name change from Time-Sharing Service to MARK I?
It was never called MARK I Service until after the larger GE-635 computer began to be used on a trial basis in 1967. This new system needed a name to differentiate it from the first, and initially it was called MOD EC. The title was considered temporary, however, and in November 1967, the new GE-635 based service was named MARK II. At that point, the original service was renamed MARK I. MARK II Service was officially announced to the public in April 1968.

When did Europeans first begin using service via satellite?
In September 1970, and they were accessing the MARK II system, not MARK I. Several countries in Europe had their own time-sharing service, which was sold by local distributors under licensing agreements with GE. When the satellite link made it possible to access the bigger, faster MARK II Service, it eventually replaced the local MARK I Service.

How did we get from MARK II to MARK III®?
MARK II became MARK III when Background Processing (RJE Batch) was added. Although Background was based on the same processor as interactive MARK II Service, it had a different operating system.

What was the name of our IBM Service when it was first introduced?
It was called CRISP III/70. The name was changed to MARK 3000 Service in 1979.

What equipment was being used when IBM Service first started?
There were two IBM 370/158s. One of them was using MVS for commercial service, and the engineering system was running VM. This was followed by two IBM 3033s and then by three 3081s.

Is it true that one of the MARK I computer centers was bombed?
Yes. A pipe bomb blew out the front window of GE's corporate headquarters building in New York City, where we had a computer center that processed checks for banks and provided MARK I time-sharing service. The damage was superficial, and the systems were not harmed. At the time, large companies thought it was prestigious to display computers, but similar incidents since then have led to most computer centers being made invisible to the public.

—Jim Doyle

Milestones Milestones

Twenty years ago, in September 1965, General Electric started selling Time-Sharing Service commercially. The Information Processing Business (IPB), then a section of GE's Computer Department, was responsible for developing and marketing the service.

Although the Computer Department was located in Phoenix, Arizona, the IPB was headquartered in Bethesda, Maryland. Employees were located in these two cities, in the various cities where Information Processing Centers (IPCs) were established, and in the several sites where contract programming or data processing operations were conducted.

A number of individuals who worked for the IPB in September 1965 have stayed with the business throughout its evolution. Thirty-three are listed here, but there may be others who couldn't be identified. In appreciation for each of these individual's 20 years of service, General Electric Information Services Company has awarded them a certificate that attests to their dedication.

This special edition of "Milestones" presents the veterans of time-sharing, where they were working when it all began, and some of their memories of the early days.

Bethesda, Maryland
Richard J. Lewis
Zigmund Quastler
Warner R. Sinback

Chicago, Illinois
Oman R. Barkdoll

"Twenty years ago, I was just returning from two and one-half years on Kwajalein Island. I spent a few months in Phoenix becoming a GE-265 expert, and my son was born while I was giving a class.

Those were the 'good old days,' roaming around the country, installing 265s in New York City, Schenectady, Chicago, Cleveland, and elsewhere.

The next 19 years seem to have flown by: my son is in college now. I think I've particularly enjoyed meeting and dealing with our diverse clientele. Our environment has changed a lot. Our clients are much smarter, tougher, and more demanding. But I'm still optimistic."

—Ed Isaacs

"In 1965, our Cleveland IPC manager had all the troops gather around a Model 33 teletype. When he had everyone's attention, he announced that here was the future business of the IPCs. He then ran one of the games that was available on the system at the time. When he finished, there were several mild snickers and comments. Those soon departed for greener pastures."

—Marty Drabek

"I started at the Chicago IPC in March 1965. When the old GE-265 system turned on in Chicago, I was the first time-sharing operator."

—Jim Grogan

"Twenty years ago, I was a 'sales engineer' reporting to the manager of the Schenectady IPC. After the Computer Department subsidized the installation of the Dartmouth computer, we sold extra time on the college system to a variety of 'time-sharing' clients. Once in a while, one of those clients would call to tell us that the computer couldn't be accessed, and we would discover that it was a college holiday—or a football game—and the students had shut down the computer.

The early users were very patient and understanding. After all, our service was the only game in town."

—Al Parker

"Joining GE was a major career change for me. I was almost 40, with a young family, and well settled in public school work. But GE was doing some interesting things for schools on the computer, and it sounded like fun. So my family supported me in picking up stakes and moving to Schenectady.

I remember when customers used to call up to get a new user number, and we'd put down the phone, go up to the master console, and validate the user number. Then 'instant validations' were discontinued, and we had to fill out a piece of paper and send it to Operations. We wondered how customers would ever tolerate the delay!

Lots of memories, lots of good times, and best of all, some great people to work with. It

Milestones Milestones

Leland A. Denny
James M. Grogan
John Putnam
Melvin F. Szot

Cleveland, Ohio
James Bellomo
Martin S. Drabek
Dominick V. Peduzzi
I. Wayne Rice

Dallas, Texas
Kenneth Fowler

Falls Church, Virginia
Joseph Snyder

Florham Park, New Jersey
Leroy K. Stanton

Huntsville, Alabama
William R. Bacon
Frank Beal
David J. Clark
Verkuel N. Eubanks
Addison L. McGarrity
F. Don Montgomery
J. Dexter Nilsson
Lincoln E. Shannon
John P. Wallis

Phoenix, Arizona
William L. Backer
Marilyn J. Friend
Edward L. Isaacs
Glenn A. Oetzel
Larry L. Rollins

Schenectady, New York
Allan G. Boynton
William P. McClary
Alexander V. Parker
Thomas J. Sullivan

must be hard for newcomers to understand the camaraderie that exists. But I have only to call, and so many will have an immediate, common understanding and appreciation of the fun that this business has been for the last 20 years. It's been a lot of fun.''

—Bill McClary

''I remember when BASIC instructions fit on one 8 1/2 x 11-inch page; when one of the Schenectady guys broke into the system and put out the banner message to all who signed on, 'The Jolly Green Giant strides through the valley of the sun—Ho Ho Ho.' And I remember when the only machine time available for debugging system software, for putting in changes and testing, were the wee hours from 2:00 to 6:00 a.m.''

—Marilyn Friend

''In September 1965, I was with the IPB in Phoenix. I could not visualize anybody paying money for BASIC with no peripheral input/output other than a ten-character per second teletype terminal!''

—Larry Rollins

''I was in Huntsville in 1965, and after the NASA contract ended in '66, I transferred to the IPB in Bethesda. I went to work on what I felt was the most interesting and challenging opportunity around at the time, namely time-sharing. Most people had never heard of it. When I reported in, there were about 30 people in Bethesda.''

—Frank Beal

''I was a member of IPB during that historic month in 1965. My assignment was in Huntsville, helping test the Saturn-V rocket, the largest and most powerful piece of machinery ever built by humans.

Europe probably was the biggest milestone of our corporate history. That's the step that gave us a viable worldwide network. It turned computing into a 'global village' and separates us even today from our nearest competitors.''

—Lincoln Shannon

''The 'good old days' were filled with heroic efforts. In the beginning, each person contributed to the entire business spectrum of operations, sales, billing, and technology. The personal rewards were immediate, since each step toward becoming a profitable, viable business could be identified by individual efforts.

As we became profitable, the individual's efforts became more specialized and integrated; sometimes it was difficult to identify one's own impact on the business's success. Now that we're beginning to penetrate new markets again, I see the same pioneering efforts in all the new product areas.

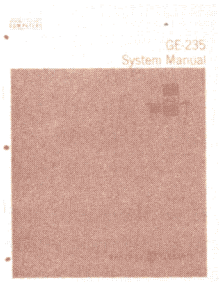
With the same intensity of purpose and with the quality of our people and products, history is sure to repeat itself as we fulfill our position of being the best.''

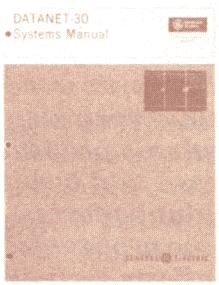
—Lee Denny

Old and Revised Documentation

Here's a collection of 20 documents designed to trigger memories among old-timers and update newcomers.

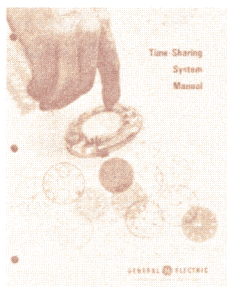
GE-235 and DN-30 manuals





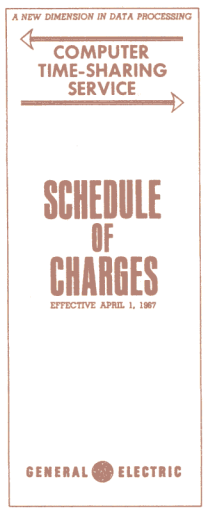
Twenty years ago, documentation was provided through GE's Computer Department in Phoenix, Arizona. This GE-235 Systems Manual, with its then-new Information Systems logo, and the DATANET-30 Systems Manual are of 1966–67 vintage. The GE-235 served as the processor, the DN-30 as switcher and remote concentrator. Putting the two systems together resulted in the GE-265 time-sharing system—showing that GE engineers back then could, among other things, add.

The Clock Book



The most well-known book of the period was the *Time-Sharing System Manual*, popularly known as the "clock book." This 1967 revision, updated at the Bethesda headquarters, was the first document to bear the Information Service Department designation. It describes the hardware and operating system, system and editing commands, even informative and mode commands—everything needed to use the system—in 18 pages.

1966-67 Schedule of Charges

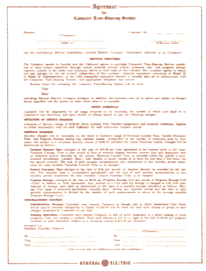


Was it expensive? The 1966–67 Schedule of Charges says terminal connect time was $10 per hour, CPU time was four cents per second, and program storage was $2.50 per unit—with a maximum program size of four units. Walk-in service at an IPC was encouraged, at $25 per hour.

First Time-Sharing Service brochure

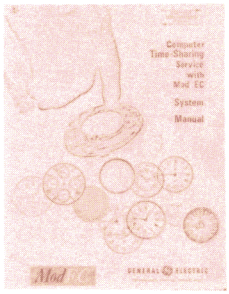
Before the Information Processing Business (IPB) was split off from the main Computer Department, a group of Marketing Communications and Documentation personnel began customizing the department's documentation to fit time-sharing's needs. The first brochure that mentioned "time-sharing" appeared in 1965, complete with explanatory telephone dials and telephone poles. It suggests contacting on of GE's Information Processing Centers, which then were located in Schenectady, Chicago, Cleveland, New York, Phoenix, Richmond (California), Washington, Dallas, and Wichita Falls (Texas).

Original agreement—Form 1



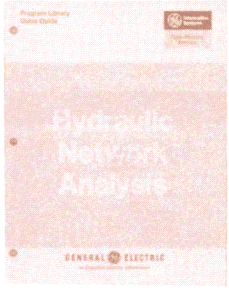
The original Agreement for Computer Time-Sharing Service, called Form 1 in 1967, looks surprisingly like today's.

Clock Book with "Mod EC"



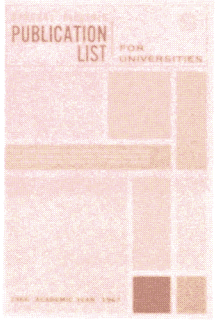
In early 1967, the Time-Sharing System got enhanced with "MOD EC." Some thought EC meant extra core; others thought it meant enhanced capabilities. In reality, no one could come up with a name for the system or its enhancements, so Eugene Chartier, then manager of marketing communications, simply used his initials.

First user's guide



The new time-sharing system's first applications were civil engineering programs. Built under the guidance of project manager Mulik Sayeedi, the programs needed a series of how-to-use documents that were totally different from previous system manuals. Bill Backer and Dex Nilsson, working with Sayeedi, coined the phrase "user's guide," which appeared for the first time on the documentation for NETWK$, Hydraulic Network Analysis, in August 1967. NETWK$ is still on today's MARK III® system.

Publication List for Universities (PLUS) for 1966-67

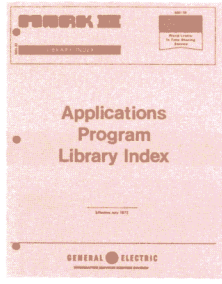


GE has long offered publications to colleges and universities as part of its corporate public relations campaign called PLUS. For 1966–67, GE offered 109 titles, and the most popular—a moon map—was no surprise. The runnerup, however, was a surprise: it was our manual, *BASIC Language for Computer Programming*.

Flyer announcing MARK II Time-Sharing Service

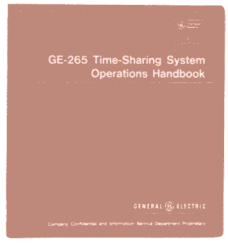
GE's Time-Sharing Service (on the GE-265 computer) was renamed MARK I after the new, expanded version on the GE-635 had been named MARK II. This mid-1968 prototype of today's product profiles introduced the "bigger, tougher" MARK II.

MARK II Library Software Index

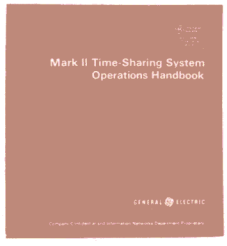


The *Library Software Index*, shown here in its first MARK II edition, provided capsule descriptions and access information for hundreds of on-line programs. It was, over the years, the most popular single publication produced, with more than 100,000 copies ordered and distributed in one year alone. Last updated in 1980, the index was finally left out of stock in 1983.

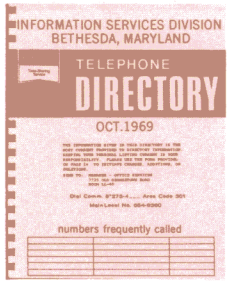
MARK I and II operations documents



Not all documentation was for clients. Operations personnel have relied heavily on documentation. MARK I and MARK II operations handbooks and reference manuals were invaluable tools for them from 1968 to 1973. Similar MARK III and Network publications continue to serve today's personnel.

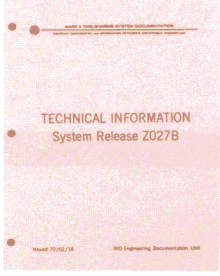


October 1969 ISD telephone directory



By 1969, headquarters personnel were housed in five Bethesda buildings—Arlington Road, Fairmont, Georgetown Road, Rugby, and Suburban Trust. Ron McKinney operated an in-house print shop within Documentation, where a 30-page phone book was printed. Nothing new—it asked recipients to help keep it updated and to refer problems to Sam Wenck.

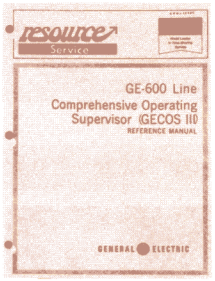
Z027A Blue Book



Technical Information Guides appeared about 1970 and described operational and user changes in software releases. The print shop had an oversupply of blue paper and used it for the covers, giving rise to the name "blue books." One of the first blue books was Release Z027A, which supported the first satellite communications

to remote sites in London. Blue books were discontinued for several years, but they resurfaced in 1983 and remain in use.

GECOS manual for RESOURCE Service

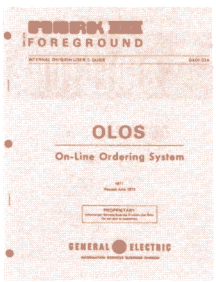


A batch-oriented offering named RESOURCE ran on an operating system developed by the original Computer Department. They had named the system GECOS, short for General Electric Comprehensive Operating System. When the computer business was sold to Honeywell in 1970, the "E" was dropped from the name, and their system became simply GCOS. This RESOURCE book from 1970 still bears the old title.

First International Access Directory

The *International Access Directory*, now in its fiftieth edition, was originally published in 1971. It showed 250 cities with international links to Canada, Mexico, Great Britain, France, Belgium, and The Netherlands. At the time, engineering was experimenting with on-line editing, punched paper tape, and phototypesetting devices, and the initial issues of the IAD were produced in-house.

1973 edition of OLOS User's Guide



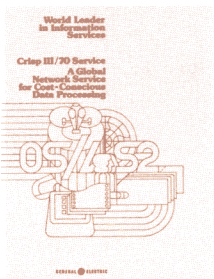
The first order entry system of the company was conceived by Marketing Documentation in 1971. Technical Services Operation (a predecessor to SDC) programmed it in MARK II BASIC during 1972, and Documentation implemented it in 1972–73. All documents had to be renumbered for this ordering system, which was the start of the Market File where documents are numbered by subject. Market Files are still maintained, and the On-Line Ordering System, OLOS, is still used by every GE Information Services component worldwide for publication ordering.

Inside page from first Course Quarterly, 1975

During the years 1974 to 1976, Documentation was moved into the Training organization, and a major effort was undertaken to create uniform instructor's guides, viewgraphs, and student's guides. This meant that a client taking a course in one city would receive the same training, for the same fee, as a client taking the same course in another city. Training bulletins issued by individual sales regions were consolidated into one publication, the *Course Quarterly* (CQ). Published 41 times without missing a deadline, CQ made its final appearance with this year's July–September edition. It was replaced by the *Educational Services Catalog*.

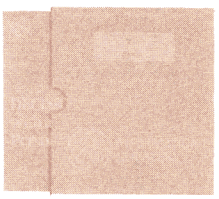
CRISP III/70 brochure

IBM was added to the network in 1975 under the name CRISP III/70, an acronym for the not-so-crisp phrase, Conversational Remote job entry IBM Services Products. Yet it was the "parent" of today's MARK 3000™ Service. Initial hardware was an IBM 370/158. Its brochure is typical of the Advertising & Sales Promotion (A&SP) organization's style during the mid-1970s.



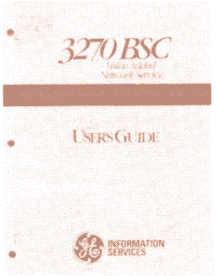
Original TSI documentation, circa 1982

The recent distribution of computing power from mainframes to personal computers gave rise to GE Information Services' marketing of PC-based product offerings. First of these was TSI, The Systems Interface, packaged to match the box-binders of the IBM PC DOS and Operations documents. TSI was originally Time-Sharing Interface, housed in a box-binder under the trademark "Decisionware."



Today's typical client document appearance

The overall family look of today's GE Information Services publications originated with a marketing/sales effort known as the "Big Play" or the "Renaissance" of 1983. In concert with the theme of providing integrated solutions to business problems, Documentation and A&SP developed an integrated approach to cover design. Thus, regardless of the product or service, a book or package could more readily be identified as a publication of General Electric Information Services.



This article was prepared by Dex Nilsson, documentation manager, with the assistance of Roy Gamer and Bill Backer.