Chapter 4

High-Level Economic Growth, and Entrance into New Business Areas

(1949-1965)

1. Postwar Restructuring of Oki Electric

Oki Electric Industry established, and President Suteji Kanbe takes office

On November 1, 1949, Oki Electric Industry Co., Ltd. ("Oki Electric") was established to replace the former Oki Electric Co., Ltd., and President Suteji Kanbe was assigned the task of leading the new company. President Kanbe joined the Yasuda Bank (today's Fuji Bank, Ltd.) in 1925. After working for a period in Yasuda Hozensha, the holding company of the Yasuda zaibatsu, in 1944 he moved to Imperial Piston Ring, a Yasuda affiliate, where he became senior managing director. He was invited to join Oki Electric Co., Ltd., as a managing director in November 1945, three months after the war ended, the same time as President Yanai. In August 1947, he became senior managing director, and in April 1949, about seven months prior to the company's dissolution, he was appointed president. When President Kanbe first joined Oki Electric, telecommunications equipment was an unfamiliar industry to him. But he quickly earned a reputation in the company for being "smart, sensible, and warmhearted"; he was especially popular among the company's younger employees. He was destined to lead Oki Electric for more than 16 tumultuous years, until he became chairman in January 1966.

President Kanbe's first important task was disposing of the predecessor company's debt, recorded on Oki Electric's books as an extraordinary loss and amounting to over 178.5 million yen. President Kanbe decided to have the stockholders and general creditors bear the losses, in line with the Enterprise Reconstruction and Reorganization Act. The stockholders were asked to bear 54 million yen in losses (writing off 90 percent of the company's capital), and the general creditors were asked to bear the remaining 124.5 million yen in losses (writing off 40.86 percent of their credits). Settling that account took three years, until May 1952. Meanwhile, 180 million yen in new capital was distributed to the stockholders and general creditors in stocks commensurate with their losses, i.e., 54.36 million yen

Suteji Kanbe

worth to the stockholders and 125.64 million yen worth to the general creditors. These steps freed the company from debt contracted by the old company, thus improving its financial standing markedly.

In November 1951, Oki Electric's shares were listed on the Tokyo Stock Exchange. Next, in 1952 the company doubled its capital to 360 million yen. Then, from April 1951 to March 1955, special and ordinary dividends were distributed at the high rate of 20 to 22.5 percent to the stockholders and general creditors, thereby rewarding them for the burden they bore at the company's restart.

At any rate, Oki Electric, forced to undergo a painful reconstruction and reorganization in the late 1940s and early 1950s, began a full-scale rebuilding under a management team led by President Kanbe. The telecommunications industry, however, was still operating in a controlled economy. Also, inflation was worsening, and the government had frozen prices. All this made it difficult to conduct normal business operations. Ironically, a war that broke out in neighboring Korea helped to support Japan's postwar economic reconstruction. The Korean War started in June 1950, less than a year after Oki Electric was established. It brought about special military procurements in Japan, a staging area for the U.S. military. The military procurements had not only positive factors but also negative ones affecting telecommunications manufacturers because of the controlled low product selling prices and the high materials prices at the time. Price controls were later abolished, however, and by the time the Nippon Telegraph and Telephone Public Corporation (NTT, the predecessor of the Nippon Telegraph and Telephone Corporation) was established in 1952, the business foundation of all the telecom-

munications manufacturers had been stabilized.

During the postwar occupation of Japan, General Headquarters (GHQ) of the allied forces demanded strict quality control for products supplied by manufacturers in the telecommunications industry. NTT, moreover, as a public corporation, emphasized improved service and innovations in telecommunications technology to its suppliers. In response to NTT's expectations, telecommunications manufacturers competed fiercely to improve their product quality and raise their technical levels to international standards. As a reflection of NTT's wishes, and in the process of reorganizing Oki Electric, President Kanbe emphasized two major policies for the fiscal year starting in April 1951. One was to bring stability to production process control; the other was to raise the level of the company's engineering competence. For the fiscal year starting in April 1952, a third policy was added: the reform of administrative operations. President Kanbe said that by implementing these three policies the company could win out in the increasingly severe competition among telecommunications manufacturers.

In November 1950, one year after Oki Electric was established, management introduced two important measures to reinforce the company's technical competence, one of President Kanbe's major policies. One measure was the relocation of engineers from the headquarters engineering and production departments to key locations in the Shinagawa and Warabi plants. The second measure was reorganization of the plants with the twin aims of raising the level of technology and improving product quality. At the board of directors meeting held in January 1953, President Kanbe spoke as follows. "In our industry," he said, "new technology is being developed rapidly even as demands to improve the quality of existing products are becoming increasingly vocal, especially since establishment of NTT. ... In order to maintain a dominant competitive position with other companies in our industry, it is thus more important than ever to implement the three major policies set in 1951 and 1952." In the background of his comments were strong demands from NTT for the company to improve its product quality and raise the level of its technical competence. In fact, NTT's demands became a powerful incentive that pushed

all of Japan's telecommunications manufacturers toward improvements in product quality and technical innovation.

Another task facing Oki Electric, in the context of the push toward technical innovation, was development of new business areas. The company's mainstay products during this time were still telephones and telephone exchanges. President Kanbe, however, always making certain first that the company maintained a firm foothold in the traditional telecommunications market, promoted the company's entry into the rapidly expanding electronics equipment field. Those efforts were supported by investments from the limited human and financial resources available.

NTT established, and first five-year telegraph and telephone expansion plan

Included among the postwar reforms led by GHQ, the government was compelled to review the telegraph and telephone business system. In June 1949, based on a recommendation from the Civil Communications Section (CCS) of GHQ, the Ministry of Posts and Communications was divided into the Ministry of Posts and the Ministry of Telecommunications. CCS and the Japanese government, in other words, both recognized the urgent need to quickly restore telegraph and telephone communications, and that recognition led to establishment of a ministry to exclusively handle the task. Two public corporations—the Japan National Railways, and the Japan Monopoly Corporation—were established around this same time, and the possibility thus existed even at its start that the Ministry of Telecommunications might be reorganized into a public corporation not long after it was established.

In the chaotic postwar period the government was doing almost nothing to alleviate the strong demand for telephone service. Applications were filed but few telephones were installed. Especially after the nation's reconstruction started proceeding smoothly, applications for telephones poured in. Meanwhile, long lines formed in front of public telephones, and people calling long distance between large cit-

ies had to wait hours to be connected. In those circumstances, dissatisfaction with the telephone system grew increasingly vocal. Because telegraph and telephone services were public services, moreover, and still lagged far behind, many said that a state-run system would never be able to satisfy the demand. The fiscal state of the nation, however, directly influenced government plans to expand telegraph and telephone coverage, and thus the plans could not always be completed on schedule. The ministry did not always respond sufficiently even to demands from existing subscribers regarding business matters or complaints about poor service.

The role of the Ministry of Telecommunications ended after just three years, and in August 1952 the Nippon Telegraph and Telephone Public Corporation (NTT) was established. Immediately upon establishment, NTT drew up the first five-year telegraph/telephone expansion plan, scheduled to start in the fiscal year beginning in April 1953. At the start of the plan, there were 1.55 million telephone subscribers and 2.55 million telephones, but only 41.5 percent of the telephones were automatic types. Public telephones accounted for 20,000 of the total. There was also a backlog of more than 340,000 applications for telephone service.

The expansion plan called for adding 700,000 subscribers and 15,000 public telephones. It also called for installing 1.18 million kilometers of trunk lines, and responding quickly to complaints about delays in telephone installation and poor connections. At the completion of the first five-year plan, however, the actual performance far exceeded those figures. New subscribers totaled 2.64 million, and 66,000 new public telephones and 3.3 million kilometers of trunk lines were installed. Also, long-distance calls immediately connected Tokyo with Sapporo, Sendai, Nagoya, Kyoto, Osaka, Kobe, Hiroshima, and Fukuoka. A dial toll call service was also begun within the Keihin (Tokyo and Yokohama area), Chukyo (Nagoya area), Keihanshin (Kyoto, Osaka, and Kobe area), and Kitakyushu (Fukuoka area) regions.

In the context of the high-level economic growth at the time, the demand for telephone service increased at an even faster pace than the fine performance of NTT's first five-year expansion plan. At the

end of fiscal 1957, in March 1958, when the first five-year plan was completed, there was a backlog of 580,000 applications. In addition, the ratio between number of applications and telephones installed actually worsened over the five years. In that situation, NTT launched its second five-year telephone expansion plan, running from April 1958 to March 1963. At the same time, it also publicized two clear goals it would meet by the fiscal year ending in March 1973: (1) to install telephones immediately after application, and (2) to have telephones connect immediately to any location.

Managerial reform amidst intensified competition

During the period of high-level economic growth, corporations moved almost in unison to modernize their business organizations. The start of these moves can be traced back earlier, to guidance provided to Japanese corporations by CCS of GHQ in the late 1940s and early 1950s. CCS brought in managerial skills from the U. S., such as how to bolster quality control systems and rationalize business organizations. In September 1949, for example, CCS hosted a management course for Japanese businessmen to introduce U.S. management theory and techniques for managing organizations and achieving high-level quality control.

Oki Electric was especially interested in quality control, and in October 1949 invited Professor Eizaburo Nishibori, an authority on quality control, to visit its Shinagawa Plant to lecture and provide guidance on that subject. After his theories were put into practice at the telephone dial plant in Shinagawa, the percentage of rejects dropped by 50 percent over a period of three months. In 1950, Oki Electric set up a Quality Control Committee and tasked it with having quality control activities introduced in all the company's plants. In June 1950, quality control experts were assigned to the Improvement Section of the Shinagawa Plant and the Product Engineering Section of the Warabi Plant.

Stimulated by the ideas regarding U.S. management theory and quality control, Oki Electric moved forward with its own manage-

ment reform. In the fiscal year starting in April 1951, as mentioned earlier, President Kanbe introduced two major policies—to bring stability to production process control, and to raise the level of the company's technical competence. In the following year he added, for the first time, the reform of administrative operations as a third major policy. As specific steps to support these policies, a Planning Section (later reorganized into the Administration Office of the Administration Department) was established in 1951. Next, in 1953, the Head Office organization was expanded from four to six departments. The former four departments had been the General Affairs, Accounting, Sales and Engineering departments. Of those, the Engineering Department was divided into the Production, Technical Development, and Research and Development departments. On the sales side, two branch offices and two sales offices were set up in 1949 to expand and improve the sales network, and in November 1951 four branches—in Osaka, Fukuoka, Nagoya, and Sapporo—were renamed sub-offices. In 1956, a Marketing Department was set up to augment the existing Sales Department.

On the production side, the company adopted a policy of integrating its plants in the general Tokyo area. First of all, the idle Shibaura Plant was reopened in 1953 as a plant exclusively producing new models of telephones. Next, the automatic exchange division of the Warabi Plant was shifted to the Shinagawa Plant. The Fukushima Plant, meanwhile, was left as is but was made into a wholly separate profit center, with the idea of spinning it off sometime in the future as an independent company.

Oki Electric experienced the first availability of internal funds for expanding its production facilities from around 1952, after orders from NTT began to increase. To respond to the orders from NTT, state-of-the-art machinery was imported. And when the demand for exchanges increased, an extension was added in 1959 to assembly machine facilities inside the Shinagawa Plant. A second extension was added to that plant in 1960. The Shibaura Plant was also expanded around this same time.

New product development, and introduction of overseas technology

Around the same time that the Ministry of Telecommunications was established (mid-1949), the first Type-4 telephone—called a symbol of Japan's postwar reconstruction—was put on sale. The previous Type-3 telephone, remaining from prewar days, had a brassy sound. As well, because the materials available for producing telephones after the war were poor in quality, postwar telephones came to have a strong image of being hard to hear. After repeated experimental production by six companies—Oki Electric, NEC, Fujitsu, Hitachi, Iwatsu Electric, and Anritsu Electric—in August 1948 the highly efficient, high fidelity Type-4 telephone cleared the target performance set for it. The telephone's design was decided through competition among the six companies; Oki Electric's streamlined design was selected.

In the manufacture of the Type-4 telephone, each of the six companies was assigned specific components to produce, and the companies then swapped components and assembled their quota of telephones. From 1950, however, Oki Electric began producing all the necessary components at its Shinagawa Plant and assembled Type-4 telephones completely on its own. In 1953, the Type-4 telephone production lines were shifted to the Shibaura Plant. Until production there was halted in 1963, the Shibaura Plant produced a total of 2.3 million Type-4 telephones.

In November 1950, Oki Electric received a request from the Ministry of Telecommunications for trial production of equipment needed for automating telegraph repeater stations. During the years prior to automation, telegrams were first transmitted to a repeater

Type-4 telephone

station part way to their destination where personnel checked addresses for accuracy, perforated a tape, and then set the tape for transmission. The ministry wanted to automate these operations by combining a teletypewriter with a repeater. Fortunately, the Tomioka Plant had already succeeded in 1949 in the experimental production of a teleprinter with the same performance as machines made by Western Electric (WE). The ministry was also studying the automation of telegram repeating, and requested Oki Electric to produce such a machine. Engineers in the teletypewriter and switch groups cooperated to produce a test model. In March 1953, using an Oki Electric product, the Mito Telegraph Office completed the first automated telegraph repeating. The page teletypewriter developed at this time was sold separately as a teletypewriter from September 1953. This machine did not punch holes in a column on paper tape but instead printed on ordinary paper. It was widely used and was later developed into the OKITYPER.

To reduce the technological gap between itself and overseas companies, Oki Electric energetically introduced new technology from abroad. In 1953, for example, the company introduced teletypewriter production technology from WE. Next, in 1954, it introduced design and production technology for a teletypewriter that printed Chinese characters. For in-house technical research, meanwhile, the company expanded and improved its research system in 1953. A research department was set up at that time to replace the research laboratory, and four R&D offices, divided by research theme, were set up and placed under the research department.

One business area Oki Electric wanted to enter was transmission and wireless products. Its first steps were taken in that area when it concluded an agreement in March 1954 for technical cooperation with the French company Compagnie Industrielle des Telephones (CIT) concerning carrier telephones and telegraph equipment. The company signed another agreement in the same month for technical cooperation with Raytheon Company of the U.S. concerning radar for navigation use.

It was recognized within Oki Electric that as a general telecommunications manufacturer it was necessary to have a strong carrier

section. Based on that recognition, the company changed its articles of incorporation at the general stockholders meeting held in November 1951, adding carrier equipment to the line of products it manufactured. Around the same time, it decided that its full-scale entry into the carrier equipment market would be based on technical ties with overseas manufacturers. By coincidence, Takeshi Kajii, the first president of NTT, happened to introduce Oki Electric to CIT, and discussions about technical ties between the two companies moved forward smoothly. While the business negotiations were still ongoing, CIT completed its development of a 6KC spacing short-haul carrier system that received worldwide recognition. This announcement boosted CIT's reputation in a single stroke, and the Japanese government quickly approved Oki Electric's request to introduce technology from CIT. The agreement with CIT was comprehensive, also covering know-how. Oki Electric thus had to pay royalties even for related equipment it developed on its own. While thus struggling as its engineers studied CIT technology, the company was eventually able to supply NTT with carrier equipment and establish a firm footing in the field of short-range transmission.

The technical assistance agreement with Raytheon, also signed in March 1954, was for introducing radar technology in the radio equipment field, an area Oki Electric had experience in from prewar days, especially related to shipborne radio equipment. During the postwar occupation, GHQ prohibited Japanese companies from conducting radar research, but after the San Francisco Peace Treaty came into effect in 1952, all the Japanese telecommunications manufacturers resumed their radar research. After acquiring radar production technology from Raytheon, Oki Electric was able to tackle the remodeling of the SO3 (3-centimeter wavelength) radar leased by the U.S. to the Maritime Safety Agency. Next, in 1955, with technical cooperation from Raytheon, Oki Electric manufactured its Model 1500 radar. Later, by making good use of Raytheon patents, Oki Electric developed various types of radar, such as for use aboard ocean research vessels, large merchant ships, oil tankers, and small fishing boats.

2. Start of High-Level Economic Growth, and Modernization of Management

Challenging technical innovation, and building new plants

In 1955, the year that Japan's first postwar period of high-level economic growth—the Jinmu boom—started, the so-called "1955 political system" was formed, centered on the Liberal Democratic and Socialist parties. That was also the first year for the "spring offensive," which afterward became an annual series of labor-management wage negotiations. In effect, a social structure was completed around this time that would continue until the 1990s. The annual economic White Paper for the fiscal year ending in March 1957 commented that "the postwar period has ended," meaning that Japan's postwar economic reconstruction had been completed and that a new period had arrived. Although a business recession occurred at the end of the Jinmu boom, the economy began growing again from 1958, in what was later called the Iwato boom. In 1960, Prime Minister Hayato Ikeda announced his plan to double the national income, and the government began introducing measures to promote another period of high-level growth. Although there were several short-term economic fluctuations between 1955 and 1959, Japan's economy recorded annual average growth in real terms of 7 percent or more during those years—truly high-level economic growth.

One of the factors supporting the high-level economic growth in the second half of the 1950s was technical innovation. In order to win out in competition, Japanese companies were extreme in their determination to introduce technology from abroad, particularly in the petrochemical and electronics fields. It was around this same time that Oki Electric's move into the electronics field took on concrete form. In his New Year's address at the start of 1956, President Kanbe spoke about the central importance to the company of the wired telecommunications equipment field, and how it was necessary to develop that business further. He also spoke about the importance of

the wireless field, and about how the company's capabilities in the electronics field could well determine its very future, thus showing early on that he recognized the significance of electronics.

From that point on, Oki Electric's commitment to the electronics business became much clearer. In his New Year's address in 1958, for example, President Kanbe said the company faced an important crossroads where there was with no room for complacency. "It is important," he said, "to place the company's greatest efforts on R&D in the electronics field. Although doing so will require substantial financial investments and might even mean temporary losses, some degree of sacrifice is necessary. The company is determined to succeed in this field." This was a clear statement of President Kanbe's policy of supporting whatever investments were needed in the electronics field.

To compete in the area of technical innovation in the late 1950s, it was necessary to obtain cutting-edge technology from abroad. In 1958, Oki Electric signed a contract with WE for using its production technology related to transistors. The company's introduction of technology from abroad thus began in the telecommunications field and was expanded afterward to include electronics. For R&D of new technology, the company built a research center in the Shibaura section of Tokyo in 1958 and brought together there the research sections for wired telecommunications, wireless, telegraphic communications, materials/components, and acoustic waves.

As the company's business expanded, another round of organizational reforms became necessary. In April 1958, the company introduced major structural reforms, such as establishing a Comprehensive Technology Planning Office, reorganizing the Business Research Department into the Commerce Department, and adopting a new plant system. Up to then, the separation of responsibilities inside the plants for functions such as production and inspection, and design and development, was not clear. Under the new plant system, the production and inspection departments were left inside the factories and an engineering department was set up separately outside the factories and put in charge of design and development. Thus, each plant had a factory and an engineering department under its control, each performing clearly different functions.

Until the late 1950s, the plants in Shinagawa and Shibaura were Oki Electric's main plants. Starting in 1958, however, when the Takasaki Plant was built in Gunma Prefecture, the company adopted an aggressive policy of building new production facilities on the fringe of the Kanto region around Tokyo. With the Takasaki Plant exclusively producing computer I/O devices, a plant was built in 1961 in Hachioji, west of Tokyo, for producing semiconductors, and another in 1962 in Honjo, Saitama Prefecture, for mass-producing Type-600 telephones. Because of this concentration of capital investments in production and R&D facilities, Oki Electric's tangible fixed assets expanded 3.5-fold in five years, from about 1.4 billion yen at the end of March 1956 to 5 billion yen at the end of March 1961.

In 1959, Oki Electric increased its capital to 2.16 billion yen. It also issued its first corporate bonds that year. Its borrowings increased in line with its increased capital investments, and its owned capital ratio thus decreased from 46.8 percent in 1955 to the 20 percent level in 1960. At the board of directors meeting held in February 1959, a tentative goal of 10 billion yen or more in annual sales was set "to ensure the company's future growth." In order to reach this goal, the board adopted a clear policy of "concentrating all measures on reaching the goal of 10 billion yen in sales, and prioritizing the expending of funds for production, technology, research, and sales, items directly linked to achieving that goal. Expenditures for all other items will be temporarily suspended."

Shift toward domestic production of crossbar-switching systems

One of NTT's initial goals in the early 1950s, after its establishment as a public corporation, was developing the technology that would allow automatic dialing and immediate connection to any telephone in Japan. The research into, and development of, domestically made crossbar-switching systems was thus made a priority task. When immediate toll call service began, with subscribers calling long distance between large cities and being directly connected to the other party, it was quickly realized that the step-by-step switching system

being used could not process all the calls. After studying switches used in the advanced countries, NTT concluded that crossbar-switching systems were needed in Japan.

The crossbar-switching system was invented in Sweden and advanced upon in the U.S. NTT decided to import various exchanges made overseas, experiment with them, and select the one most appropriate for production and use in Japan. After its first round of experiments, NTT decided that its final selection would be between the crossbar-switching systems of WE and Kellogg in the U.S. and Ericsson in Sweden. Oki Electric was familiar with all those systems but favored Ericsson's because it was compact and economical, making it more appropriate for the Japanese situation. In 1953, therefore, the company started at its Shinagawa Plant to produce experimental crossbar switches and relays like those of Ericsson. It completed experimental products one year later, in 1954. After testing, Oki Electric found not only that the Ericsson-type crossbar switch had cost advantages over other systems but also that it could use almost as is the production facilities it already had for Strowger-type exchanges.

While preparing the experimental switch and relay, Oki Electric invited Ericsson representatives to Japan. NTT also showed an interest in the Ericsson crossbar exchange and suggested using it experimentally at several telephone offices, including the Ome Office. Ericsson, however, decided not to participate in the project, and its crossbar exchanges were thus not used. NTT, meanwhile, had continued joint research with NEC of WE-type crossbar exchanges at its Electrical Communication Laboratory from 1953. In that situation,

Crossbar exchange

Oki Electric sent engineers to the U.S. to acquire technical competence on WE's crossbar exchange, and at the same time produced and sold small Ericsson-type crossbar-switching systems. Also, because the type of crossbar-switching system was not stipulated for PBX use, Oki Electric was the first to produce Ericsson-type exchanges for commercial use, producing an exchange with 100 lines for in-house use in January 1956, prior to NTT's announcement of the type to be used for public telephone offices.

In February 1958, NTT announced its specifications for the type of crossbar-switching system it wanted to have produced domestically. As expected, it was to use the WE-type crossbar switch and wire spring relay. Oki Electric immediately turned to producing crossbar exchanges to meet NTT's specifications. Since production required the use of WE patents, Oki Electric entered into a patent licensing contract with WE in 1959 for production of crossbar exchanges. In April 1960, Oki Electric received NTT's official authorization for the WE-type switch and relay it was producing. But even while waiting for NTT's authorization, Oki Electric had moved forward with construction of a production facility inside the Shinagawa Plant for exclusively producing crossbar exchanges. The end of 1960 saw completion of the first and second stages of construction. The third stage was completed in 1963, making the plant ready to begin mass-producing the exchanges.

In 1960, the Shinagawa Plant successfully produced C41 and C51 crossbar exchanges—the standard type for local calls—and installed them in about a dozen domestic telephone offices in 1961. These standard exchanges were developed in an NTT joint research project that included the four major exchange manufacturers—Oki Electric, NEC, Hitachi, and Fujitsu. The three main themes for the project were to make the switches economical, expandable (in capacity), and power conscious. Development of the C400, completed and delivered in 1966, was likewise a result of joint research by the same four companies. Oki Electric's production of crossbar-switching systems expanded steadily, recording a 50 to 60 percent increase in orders in the fiscal year ending in March 1965 year-on-year. The first switch Oki Electric sold was an Ericsson-type for use at the Ryuo

Station in Tokyo. Counting only the models supplied to NTT, Oki Electric delivered a total of over 70 sets.

Start of transistor research

William B. Shockley and other researchers in Bell Laboratories in the U.S. invented the transistor in December 1947. The September 6, 1948, issue of *Newsweek* magazine carried an article on the invention. Although Oki Electric was also interested in news about the transistor, a serious problem in the early stages was the transistor's low production yield. General Electric and RCA of the U.S. began marketing transistor products from around 1952, nearly five years after the invention, marking the start of the transistor industry. Tokyo Telecommunications Engineering Corporation (today's Sony Corporation) was one of the first companies in Japan to produce transistor products for commercial use. It acquired a transistor-manufacturing license from WE in 1954 and produced its own transistors, eventually putting on sale the world's second transistor radio.

In 1956, researchers in the materials research section of Oki Electric tackled the development of a germanium transistor. Their focus was the application of transistors to electronic telephone exchanges. They took turns lecturing to each other about Shockley's paper on the transistor, and the youngest were sent to study at Tohoku University and at the Electric Technical Laboratory of the Ministry of Internal Trade and Industry (MITI) for advanced semiconductor research. Their studies there began with the generation of germanium crystals. At the time, the trend in transistors was already shifting from point-contact type to the growing junction type. Oki Electric, however, decided to concentrate its development efforts on the even further advanced alloy junction transistor. But to produce alloy junction type germanium transistors, alloy junction technology was needed, as was the technology for making homogeneous monocrystals with a high level of purity. In the summer of 1958, Oki Electric succeeded in producing a "Ten Nine" monocrystal, so called for its ultrahigh level of purity—99.99999999 percent. It also successfully produced an alloy junction.

Besides developing transistors for electronic exchanges, Oki Electric also produced transistors for use with carrier equipment. The time was fast approaching, therefore, for Oki Electric, one of the latecomers in producing transistors, to tackle full-scale transistor production. To do this, the company first of all built a transistor pilot plant in its Shibaura Plant in 1959, at the same time concluding patent licensing contracts for transistors and diodes with WE and RCA. The company also bought a huge 122,100-square-meter plot of land in a suburb of Hachioji, and began building an exclusive semiconductor mass-production plant. Construction was completed in June 1961. Because transistor production required an ultra-clean environment, with absolutely no dust or other impurities in the air, the Hachioji Plant had no windows and the employees wore dust-proof clothing. The transistors produced at the plant were used at first solely for in-house production. NTT also qualified them for use in carrier equipment that Oki Electric produced at its Shibaura Plant.

Just prior to the start of operations at the semiconductor plant in Hachioji, a group of Oki Electric's employees visited the production plants of U.S. semiconductor manufacturers. There they were surprised to see not germanium but silicon transistors being produced. Upon hearing that news, researchers at the Hachioji Plant immediately turned to developing epitaxial planar type transistors, the cutting-edge even among silicon transistors. But because a new type of transistor had to be produced, new technology also had to be introduced. For that purpose, Oki Electric concluded technical ties in October 1961 with General Instruments Corporation (GIC) in the U.S.

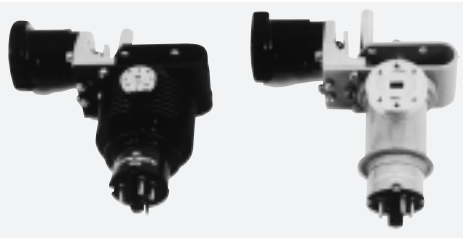
Aerial view of Hachioji Plant

Full-scale production of the epitaxial planar type silicon transistors began at the Hachioji Plant in mid-1963; the products received NTT's qualification in 1966. The silicon transistors produced in Hachioji reached the highest quality and performance levels seen in Japan. In 1965, Oki Electric was producing over 100 different kinds of semiconductor products.

Development of millimeter wave magnetron

Another area Oki Electric began new research into was electron tubes. Microwave applications were enjoying great popularity at the time, and Oki Electric and other manufacturers were tackling research for making wavelengths shorter. As wavelengths became shorter, more multiplex transmissions became possible in communications. As well, higher resolutions became possible in radar transmissions. From the spring of 1955, Oki Electric's researchers struggled with development of millimeter wave electron tubes. At the end of 1955, the researchers succeeded in creating a magnetron—a high-power, ultra-high frequency electron tube oscillator—that generated millimeter waves 7mm in wavelength.

Next, in April 1958, Oki Electric developed a klystron electron tube that generated continuous millimeter waves, making it possible to use millimeter waves for transmission. Success in developing a klystron tube reflected positively on Oki Electric's reputation in this field. One after another, orders and requests for information came from leading corporations and research institutions in the U.S., such as Bell Labs, RCA, Hughes, NASA, COMSAT, Lockheed, and Douglas. Orders also came from prestigious universities. After being used



Millimeter-wave klystron

in ground stations for the Telstar communications satellite in 1962, klystron tubes from Oki Electric came to be used in many other satellite ground stations, demonstrating to the world the company's high technical competence.

In April 1961, Oki Electric began construction of a production facility inside the Hachioji Plant for exclusively producing millimeter-wave electron tubes. Production operations began in May 1962. Magnetrons produced there were installed in 1964 for use as the harbor radar for the Port of Osaka. This was Japan's first 9.2mm millimeter-wave radar, and its resolution was far superior to microwave radar used previously, thus contributing substantially to ship navigation safety. Oki Electric's millimeter-wave electron tubes were highly evaluated for their high power, high stability, and long life. The company produced a line of about 60 of these electron tubes, including millimeter-wave magnetrons for harbors and airports.

The development of millimeter-wave electron tubes tied directly to the development of radar technology, a research area in which Oki Electric engineers had made progress after the war. Radar technology led to the development of new products such as radar rain gauges and cloud detection radars. Weather experts knew that if radar reflectivity could be used to calculate rainfall rates it would be possible to quickly estimate rainfall distribution within a 10-kilometer radius of where a radar rain gauge was placed. From the viewpoint of avoiding potential disaster from heavy rain and flooding, the demand for such radar was substantial, especially from electric power companies and the waterworks bureaus of local governments. After hearing an explanation of these applications, management at Oki Electric quickly approved the development of a radar precipitation measurement system. The CPM6 radar rain gauge was completed in 1961.

Oki Electric: manufacturer of peripheral devices

High-level economic growth brought with it an expansion of business activities. As organizations and the volume of administrative operations burgeoned, business enterprises took the lead in pro-

moting management reform and the streamlining of administrative operations. Among businesses with large numbers of customers, for example, such as financial institutions and electric power companies, the use of punched card systems (PCS) spread. Eventually, some companies began using integrated data processing (IDP), a system that connected head offices with branch offices and production plants via a telex network. IDP systems allowed the integrated processing of paperwork such as order forms, invoices, and shipment and billing requests.

In response to the emerging needs of corporations, Oki Electric began producing and supplying high-quality business machines. Two good examples are the Teletypewriter, a page teletypewriter put on sale in 1953, and a Perforation Typewriter developed for Fuji Steel in 1956. The Perforation Typewriter won an especially favorable reputation, and, coupled with energetic sales efforts, special models were produced according to the specifications of each corporate customer. Another popular machine produced around the same time was a converter that automatically made a tape from a punched card or a punched card from a tape. The company also began developing a teletypewriter that could handle Chinese characters. Existing teletypewriters could only handle kana, the Japanese phonetic symbols, making the text difficult to read. The printouts could not be used as is for official documents or report documents. The original teletypewriter the company developed handled 2,500 characters. Some of its main customers were the Ministry of Foreign Affairs and newspaper publishing companies. This teletypewriter was developed further to handle 5,000 Chinese characters, and was exported to Taiwan. Based on the English-Japanese teletypewriter, another machine was later developed for use with the Korean writing system.

On seeing how the in-house production of transistors, the domestic production of computers, and the move in government offices and corporations to automate the flow of paperwork were affecting business, Oki Electric concluded that the demand for peripheral equipment, such as perforation typewriters, was certain to grow in the future. The company also believed that with the diffusion of IDP systems, a teletypewriter network would eventually spread through-

out the country. It was felt that a production plant for manufacturing data processing equipment should be built, thus clearly indicating the new path Oki Electric intended to follow. At the time, the municipal authorities in Takasaki, Gunma Prefecture, were earnestly inviting Oki Electric to locate a production plant in their city. A plot of land about 50,000 square meters in size was available in the Shingokan-cho section of the city. The first-stage construction of the new plant in Takasaki was completed in November 1958 at a total cost of 1 billion yen.

Even as the Takasaki Plant was fitted with the most up-to-date production equipment, researchers at Oki Electric developed various data processors for production at the plant. The production lines at the Takasaki Plant had three times the output capacity of the Tomioka Plant, and produced a steady stream of new products. The first product produced in volume at the plant was a telex network, comprising a tape-type transit exchange and teletypewriters. At the time, there was a critical need for an automated system that would allow financial institutions to connect their head offices with their network of branches in order to quickly process exchange transactions. A move thus emerged, centered on financial institutions, to install online sys-

Aerial view of Takasaki Plant

tems for processing administrative operations. This was the so-called first generation of online banking systems. A demand emerged to build online systems using a telex network. Oki Electric quickly responded to this demand.

Not only did the telex network for financial institutions have to be tailored to the paper forms each company used but also each bank wanted its network to be more advanced and multifunctional than that of its competitors. Production thus began after receiving a confirmed order. In 1958, Oki Electric delivered an automatic telex network to the Hokkaido Takushoku Bank. Orders from other financial institutions followed one after the other. At its peak, Oki Electric's market share for telex networks reached 90 percent.

Oki Electric developed several new products in 1958, such as a belt line printer, a photoelectric tape reader, and a general-use I/O device. The line printer surprised those in IBM's printer division. Unlike serial printers, which printed one letter or number at a time, the high-speed line printer printed a line at a time. At the time, drum type printers that distributed the fonts on a drum were the mainstream printers. Oki Electric engineers were the first to develop a belt line printer, in which the fonts were arranged on a belt. The belt line printer printed 600 lines a minute, and did away with the problem of printing jumping up and down the way it did with drum type printers. IBM rated the line printer highly and approached Oki Electric with an offer of joint research.

The offer from IBM, the world's largest computer manufacturer, for joint research said much for the high level of Oki Electric's technical competence. Oki Electric accepted the offer, and afterward the two companies conducted joint research for about three years, mutually exchanging technology from their strongest areas. They also produced experimental products, and checked their performance. Oki Electric learned much from IBM during the period of joint research, including about computers and about IBM's strict quality control standards. The belt line printer was displayed at the First International Federation for Information Processing Exhibition Automath '59 in Paris in 1959. It attracted international attention for its innovative mechanism, accurate operation, and high speed.

3. Business Expansion, and Slowdown in High-Level Economic Growth

Managerial reform and recession of 1965

As the demand for telephone service increased, NTT drastically amended and expanded its second five-year telephone expansion plan (April 1958-March 1963). The plan's expenditures swelled to 620 billion yen as NTT moved to add 2.14 million new subscribers, 100,000 more public telephones, 7.7 million trunk lines, and 538 telephone exchanges. But even with these upward adjustments, supply could not keep up with demand, and the backlog increased to 1.01 million applications. Service was improved, however, with the percentage of immediate connection of toll calls increasing to 75 percent from its former 47 percent. NTT was thus approaching its goal of providing telephones that connect immediately to all other telephones. At the completion of the second five-year plan, NTT then put its third five-year plan (April 1963-March 1968) into effect. These successive telephone expansion plans created a tremendous demand for telecommunications equipment, and led to the development of crossbar-switching systems and the Type-600 telephone.

Oki Electric's organization and workforce both expanded with the increase in its business due to the high-level economic growth, and it gradually became necessary to speed up business operations and clarify responsibilities. The company took its first step in February 1960 when it clearly stipulated the lines of authority for each job title, starting with the president and including managing directors and general managers. This step resulted in a company-wide power shift. Next, in October 1961, it established new provisions for the executive committee, thereby creating a system for quicker decision-making. After the Takasaki, Hachioji and Honjo plants were built, moreover, this system was improved to allow the comprehensive management and operation of all business offices and plants. A streamlining of management procedures was also gradually implemented,

such as automating in-house administrative operations and establishing a comprehensive budget system. The company marked the 80th anniversary of its founding in November 1961, and on that occasion moved its head office to the Shin Toranomon Building in Tokyo's Minato Ward.

Once into the 1960s, Oki Electric bolstered its efforts further in the electronics field. In his New Year's greeting in January 1960, President Kanbe spoke about the company's performance in the electronics field as affecting its very existence. "Lagging behind in either the energy revolution or the development of electronic equipment," he said, "could mean our fall into becoming a third- or fourth-rate company. For our company's future prosperity, therefore, I want you to make strenuous efforts now, efforts you will not regret later, to develop products in the electronics field. Our main goal will be to use more electronics in our communications equipment, and to gradually use electronics in other equipment as we move along."

As concrete goals, President Kanbe mentioned developing electronic switching systems and electronic computers, building a transistor plant, establishing other plants to bolster the production of general products, and improving the system for mass-producing crossbar-switching systems. In addition, President Kanbe said the company would achieve its goal of 200 million yen in monthly output from the Takasaki Plant, advance overseas in the area of parts for

Shin Toranomon Building (1961)

telecommunications equipment and electronic products, realize its business goal of 14 billion yen in orders, and bolster reforms aimed at achieving higher efficiency in administrative operations. Oki Electric's business foundation had always been solidly based on the telephone business, but its most important tasks for the future had clearly shifted to electronic products, including business machines made at the Takasaki Plant.

In 1961, the company reorganized its R&D structure. The previous five research centers were broken into 16 groups. Chief among them were telephones, electronic automatic exchanges, computers, applied acoustic equipment, millimeter waves, electron tubes, semiconductors, and electronic components. Another R&D reorganization took place in 1963 when a seven-laboratory system was set up with three principal research themes—electronic automatic exchanges, millimeter-wave communications, and data transmission.

On the financial side, the company increased its capital to 4 billion yen in 1961 and to 6 billion yen in 1962. For the fiscal year starting in April 1960, the company needed about 2.67 billion yen to cover expenditures planned for plant and equipment investments, loans, repayment of debt, and increases in operation expenses. Of that amount, it could only raise about 620 million yen of its own capital. It financed the rest by issuing corporate bonds and borrowing the balance. Between 1959 and 1965, the company issued corporate bonds ten times through its main bank, the Fuji Bank. Although the company's ratio of net worth rose between 1960 and 1962, it decreased to 20 percent in 1965 because of the increased borrowings.

During the first half of the 1960s, Oki Electric established several affiliates with the aim of improving its management efficiency. In April 1960, for example, it spun off its idle Tomioka Plant and made it independent as Tomioka Oki Electric Co., Ltd., with capital of 20 million yen. Because of production increases, Oki Electric's existing plants were running out of space. Tomioka Oki Electric was established mainly to produce mechanical parts under subcontract from the Takasaki Plant. Next, in May 1960, the construction department of Oki Electric was made independent as Oki Electric Installation Co., Ltd., with capital of 30 million yen. This was done to handle

more efficiently the increase in orders for the installation of PBX equipment. In another move, in October 1960, the ceramic industry division of the Shibaura Plant was spun off and made independent as Oki Ceramic Industry Co., Ltd., with capital of 8 million yen. Yet another affiliate was set up in December 1961, Tohoku Oki Electric Co., Ltd., established with capital of 200 million yen and about 1,100 employees. It was assigned the production of broadcasting equipment for cable broadcasting systems.

Even as Oki Electric was growing larger, the high-level growth of Japan's economy came to a standstill around the time of the Tokyo Olympics in 1964. That was followed in 1965 by an unprecedented business recession, causing the bankruptcy of some middle-sized corporations and major securities companies. The government overcame the crisis by taking the extreme measure of providing special Bank of Japan loans to companies needing financing. But the recession seriously affected the business of Oki Electric, and its profit rate dropped. In his New Year's greeting in 1965, President Kanbe explained how the company should aim for qualitative improvements. "In general," he said, "the overall performance of a company and its business activities is evaluated by the profits it earns. The fact, however, is that our company has fallen slightly behind other companies over the past few years in its profit-earning capabilities. Frankly speaking, that fact is sufficient for telling us that we still have weaknesses to overcome."

Type-600 telephone, and exclusive mass-production plant

In early 1959, NTT announced a project to develop a more economical telephone with a higher performance to replace the high-fidelity Type-4 telephone. The result of that project was development of the Type-600 telephone. Using the same cable thickness, the Type-600 was three times more sensitive than the Type-4. Even if the cable thickness were halved, the Type-600 would still provide sensitivity on a par with that of the Type-4. So it was also possible to cut line construction costs. The Type-600 proved to be indispensable in meeting the goal in NTT's telephone expansion plans of immediate con-

nection to any telephone in the country.

In February 1959, NTT assigned Oki Electric the task of producing experimental parts for a magnetic bell for the new telephone. The bell's frequency was lowered below that of the Type-4's bell, making the ring easier to hear, and the bell's structure was simplified to reduce production costs. Oki Electric knew, however, that merely completing the bell according to NTT's guidelines did not guarantee that it would win out in competition with other manufacturers. Also, if the company waited for other companies to complete their task of producing experimental handsets, there would be no time afterward to prepare a mass-production system. Oki Electric thus decided to move ahead and produce its own experimental handset.

NTT opened a design competition for the new telephone, and once again, as with the Type-4 telephone, Oki Electric's design was selected. The new telephone was more compact than the Type-4, and NTT decided to call it the Type-600. NTT then instructed the manufacturers that participated in the project to exchange the parts each had produced and to develop experimental models. Oki Electric had great business expectations for the Type-600 and was determined at all costs to succeed in mass-producing it. To do so, the first step was construction of a mass-production plant. Thus, while moving forward with the production of experimental parts at its Shibaura Plant, Oki Electric began construction in February 1961 of a mass-production plant in Honjo, Saitama Prefecture. The plant site was 132,000 square meters in size, and floor space totaled about 40,250 square meters, making it the largest of Oki Electric's plants at the time.

Oki Electric aimed to make the Honjo Plant one of the world's finest production facilities exclusively producing telephones. Various

Type-600 telephone

innovations were introduced to achieve that goal, including a unique floor layout. In the huge production area, for example, not a single partition was erected, effectively turning the entire building into a single working space to support mass-production. As a quality-control measure, and for dust control, the air conditioning system maintained a fixed temperature and humidity. Also, work processes previously completed manually were automated, and numerical controlled machine tools were used widely. In a mass-production system, of course, when defects are found during the inspection process, it could mean that a large volume of defective products had been manufactured. To prevent defects, therefore, product quality was maintained by adopting a field management system, with personnel at the worksites directly coordinating production and making measurements.

The transfer of production processes from the Shibaura Plant to the Honjo Plant was completed in April 1963, and training production began. At first, telephones were assembled using the parts manufactured at the Shibaura Plant. Even so, training new, young employees sufficiently to get production running smoothly required great efforts. In particular, the belt conveyor system introduced at the Shibaura Plant for assembly line operations was adopted on a full scale at the Honjo Plant, a first-time experience that caused all sorts of minor problems.

Four months after the telephone production operations were transferred to the Honjo Plant, in August 1963, NTT announced its specifications for the Type-600 telephone. Because Oki Electric built the Honjo Plant and conducted training production on speculation, it was prepared to make a sacrifice. Fortunately, however, NTT's specifications fit the company's production operations nicely and it was thus able to begin all-out production far earlier than the other companies participating in the project. Three months after NTT announced the specifications, in November 1963, trucks loaded with the first Type-600 telephones for delivery to NTT left the Honjo Plant and headed for Tokyo. Large banners, draped on the sides of the trucks, read: "Type-600 telephones made by Oki Electric."

Electric teletypewriter OKITYPER 2000

The companies competing in the data processing equipment industry included not only telecommunications manufacturers but also business machine manufacturers and others. Competition was fierce and new models with value added were frequently introduced. Even as Oki Electric, known for its peripherals, was moving forward with research to make perforation teletypewriters more compact, it developed and put on sale in June 1961 an electric teletypewriter, the OKITYPER 2000. This teletypewriter could simultaneously also make perforation tapes and book entry forms. It printed 500 letters a minute.

The OKITYPER 2000 was a wonderful machine that resulted from painstaking development and design efforts by personnel at the Takasaki Plant. Being a fully automatic teletypewriter, it was easy to operate. And because it was small and light it was possible to use it at teller windows in banks and at public offices. Owing to these various features, and its reasonable price, the OKITYPER 2000 became quite popular. It could also be connected for direct input to a computer, and was thus utilized as an I/O device as computers came to be used widely. Other models were added to make an OKITYPER series. An ultra-small computer was fitted inside one model to provide it with accounting and slip issuing functions. The series grew to become the mainstay product among Oki Electric's teletypewriter products, selling better than all the others.

The next hit product Oki Electric developed after the OKITYPER was the OKIDEX 7000, a fully electronic data exchange. As financial institutions catered more and more to individual customers, data ex-

Early period electric typewriter

change systems that recorded on paper tape were gradually unable to keep up with the increased volume and diversification of data. In that situation, the financial institutions began introducing mainframe computers. Oki Electric developed the OKIDEX 7000 as a fully electronic data exchange for use with mainframes.

In March 1957, Oki Electric established Oki Business Machine Sales Co., Ltd. (OBMS), with capital of 4.5 million yen. For years, Oki Electric's business had been centered on NTT and other government offices. It thus did not develop the same strong sales capabilities in the private sector. Establishing OBMS would allow it to compete more effectively with other companies in the terminal equipment market. OBMS had over 40 sales and service offices throughout the country, and boasted of being able to dispatch a service engineer to any domestic customer's location within two hours. In 1967, OBMS was absorbed into Oki Electric's Data Processing Service Division.

General-purpose computer OKITAC-5090, and establishment of Oki Univac

After completing the development of a medium-size computer jointly with other manufacturers under MITI guidance, Oki Electric completed development of the OPC1 in September 1959. This computer used parametrons—circuit elements invented in Japan. After the transistor became the mainstream circuit element from around 1960, however, Oki Electric set up a Computer Research Laboratory inside its research institute and began tackling the development of a computer using transistors.

Other manufacturers were also moving all-out to develop similar computers. In 1959, three manufacturers announced new computers: Tokyo Shibaura Electric Co., Ltd. (today's Toshiba Corp.), the TOSBAC 2100; Hitachi, the HITAC 301; and NEC, the NEAC 2203. The domestic computers at that time, however, incorporated some of the thinking behind computers made overseas, and an imbalance was created between the mainframe and the I/O devices that led to certain problems when using the computers. Oki Electric, mean-

while, because of its strengths in peripheral equipment, viewed computers as merely components in an overall data processing system. That was the attitude with which it tackled the development of a mainframe.

The experimental OKITAC-5080, conceived on the assumption that it would be connected to terminal units, was not only small and light but also provided an outstanding balance between the mainframe's speed and the high-speed line printer used as its output unit. That design contributed to the system's ease of use. In May 1961, the experimental model was completed for commercial use as the medium-size OKITAC-5090. To handle its computer-related business, Oki Electric set up a Computer Systems Division in 1962.

The OKITAC-5090 was the first domestically produced computer to use core memory. It also used peripherals that Oki Electric produced in-house, including a line printer, card reader, card punch, and magnetic tape. In performance, the OKITAC-5090 competed effectively with the IBM 1401 that IBM Corp. was selling in Japan. National universities were among the first to inquire about the OKITAC-5090. These universities had their budget for the purchase of computers set by the Ministry of Education (MOE). The OKITAC-5090 was the most suitable computer available for academic tasks and its price was within MOE's allotted budget requirements. It thus became popular for use by national universities, and orders to Oki Electric accounted for about 80 percent of the MOE's total budget for computers for these universities. The first machine put on sale

OKITAC-5090A general-purpose computer

was called the Type A. Afterward, Oki Electric introduced types B, C, and D. Type B was fitted with a card reader and a card punch for calculation applications in offices, Type C was fitted with a magnetic tape unit, and Type D was a general-purpose system. Over the three years from 1962 to 1964, a total of 52 of these systems were sold. It was highly unusual at the time for a single model of a domestically made computer to sell in such large numbers.

Developing mainframe computers for commercial use was not a simple task. Huge amounts of capital were required to develop both the computers and the accompanying software. Oki Electric, moreover, was certain that IBM would eventually stand in its way as a formidable competitor. As well, the other domestic computer manufacturers were already forging technical ties with leading U.S. computer companies. In that situation, Oki Electric decided to approach a U.S. manufacturer to sound out possible technical ties. After reviewing the history and performance of a number of candidate companies, Oki Electric decided to approach Sperry Rand Corporation.

Sperry Rand was formed in 1955 as a joint venture between Remington Rand Inc., founded in 1927 as a manufacturer of typewriters and other business machines, and Sperry Corporation, founded in 1933 as a manufacturer of instruments. In February 1950, Remington Rand acquired the Eckert-Mauchly Computer Corporation, owned by J. P. Eckert and J. W. Mauchly, inventors of the world's first large-scale, general-purpose electronic computer, the ENIAC, and later the UNIVAC. It was after Remington Rand acquired Eckert-Mauchly Computer Corporation, however, that the UNIVAC-1 was developed for commercial use. As the successor to Sperry Corp. and Remington Rand, Sperry Rand had already accomplished much in the computer industry, and the company's computer division, Sperry Univac, had just been spun off in 1962 to form the independent company Univac Corporation. Univac had a sophisticated level of hardware technology, and was especially strong in online and technical computing. Univac and Mitsui & Co. established the joint venture Nippon Remington Univac Kaisha Ltd. (later Nihon Univac Ltd.) to import and sell the Univac brand of computers in Japan. Univac held the second largest share of the U.S. market after IBM Corporation.

The negotiations between Oki Electric and Sperry Rand did not proceed entirely smoothly. Oki Electric wanted only technical ties, for example, but Sperry Rand, actively seeking overseas expansion, was resolute in wanting to establish a joint venture with both companies providing start-up capital. Sperry Rand said it would provide computer patents and technical know-how and in return wanted the computers the joint venture produced to carry the Univac brand. Oki Electric management thus faced a difficult decision. If it continued to insist on having technical ties only, the negotiations would likely break off and Oki Electric would have to abandon the idea of entering the market for mainframe computers. On the other hand, if it agreed to Sperry Rand's conditions, its products would not carry the Oki Electric brand. One point concerning Sperry Rand that influenced Oki Electric's decision was its strong position in the market for online systems for financial institutions. Looking only at that market segment, Sperry Rand surpassed IBM and held the top market share in the U.S.

Oki Electric was also strong in online systems for financial institutions, especially with its line of terminal units, such as teletypewriters, the OKITYPER, and OKIDEX. If Oki Electric elected to go the joint venture route, the sales approach would be Sperry Univac mainframe computers connected to Oki Electric peripheral equipment. After much consideration, Oki Electric management chose substance over appearance, and agreed on the conditions for the joint venture. In November 1963, Oki Univac Co., Ltd., was established with capital of 400 million yen. Oki Electric provided 51 percent of the equity,

Oki Univac Co., Ltd.

and Sperry Rand 49 percent. As part of the joint venture, Oki Univac and Sperry Rand concluded a technical assistance contract that included patent licensing.

Oki Univac soon began producing the OUK-1004 and OUK-1050 series of computers. The company's main products were sold to Japan Electronic Computer Company (JECC) through Oki Electric and then rented out to users. Nihon Univac became a sales agent for Oki Univac, and took charge of sales, maintenance, and software services. Concerned about competition with the OUK series, meanwhile, Oki Electric halted production of its OKITAC-5090. The joint venture with Sperry Rand meant selling the OUK series as system mainframes and combining them with Oki Electric's peripherals and terminals. Centered mainly on financial institutions, Oki Univac's customer base was gradually expanded. Years later, however, Oki Electric's decision to leave the development of mainframe computers to Oki Univac was fated to exert a negative influence on Oki Electric's business.

Making inroads in overseas markets

Trade activity was very limited in Japan during the first three years of the postwar occupation. GHQ controlled all imports and exports, and all trade was done on a government-to-government basis. It was only slowly restored to private hands. Exports, in particular, were sluggish because of the low level of output. In 1946, Oki Electric resumed export activity after appointing a person inside the sales department to be in charge of negotiations with GHQ. When trade was returned to the private sector in late 1949, Oki Electric set up an independent trade section and trade started moving in the right direction. At first, the only exports were maintenance parts for telephones and exchanges sent to neighboring countries. Orders for building telecommunications networks began coming from countries in Southeast Asia only from the second half of the 1950s. One such order was from the Vietnamese military in 1957 for building a telecommunications network. Oki Electric won that project in an inter-

national bid. In the project, the company built 4,600-line automatic exchange facilities. On Okinawa, meanwhile, occupied by the U.S. until May 15, 1972, Oki Electric supplied almost all the materials and equipment used for reconstruction of the island's telecommunications network. In 1959, when the Ryukyu Telegraph and Telephone Public Corporation was established and began promoting automation of telephone switching on Okinawa, Oki Electric received an order for building a telecommunications network. Afterward, Oki Electric was the sole supplier of equipment related to that network.

Tenacious sales efforts led to the export of large plants in the 1960s. In the second half of the 1950s, Oki Electric was forced to develop new markets abroad and began approaching countries in Latin America. El Salvador, a country slightly larger than Shikoku, the smallest of Japan's four main islands, was first. At the time, El Salvador had a population of about 2.5 million. In 1957, the government of El Salvador called for international bids on construction of a telecommunications network, and Oki Electric initially won the bid. European and U.S. manufacturers, however, such as Ericsson and Siemens, requested a second round of bids, which the government agreed to, and Ericsson won the second bid. The experience of losing that bid taught Oki Electric a valuable lesson: because Japan was known in some areas only as a country defeated in the Second World War, it was necessary to let people in those areas know about the real situation in Japan, especially the high level of its technology and the quality of its products. The way to do this was through the governments of the countries in those areas.

A few years later, the Honduras government announced an international bid for constructing a domestic telecommunications network, a huge project accounting for fully 5 percent of the national budget. On the occasion of participating in the bid, Oki Electric invited members of the Honduras parliament to visit Japan. The company arranged tours of various plants for them so that they could see for themselves the progress of industrial technology in Japan, particularly Oki Electric's high technical level. These efforts later paid off, and Oki Electric won the bid for building the telecommunications network. In June 1962, Oki Electric signed a contract with the

Honduras government to build telephone facilities in Tegucigalpa, the capital, and in San Pedro Sula, the country's second largest city, and to build microwave trunk line facilities connecting the two cities. The overall cost of the project reached $4 million. It was Oki Electric's first large-scale telecommunications plant export.

While this project was still underway, a revolution broke out in Honduras and a new government came into power. The new government, however, allowed construction of the telecommunications network to continue. At the end of 1963, the Tegucigalpa Telephone Office was opened. The degree to which the Honduras government evaluated completion of the telecommunications network was proven clearly several years later when the government awarded Oki Electric the entire contract for a large-scale expansion of the domestic microwave network.

Immediately after starting construction of the project in Honduras, Oki Electric set up a Central America Liaison Office in its Export Department to expand sales routes further in Latin America. Other countries in Latin America evaluated the company's performance in El Salvador and Honduras highly, and Oki Electric later won bids in Bolivia for construction of an automatic telephone exchange in Santa Cruz and for construction of a telephone exchange network in La Paz, the capital.

In the early 1960s, when Oki Electric was experiencing success in the export of telecommunications networks, it began establishing joint venture companies for local production operations. A typical joint venture was Far Eastern Electric Industry Co., Ltd., in Taiwan. Oki Electric had been active in Taiwan since the 1950s, and it boasted of a large share of the Taiwanese telecommunications equipment market. It received an order for telecommunications and broadcasting facilities, for example, for reconstructing the police communications network. In 1957, Oki Electric provided production technology to its import agent and cooperated with them in setting up a plant for producing telecommunications equipment. At that time, the import agent changed its name to Far Eastern Electric Industry (FEEI). In 1960, Oki Electric purchased equity in FEEI, with Oki Electric holding 49 percent and the chairman of FEEI holding 51 percent. The

company's capital was NT$5 million (approximately 45 million yen), and the company started its new corporate life as a locally incorporated corporation. As a joint venture, FEEI received technical guidance on production from technical trainers of Oki Electric. Beginning with assembly of the Type-4 telephone in 1961, the company produced manual telephone switchboards in 1962 and Strowger-type automatic exchanges and Type-600 telephones in 1965. The company's sales expanded rapidly, increasing 10-fold during the six years between 1961 and 1967. It eventually became Taiwan's foremost telecommunications equipment manufacturer.

Compared to exports to the countries of Latin America and Southeast Asia, the export of telecommunications equipment to the advanced Western countries was extremely difficult. In the U.S., in particular, Bell-related and other telecommunications manufacturers accounted for the greatest share of the market, and European manufacturers accounted for the rest. Exporting from Japan to the U.S. was not easy.

From the early 1960s, Oki Electric had been gradually exporting single-piece products, such as hand-held radio transmitters/receivers, to the U.S. A breakthrough came with the export of millimeter-wave klystrons. At the time, those products were highly evaluated as being based on original technology that surpassed world standards. In particular, after the klystrons were used in ground station facilities for the Telstar communications satellite in 1962, Oki Electric's name came to be known widely in the U.S. market. In April 1962, Butler Roberts, the sole agent for Oki Electric's millimeter-wave electron tubes in the U.S., established Oki Electronics of America (OEA). Eighteen months later, in October 1963, Oki Electric purchased equity in OEA. Afterward, OEA succeeded in selling relays made by Oki Electric to International Telephone and Telegraph Company (ITT), an independent telecommunications manufacturer. A wide variety of Oki Electric relays were sold in large volume, serving to expand the company's sales channels in the U.S.