Chapter 5

Oki Electric, the Electronics Company

(1966-1978)

1. Entrance into Electronics Industry

Installation of President Akira Mori, and growth during Izanagi boom

Business conditions began to improve in Japan from the fall of 1965. Although not realized at the time, that was the start of the Izanagi boom, a period of robust economic activity that lasted for 57 months, until the summer of 1970. Average economic growth in real terms for the five years from 1966 to 1970 reached 10.9 percent, and in 1968 the nation's GNP came to rank second in the free world. Oki Electric's return on total assets improved by 2.2 percent in the fiscal year ending in March 1966, slipped slightly to 2.1 percent a year later, and improved again between April and September 1967 to 2.5 percent.

In January 1966, in the midst of this growth, President Suteji Kanbe left his position as president to become chairman, and Senior Managing Director Akira Mori succeeded him as president. President Mori entered Oki Electric in 1928 immediately after graduating from the Department of Electricity of Tokyo Technical High School (today's Tokyo Institute of Technology). His responsibilities over the years were mainly in the engineering and manufacturing areas of telecommunications equipment. He served with Oki Electric in China before the war as general manager of both the Harbin Branch and the production department of the Dalian Works. After the war, he returned to Japan and became a director. He served as manager of the company's plants in Fukushima and Shinagawa, and was promoted steadily, first to managing director and then to senior managing director. His entire professional career had thus been with Oki Electric and he was especially well versed in production-related matters. When he assumed the presidency he was 58 years old. As it turned out, President Mori and the company's other top managers tackled various management problems just before the start of Japan's second round of high-level economic growth, placing their highest priority on radical reform of the company.

Akira Mori

In 1964, Japan accepted the obligations of the Articles of Agreement of the International Monetary Fund (IMF), thereby assuming Article VIII status. Afterward, capital was gradually liberalized, leading inevitably to intensified competition in the domestic market. The situation called for a reinforcement of Oki Electric's internal structure. In the medium-term business plan for the period April 1966 to March 1969, President Mori outlined three main challenges while requesting the overall cooperation of the company's employees in reforming the company. The challenges were: (1) to introduce radical reforms centered on the recovery of profit-making capabilities; (2) to concentrate on and improve the company's technological capabilities to cope with rapidly progressing technical innovation, and to emphasize the development of new products in R&D activities; and (3) to expand business by gradually increasing the volume of orders received. President Mori also asked the employees "to produce first-class products," thus using a catchy, easy-to-understand phrase in urging the employees to change their way of thinking. The board of directors introduced every measure available to ensure an improvement in the company's operating performance under the severe economic conditions. A rationalization section was also established and given instructions to quickly formulate and implement a rationalization plan. At the same time, the business divisions were reorganized in order to simplify the company's overall structure.

Supported by high-level economic growth that began to move steadily forward again, Oki Electric's profit ratio turned upward from the fiscal year starting in April 1966. It then started improving rapidly from the following year. After making certain the medium-term

plan announced previously was progressing smoothly, the company next announced a five-year, long-term business plan, to run from April 1968 to March 1973. The main theme of the long-term plan was "To create a foundation that will support a move from business improvement to business growth." The plan emphasized three main points: (1) to improve the level of technical competence, centered on information processing and electronic components, and develop strategic products in a timely manner; (2) to establish a sales strategy to cope with intensified international competition; and (3) to thoroughly rationalize company-wide operations, and make management more efficient. Through this long-term plan, Oki Electric aimed at raising itself to levels of product quality, performance, productivity, production facilities, and technological development capabilities on a par with leading companies in Japan and Europe, even if those levels did not quite reach the levels of companies in the United States.

To support achievement of the long-term business plan, management promoted a company-wide campaign called the "IDEA Movement." The acronym "IDEA" was taken from the first letters of the words "International" (achieving international levels in all areas of business competence), "Development" (vigorously promoting the development of technology and marketing), "Efficiency" (increasing efficiency in all areas of management), and "Aggressive" (stimulating a youthful aggressiveness in all corporate strategies, and, as a base for that, realizing the abilities of each employee). "IDEA" also referred to connotations of the word "idea," such as ingenuity and creativity.

The second half of the 1960s witnessed remarkable progress in information-oriented fields. In that situation, Oki Electric tackled squarely the increase in demand for machinery and equipment using electronics. In his New Year's greeting at the beginning of 1968, President Mori said the company must emphasize two areas for growth in the future—data processing equipment, and exports. Around 1965, switching equipment and telephones were still the company's mainstay products, and their sales were increasing every year. Viewed in terms of their percentage of overall sales, switching equipment and telephones accounted for 51.3 percent of total sales in the fiscal year ending in March 1967 while telegraph and business machines, cen-

tered on electronic equipment, accounted for barely 16.0 percent, less than one-third of the former. This relationship, however, was reversed in the fiscal year ending in March 1972, although only slightly, when switching equipment and telephones accounted for 35.4 percent and telegraph and business machines accounted for 35.5 percent of total sales. By coincidence, 1971 also marked the year that Oki Electric celebrated the 90th anniversary of its founding. In other words, Oki Electric, known for so many years as a manufacturer of telephone equipment, had begun moving during the period of high-level economic growth to break away from that image and was successfully transforming itself into Oki Electric the electronics company.

Development of electronic switching system and digital transmission devices

As Oki Electric gradually transformed itself into an electronics company from the second half of the 1960s into the 1970s, the shift toward producing electronic switching systems played a leading role. The company first began research into electronic switching systems in 1956. That year, the Electrical Communication Laboratory of the Nippon Telegraph and Telephone Public Corporation (NTT) invited Oki Electric and Fujitsu to participate with NEC and Hitachi in joint research of electronic switching systems. Based on the premise of using the stored program control (SPC) method already in practical use in the U.S., NTT formulated a plan in 1964 for practical application of electronic switching systems. The DEX1, to be used for laboratory testing, was scheduled for development by March 1967, with its commercial use to start in the fiscal year ending in March 1974.

Each of the four telecommunications manufacturers was tasked with developing a different part of an experimental DEX1. Oki Electric's task was to develop a semi-permanent storage system using metal card memory. For that purpose, the company set up an electronic automatic exchange R&D division. The company eventually developed and delivered four 800,000-bit metal storage cards to NTT. After NTT completed the DEX1 in 1966, the Electrical Communica-

tion Laboratory and the four companies began developing the smaller, more economical DEX2. An experimental model was completed in 1969, and field tests were conducted at the Ushigome Station in Tokyo. Afterward, development moved forward on the even more economical DEX21.

In the process of conducting R&D on the DEX prototypes, Oki Electric accumulated much technology related to electronic switching systems. The company also promoted independent technical research of its own. NTT's Electrical Communication Laboratory developed the miniature crossbar switch used in the DEX2, for example, and Oki Electric manufactured it. At the time, there were many fields of technology in which Oki Electric had no experience. But through a trial-and-error process it acquired precise mass-production processing technology. Also, concerning the semi-permanent storage device, Oki Electric later changed from the metal card to wire memory it developed independently. Because wire memory was both highly convertible and economical, NTT used it as the storage device in the DEX21 and in later switching systems. After completing several experimental models for testing for commercial use, NTT decided to adopt the electronic switching system. Called the D10, this was a key system included in NTT's fourth five-year plan, and NTT placed orders for the D10 with the four telecommunications manufacturers. In December 1969, Oki Electric set up a new department for promoting electronic switching and made it responsible for designing and manufacturing the D10. Oki Electric was at a disadvantage because it had no experience in manufacturing central control systems. Its research-

Model D10 electronic switching system (Yodobashi Telephone Office, Tokyo)

ers pushed forward, however, and in October 1971 the company delivered its first commercial D10 electronic switching system.

Compared to exchanges, Oki Electric lagged in the area of transmission. It was especially good news, therefore, when NTT selected the company to respond to an order in the area of transmission technology, which had already shifted to the digital method. Concerning Pulse Code Modulation (PCM) transmission devices, already in practical use utilizing transistors, 24-channel multiplex equipment was first used commercially in 1962 in the U.S. Not long afterward, in 1965, NTT put short-distance 24-channel multiplex equipment into practical use in Japan. Communications systems became increasingly digitalized from that point.

Oki Electric started its basic research into PCM transmission and trial production in 1960, two years before it was put into practical use in the U.S. Besides the U.S., similar research was also being promoted in other countries. In that situation, Oki Electric shifted the direction of its research toward development of IC PCM equipment, and carried the research close to establishing the basic technology for miniaturization of a channel board, a synchronous circuit, and a digital compression CODEC (coder/decoder) device. In April 1972, NTT approached Oki Electric about supplying a transmission device for a primary terminal station. The company accepted the challenge and in October 1973 was able to deliver the first commercial test equipment to a repeater station in Kagoshima Prefecture where the equipment performed well. It later delivered similar equipment to two stations in the Kanto region and Hokkaido. Oki Electric was thus a pioneer in developing digital communications using the PCM-24B transmission system.

Transfer of telephone production

Since before the war, Oki Electric had been well known as a manufacturer of telephones and related equipment. Even in the late 1960s it was still leading the industry with its Type-600 telephone. At its mass-production Honjo Plant in Saitama Prefecture, between 2,500

and 2,800 of these Type-600 telephone sets were being produced every day. Even telephones, however, were being affected by the spreading use of electronics. Oki Electric, for example, cooperated closely with NTT in a new telephone service by developing push-button and mini-push-button telephones. These telephones allowed faster and easier input of numbers than the rotary dial type of telephone, making them more fitting for NTT's new service.

Oki Electric put on sale four types of its Business Phone series (key-telephone system) in 1966. These telephones sold well to business offices because they allowed the use of multiple lines. The user could select a line, put a call on hold, or transfer a call to another person. The telephone also indicated when a line was busy. Next, in 1968, Oki Electric marketed an automatic dialer, and in 1971 a phone with an automatic alarm. This automatic alarm combined magnetic recording with automatic dial technology to send messages automatically through a public circuit. It proved popular among security companies for use as an emergency alarm.

As its telephone business steadily developed, Oki Electric decided to transfer the production of Type-600 telephones to Taiko Electric Works in the Shinagawa section of Tokyo. When Oki Electric made this decision at the end of the 1960s, the Type-600 was its par excellence telephone product, selling steadily and surpassing other models in cost rate. But the company's total telephone sales at the time were only about 4 billion yen annually. At their peak, telephones had accounted for as much as 25 percent of Oki Electric's total sales. From the early 1960s, however, that percentage dropped below 10 percent. Crossbar-switching systems replaced telephones as the company's main pillar of sales. Electronic business machines, meanwhile, were already being nurtured to become the mainstay products in the near future. That was the backdrop to the company's decision to transfer production of the Type-600 telephone from the Honjo Plant to Taiko Electric Works.

In March 1971, with President Mori among the guests, the managers and employees of the Honjo Plant watched as the last Type-600 telephone to be made at the Honjo Plant moved down the conveyor belt. It was the 3,908,706th unit produced since November 1963.

Although this was a rather emotional moment, those present knew they had little time to dwell on the past. The crossbar facility in the Honjo Plant was already being expanded to prepare for the assembly of switching equipment, scheduled to begin only six months later, in September.

First-generation online banking systems, and development of terminals

IBM introduced its System/360 in April 1964. This was the first family of computers, with a line of six models from small machines to mainframes. Its OS functions were also improved. As a third-generation computer, the System/360 could be connected directly to data terminals through a communications line. It also allowed online real-time processing of large volumes of information. For these reasons, terminals suddenly became much more important products in the marketplace—and Oki Electric had much experience in producing terminals.

In 1966, Oki Electric developed a teletypewriter that automatically transmitted and received Chinese characters. This machine was well received by newspaper publishing companies for communicating in Japanese. Next, in 1968, the company developed an improved version of the OKITYPER perforation typewriter. The new model had a printing speed of 1,000 characters per minute, double the speed of its predecessor. In the early 1970s, the company also began supplying various I/O devices, such as an online cash dispenser (CD) and an electroprinter in 1971, and a dot printer in 1972. Because Oki Electric offered a wide variety of peripheral equipment in its product lineup, the company's name gradually became synonymous with "terminals." Centered on the financial industry, the company received a steady stream of orders for terminals for online systems.

One of Oki Electric's first large orders for online terminals was for a passenger reservation system, completed in March 1967, for Kinki Nippon Tourist Co., Ltd. Nine months later, in December 1967, the company completed an online system for the Fuji Bank, one of

Japan's largest city banks. Financial institutions were among the first organizations in Japan to begin rationalizing their administrative operations, and the Fuji Bank was the earliest among Japan's banks to install an online network. The order from the Fuji Bank was also a tremendous opportunity for Oki Electric to gain experience in constructing online networks, and the company expended great efforts on the project. The bank's first requirement was to have its ordinary savings accounts online. Throughout the 1960s, the number of ordinary savings accounts in banks had increased rapidly, and the clerical burden had increased proportionately. For each transaction, a teller had to obtain the customer's ledger card from storage, log the transaction, and then return the ledger card to storage. This clerical work was time consuming, and storage space was swelling.

The Fuji Bank decided in late 1964 to have an online savings account system built based on UNIVAC 418s. At that time, the bank requested Oki Electric to provide the terminals needed for the system. The system began operating in December 1967. In the U.S., the processing of checks was one of the main operations of banks, but in Japanese banks the processing of bank account passbooks was one of the main teller operations. No terminals were thus available in the U.S. for processing the main clerical work in Japanese banks. In developing these special terminals for the Fuji Bank's online system, personnel at the Takasaki Plant of Oki Electric played a central role in working jointly with the bank. Besides the processing speed, emphasis was placed on compactness and precision, i.e., because savings accounts were being handled, mistakes in numbers were unacceptable. In 1964, Oki Electric completed the OKISAVER, its first terminal for online deposits.

The Oki Electric OKISAVER terminal underwent testing at a

OKISAVER in use at Fuji Bank

Univac Corp. plant in Minneapolis in the U.S. It was the first time for the UNIVAC 418, developed for the military, to be connected to a bank terminal. Representatives from both the Fuji Bank and Oki Electric were present as Univac engineers conducted various tests over and over. The tests proved successful and eventually the first OKISAVER terminals were installed in branches of the Fuji Bank in December 1967 when the bank's online savings account system went into operation.

After experiencing first-hand the beneficial effects of real-time, online processing, the Fuji Bank next decided in 1969 to install an online network to cover all deposits and foreign exchange transactions. It chose the UNIVAC 1108 multiprocessor system as the host computer. The new online system was completed in 1972. Starting with branches in Tokyo and Osaka, it linked over 200 branches throughout the country in a comprehensive online system. Oki Electric provided all the terminals for this network. The success of the Fuji Bank system stimulated other banks and companies in the securities industry to install similar systems, thus promoting the diffusion of online networks. Many of these new online banking systems used the OKISAVER and other Oki Electric terminals.

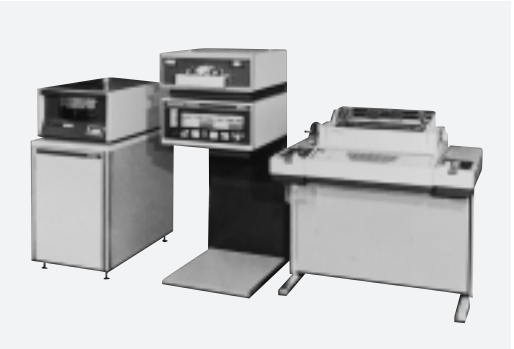
Development of minicomputers

To avoid direct competition with the OUK series of mainframe computers, Oki Electric's computer division halted the development of mainframes and instead concentrated on developing the ultra-compact OKIMINITAC series. The first model completed was the OKIMINITAC 500, used for preparing invoices. It could be more correctly described as a small, low-priced typewriter fitted with a calculator. It proved to be a popular machine because users could select fractions, number of digits, number of digits to be printed, periods, and commas. In the OKIMINITAC 600, the 500's successor, a computer chip was used, improving performance by increasing the number of digits handled and raising storage capacity. A later model, the OKIMINITAC 2001, was aimed at medium-size and smaller com-

panies. It was used for clerical work in offices, such as creating forms and calculating large number totals. Another model, Type 7000, was developed for scientific computing at universities and research laboratories.

Even as Oki Electric produced and sold the ultra-compact OKIMINITAC computers, the computer division began experimental production of the general-purpose OKITAC-8000 from about 1968. IBM had already put on sale in 1964 the System/360 series of general-purpose computers, the first of the so-called third-generation computers, and it was selling well. Oki Electric's engineers moved ahead with their development work while carefully reading the OS manual for the System/360 for reference. From the start, however, the OKITAC-8000 was not being developed for the market; after completion, it was used only inside Oki Electric.

The main aim in trial production of the OKITAC-8000 was improvement of the engineering staff's technical capabilities. Although Oki Electric decided early on not to develop general-purpose computers, it was important to have software development experience. This was important for accumulating technology inside the company, and for the future. It was conceivable that NTT might ask Oki Electric to participate in computer development projects in the future, and the company would then have to demonstrate its technical competence. In April 1969, however, Oki Electric suffered great disappointment when NTT instead chose Fujitsu, NEC, and Hitachi to participate in its DIPS (Dendenkosha Information Processing System) development project.



OKITAC-4300 minicomputer

The second half of the 1960s saw the first ultra-compact, program-controlled computers go on sale. Fast becoming popular, these machines were affectionately called "minicomputers." Minicomputer systems selling for as little as $10,000.00 in the U.S. became the subject of much attention. Oki Electric had been following these developments, and decided to enter the minicomputer market. With minicomputers, the thinking was, the company could utilize I/O devices it already had, such as line printers, card readers, and typewriters, as parts of any system it might develop. In July 1969, the OKITAC-4300 was completed. ICs were used in all its circuits, and its computing performance speed was comparable to existing medium-size machines. Not long after going on sale it was being called Japan's $10,000.00 minicomputer, and it soon became a best seller. In April 1970, the high-end OKITAC-4500 was also put on sale, aimed for use in scientific computing, process control, instrument control, and line control. In those areas it offered a performance on a par with mainframe computers. Large numbers of the 4500 were installed at universities, research centers, and technical high schools.

Software Division established

In 1970, the same year that IBM Corp. began charging separately for hardware and software, Oki Electric established a Software Division. Until then, the various separate divisions had been writing their own software. The two principal aims of integrating the software operations were: (1) to improve efficiency by concentrating the engineers in a single division; and (2) to raise the overall engineering level of the software. The Software Division was tasked with preparing programs for electronic exchanges and computers, for numerical control machines, and for automation related to in-company design, manufacture, and inspection processes. Design technology for software was highly dependent on the thinking of the designer, required many processes, and was labor intensive. Another major aim in establishing the Software Division, therefore, was to raise productivity.

Although IBM Corp. charged customers separately for its hard-

ware and software, almost all companies in Japan set market prices for their hardware that included the software. This was because the general level of awareness among Japanese of the value of software was extremely low at the time, and companies figured cost by setting an hourly rate and multiplying it by the number of hours it took to complete work processes. But the cost of software as a part of a system's total cost kept rising, and it was almost entirely for personnel expenses. The prices set on many systems did not allow for retrieving software expenses. This situation could not be ignored, and increasing productivity was thus a most urgent task.

Start of IC research

Jack Kilby of Texas Instruments (TI) in the U.S. invented the integrated circuit (IC), and TI filed for the first patent for it in February 1959. When news of this invention reached Japan, it surprised all concerned persons. In December 1965, convinced that a shift was occurring from transistors to ICs, Oki Electric established an IC Research Section inside its laboratory and research on ICs commenced there. As its first task, the IC Research Section had to develop by 1971 an IC approved by NTT for use in its electronic exchanges. To develop such an IC, micro IC processing technology was required. Through its transistor production, Oki Electric had acquired experience in growing epitaxial crystals, but with ICs it faced new technologies to conquer, such as impurity diffusion, ion implantation, and various wiring processes.

It was decided to use bipolar-type ICs in the electronic exchanges, and the technical staff at Oki Electric was soon immersed in research centered on bipolar ICs. After many false starts and repeated testing, Oki Electric's engineers finally developed a bipolar IC that NTT approved in December 1971, as scheduled. The first of these devices were immediately used in the D10 electronic switching system scheduled for delivery to NTT. They were also used in the Electronic Private Branch Exchange KC300 series. After filling the in-company demand for these ICs, they were then sold to outside customers.

2. End of High-Level Economic Growth, and First Oil Crisis

President Masaaki Yamamoto takes office, and first oil crisis

On August 15, 1971, U.S. President Richard Nixon halted dollar-gold convertibility and announced a 10 percent surcharge on selected imports. These steps sent a shockwave felt around the world. The U.S. economy was in its worst shape since the Great Depression, with inflation increasing due to high government spending (spurred on partly by funding of the Vietnam War), and with the balance of payments in deficit. In that situation, the dollar crisis worsened. To protect the dollar, President Nixon announced an Economic Stabilization Program (ESP), popularly called Nixonomics. Within a few months after that announcement, the currencies of the major industrial nations were floated one after the other. In December 1971, the yen was floated and in a single leap appreciated from 360 yen to 308 yen to the dollar. This appreciation caused an emergency situation. Oki Electric dealt with the situation, first of all, by promoting a thorough rationalization of its operations in the period September 1971 to March 1972. President Mori spoke clearly at that time about the direction in which the company needed to move. "I am convinced there is only one way that we can tide over our company, as a comprehensive electronics manufacturer, in this crisis. We must continue to promote the streamlining of our operations and improve our business structure while we devote ourselves to R&D efforts and to selling our technology."

The Japanese economy maintained its prosperity for a brief spell after President Nixon announced his new economic program. In July 1972, Prime Minister Kakuei Tanaka made public an economic stimulus plan, called the "Plan to remodel the Japanese archipelago," centered on large-scale public spending. Before long, a land speculation boom occurred, consumer prices rose quickly, and the semi-annual business reports of most companies showed profit increases.

In that situation, in November 1972, Vice President Masaaki Yamamoto succeeded President Mori as president. President Yamamoto entered the Yasuda Bank, the forerunner of the Fuji Bank, in 1936. He later joined Oki Electric as a managing director in 1959, and served under President Mori from 1966 as senior managing director and then vice president. At the end of the first fiscal year for management under President Yamamoto, the year ending in March 1974, Oki Electric reported 100 billion yen in net sales for the first time ever. Net sales continued to increase in the fiscal year ending in March 1975, reaching 124 billion yen. The return on total assets, however, hit a peak of 5.6 percent in the fiscal year ending in March 1973, fell slightly to 5.1 percent in the next year, and fell further the following year due to the negative effects of the first oil crisis that started in October 1973.

On the occasion of the Yom Kippur War that broke out in October 1973, the Arab oil producers in the Organization of Petroleum Exporting Countries (OPEC) launched an oil boycott and announced drastic increases in crude oil prices. Around the world, the switch from coal to oil as the prime energy source had continued to progress throughout the 1960s. The sharp increase in crude oil prices thus dealt a severe blow to the world economy and brought with it a round of inflation. The negative effect on Japan's economy, dependent on oil for nearly 80 percent of its primary energy, was tremendous. OPEC raised crude prices twice—in October 1973, and January 1974—causing them to skyrocket to nearly four times the level they had been at prior to the oil crisis. Japan's economy in 1974 recorded its first negative growth since 1945, and its international balance of payments fell heavily into deficit.

From the fall of 1973, the Japanese government introduced measures to reduce by 10 percent the supply of electric power and oil for 11 types of businesses. At the same time, the government requested drivers to conserve energy by using their cars less, and asked businesses to halt the use of neon signs and to reduce television broadcasting time. Consumers, however, anxious about oil supplies running out, rushed to supermarkets and other retail stores and began hoarding items such as detergents, laundry soap, and other petrochemical

Masaaki Yamamoto

products, and paper products such as toilet paper. Wholesale and consumer prices both recorded annual increases of 20 percent or more, called "frenzied increases" at the time. The situation was so critical that in March 1974 the government froze the prices of daily necessities. Corporate profits, meanwhile, began rapidly deteriorating from the spring of 1974. Several developments weighed especially heavily on corporate management. The Bank of Japan raised the official discount rate drastically, for example, and the interest rate on loans became a heavy burden. Also, the average annual wage increase was a tremendous 33 percent up from the previous year, the highest rate of increase in the postwar period. The first oil crisis effectively ended the period of high-level economic growth.

Development of electronic products for data communications

In the early 1970s, financial institutions began to plan their second-generation online systems. In 1972, around the time that the Fuji Bank completed its comprehensive online system, it asked Oki Electric to participate in building its second-generation online banking system by developing a new terminal system. The bank wanted a system that could manage the increased volume of administrative work and handle the complete range of bank operations, from deposits and exchange to loans and foreign exchange business. In 1973, in response to the bank's request, Oki Electric completed the OKITAC-1300 terminal. Using this terminal, the Fuji Bank's new online system, covering all operations, was up and running in February 1978.

Despite the volume of bookkeeping entries having increased by 35 percent between the first- and second-generation online systems, the increase in clerical personnel increased by only 3 percent. Overtime work also decreased. Oki Electric next developed the OKITAC-1200 terminal system for medium-size and smaller financial institutions. It likewise earned a good reputation.

Other business areas Oki Electric promoted around this time were the development and sale of cash dispensers (CDs), automatic depositors (ADs), and automated teller machines (ATMs). The company delivered online CDs to the Fuji Bank in September 1971, and in 1974 its cumulative sales of CDs reached 2,000 units. At the end of the 1970s, Oki Electric's share of the CD market was about 25 percent of the total, top in the industry.

Progress was being made, meanwhile, in developing communications equipment with integrated electronic automatic exchange and information functions. The first electronic switching system for the private sector was the KC300, installed in the Fuji Bank Business Center in April 1974. It was a medium-capacity exchange with a stored program control system, and it required only 10 to 20 percent of the space needed for the earlier crossbar-switching system. The KC300 included service functions such as specific interruption calls, pick-up, and automatic call forwarding. The next exchange developed after the KC300 was the standard KC310. In April 1975, operations began at the Honjo Plant exclusively producing electronic switching systems. In 1977, both the KC100 and KC200 were put on sale. This series became quite popular, called simply the "Oki Electric KC series."

Based on its experience with the KC series, Oki Electric next developed the multi-function electronic switching system OMNIPAX. This was an original system developed using technology from EPBX and equipment already widely used in Oki Electric terminals, such as I/O devices, modems, and carrier equipment. The OMNIPAX made it possible to construct leased line networks connecting telephones, facsimiles, and data communications inside companies. Unveiled at the Oki Data Communications Equipment Exhibit in 1976, the OMNIPAX attracted the attention of users concerned about cost sav-

ings and rationalization measures, in the backdrop of the long-term recession following the first oil crisis. As a link in rationalization measures, most companies were thinking about ways to save on communications expenses and reduce personnel expenses by using fewer operators. The OMNIPAX system was especially effective when used in a leased line network, because telephone charges were much less than if public circuits were used.

Demand for a new type of telecommunications terminal equipment, the facsimile, emerged around this time. The stimulus for widespread use of facsimiles was the revision of the Public Telecommunications Law that opened telecommunications lines and allowed the connection of terminal units such as facsimile machines. Oki Electric's thermal-type facsimile also stimulated demand. A newspaper publisher who visited the Oki Data Communications Equipment Exhibit in November 1972, the same month that telecommunications lines were opened to terminal units, became quite interested in the print head of a thermal printer on display. The publisher later requested Oki Electric to develop a thermal-type facsimile machine. This request became the incentive for Oki Electric to develop a facsimile machine utilizing a thermal head. Compared to other types of facsimile machines, the thermal type had four main advantages: (1) operating costs were low, and the cost of journal paper was one-third to one-quarter that used in electrostatic systems; (2) little maintenance was required, and no special operations were necessary except changing the paper; (3) the printing mechanism was simple, the machine was compact and light, and the price was reasonable; and (4) there was less acoustic noise, and no emission of electric noise.

When Oki Electric delivered the first of these thermal facsimiles in October 1973 its engineers had already begun developing the OKIFAX 600, put on sale in September 1974, for use with general telephone circuits. The next facsimile the company developed was the digital OKIFAX 7100, put on sale in May 1976. Oki Electric thus entered the facsimile market with a thermal-type machine, a machine that at the time had unsurpassed high growth potential. Other telecommunications manufacturers also entered the market, of course, as did companies from the business machine and consumer electron-

ics industries. In all, about 20 Japanese companies alone competed intensely in the domestic market. Two advantages of Oki Electric's thermal-type facsimile that allowed it to win out in the fierce competition were its ease of use and low operating costs. The thermal-type machine soon became the de facto standard facsimile around the world, and other Japanese facsimile manufacturers also began producing them.

Expansion of foreign markets

At the beginning of the 1970s, Oki Electric's main exports were telecommunications systems to countries in the Middle East. The dollar income of the oil producers in that region had rapidly increased and those countries began all-out programs to build telecommunications networks. In July 1973, Oki Electric won an order worth 5.7 billion yen for construction of a national microwave network to transmit television signals and television electric waves between Baghdad and other major cities in Iraq. Next, in 1974, Oki Electric built an international microwave circuit that extended from Iraq to Syria and Kuwait, and also built related switching centers. In 1977, another order from Iraq was received for building seven crossbar central exchange offices and 58,000 circuits. Oki Electric won the confidence of the Iraqi government by not only providing the construction work for these projects but also by offering detailed services such as the training of technical personnel and advice on how to draft plans for building a telecommunications network. By 1978, Oki Electric had become the top supplier of telecommunications systems in Iraq, winning contracts worth a total of 30 billion yen.

Based on its experience with the projects in Iraq, Oki Electric won out over U.S. and European manufacturers in bids for building telecommunications networks in other countries in the Middle East. In February 1976, for example, the company received an order from Kuwait for two completely electronic telex exchanges, one of the largest-scale projects in the Middle East around that time. Oki Electric also won a contract in 1978 from the United Arab Emirates for key-

telephones and PBXs, and not long afterward contracted to build a microwave network in Nigeria. Besides the brisk business from countries in the Middle East, exports of telecommunications systems to Central and South American countries also picked up steadily. All in all, Oki Electric earned an excellent reputation in overseas countries for performing quality work. The export of telecommunications systems, however, required much time and many personnel. In addition, overseas contracts were always accompanied by foreign exchange risk. In that context, the company began studying the export of single products for which a mass-production effect might be expected.

The first success in exporting single products was line printers exported to Europe at the end of 1977. The original line printer, the DP100, adopted a wire dotted system. It was developed as a peripheral for medium-size and smaller computers, or as a printer used with terminals. Oki Data Corporation (ODC; today's ODA), a Japan-U.S. joint venture established in New York in December 1972, developed the DP100. The printer mechanism was exported to ODC from Oki Electric in Japan, and ODC then assembled the printer by using control circuit parts procured in the U.S. Initially, the DP100 was sold only in the U.S. Compared to similar printers made in the U.S., the DP100 used new technology in its printing mechanism, and it soon won a fine reputation as a solid, durable workhorse giving dependable service. Sales in the U.S. steadily increased to about 3,000 units a year. These favorable sales gave Oki Electric additional confidence and the company decided to start exporting printers to Europe. Agency

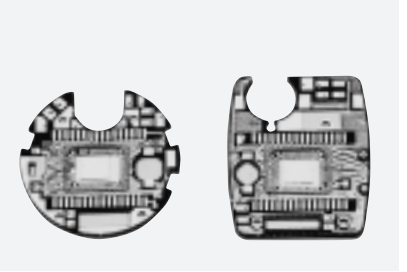
DP100 dot printer

contracts were signed with sales agents in 10 countries—Belgium, Denmark, France, Italy, the Netherlands, Norway, Sweden, Switzerland, the U.K., and West Germany—and exports quickly increased to over 1,000 units a year.

These were the first exports of completely built-up printers to countries in Europe. Realizing that the export of single products to overseas markets could be profitable, Oki Electric next developed the dot matrix printer type MT100 teleprinter with microprocessor control and exported it to countries in Southeast Asia and the Middle East. This printer contributed to the improved reputation overseas of products carrying the Oki Electric brand.

From industrialization of ICs to independent VLSI development

While tackling the development of bipolar ICs, Oki Electric's research staff also began studying metal oxide semiconductor (MOS) ICs. The company's first production of MOS ICs began in April 1967. That product received NTT approval in 1969, ahead of the company's bipolar ICs. Subsequent sales of MOS ICs were gradually expanded mainly for use with terminal units. Next, Oki Electric researchers succeeded in developing complementary MOS (CMOS) ICs. The original stimulus for developing CMOS ICs came in 1968 when a watch manufacturer approached Oki Electric and requested an IC that would operate from a 1.5V battery. Unfortunately, such an IC could not be fabricated with the technology available at the time. Not too much later, though, Oki Electric's research staff was able to develop a CMOS IC that would operate from a 1.5V battery. In 1972, Fuji Photo Op-



Custom-designed ICs for watches

tical Co., Ltd., approached Oki Electric and said it wanted to switch to electronics and use an IC for the exposure meter in one of its cameras. The company responded to this request, and in the fall of 1972 marketed a camera equipped with this new IC. It was also displayed at the Photokina camera show in West Germany and won a prestigious award. This IC was the first instance of a custom-designed CMOS IC developed to a customer's specifications. After this success, a flood of similar orders came from other leading camera manufacturers.

The watch industry supported the subsequent growth of Oki Electric's CMOS business. It took a year for the company to develop a CMOS for Casio Computer Co., Ltd., for use in watches, and afterward it became the world's first company to mass-produce ICs for digital watches with liquid crystal displays (LCD). Hearing about the success of Casio, other watchmakers, such as Seiko Corp., Omega SA, and Timex Corp., successively ordered IC products from Oki Electric. The company watched the situation closely and judged that it could compete sufficiently by mass-producing original multi-functional products. It thus decided to upgrade the production facilities at its Hachioji Plant, doubling output capacity of CMOS ICs from 50,000 units to 100,000 units per month. This move secured it the status of top manufacturer of ICs for watches. After ICs for cameras and watches, a rush of orders was received for CMOS ICs for use in transceivers. The main stimulus for this was the use of citizen band (CB) transceivers by truck operators in the U.S. Exports from Japan to the U.S. increased rapidly from 4.5 million units in the fiscal year ending in March 1976 to over 10 million units the following year.

Around this same time, Oki Electric added products to its lineup that applied optoelectronics technology. The company had begun research into light emitting diodes (LED) in 1966. In 1968, an LED using gallium arsenide was applied in an optical mark reader (OMR) that the Ministry of Labor used in a computerized job-search system, the first instance of LED technology being applied for commercial use in Japan in a large-scale system. Once into the 1970s, Oki Electric developed a series of optoelectronic products. It began the mass production of red LEDs in 1971, for example, for products such as those

used in the indicator lights of NTT's Home Telephone series. The company also marketed a gallium arsenide phosphorous LED in 1972, used widely for indicators in aircraft, cameras, watches, and calculators. In 1973, for the first time in the domestic market, Oki Electric offered LEDs in a color series of red, green, and yellow.

The progress made in IC technology led Oki Electric directly into the development of VLSI (very large-scale integration). The direct stimulus was Oki Electric not having been able to participate in a Ministry of International Trade and Industry VLSI project. When that happened, Oki Electric could not stand idly by and watch as other companies in the same industry worked together to develop VLSI. As an indication of the IC business's importance, it was already being called the "sustenance" of industry in Japan. It was obvious that if an electronics manufacturer expected to survive, it had to have an IC division, and falling behind could lead to dire consequences for the company. In July 1977, Oki Electric established an Electronic Devices Division, and the following month built a VLSI research facility inside the Hachioji Plant. These actions started the company down the path to independent development of VLSI. The largest problem facing the company's engineers in developing VLSI was the processing technology for IC micropatterns. On a visit to Bell Labs in the U.S. around this time, however, President Yamamoto and members of his staff were shown electron beam exposure equipment that happened to be undergoing trial tests. In December 1977, Oki Electric installed a manufacturing electron beam exposure system (MEBES) created by Etec Systems, Inc., of the U.S. in the VLSI research facility in Hachioji. From that point on, the company's full-scale development of VLSI moved forward.

Efficient management in post high-level economic growth period

Because of his strong sense of corporate social responsibility, President Yamamoto opposed workforce cutbacks as a means of reducing the burden on management, even in difficult times. Still, economic conditions were worsening beyond expectations. Concerned about

what might lay ahead, corporations were holding down their capital investments, which caused a reduction in business for Oki Electric. And because Oki Electric's sales system was geared mainly to doing business with government offices and large corporations, its sales personnel could not shift easily to developing private sector business. Neither could exports to developing countries be expected to cover the decrease in domestic demand, because the yen had appreciated and dollar-denominated credits kept depreciating.

Business from Oki Electric's main customer, NTT, was also decreasing. NTT had begun its fifth five-year plan, starting in April 1972, but the first oil crisis broke out in October 1973, forcing a reduction in the plan's budget. The original large-scale plan called for an additional 15.3 million subscribers and a system that would allow immediate telephone connection anywhere in Japan. Because of the budget reduction, the orders Oki Electric received from NTT related to this plan were substantially less than originally expected.

Oki Electric's net sales surpassed the 100 billion yen mark in the fiscal year ending in March 1974 and increased further to 124 billion yen in the following year. From then until the fiscal year ending in March 1978, however, they leveled off at around the 120 billion yen mark. Sharp rises in the cost of materials and personnel expenses, and an increase in interest payments, could only lead to a reduction in profits. The return on total assets fell in a single stroke from the 5.1 percent realized in the fiscal year ending in March 1974 to 2.0 percent in the following year. Following the decrease in profits, dividends were reduced from 12 percent to 10 percent in the second half of fiscal 1974, ending in March 1975. The main theme in the medium-term (three-year) business plan President Yamamoto announced in 1976 was "Efficient management, moving from quantity to quality." The plan called for a thorough review of operations and radical reforms.

In January 1977, a Task Force for Reinforcing Management was set up, with President Yamamoto serving as chairman and the members of the executive committee as members. At the same time, a business research office was established to act as the Task Force's secretariat. This Task Force, meeting separately from the regular Ex-

ecutive Committee, was positioned as a venue chiefly for discussing management reinforcement measures related to business recovery. Although the company's business results were slightly in the black in the fiscal year ending in March 1977, profits decreased to only one-third of the previous year's level. Dividends were reduced again, from the previous 10 percent to 8 percent, and reduced further in the fiscal year ending in March 1978 to 6 percent. As a result of discussions conducted by the Task Force up to the fall of 1977, it was reconfirmed that unless the company fundamentally changed its corporate structure it would not survive in the changed situation. The most urgent problem was the pressure of personnel expenses. These expenses had come to account for over 35 percent of operating costs, while the company's per capita sales were the lowest in its industry. Some of the measures carried out at this time were cuts in directors' salaries, suspension of pay raises for managers, and temporary layoffs. But President Yamamoto, who placed great emphasis on the company's corporate social responsibility, would not approve a daring plan for reducing personnel expenses. Dividends also continued to be paid to stockholders. For restructuring the company, however, a reduction in personnel expenses could not be avoided.

In the spring of 1978, during the annual labor-management discussions about wage increases, President Yamamoto explained that there was only one choice: employment, or wages. He suggested wage cuts to the labor union, but his suggestion was not accepted. In that situation, and determining that there was no other way to bring about the change of heart needed among employees for corporate restructuring, President Yamamoto resigned. Although the accounts settlement for that year, the fiscal year ending in March 1979, recorded net sales of 136.6 billion yen, the company posted a pre-tax loss of over 1 billion yen. No dividends were paid to stockholders.