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Japan Report

SCIENCE AND TECHNOLOGY

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JAPAN REPORT

SCIENCE AND TECHNOLOGY

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BIOTECHNOLOGY

RECOMBINANT DNA APPLICATIONS TECHNOLOGY DISCUSSED

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 32-33

[Article by Norihiko Nakayama, Technology Section Assistant Chief, Biotechnology Developmental Technology Research Union: "Recombinant DNA Applications Technology"]

[Text] 1. Preface

The Industrial Base Technology System for the Next Period--"Biotechnology"--is made up of three parts: (1) a bioreactor, (2) a large volume cell culture, (3) and a combinant DNA. The project was initiated in 1981 with view to developing a basic technology for the industry for the next era. The initial phase of the plan has been concluded. This article will discuss the focus for the second phase which is now under way--the combinant DNA application technology and summarize the results of each research/development theme.

2. Bacterial Stock Production for High Oxidation Reaction Process

An important chemical reaction in current industrial technology is oxidation. The two methods used are automatic oxidation and one using a catalyst. But both are implemented by raising the temperature and applying pressure and there is the problem in selectivity and so on. In contrast, oxidation that utilizes a biological process has the potential for conquering the drawbacks of industrial catalysts currently in use. It is, however, expensive. The biological process is especially strong in terms of selectivity and a position specific reaction. Oxygen reinforced enzyme which belongs to chitochrome P-450 (hereafter referred to as P-450) that resides in a liver microsome is one such material that has an application possibility in such area. Actually the enzyme belongs to a compound enzyme family made up of P-450 and NADPH-P-50 reduction enzyme (hereafter referred to as the restored enzyme). The supplementary enzyme NADPH acts as an electron donor against the fat melting compounds to enable oxidation. There are many kinds of P-450 but those that are induced by 3-methylchlonthrene (hereafter MC) enables a fragrant hydroxidation. Although P-450 is found in micro-organisms such as yeast, etc. the activity level is low and it is not suitable for industrial application. Therefore by cloning the gene of the original enzyme onto and reproducing the same on a microbe, a bacterial stock with high oxidation potential can be manufactured.

In order to apply this to oxidation, a variety of researches were implemented: (1) improved P-450 manifestation volume, (2) manufacture of chimera P-450 molecule type by genic change, (3) cloning and manifestation of rat liver restored enzyme cDNA and a simultaneous manifestation of P-450 and restored enzyme, (4) synthesis of acetoaminofenon from improved yeast and so on. The results are enumerated below.

(1) New P-450 expressed unit is expressed on yeast by building a newly expressed pyramid, incorporated into the high copy expression vector. By doubling the P-450 cDNA copy quantity per cell, the P-450 expression volume was doubled.

(2) There are two MC induced P-450 molecular types but they differ in substrate specificity. Therefore a chimera cDNA which has both of these characteristics was built and manifested using yeast. It became $4x10^5$ molecules and through meta structural improvement oxidation activity triple that of P-450 MC was obtained.

(3) Restored enzyme mRNA obtained from rat liver was segregated and cDNA synthesized to obtain a transformed cell of escherichia coli then the restored enzyme's full length cDNA clone. Based on this, P-450 and the restored enzyme's simultaneously manifested pyramid was built. By inducting yeast, P-450 with $4x10^5$ molecules per cell and a restored enzyme with $1x10^4$ molecular structure were synthesized. The said oxidation level was twice that of P-450 single manifestation bacterial stock.

(4) When aceto-anyride or aceto aminofen are synthesized, using manufactured yeast bacteria, the sole product is P-hydride. The activation level was 2.5 times the P-450 MC manifested bacterial stock.

In the future, in order to further improve the oxidation capability, improvement of P-450 gene, electronic transmission line, host vector line will be implemented. At the same time, in order to expand the application range of oxidation reaction, the substrates will be increased.

3. Manufacturing Method for High Efficiency Secreted Bacterial Stock of Bacillus Subtilis

Bacillus subtilis is a relative of bacillus natto that has been in use in Japan from the ancient times. It is safe and secretes a large volume of protein. Thus it is used industrially. By using this bacillus subtilis as a base, an ambitious research concerning (1) the structure of secretion vector that can withstand industrial usage and (2) several target genes upon which the manifestation and secretion of the said secretion vector were tried. Following results were obtained.

(1) Neutral proteazoa genes of bacillus subtilis were processed to suit the secretion vector structure and by combining the hIFN-B gene with it, the basic character of bacillus subtilis was changed, yielding a virus infection preventive stock, thus verifying the formation of a hIFN gene. Next, bacillus subtilis α-anylase secretion method was used and a portion that secretes protein voluntarily was discovered in the neutral proteaze's propro structure.

That is to say, a strong promoter and an efficient secretion signal were discovered. In other words, the α-amiraeze secreting prosymyde which uses neutral protease genes was obtained and a manifestation of different genes capable of different genic secretion plasmyde selection and building of a secretion plasmyde were accomplished. In reality, when a mature hIFN-β was inserted into the plasmyde and by inducting it into the bacillus subtilis, lacking neutral protease and IFN secretion volume was checked, it reached 10 mg/liter.

(2) As a result of inserting human growth hormone hGH--one of the targeted dissimilar genes--into a similar manifested/secretion plasmyde to try to manifest and secrete hGH with bacillus subtilis, 32 mg/1 was obtained, and it was verified that the neutral proteaze propro structure is effective. In the above enumerated manner, bacillus subtilis' weaknesses--inducted plasmyde's instability and the difficulty of dissolving the secreted protein protease--were challenged. A reform in favor of a host with a low protein dissolution activation level was tried with the result of obtaining a significant volume of human protein.

4. High Secretion Yeast Bacillus Manufacture

Another secretion vector research had to do with a method that uses bread yeast's α factor gene. When, in order to analyze the secretion signal's necessary boundaries, each variety's deletion is inducted into the "leader" line-up and the secretion volume of β endlefin is examined, the signal line-up itself will demonstrate activity. Moreover it was verified that the three sugar chains in the leader line-up thought to be crucial to secretion, do function to effect an efficient operation. This discovery was appraised upon its publication at the Cold Spring Harbor. In addition, a search for a plasmyde that's safe, that has a large copy number and easy to use as a manifestation vector was made, and among the yeast varieties, the second linear plasmide was discovered.

5. Postscript

Some 30 years have passed since the Watson Clinic advocated a double spiral structure. But in order to apply the existing combinant DNA technology to chemical industrial processes, there are many problems that need to be addressed. Recently genic transformation is beginning to be recognized as a viable research method for a variety of research themes. This will lead to synthetic enzymes and artificial proteins in the future. It will no doubt develop into an important elemental technology among industrial technologies in the future. That era may be surprisingly close at hand.

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NIPPON KOKAN: HISTORY, STRUCTURE, STRATEGY DISCUSSED

Looking Back

Tokyo ZAIKAI TEMBO in Japanese Dec 85 pp 116-131

[Article by economic commentator Taro Sakura and a team of Zaikai staff writers]

[Excerpts] Nippon Kokan (NKK) is representative of Japanese large industry. Nonetheless, with the existence of the world's largest steel maker, New Japan Steel, NKK has always been treated as a "second son." And, lacking anything outstanding, they themselves have come to have a modest self-image. However, its real image is one of pluck, that exceeds "private enterprise." In the midst of the steel recession, for example, NKK invested Y1 trillion to build a state-of-the-art Ogishima Steel Works in the Keihin District; they bought 50 percent of the stock of the National Steel Corporation in the United States. So there is another side of NKK that is bold enough to astound the rest of the steel industry. What accounts for this real image? We will follow the path taken by the successive leadership of NKK, and probe their philosophy of management.

Declining To Participate in Steel's Grand Merger and Maintaining Its "Private" Enterprise" Character

Vice President Yoshinari Yamashiro formally assumed office as the tenth president of NKK at a meeting of the Board of Directors following the stockholders meeting on June 28th. On the same day, it was decided that Minoru Kaneo would become Chairman, and the man known as "The Emperor," Hisao Makita, would retire from the chairmanship to become an Advisor. With these changes NKK faced a new era.

Among the firms in the steel industry, the quintessential heavy industry, NKK has been thought of as the younger brother of New Japan Steel. New Japan Steel is tied up with the Nippon Seitetsu school, which was established in 1936 through the steel industry's grand coalition in which Yawata Steel Works, that government-managed Yawata Steel Works, was the central player, and even today New Japan Steel still has a "governmental" character.

In contrast, NKK has had a "private sector" air about it for the 73 years since it was established in 1913 and capitalized at 2-million yen, until the present.

From the first president, Ganjiro Shiaishi, to the ninth president, Minoru Kaneo, each has wrestled with new enterprises, and has demonstrated a splendid challenging spirit. This tenth president, Yoshinari Yamashiro, too, together with his predecessors, is hoping resolutely to challenge these new industries.

Minoru Kaneo said that he chose Yamashiro as his successor upon retiring to the Chairmanship to be the next president because "I believe it is appropriate to have a young, active individual at the top in order to implement new strategies."

Yoshinari Yamashiro is 62 years of age, born 7 February 1923, 9 years younger than the 72 year old Kaneo who was born on 30 July 1914. Among the leaders of the steel industry, New Japan Steel's president, Yutaka Takeda, is 71, Sumitomo Metal Industries Limited president Norifumi Kumagai, is 69, Kawasaki Steel's president, Yasuhiro Yagi, is 65, and Kobe Steel's president, Fuyuhiko Maki, is 62. Maki was born on 2 December 1923, three months before Yamashiro. Yamashiro is the youngest president among the five major steel companies.

Of course, his youth was not the only reason that Minoru Kaneo named Yoshinari Yamashiro as his successor. At this important turning point for the steel industry as a whole, NKK too must must devise new strategies. Yamashiro impressed Kaneo as the individual most appropriate to develop those new strategies.

Japan's steel industry developed remarkably after World War II during the period of economic recovery and on through the high growth period, identified as a key basic industry. During FY 1973, the year of the first oil shock, crude steel production was 120 million tons, an all-time high. At that time, the Japanese industry's production capacity was 150 million tons per year, and until just before the oil shock, because demand was strong for steel products, a basic material in public works and construction, within the steel industry, as in the past, the tendency strengthened to expand and strengthen (manufacturing) facilities. NKK too, as will be explained later, began construction at Ogishima (the Keihin Steel Works), said to be a 1-trillion yen project. That trend attracted attention. However, demand for steel suddenly declined due to the impact of the first oil shock, and all of the steel companies were forced to take countermeasures.

Since the second oil shock in 1979, Japan's steel production has for the time being shifted to a stable level of a little over 100-million tons per year. All of the steel companies have been frantically struggling to rationalize their operations, eliminating excess capacity.

NKK is no exception. Rather, it can be said that NKK through its involvement with shipbuilding and heavy industry that felt the impact of the recession earlier than the steel industry, was in a worse position than the other companies. For NKK, which was in the midst of rationalizing while proceeding

with the construction of Ogishima, the later half of the 1970s and early half of the 1980s was a period of austerity without precedent.

The eighth president, Hisao Makita, and his successor as the ninth president, Minoru Kaneo, were the two men who brought the company through this difficult period. During Kaneo's presidency the rationalization process settled down for the time being. With an eye on the international trade friction problem, internationalization was promoted during this period, as seen in the National Steel investment.

Further, it was during Kaneo's presidency that the new lines of business came along, mobilizing the technology, knowhow, and human resources which had been cultivated in steel, an industry of comprehensive technology.

Upon receiving the baton from Kaneo, Yamashiro's role was "To bring to fruition the works begun by Chairman Kaneo." This requires youth and energy, as well as a sense of balance and overall judgement.

The New President, Yamashiro, Chosen for the Quality of his Sense of Balance

Yoshinari Yamashiro succeeded Minoru Kaneo this May 8th. On that day, Yamazaka was supposed to leave for New Zealand to attend the Pacific Economic Council.

Kaneo was hospitalized at that time, but he called Yamazaka to the hospital and requested that he assume the presidency. Although he acknowledged the request there, it is said that Yamashiro, wasn't thinking about receiving a request as important as assuming the presidency of the company on the day that he was to leave for New Zealand, only replied "Is that so."

The reason that Kaneo chose that day was that a special meeting of the board of directors was to be held on May 17th at which it was planned that top corporate personnel changes would be informally decided, including that of the presidency. He thought there would be little time left until the special board of directors meeting for Yamashiro to think the offer over if he were to wait to ask him until he returned from his trip, a thoughtful gesture.

However, even though Kaneo asked Yamashiro to assume the presidency for the first time that day, as might be expected from the fact that within and without the company everyone looked upon Yamashiro as Kaneo's successor, by Yamashiro only replying "Is that so," an extremely normal change of personnel was conducted.

Yoshinari Yamashiro was born in Tokyo, but raised in Niigata from his second year of primary school. He entered the Niigata Prefectoral Middle School from the primary school attached to the Niigata Normal School. From there he went on from the old system's Niigata High School to enter the Law Faculty of Tokyo University. He entered Tokyo university in the hope of becoming a bureaucrat after graduation in 1946. But during the last year before graduation, he and a classmate from the Law Faculty worked as a lathe man the Yokosuka Naval Shipyards "Wanting to do some work that would surely benefit the nation."

When Yamashiro left Tokyo University he hoped to be of service himself in the effort to revive a war-parched Japan. At that time, he knew that the Kawasaki Steel Works of NKK was seeking factory workers, and he applied. The first work to which Yamashiro, who had entered the company full of high spirits and tossing aside any ambition of becoming a bureaucrat, was assigned to cost accounting.

After that he went from the Accounting and Budget Section to the Budget Divion of the parent company, to the Materials Division, on to the Personnel Section of the Organizational Management Division, and from there he moved on into the Planning Department. Thereafter he focused upon management planning, finance, and administration. Since his appointment in 1982 to vice president he has been looked upon as a strong contender to become the next president of the company, together with operations specialist, Vice President Haruki Kamiya.

Especially after around 1983, when the large steel makers all began to show an interest in new industries, aiming at becoming basic materials manufacturers, Yamashiro, highly regarded as an all-around player with a good sense of balance, became the front runner.

Minoru Kaneo, the man who paved the way for the promotion of internationalization and new industries, ultimately selected as his successor Yamashiro who was adaptable to change. That was the change at the top that everyone in and outside the corporation had expected. Within NKK, this second son of the steel industry, in the past there had been unpleasant times during which top management changes had occurred without regard for changes in the times. But that weakness was completely cured by the presidential succession of Makita, Kaneo, and Yamashiro. NKK has been reborn as a company which shows once again enthusiam like that which burned at its founding.

NKK Founded With the Support of Eiichi Shibusawa and Others

Nippon Kokan, as its name implies, began operations in 1892 as Japan's first steel tubing manufacturer. Preparations for its founding had begun four years before, in 1888. At that time steel tubing was not made in Japan and we were solely dependent upon imports. That was because it was thought that it would be difficult to make a profit from steel tubing manufacturing since the greater part of steel demand was for crude, shaped and sheet steel, and also because the manufacture of steel tubing required special equipment and technology.

However, the demand for steel tubing gradually increased even in Japan, and it was thought that if it became possible to make the product cheaply and efficiently, that demand too would rise rapidly. One of the men who held that opinion was Kihachiro Okura of the Okura-gumi, and he decided to try to manufacture steel tubing in Japan.

Okura tried to make welded steel tubing from band steel, which required the acquisition of band steel. His first thought was to purchase it from the government-run Yawata Steel Works, but that scheme was derailed.

Then, in order to explore the possibility of promoting a steel tubing industry with imported band steel, Okura asked a friend who was an engineer at the Yawata Steel Works, Kaichiro Imaizumi, to investigate the matter. In 1889 Imaizumi visited Europe where he investigated the steel tubing situation in great detail. He concluded that Okura's plan for manufacturing welded steel tubing in Japan would be difficult, but that the manufacture of seamless steel tubing directly from steel ingots looked promising.

So, Okura and Imaizumi decided to manufacture seamless steel tubing in Japan, and established NKK. However, things didn't go as planned. Since there was difficulty accumulating capital they didn't do very well at procuring their basic raw material, pig iron.

Their plans were brought to a standstill. And the man who got things moving again was NKK's first President, Ganjiro Shiraishi. Shiraishi was the adopted son-in-law of Soichiro Asano, the head of Asano Konzern, who had made a name in marine shipping. Asano had a relationship with Eiichi Shibuzawa, an important figure in the business community, and through that connection Shraishi also became acquainted with Shibuzawa.

Shiraishi planned to import cheap pig iron from India, but he still had a problem raising capital adequate to manufacture the steel tubing. Ultimately, Shiraishi persuaded both his father-in-law, Asano, and Shibusawa to procure the funding. They raised the capital and NKK was established with the inaugaural meeting held on June 8th, 1892.

The new company included six officers, including Shiraishi, Kihachiro Okura, Kaichiro Imaizumi, and Heisaburo Okawa, who later became NKK's second president. Together with the establishment of the company, land reclamation work began in the Wataruda area, the present cite of the Keihin Steel Works, and in April of the following year construction was begun on the plant. So, by December of 1893 a steel plant with two blast furnaces, a pipe manufacturing plant, and a repair shop had been completed.

This plant was was supervised by a German engineer, but it made liberal use of domestic equipment and made an effort to develop its own technology. In January of 1914 steel was successfully produced from furnace number one. Japan's first steel tube manufacturer was in business.

NKK expanded without pause after that because of domestic production protection government policies and the outbreak of World War I. NKK also produced rolled steel, in addition to steel tubing, and grew very rapidly. But with the end of World War I in 1918 the company faced its first turning point since its founding.

With the weakening of demand worldwide, cheap foreign steel poured into Japan. Competition within the domestic industry also intensified, and one after another companies were forced from low profitability into the suspension of operations. In 1921 NKK was forced to cut capital by 50 percent. And the same year the management system was revised to include a vice president in an effort to revive operations. The senior Heisaburo Okawa was appointed the second president, and Shiraishi, the first president, became Vice President.

The Decision To Focus Operations on Blast Furnace Construction and Shipbuilding

The depression intensified as Japan entered the Showa Era in the latter half of the 1920s. As part of their program to counteract the effects of the depression, the government planned to arrange a large-scale merger within the steel industry around the government-run Yawata Steel Works, and Japan Steel was created in 1934 as a result. However, around this time, demand for steel also began to rise. Economic prospects for many of the private sector steel makers which had fallen on hard times improved as a result of the Manchurian Incident which erupted in 1931, and because of that they declined offers to participate in the industry's grand merger, remaining independent.

As the leader of the private sector steel makers, naturally NKK too was asked to join in the grand merger, and their attitude toward the proposal was a matter of public interest. But NKK Vice President Shiraishi said that a grand merger with the government-operated Yawata Steel Works at its center "Would run counter to the spirit of independent industry and would have an undesirable effect on technical progress and the development of the industry." So NKK did not join the grand merger, and carried on as a private sector firm.

If NKK had agreed to join the grand merger the company would not exist today. It was this fiercely private sector NKK which insisted upon pursuing its plans for industrial development independent of government interference which as a private sector enterprise first established the integrated steel production system which secured the basis of the business.

With the outbreak of the Manchurian Incident in 1931 Japan began to expand its military equipment, a move which brought Japan's steel manufacturers into a period of development. NKK was no exception. But in spite of the fact that NKK was said to be the most promising of the private sector steel manufacturers, and in spite of their good performance, the company still had an important weakness.

That weakness was the lack of blast furnaces. Steel makers that didn't have their own blast furnaces did the bulk of their business as the suppliers of pig iron. This made them dependent upon Japan Steel. This had been a problem since the founding of the company, and the opinion spread within the company that NKK must obtain their own blast furnaces at the earliest possible opportunity.

At last Ganjiro Shiraishi decided upon the construction of a blast furnace. Under favorable business conditions, and with adequate financial backing, Shiraishi gave the go-ahead and the long awaited first blast furnace was built in June of 1936 at Ogimachi in Kawasaki. The second was fired in February of the following year, and also a third in May of 1938.

With intensification of demand caused by the war, a fourth blast furnace was completed in September of 1941, and NKK's position as the premier private sector integrated steel manufacturer was secured.

Meanwhile, Ganjiro Shiraishi had returned to the presidency of NKK from the vice presidency in 1937, the commander leading his troops. At the time Shiraishi recovered the NKK presidency the government was pressing plans to strengthen the steel and shipbuilding manufacturers in response to the military build-up. In 1940 the merger of NKK and Tsurumi Iron Shipbuilding Corporation surfaced.

Tsurumi Iron Shipbuilding Company had been established in 1916 by Soichiro Asano. In 1940 Soichiro Asano's second son and Shiraishi's brother-in-law, Ryozo Asano, was president of Tsurumi Iron Shipbuilding Company.

The companies merged in October of 1940, and NKK became a shipbuilding steel maker, a rare phenomenon even viewed worldwide.

On December 8th, 1941, war broke out between Japan and the United States. As a manufacturer of important war materials, NKK cooperated completely with the military's demands, and built steel plants abroad. Not only NKK, but all of the other steel manufacturers, including Japan Steel, unavoidably cooperated in the effort.

Great Blow From War Damage Invited by Construction of the Most Advanced Steel Plant

Japan faced the end of World War II on August 15, 1945. NKK, with its manufacturing facilities in Keihin, was dealt a crushing blow by the war damage. Since Keihin was on the southern route of American aircraft headed for Tokyo, it was an easy target.

Japanese crude steel production was only 560,000 tons in 1946, down to less than 10 percent of its previous production peak of 7.65-million tons in 1943. This figure reveals the the enormity of the war damage suffered by Japan's steel industry, of which NKK was especially hard hit.

As Hisao Makita, currently an NKK Advisor, wrote in "My Personal History," "It wasn't a question of the extent of the damage; it was more a sense of wondering what is left." It was in this condition that NKK entered the postwar period. The extent of this devistation made NKK's recovery slower than that of the other companies, and also became a remote cause for the construction of the state-of-the-art Fukuyama and Ogishima steel plants.

NKK's plant and equipment suffered heavy damage in World War II, but the war also had an important effect on the corporate management structure. During the war the company presidency was held by Shiraishi and his brother-in-law, Ryozo Asano. But, due to involvement with the production of military goods, Asano could not escape the purge. He resigned the presidency in April 1946, the year after the end of the war.

Masato Watanabe, who was in the forefront of the push to construct blast furnaces, was appointed to succeed Asano as president. Within NKK, he was not expected to be purged. But the reverse proved true, and Watanabe served only a year as NKK's fifth president.

This top-level management change also slowed NKK's recovery, but NKK's luck was not all bad. The General Headquarters of the U.S. Army occupying Japan decided to break up large industrial combines and zaibatsu in order to assure that Japan would be unable to build armaments again. In the steel industry, Japan Steel was divided into Yawata Steel and Fuji Steel on April 1, 1950. And in the beginning they planned to divide NKK into three parts, such as steel, shipbuilding, and so on.

This plan was not realized because the GHQ's plans were changed by the emergence of a new world order of East-West rivalry. If their plan had been implemented, the NKK of today would not exist.

As East-West tension increased, GHQ, or rather, the United States, decided upon a policy of reconstructing Japan as a member of the Free World camp, including direct efforts to revitalize the steel industry, a sector essential to economic reconstruction.

The presidency of NKK changed quickly from Masato Watanabe to Hisashi Kawada. Kawada actively promoted the rationalization of equipment. In September of 1949 he established the Steel Division Rationalization Promotion Comittee with himself as chairman, and put all of his effort into improving the company's facilities.

He also put great effort into the rationalization of the facilities of the shipbuilding division, and promoted expansion of the capacity of the Tsurumi and Shimizu Shipworks and introduction of electric welding machinery. The postwar shipbuilding record was established in 1957. NKK's share of production was second only to Mitsubishi Shipbuilding (currently Mitsubishi Heavy Industries).

After that demand for steel rocketed as Japan entered the high economic growth period. Kawada planned to expand plant and equipment drastically in order to respond to increasing demand. But even so, demand greatly outran NKK's increasing productive capacity. As a result, even though NKK's share of the crude steel market was a great achievement, ironically, it gradually declined, and during the so-called "Iwato Boom" of FY 1959, it fell to the single-digit market share, 9.2 percent.

NKK's share of the crude steel market had fluctuated around 13 percent in the prewar period. So a decline to less than ten percent was a problem that could not be overlooked. The story behind this decline in share of the market was that expansion of the productivity of NKK's plant in the Keihin District had reached its limit.

In order to greatly increase productive capacity and recover its share of the market, Hisashi Kawada had to decide on the construction of a new steel plant. NKK examined ten potential cites from various angles, and finally pared the choice down to Chiba, Toyohashi, and Fukuyama. Fukuyama was selected as the cite after consideration of such factors as the ground, water supply, and harbor, and in February of 1961 construction of a state-of-the-art steel works with capacity of 6-million tons of crude steel was announced.

Recovery of Second Place With Construction of the World Class Fukuyama Steel Works

Hisashi Kawada's presidency lasted for seventeen years, from May 1947 to November 1963. It was an extermely long term of office, during which Kawada ran the company as a one-man show. Kawada held extreme opinions about people, and he discharged capable personnel one after the other. Productivity increased greatly during his presidency, but it is also true that in the area of personnel policy, the undesirable aspects of a long tenure in office became strikingly apparent.

Takeshi Akasaka was appointed president after Kawada, a personnel move that occurred while Kawada was abroad, a coup d'etat of sorts in the opinion of some observers. Concern was growing within the company and the associated banks that further erosion of NKK's basic position could not be avoided if Kawada's administration was not brought to an end. Putting Kawada on the shelf as Chairman and appointing Akasaka as his successor was considered the sensible course of action.

Construction began on the Fukuyama Steel Works at the same time as the appointment of Akasaka as president. It was decided to make drastic personnel changes as well. Within two or three years of Akasaka's assumption of the presidency everyone considered to be a member of the Kawada faction had been removed, a matter of regret later on. Akasaka not only removed capable people who were associated with Kawada, he also called back some of those who had been out in the cold during the Kawada presidency.

In May of 1965, Akasaka brought Hisao Makita, the man Kawada had replaced as NKK president in 1961, back in as a company director. Makita later succeeded Akasaka as president, and this personnel change was a good thing for NKK. But Akasaka didn't call Makita back to be his successor. Rather, it is better thought of as a stop-gap personnel move to fill the void created when Senior Managing Director Anjiro Yasuda, respected for his management abilities, moved to the presidency of Toshin Steel Works. However, motivation apart, if Akasaka had not called Makita back, presidential succession after Akasaka would have been different, making possible differences in presidential succession after that.

Akasaka was born in 1900. After working as a municipal office employee, a substitute teacher, and an insurance salesman, he entered the Economics Faculty of Tokyo University, graduating in 1930 at the age of 30. He joined Japan Life Insurance Company upon graduation, and joined NKK in 1934.

When the hard-working strategist Akasaka became president he straightened out problems left over from the Kawada era, and put all effort into recovering NKK's share of the steel market. In 1966 the first blast furnace was built at the Fukuyama Steel Works in Fukuyama, Yamaguchi Prefecture, followed by the second in 1968, the third in 1969, and the fourth in 1971. Then in 1973 the fifth furnace was completed during the presidency of Akasaka's successor, Makita. Through this ceaseless effort to expand the company's facilities, crude steel production at the Fukuyama Steel Works rose 10-million tons from

an initial 6-million tons to 16-million tons to become the world's largest steel plant.

With the completion of this Fukuyama Steel Works, NKK rose from fourth place to regain its position as the second largest crude steel producer. Construction of this Fukuyama Steel Works certainly can be said to be Akasaka's greatest contribution. But while he was building at Fukuyama he also constructed a third shipbuilding plant, Tsu Shipbuilding (now Tsu Manufacturing), in addition to the two existing Tsurumi and Shimizu shipbuilding plants.

Together with the shipbuilding plant at the Tsu Shipbuilding Works in 1969 he built a heavy equipment manufacturing plant which would be used to manufacture large heavy equipment, combining a strengthening of the heavy equipment division.

In June of 1969 when the the Tsu Shipbuilding Works were constructed, NKK announced intentions to begin a 1 trillion yen project called the "Ogishima Plan."

Akasaka was initially hesitant to embark upon such a big project, but at last even he approved when it was decided that if they ignored the Keihin Steel Works, at which the equipment had become surprisingly deteriorated, it could seriously weaken the company.

However, due to Akasaka's sudden death, this Ogishima Plan was handled by Hisashi Makita, Akasaka's successor.

The Trillion-Yen Project Completed in the Midst of the Steel Recession

Around the spring of 1971, beginning his fifth term as president, after building the Fukuyama Steel works and recovering NKK's share of the market, people began to wonder about Takeshi Akasaka's successor. Within the steel industry there was the strong opinion that he should retire to the chairmanship after completing his fifth term, and ten years, in 1973.

It seemed especially likely that it had been decided that Akasaka would assume the chairmanship two years later after it was decided internally at the May 11, 1971 Budget Committee meeting that he would promote two directors, former MITI Administrative Vice Minister Kinzo Matsuo, and his protoge, Haruo Sakurai, to vice presidencies. With the promotion of Matsuo and Sakurai, NKK at one stroke was left with five vice presidents.

These days it is not unusual for large companies to have five vice presidents, but it was extremely rare then in 1971. The public was surprised by the move. Akasaka was hospitalized the day after that Budget Committee meeting, and was operated on after extensive tests.

The only instructions that Akasaka left when he entered the hospital were "I am asking Makita to assume the chairmanship of the general stockholders meeting on May 28th." Akasaka's associates and the press assumed that he had

said he would discuss his ideas about the new system of five vice presidents and the next NKK president after he returned from the hospital.

However, Akasaka died unexpectedly of stomach cancer at the Tokyo's Keio Hospital in Shinano-machi on June 6th. It wasn't known who Akasaka was thinking of naming as his successor. Some observers thought the favorite candidate was Sakurai. But in the end, it was the most senior vice president, Hisao Makita, who was named to succeed Akasaka as president.

Yoshizane Iwasa, Senior Managing Director of Fuji Bank, NKK's main bank, said "In the event of a sudden personnel change like this it is natural for the most senior vice president to be promoted." Other leaders of the Fuyo Group expressed the same opinion as Iwasa. So, the change in NKK's leadership was decided against this background.

At a press conference on June 10th at the time of his appointment as NKK's eighth president, Hisao Makita said the following: "I am neither a genius nor an extraordinary person. All that I can do is to harmonize everyone's opinions, and unify the company."

Makita was the most senior vice president, but he was almost unknown to the public. For that reason some observers expected him to serve only a short time. However, Makita turned out to be more tenacious, an excellent appointment which began a long administration. Makita remained in the presidency for nearly ten years, to June 1980. Around the time of his third term, after six years at the helm, he had become an influential corporate president, given the nickname "Emperor Makita."

Japan's steel industry experienced periods of heaven and hell during Makita's long administration. Makita pressed forward on the Ogishima Plan that Akasaka had announced in 1969, and at last in 1971, the year he became president, the groundbreaking ceremony was held and land reclamation work began.

The Ogishima Plan envisioned construction of the world's most advanced computer controlled steel plant to replace the Keihin Steel Works on a man-made island reclaimed in Ogishima, Kawasaki.

Sand for the reclamation work was to come from the leveling of a mountain on the opposite shore near Kisarazu in Chiba Prefecture, to be transported piston-style in huge cargo ships. The first oil shock hit just in the middle of the reclamation work, suddenly changing the whole situation. There had been signs of the economic boom associated with the "Remodeling of the Japanese Archipelago" thesis when construction began, and demand for steel was rising. In 1972 the construction boom spread, and the outlook for the Ogishima Plan was quite bright. Around mid-1973 the steel industry was in good spirits, with crude steel production that year reaching a historical high. However, the first oil shock hit in October and the energy-dependent steel industry suddenly felt the pinch.

The reclamation work was nearly completed around October of 1974, one year after the oil shock. Makita was forced to decide whether to proceed as planned with construction at Ogishima or not. He was troubled by the

liklihood that slack demand for steel would be prolonged, and the need for a huge investment of Y1 trillion to complete the Ogishima Plan.

At that time the strong opinion developed within the company that the project definitely should be pursued as part of NKK's 100-year long-term plan. The central figures behind this position were Director of the Accounting Bureau, Yoshinari Yamashiro, and Director of the Office of Administrative Planning, Haruki Kamiya. These two made the rounds of the company trying to persuade everyone that construction on this project which was planned to replace the Keihin Steel Works should begin as soon as possible.

In the end Makita too decided to pursue the Ogishima Plan, and in December of 1974 construction was begun on the first blast furnace. NKK was criticized for not being able to handle the investment required at Ogishima, but the first phase of construction was completed in November 1976, followed by commencement of work on the second phase which included the second blast furnace.

The Ogishima Plan was completed on July 11, 1979, and Makita himself fired the second blast furnace. Makita had completed the Ogishima project in the midst of the longest recession that Japan had experienced.

A Switch to the Offensive With Capital Participation in a U.S. Steel Maker

Hisao Makita decided to pass the baton to Minoru Kaneo when he suffered a temporary stroke during a trip to Southeast Asia in April 1980. Makita was over 70 years old, and considered this problem with his health an omen.

Makita entered the NKK Hospital as soon as he returned from Southeast Asia, called Kaneo to the hospital and asked him to assume the presidency. However, Kaneo strongly declined, replying "I am not presidential material." Makita was just in the middle of a term as president, and Kaneo urged him to continue in office. But Makita was determined and at last Kaneo had to accept.

Minoru Kaneo was born in July of 1914 in Toyama Prefecture. He graduated from the Commerce Faculty of Waseda and entered NKK in 1938. Kaneo himself hoped to go to Manchuria, but changed his plans on the advice of his father. Kaneo was first assigned to the Engineering Department, where he worked with Hisao Makita. It is said that Makita had great confidence in Kaneo who had been the leader of their mountain climbing club back in Waseda. It was here that Kaneo was taught the basics of the steel industry.

The turning point in Kaneo's life came after the end of the war with his internment in Siberia. He was demobilized in 1948 and returned to the company. But the strain of his Siberian ordeal left him in need of an operation on his chest. Kaneo's promotion took some time, but he made steady progress. From this experience he came to understand round-about paths to his objectives. The reason Makita selected Kaneo as his successor was because of his dilligence.

Internationalization and entry into new enterprises were subjects of discussion during the period of Kaneo's presidency. Makita too had looked

into expansion abroad as a means of dealing with trade friction in the international market, and planned to buy the American Kaiser Steel Company in 1979. If the opportunity arose, NKK hoped to produce steel in their main market, the United States, and set out to purchase the Rouge Steel Works, another American steel maker affiliated with the Ford Motor Company, after Kaiser. This plan had to be abandoned in May of 1983, and three months later NKK entered negotiations to invest in National Steel Corporation in the United States.

In April 1984 NKK bought a half-interest in National Steel. This company was brought to their attention because they were a manufacturer of sheet steel, a large percentage of which goes to automobiles, and because among American steel makers they had the highest ratio of continuous casting operations, one measure of rationalization.

National Steel already had begun construction of facilities to produce rust-resistant galvanized sheet steel for use in automobiles, scheduled to go into production in the middle of the following year.

Also, in August 1984 Kaneo announced the formation of a new corporation, a joint venture with the American company Martin Marietta, involved in aluminum and titanium alloys and other metals. Internationalization was ceaselessly pursued during Kaneo's presidency, and with the formation of the New Materials Development Center in July of 1983, the seeds were sewn for advancements in the new materials area as well.

Further, in September of 1984 Kaneo indicated a new course for the company with the unveiling of a "Vision of the Future," a forecast of the shape of the company in ten years. This "vision" included the objective of shifting the composition of NKK's sales from the present 75 percent in steel and 25 percent in shipbuilding and heavy industry to 50 percent in steel, 25 percent in shipbuilding and heavy industry, and 25 percent in other areas.

Mitsuru Kaneo formulated a new management strategy for NKK and charged the new president, Yoshinari Yamashiro, with its implementation. Yamashiro announced that he would "Grow the seeds planted by Chairman Kaneo," and quickly moved to respond to the new age after his succession to the presidency with an organizational reform.

On July 1st he reorganized the shipbuilding and heavy industries sections, creating three new sections: marine and steel, engineering, and machinery. So, with the existing steel industry section and the new materials section begun in January of 1985, there are now five sections in all. He intends to clarify responsibility and improve the efficiency of management by giving responsible officials at the senior managing director level and above representation on the board, and planning to transfer their areas of authority.

There are particularly high expectations for the new materials industry section. It was created during the reorganization from a combination of the previously existing organizations with some connection with new materials, such as the New Materials Development Center, the metal alloys section, and

the industrial development section. As seen in the "Future Vision," the company plans to develop it into their fourth principal industry, just after steel, shipbuilding, and heavy industry. It already has become very active.

For example, on October 2, 1985, following the cooperative venture in the United States with Martin Marietta, the company reached basic agreement to purchase outright General Electric's silicon division, the Great Western Silicon Plant, for around $16 million.

The intensity of NKK's revitalization efforts can be expected to increase, centered around internationalization and new materials. The new president, Yamashiro, as of September first, has established a "Committee to Promote Corporate Identity [CI]), headed by Vice President Toshio Tsunagane, to create concepts appropriate to this sort of industry.

With the appointment of this new president, NKK, heretofore labeled a "second son" company, intends to transform itself into an enterprise that will require watching.

A Short History of NKK

DATE	IMPORTANT EVENTS

JUN 1912 NKK is incorporated as a manufacturer of seamless pipe (capital of 2-million yen, with Ganjiro Shiraishi as president).

JAN 1914 First open hearth furnace (20-ton) fired; seamless pipe production begins.

JUN 1921 Ganjiro Shiraishi becomes vice president; Heisaburo Okawa appointed president.

JAN 1934 NKK decides not to join the government-sponsored coalition of steel manufacturers, chosing instead the path of "private sector" manufacturer.

MAY 1936 The first blast furnace is fired; NKK becomes the first private sector steel manufacturer to introduce the integrated system of production.

JAN 1937 Vice President Ganjiro Shirishi becomes president again after the death of Heisaburo Okawa.

FEB 1937 Blast Furnace # 1 (400-ton capacity) is fired.

OCT 1940 Merger with Tsurumi Iron Shipbuilding Company; NKK becomes a diversified shipbuilder and steel manufacturer.

JUN 1942 Ganjiro Shiraishi becomes Chairman; Senior Managing Director Ryozo Asano appointed President.

APR 1946 Vice President Masato Watanabe appointed President.

MAY 1947 President Masato Watanabe appointed Chairman; Vice President Hisashi Kawada appointed President.

OCT 1953 Construction of the Kawasaki Steel Plant's blooming mill.

NOV 1955 Visit by Their Majesties, the Emperor and Empress, to the Kawasaki Steel Plant.

NOV 1963 Construction begins at the Fukuyama Steel Plant.

NOV 1963 President Hisashi Kawada appointed Chairman; Vice President Takeshi Akasaka appointed President.

AUG 1966 Completion of the first phase of construction at the Fukuyama Steel Plant; Blast Furnace # 1 (capacity of 5,500 tons) begins operation.

APR 1968 The Kawasaki, Tsurumi, and Mizue steel plants merged; start-up of the Keihin Steel Plant.

JAN 1969 Ground broken at the first section of the Tsu Shipbuilding Plant.

JAN 1970 Inaguration of the steel, heavy industry, and shipbuilding three-division corporate organization system.

JUN 1971 Sudden death of President Takeshi Akasaka; Vice President Hisao Makita appointed president.

NOV 1973 Completion of construction of the Fukuyama Steel Works, the world's largest in size (1700 square meters) and capacity (16-million tons), and commencement of full-scale crude steel production.

MAR 1976 Inauguration of the Heavy Engineering Section.

JUL 1976 Completion of the first phase of construction at the Keihin Steel Plant in Ogishima.

JUL 1979 Completion of all construction at the Keihin Steel Plant in Ogishima, an ultra-modern plant of 5.5-million square meters with 6-million ton annual crude steel capacity.

JUN 1980 President Hisao Makita becomes Chairman; Vice President Minoru Kaneo appointed President; reorganization of the structure of the heavy industries section into a three-section system.

OCT 1980 Contract signed with the Libyan national oil company AGOCO (Arabian Gulf Oil Company) for the oil pipeline and related equipment required for the development of the Libyan Mesura Oil Fields.

JAN 1981 Long-term contract signed for the import of coking coal with the Canadian province of British Columbia

JUN 1982 Completion of 70 years of operation since the founding of the company.

JUL 1983 Establishment within the company of the New Materials Development Center, and embarkation into the development of new areas.

MAR 1984 Accumulation of a 12.2-trillion yen operating deficit during the 1983 fiscal year.

APR 1984 Measures to strengthen the company's base for overseas expansion with the purchase, together with the Marubeni and Mitsubishi International trading companies, of 50 percent of the stock of the 7th largest American steel firm, National Steel.

JUN 1985 President Minoru Kaneo becomes Chairman; Vice President Yoshinari Yamashiro appointed President.

JUL 1985 Division of the Heavy Industries Section into three sections--Engineering, Machinery, and Marine and Steel, which together with the existing Steel and New Materials sections, make up a new five-section corporate structure.

OCT 1985 Agreement to purchase General Electric's Great Western Silicon Plant for production of polycrystalline silicon in the United States.

New Style

Tokyo ZAIKAI TEMBO in Japanese Dec 85 pp 132-139

[Text] Consideration of Personnel Administration at the Corporate Director Level

NKK's aggressive style of operations recently has been attracting attention. Active measures, such as buying into the American National Steel Company, joint operations with Martin Marietta, and the change to a demand-based sales system, all have contributed to the destruction of NKK's former corporate image. This company, previously noted for its steady strategy, seems to be experiencing a wave of change of historical proportions. Just now Yoshinari Yamashiro, a new helmsman, has come on the scene. Will he succeed in returning this prestigious corporation to the prosperity it had known during its 70-odd year history? And, who will carry on the struggle through to the next generation?

A Behind the Scenes Look at the Emergence of Yamashiro as President: Very Similar to the Previous Presidential Succession

On the afternoon of 23 July 1985, a reception was held at the Hotel Okura in Toranomon, Tokyo to announce the appointment of a new NKK president. President Yoshinari Yamashiro (age 62), together with Chairman Minoru Kaneo (age 71), and others were receiving the guests. At times Yamashiro's face showed signs of tension, but he exchanged greetings with a smile with the many guests who had come to offer their congratulations.

At about the same time at the Imperial Hotel in Uchisaiwai-cho in Tokyo, there was a reception to announce the appointment of a new president of New Japan Steel. Vice President Haruki Kamiya (age 62) delivered a courteous message of congratulations to Takashi Kai, President of New Japan Steel, and after exchanging greetings with a number of acquaintances, left the reception. He then returned to the Hotel Okura reception room and this time as a host endeavored to make comfortable the guests of his own company until the end of the reception.

These two able candidates had been considered the favorites in the race to succeed Kaneo as president, and they ran a hard-fought race. Ultimately, Yamashiro, who entered the company one year before Kamiya, with a longer corporate record, barely won the competition.

"A normal promotion of the favorite candidate" was the concensus conclusion of most of newspapers at the time. They reasoned that current Chairman Kaneo had nearly reached 70 years of age, the limit for company presidents, and that he had already topped his career off with the reintroduction of the "5 yen per year" rule. Indeed, it was widely reported to be a smooth abdication that went according to precedent. But is that certain?

Kaneo's administration, which had begun in 1980, was more than five years old, now facing that critical period of the latter half of the third term. He had hinted at a short term in office soon after assuming his post. But during the past few years, with growing maturity, he had become more self confident, surprising the heads of other company's within the industry with the implementation of one aggressive policy after another. In spite of having passed the age of seventy, he showed no signs of thinking it necessary that he retire. In spite of this, he announced his intention to assume the chairmanship at the Directors meeting on May 17th, and named Vice President Yamashiro as his successor. Why in the world did this happen?

Actually, Chairman Kaneo had been hospitalized for a few days at the beginning of May with an irregular pulse. However, according to more than one of his associates, the real reason for his hospitalization was that he was severely dehydrated, and that he had lost the feeling in his right hand. With the exception of slight partial paralysis, he would be able to recover completely through rehabilitation. But, in fact, considering the frantic pace required of the company president, he had decided to name a successor.

However, a former senior official of a related company said, "Up to that time, Kaneo hadn't really done much to train a successor." He added, "If the change had occurred next year, Vice President Kamiya would have had a chance. But even if Kaneo had been thinking along those lines, it was all too sudden. He didn't have enough time, and wasn't strong enough."

However, it is certain that realistic assessment from within and without the company had leaned toward Yamashiro for some time. The reason for that was his soft-spoken, balanced nature, perfectly fit to be an organizer. And, internal corporate personal politics also seemed to work strongly in his favor. In that sense, it may not be mistaken to describe this as a "normal" succession.

Even so, this presidential succession was surprisingly like that experienced five years before. At that time, Advisor Hisao Makita (age 75), who had maintained power for approximately ten years, intended to maintain command as company president at least until the expiration of his his term, which expired at the end of June, 1981. He signaled his intention to pass the baton to Chairman Kaneo, Vice President at that time, at the time of his re-election in 1979. But was it refused.

However, Makita, currently an NKK Advisor, was taken ill during a visit to Southeast Asia. In spite of the blazing heat he overdid his effort to avoid drinking unboiled water and became seriously dehydrated, and fell into a cerebral thrombosis-like condition. He returned home quickly but he was left with a numbness in his left arm, leg, and mouth, restricting their use. In the end he was hospitalized for two months, and in spite of the fact that he regained his health, he was left with the sickly feeling that "Once one reaches 70, one never knows when something happen," and decided to retire.

As his successor, as widely expected, he chose the present Chairman, Kaneo, saying, "He isn't flashy, and makes sound decisions at the appropriate time, a man well able to protect the company." The Sasebo Heavy Industry problem was churning up at that time, and there was another strong candidate, Vice President Hajime Tsubouchi, who was well known outside the company. But Chairman Kaneo, who had focused on internal affairs, was declared the winner.

According to an old company employee, "No one has been able to become the president of NKK through use of their talent outside for a long time. Rather, those with a solid position within the company were in a better position." Again this time that saying was unexpectedly proven correct.

The Seeds of Direct, Aggressive Management Planted During the Makita Era

In contrast to the government-style management of the Japanese steel industry's top firm, New Japan Steel, NKK, the most prestigious company in the Kanto region, has a pronounced free and active air about it. When you look over their list of corporate officials, more Todai graduates show up recently. However, when you compare the company with others it is made out of a variety of people. For some time at NKK there have been many followers of high officials of government and industrial circles, attracted by the NKK corporate culture. Further, they are the type of people eager to meet a challenge. For example, they dared to embark on the construction of the Fukuyama Steel Plant and the replacement of Keihin Steel, certainly accomplishments that demonstrate their ability to get things done based upon sound foresight.

However, in recent years an image somewhat removed from this spirit which invites challenge seems to have been setting in. For example, "They're not willing to cross a bridge even after they tap to check it for soundness and discover it is made of stone," or, "They're too comfortable," or "They don't seem to be very dedicated." In spite of the fact that the third and fourth ranked steel companies, Kawasaki Steel and Sumitomo Metals, are pushing hard to catch up, second-ranked NKK is still more hesitant than the industry

leader, New Japan Steel. It can't be denied that NKK has internal problems in the areas of corporate spirit and industrial planning.

During the last year or so, this same NKK has changed completely, turning toward aggressive management. This is symbolized by international developments such as their investment in the seventh largest American steel maker, National steel, and the formation of a metal manufacturing joint venture with the air and space equipment maker, Martin Marietta.

Further, the plan to switch from product-based to demand-based organization in the steel industry section represented a drastic break with past steel industry concepts. They have invested abundant material, financial and personnel resources in their recently formed department which focuses on new materials, and haven't spared any effort to make it into the fourth department of the company, after steel, shipbuilding and machinery.

This series of positive industrial strategies in fact all came from themes first established by NKK Advisor Makita who has continued to push them since the time of his presidency. In fact, in support of this, Chairman Kaneo was quoted as saying, "This series of accomplishments was made possible by being based upon the excellent foresight of Chairman Makita."

In spite of the fact that he retired to the position of Adviser as of this term, he still is at the center of a large and important group of NKK personnel, and remains very influential in the background. When we try to follow the complex personnel movements at NKK, we must find Advisor Makita as the source of the stream.

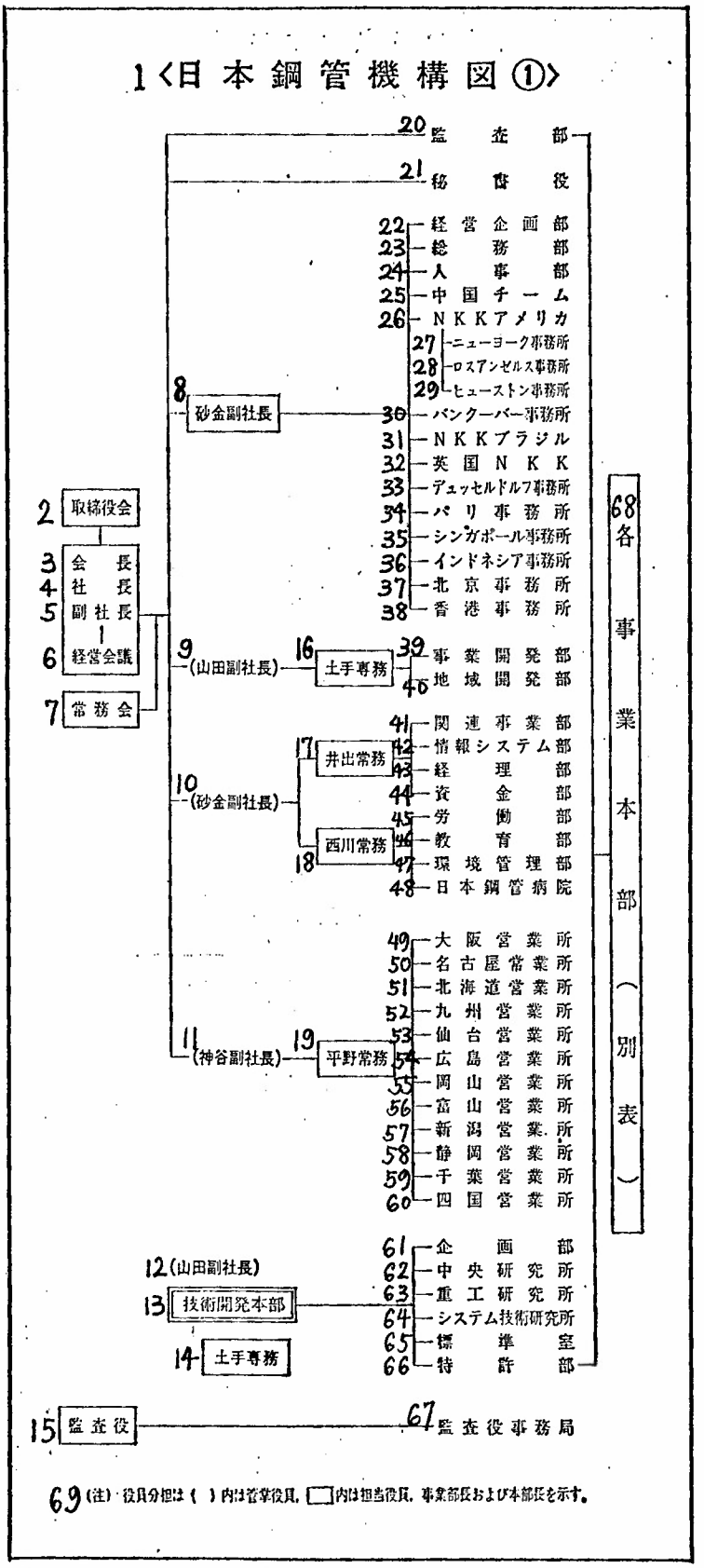
In May of 1965 Makita returned to NKK as an Executive Managing Director after having been sent out to "study management" as the president of Nihon Kokan KK. He was suddenly called back by Takeshi Akasaka, now deceased and then NKK president. He was promoted to Executive Director and Vice president, and in the summer of 1971 he was appointed to the presidency to succeed Akasaka after he suddenly died.

That was a very difficult period. The Y1 trillion plan to move to Ogishima was already under way. This huge project had to be pursued within an environment of public criticism and concern as to whether "NKK will be able to accomplish such a large project." Dealing with the unification of heavy industry and the recession in shipbuilding, he demonstrated his leadership abilities, stimulating the determination to pursue a program under which one mistake might put the management of the whole company into jeopardy.

President Akasaka was a strong enough individual to be nicknamed "The Emperor," and at the time of his retirement the company certainly had a strong "Akasaka flavor." Through the various changes in personnel that followed, that influence was diluted, and the personnel group surrounding Makita became well established. During the latter half of his appointment there was some criticism to the effect that "NKK's president has become too important." But he surely didn't run the operation as a dictatorship. Important decisions were decided unanimously in the Management Committee made up of the Chairman, President and Vice Presidents which had been established in 1975.

Chairman Kaneo, the individual in whom Advisor Makita placed the most confidence, became his successor. During the time he was Head of Personnel he persisted in his efforts to promote the policy of strengthening the heavy industries department, paying no attention to the doubts of those around him. This action which was based on personal confidence was the reason for such absolute trust. Even now, people are saying, "The more we think about it, the better choice Kaneo was."

1〈日本鋼管機構図①〉



69 (注) 役員分担は( )内は管掌役員, □内は担当役員, 事業部長および本部長を示す。

Key:

1. NKK ORGANIZATIONAL MAP 1
2. Board of Director's
3. Chairman
4. President
5. Vice Presidents
6. Managerial Conference
7. Board of Executive Managing Directors
8. Vice President Sunagane
9. Vice President Yamada
10. Vice President Sunagane
11. Vice President Kamiya
12. Vice President Yamada
13. Technology Development Headquarters
14. Executive Director Dote
15. Inspection Officers
16. Executive Director Dote
17. Executive Managing Director Ide
18. Executive Managing Director Nishikawa
19. Executive Managing Director Hirano
20. Inspection Department
21. Secretariat
22. Management Planning Department
23. General Affairs Department
24. Personnel Department
25. China Team
26. NKK America
27. New York Office
28. Los Angeles Office
29. Houston Office
30. Vancouver
31. NKK Brazil
32. NKK England
33. Dusseldorf Office
34. Paris Office
35. Singapore Office
36. Indonesia Office
37. Beijing Office
38. Hong Kong Office
39. Industrial Development Department
40. Regional Development Department
41. Related Industries Department
42. Information Systems Department
43. Accounting Department
44. Capital Department
45. Labor Department
46. Education Department
47. Environmental Management Department
48. NKK Hospital
49. Osaka Plant
50. Nagoya Plant

51. Hokkaido Plant
52. Kyushu Plant
53. Sendai Plant
54. Hiroshima Plant
55. Okayama Plant
56. Toyama Plant
57. Niigata Plant
58. Shizuoka Plant
59. Chiba Plant
60. Shikoku Plant
61. Planning Department
62. Central Research Department
63. Heavy Industry Research Center
64. Systems Technology Research Center
65. Standardization Office
66. Patents Department
67. Inspectors Office
68. Various Industrial Divisions (separate chart)
69. (Note) Official assignments of Department Heads and Division Directors in parentheses are officers with supervisory responsibility; those in boxes are officials immediately in charge.

Full of the Spirit of Challenge Handed Down Through Successive Generations of NKK Leaders

Chairman Makita and President Kaneo got along so well together that it is said there has never been another example of a team able to operate more ideally. In contrast to an individualistic, aggressive chairman with a unique philosophy, was a quiet president of the type who thinks things over carefully and then takes action. In addition to the advantages of this combination of personal styles, the two had great confidence in each other.

Chairman Kaneo is the so-called "fair and selfless" type with strong convictions. It is often said that "Once he makes up his mind he is pretty stubborn." The source of his strength seems to be the experience of facing death during his three years of internment in Siberia from 1945.

Still, he is of course not the show-off type. Therefore, when Advisor Makita was appointed Chairman, he gave up his decisionmaking authority saying, "We should shape the corporate organization into a pyramid in which there is only one individual responsible for deciding important plans and intentions." But it is certain that he exercised considerable influence over decisions during the first part of Kaneo's administration. However, after a certain time, important questions of corporate strategy and senior personnel decisions began to take on a strong Kaneo flavor.

The National Steel investment issue was a classic example. Advisor Makita who hoped to produce steel in the American market and Vice President Kamiya who was keen to promote internationalization, pressed for direct action. But there were many others who were opposed. Chairman Kaneo who was then president decided "It will be a lot of work, but looking toward the future, we shouldn't lose this chance." This decision was a surprise both within the

company and within the whole steel industry, inspiring comments like "This is really a positive move, appropriate considering that Kaneo is such a prudent person."

Kaneo's influence even extended into the area of personnel. Chairman Kaneo actually was a graduate of Waseda University. And so when he was appointed to the presidency observers imagined that he would be likely to promote individuals who were Waseda graduates. Of course, this was nothing more than a guess. However, in contrast he stayed away from university old-boy politics and sent Executive Managing Director Hisao Yamada, a Waseda graduate, off to become the president of Nihon Casting.

Also, according to one retired company official, promotions for Noboru Hirayama (age 60), who didn't get along very well with Advisor Makita, had been quite slow. But Chairman Kaneo respected his abilities and made use of him as an official. He has now become an Executive Managing Director.

In this way, during the time that he was NKK president, Chairman Kaneo did not deviate from traditional practice, paying close attention to a wide range of opinions within the company, making decisions at the appropriate time and acting upon them.

It is certain that President Yamashiro who has taken over from Chairman Kaneo will continue on in the same spirit. "We are in the middle of a severe domestic and international environment. Above all, let's build an aggressive, action-oriented company."

New President Yamashiro's first statement rang through the large conference room on the second floor of NKK corporate headquarters. During the course of his statement upon assuming the presidency on July 1st he challenged the assembled NKK employees. They were the words of a strong corporate helmsman, the tenth president of NKK, a company proud of its more than 70 years of prosperity and tradition. This strong presidential appointment statement won't translate directly into specific corporate strategy, but he said "I will do my very best, following the management line heretofore established," promising the start of a continuous sprirt of challenge.

Core of Support for Yamashiro System Comes From Officials Who Joined NKK Between 1946 and 1949

President Yamashiro joined NKK during the chaotic immediate postwar period as a temporary laborer. He hoped to become a government official, but changed plans. "Together with other young people, I hoped to help rebuild Japan's industry."

He followed an internal career path, including service in the Planning, Accounting and Information Systems Departments. He became well known for balance and good judgement. In one sense he might be considered narrowly focused, but he also has a rather large-hearted aspect. Talk of him becoming president came up "When I went to pay my respects just before being sent to New Zealand Steel, when I was told 'I have something that I need you to do.'"

From July, NKK reorganized their Heavy Industries Department into three industrial departments: Engineering, Machinery, and Marine and Steel Construction. This gives them an organization of five industrial departments, together with the two existing industrial departments of Steel and New Materials. Together with this, they have given industrial department Heads representation on the Board, heretofore restricted to the president and vice presidents. President Yamashiro explained the objective of that change as "Clairfying the system of responsibility, making each Department head and each department feel like a company and a company president," greatly promoting their independence.

Further, they have taken a forward-looking posture in new materials and other new fields, making the high-spirited statement that "One of our objectives for the 21st century is to to make steel 50 percent of our total sales, with heavy industry and new materials both 25 percent." Together with growing the seeds planted during the Makita-Kaneo era, he himself is doing an admirable job of accepting responsibility for planting the next generation's seeds for his successor. At the same time, the key to the question of whether or not the new Chairman Kaneo-President Yamashiro combo will charge into the "belle epoch" is the organization of personnel at the vice president level and below.

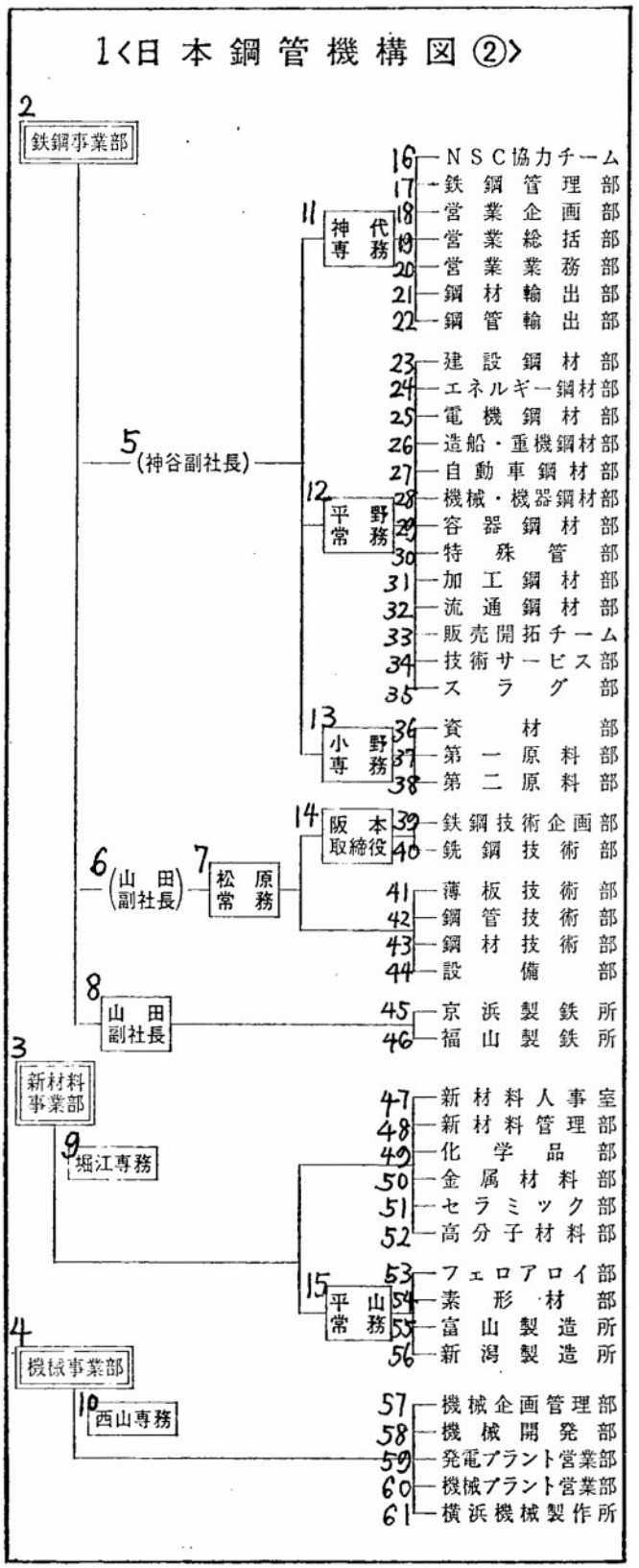
The Senior Vice President, Kozo Yamada (age 63), is in charge of the whole steel technology group. He is a rugged, primitive sort of romanticist. He appears somewhat stuffy, but his easy and casual manner is charming.

Succeeding generations of presidents of Kawasaki Steel, another steel maker, have been technicians from Tokyo University's Department of Metallurgy. But NKK has never had a technician as president. In one sense, technological ability controls decisively the quality of a steel manufacturer's products, their productivity, their costs, and competitive power.

All the more, personnel relationships within NKK's technical group continue in a long line from Shinroku Yamashita, former Chairman of Gorei Steel Company, (former NKK Vice President), Vice President Hiromoto Takano, Vice President Yamada, making up a large pipe.

As successor to Vice President Yamada as head of the technical group there are Executive Director Akira Dote, Director of the Technical Development Division (age 59), Executive Director Shigesaka Horie, Director of the New Materials Division (age 59), Executive Director Yukio Hatori, Head of the Keihin Steel Works (age 60).

Among them, Executive Director Dote is commonly known within the steel industry as a "builder," intending to open up new territority in the field of technical development. Executive Director Horie is a slim, scholarly individual, intense, who has put all of his energy into the development of new materials as a result of his experience as head of the Research Center. Executive Director Hatori is a broad-gaged, balanced individual with wide experience, considered a priceless treasure among technicians.


1<日本鋼管機構図②>
2 鉄鋼事業部
3 新材料事業部
4 機械事業部
5 (神谷副社長)
6 (山田副社長)
7 松原常務
8 山田副社長
9 堀江専務
10 西山専務
11 神代専務
12 平野常務
13 小野専務
14 阪本取締役
15 平山常務
16 NSC協力チーム
17 鉄鋼管理部
18 営業企画部
19 営業総括部
20 営業業務部
21 鋼材輸出部
22 鋼管輸出部
23 建設鋼材部
24 エネルギー鋼材部
25 電機鋼材部
26 造船・重機鋼材部
27 自動車鋼材部
28 機械・機器鋼材部
29 容器鋼材部
30 特殊管部
31 加工鋼材部
32 流通鋼材部
33 販売開拓チーム
34 技術サービス部
35 スラグ部
36 資材部
37 第一原料部
38 第二原料部
39 鉄鋼技術企画部
40 銑鋼技術部
41 薄板技術部
42 鋼管技術部
43 鋼材技術部
44 設備部
45 京浜製鉄所
46 福山製鉄所
47 新材料人事室
48 新材料管理部
49 化学品部
50 金属材料部
51 セラミック部
52 高分子材料部
53 フェロアロイ部
54 素形材部
55 富山製造所
56 新潟製造所
57 機械企画管理部
58 機械開発部
59 発電プラント営業部
60 機械プラント営業部
61 横浜機械製作所

Key:

1. NKK ORGANIZATIONAL MAP 2
2. Steel Industies Department
3. New Materials Industries Department
4. Machine Industries Department
5. Vice President Kamiya
6. Vice President Yamada
7. Executive Managing Director Matsubara
8. Vice President Yamada
9. Executive Director Horie
10. Executive Director Nishiyama
11. Executive Director Kamishiro
12. Executive Managing Director Hirano
13. Executive Director Ono
14. Director Sakamoto
15. Executive Managing Director Hirayama
16. National Steel Liaison Team
17. Steel Administration Department
18. Business Planning Department
19. Business General Affairs Department
20. Business Affairs Department
21. Steel Export Department
22. Steel Pipe Export Department
23. Construction Steel Department
24. Energy-related Steel Department
25. Electrical Equipment Steel Department
26. Marine and Heavy Machinery Steel Department
27. Automobile Steel Department
28. Machinery and Equipment Steel Department
29. Container Steel Department
30. Specialty Pipe Department
31. Processed Steel Department
32. Transportation Equipment Steel Department
33. Market Development Team
34. Technical Services Department
35. Slag Department
36. Materials Department
37. First Raw Materials Department
38. Second Raw Materials Department
39. Steel Technology Planning Department
40. Iron Technology Department
41. Sheet Steel Technology Department
42. Steel Pipe Technology Department
43. Steel Technology Department
44. Equipment Department
45. Keihin Steel Works
46. Fukuyama Steel Works
47. New Materials Office of Personnel
48. New Materials Office of Administration
49. Chemical Department
50. Metal Materials Department
51. Ceramics Department

52. High Polymer Materials Department
53. Ferro-alloy Department
54. Basic Materials Department
55. Toyama Steel Works
56. Niigata Steel Works
57. Machinery Planning Administrative Department
58. Machinery Development Department
59. Electrical Generating Plant Business Department
60. Machinery Plant Business Department
61. Yokohama Machine Works

Vice President Kamiya controls the main Steel Industries Department. He was originally noted for his abilities in the areas of administration and planning, but moved to sales in 1976. And he now represents NKK's business Division. Diligent and studious, he is a practical individual with no time for empty theorizing. He has the reputation of being far-sighted and capable of outstanding work.

He is a practical activist who pushed through the pending radical changes in corporate business structure and investment in National Steel. A senior executive from another steel company said, "He has practical business sense. His actual accomplishments are head and shoulders above those of the others." He has been a strong source of support for the Kaneo regime. He was beaten out in the post-Kaneo competition, but since he is such a loyal company man, he continued on with a new sense of challenge, accepting "responsibility to concentrate on his own work."

He also serves as the Vice President of National Steel, and for a time it was rumored he would move full-time to that position. But neither NKK nor Kamiya himself have any such intention. Moreover, the other manufacturers in the industry, and the steel consumers, didn't want to lose Vice President Kamiya's services, although he often came out ahead when handling business with them. The support group behind "Kamiya the Salemsan" includes Executive Director Tetsuo Kamishiro (age 59) and Executive Managing Director Koji Hirano (age 58). Kamishiro has managed NKK's base of operations in Western Japan, the Osaka Steel Works, and has been Head of the Business Planning Department. He is a man of great personal depth, and his frank, bright character inspires good feeling. He is an up-and-coming new face in the business world.

Vice President Tsuneo Sekigawa (age 62) heads up the Maritime and Steel Industry Department. In the past it was the shipping industry that made up for sluggishness in the steel industry, but recently that environment has deteriorated more and more, making their position quite difficult. He is eager to venture out into the unusual areas of specialty shipbuilding and man-made islands.

Generation after generation the shipping industry has had its own unique personnel structure. The next leader of this Division is Yasuyo Ishihara (age 57). He has worked only in the shipbuilding field, serving as the Head of departments such as International Shipping and Maratime Specialty Ships. He is capable of promoting a reorganization of the system.

Vice President Toshio Sunagane (age 59) is in charge of administration for the whole company. After working for many years as in the secretariat during Makita's presidency, he headed up the general affairs section, and was responsible for the reassignment of 1,000 people and the CI (corporate identity) project.

He gets along very well with President Yamashiro. According to a steel industry journalist, "Within NKK, Sunagane is the most supportive of President Yamashiro, helping to create a positive atmoshpere inside and outside the company."

Executive Director Hisanobu Nishiyama (age 62) and Executive Director Kokichi Hagiwara (age 61) are the heads, respectively, of the Machinery Industries Department and the Engineering Industries Department which since July were made independent of the old Heavy Industries section. Nishiyama, full of vitality, had been Head of the Personnel Department. In contrast, Hagiwara is a well disciplined, straightforward type of person.

The head of the raw materials Division is Hiroshi Ono (age 59), a member of the international faction with strong English language speaking ability. Known as an export specialist, he moved to the raw materials department in 1983.

NKK is the managing underwriter for Canada Coal, so the raw materials post is important. But because the personnel configuration of the raw materials Division has been temporarily disturbed, he was put in as an individual who could handle any problem.

In addition, the Executive Managing Director lineup includes such promising individuals as Shoichi Ide, (age 59) who is in charge of accounting and finances, Hiroshi Otaka (age 60), Shunkichi Miyoshi (age 56), Kenichi Hayakawa (age 59), Tadashi Nishikawa (age 58), Hiroyoshi Matsubara (age 56).

Viewed from this angle, the core of personnel support for the Yamashiro regime consists of this group of Executive Managing Directors and above who entered the company between 1946 and 1949. The group that entered in 1948 especially includes a number of stars since New Japan Steel held off on its hiring that year.

It may be too early to predict, but who is likely to succeed President Yamashiro? From a common sense perspective, the comment of a senior official within the industrial group seems to hit the mark: "Based on ability and judgement, Vice President Kamiya is the top candidate to become the next president." Others say "The Yamashiro regime won't last all that long," and on the off-chance that it doesn't last all that long a smooth transition would be possible. However, since he is the same age as President Yamashiro, he has no chance should Yamashiro remain in office for a longer period.

Another possibility is Vice President Sunagane whose career has taken off since Yamashiro's assumption of the presidency. He was only a third-ranked dark horse during the post-Kaneo race, but according to an economic reporter,

"Rumor has it inside and outside the company that this time he has suddenly shot up to become the favorite."

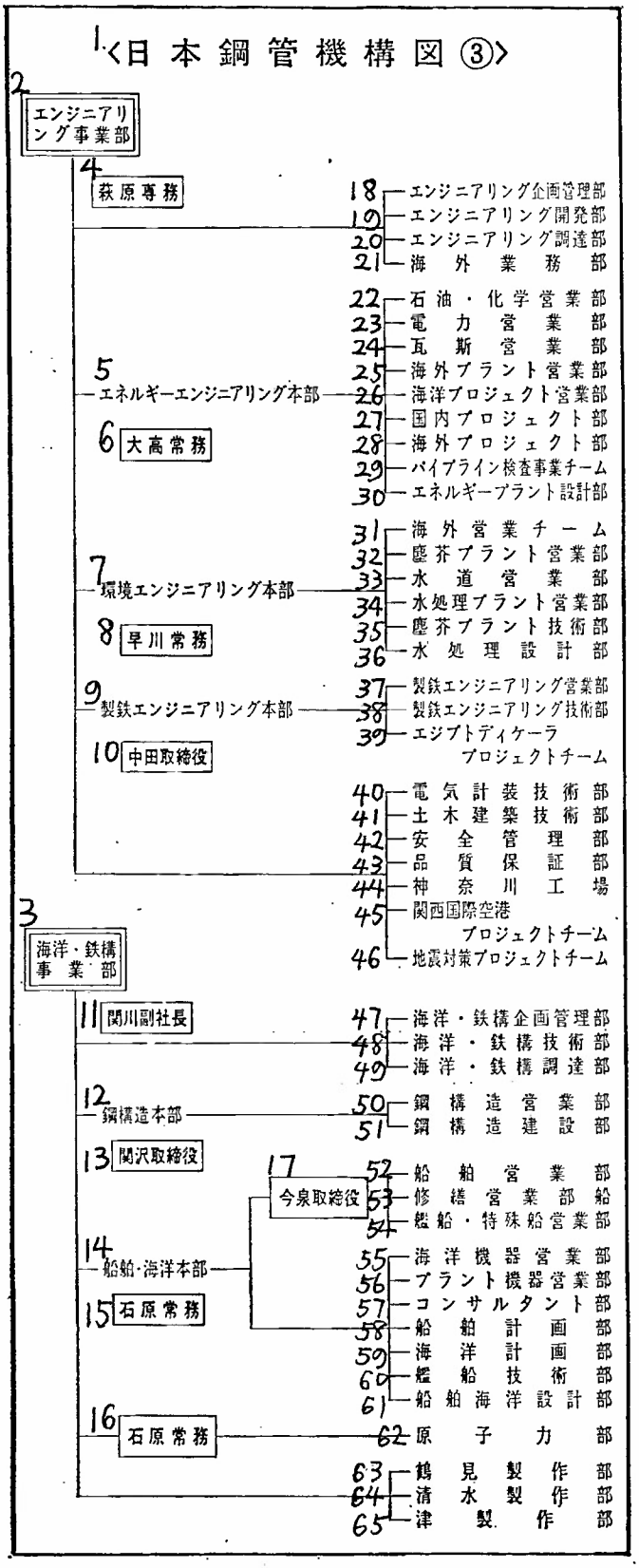
He surely was the head of the secretariat during the period of Makita's presidency, and he performed a quasi-chief cabinet secretary function during Kaneo's chairmanship, broadening his external relationships. And he has been broadening his experience at the center of the company's business while he has been polishing his coordination skills. He also has the unquestioned confidence of President Yamashiro.

Because of this, Vice President Sunagane will still be 65 at the time of the succession should President Yamashiro retire in his third term around the sixth year of his presidency. That has been just the right age for a president, and given these advantages Sunagane has a good chance of becoming president.

But if the Yamashiro regime extends on for ten years or so, naturally the situation changes. There will be a drastic shift of generation to younger officials as the members of the 1946-1949 team of senior officials retires. If so, the next president may well come from among the ranks of the current Directors or Department Heads.

Ultimately, the most important factor for the succession is to be found in its timing, and the sort of person required by the times when it occurrs. Will it require someone good at managing the day-to-day routine, or someone capable of aggressive managment capable of implementing the developments required in the 21st century?

Up to now the tendency has been toward the inside-man type with strong conservative personnel connections. But eventually there may be a reaction to that, or the established pattern may continue. Sooner or later we will be able to tell.


1 〈日本鋼管機構図③〉
2 エンジニアリング事業部
4 萩原専務
18 エンジニアリング企画管理部
19 エンジニアリング開発部
20 エンジニアリング調達部
21 海外業務部
22 石油・化学営業部
23 電力営業部
24 瓦斯営業部
25 海外プラント営業部
26 海洋プロジェクト営業部
27 国内プロジェクト部
28 海外プロジェクト部
29 パイプライン検査事業チーム
30 エネルギープラント設計部
5 エネルギーエンジニアリング本部
6 大高常務
31 海外営業チーム
32 塵芥プラント営業部
33 水道営業部
34 水処理プラント営業部
35 塵芥プラント技術部
36 水処理設計部
7 環境エンジニアリング本部
8 早川常務
37 製鉄エンジニアリング営業部
38 製鉄エンジニアリング技術部
39 エジプトディケーラ プロジェクトチーム
9 製鉄エンジニアリング本部
10 中田取締役
40 電気計装技術部
41 土木建築技術部
42 安全管理部
43 品質保証部
44 神奈川工場
45 関西国際空港 プロジェクトチーム
46 地震対策プロジェクトチーム
3 海洋・鉄構事業部
11 関川副社長
47 海洋・鉄構企画管理部
48 海洋・鉄構技術部
49 海洋・鉄構調達部
12 鋼構造本部
50 鋼構造営業部
51 鋼構造建設部
13 関沢取締役
17 今泉取締役
52 船舶営業部
53 修繕営業部船
54 艦船・特殊船営業部
14 船舶・海洋本部
15 石原常務
55 海洋機器営業部
56 プラント機器営業部
57 コンサルタント部
58 船舶計画部
59 海洋計画部
60 艦船技術部
61 船舶海洋設計部
16 石原常務
62 原子力部
63 鶴見製作部
64 清水製作部
65 津製作部

1. NKK ORGANIZATIONAL MAP 3
2. Engineering Industries Department
3. Marine and Steel Construction Industries Department
4. Executive Director Hagiwara
5. Energy Engineering Division
6. Executive Managing Director Otaka
7. Environmental Engineering Division
8. Executive Managing Director Hayakawa
9. Steel Engineering Division
10. Director Nakata
11. Vice President Sekigawa
12. Structural Steel Division
13. Director Sekizawa
14. Shipbuilding, Maritime Division
15. Executive Managing Director Ishihara
16. Executive Managing Director Ishihara
17. Director Imaizumi
18. Engineering Planning and Administration Department
19. Engineering Development Department
20. Engineering Procurement Department
21. International Business Department
22. Petrochemical Business Department
23. Electrical Generation Business Department
24. Gas Business Department
25. International Plant Business Department
26. Maritime Project Business Department
27. Domestic Projects Department
28. International Projects Department
29. Pipeline Testing Business Team
30. Energy Plant Design Department
31. International Business Team
32. Refuse Plant Business Department
33. Water Supply Business Department
34. Water Treatment Plant Business Department
35. Refuse Plant Technology Department
36. Water Treatment Design Department
37. Steel Engineering Business Department
38. Steel Engineering Technology Department
39. Dekera, Egypt Project Team
40. Electrical Measurement Equipment Technology Department
41. Public Works Construction Technology Department
42. Safety Administration Department
43. Quality Control Department
44. Shinagawa Plant
45. Kansai International Port Project Team
46. Earthquake Countermeasures Project Team
47. Maritime, Steel Planning and Administration Department
48. Maritime, Steel Technology Department
49. Maritime, Steel Procurement Department
50. Structural Steel Business Department
51. Structural Steel Construction Department
52. Shipbuilding Business Department

53. Repair Business Department Vessel
54. Naval and Specialty Ship Business Department
55. Maritime Equipment Business Department
56. Plant Equipment Business Department
57. Consulting Department
58. Shipbuilding Planning Department
59. Maritime Planning Department
60. Naval Technology Department
61. Shipbuilding and Maritime Design Department
62. Nuclear Department
63. Tsurumi Steel Works
64. Shimizu Steel Works
65. Tsu Steel Works

NKK's Strategy for Survival

Tokyo ZAIKAI TEMBO in Japanese Dec 85 pp 140-153

[Article by Hiroshi Mochizuki]

[Excerpts] An Effort To Strengthen the Managerial Base of the Company by Reducing Steel to 50 Percent of Total Sales

At the end of this June President Yoshinari Yamashiro took over the reins of NKK from Chairman Minoru Kaneo. At that time he addressed employees of the company in strong, stimulating terms: "At home we face administrative and financial reform measures; abroad, trade frictions are casting a shadow over the international free trade system. We are in the midst of both domestic and international economic hardship. Under such conditions this company's survival depends more than anything else upon our ability to create a 'strong company.' We will not be able to survive this hardship idling about."

Historically, from time to time NKK directly and boldly has pursued some farsighted strategies. This challenging spirit certainly has been the driving force behind NKK's progress.

Looking only at the period since 1975, during the period of his presidency, former Chairman Hisao Makita built Ogishima (Keihin Steel Works) which cost Y1 trillion. Together with the Fukuyama Steel Works in the west, he established an efficient prodution system of two great steel works--with one in the west and one in the east. Japan already had built a world class integrated steel works, and in addition to steel and shipbuilding, was promoting the heavy industries sector with a third key industry, engineering.

Throughout the time he was NKK President, Chairman Kaneo, Makita's successor, promoted the slogan "Let's build a strong company," and devoted all of his energies to the strengthening of the tripartite system of steel, shipbuilding and heavy machinery. He also promoted diversification into the field of new materials, and in 1984 promoted the internationalization line through investment and management participation in National Steel.

Concerning the basic direction he intends to steer in the future, President Yamashiro, the successor of both Makita and Kaneo, has stated: "I will pursue the paths established by both men. Specifically, I will take measures to internationalize and diversify the company. My task is to force the seeds planted by my two predecessors to bloom and to bear splendid fruit." This Yamashiro system lately has become a focus of interest in the management field. It includes the strengthening of the business base, the strengthening of technological development, and promotion of internationalization.

NKK, which began in 1912 as Japan's first manufacturer of seamless pipe for domestic consumption, merged in 1940 with Tsurumi Steel Shipbuilding, creating a unique industrial configuration that combined shipbuilding with the manufacture of its basic material, steel. From that time to present, some 70 years, NKK has contributed to the development and prosperity of industrial society as an important part of Japan's basic industry. But with the domestic shift to a period of low economic growth after the oil shock at the end of 1973, the change in industrial structure, and the rise of trade friction, the problem of industrial structural reform has become the most important consideration. There is more to this problem than the factors directly related to the process of simply upgrading and strengthening demand for the products of the various divisions and increasing their value-added. It also requires improvements in non-industrial areas such as capital procurement and information.

One example of this is the effort to strengthen the corporate management system. The fiscal year 1984 crude steel production of this second largest steel maker in Japan was 12.6-million tons, 11.8 percent of Japan's total crude steel production which at long last topped 100 million tons. In terms of production it can't be denied that NKK's rival, New Japan Steel, is in the lead. For example, as of March 1985, New Japan Steel's sales amounted to Y2.8 trillion, with pre-tax profit of Y90.8 billion. After tax profit was Y41.5 billion. In contrast, NKK's sales were Y1.5 trillion, with pre-tax profits of Y37.5 billion, and after-tax profits of Y19.5 billion--all lower.

Although the capital drain of construction costs at the Keihin Steel Works was over, the overall performance was pulled down by another drop in the export of seamless pipe, NKK's profit leader. In consideration of demand, they were wrapped up in the centralization of their iron supply for the Fukuyama and Keihin Steel Works. And at the same time there also was the factor of them putting all of their effort into expansion into new fields. Already at Fukuyama they have shut down one line from pig iron to steelmaking. And speaking of the long-term demand for steel, President Yamashiro also has said "In the near future we hope to reduce the share of steel to 50 percent from the current production ratios of 70 percent steel, 20 percent heavy industry and 10 percent shipbuilding," stressing his intention to expand the operations of the company into other fields.

Innovation in the manufacturing process, including the increase in the proportion of continuous casting with the Fukuyama 5th slab continuous casting operation and the implemention of the direct rolling process all started with the effort to reduce costs through making the Fukuyama and Keihin Steel Works as efficient as any in the world and reducing their energy consumption.

NKK is also setting out to strengthen their sales operations. The drastic revision of the NKK business structure from its product-specific structure to consumer-specific structure realized in July 1984 is a typical example. With the reorganization from the original four product-specific divisions of sheet, pipe, construction, and cast shapes (including the domestic and international business divisions), the six business divisions of construction, energy, electrical equipment and machine parts, shipbuilding and heavy equipment, automobiles, and containers and machinery, plus the three business divisions of special pipe, process steel, and transportation-related steel, and the market development team, NKK has made clear its move to a consumer-specific business structure.

Expressing his hopes for the new system, President Yamashiro said, "We have moved from the period in which we could sell any good product that we made to one in which we make things that can be sold. This unprecedented sales system is designed to cope with a buyer's market."

The Amazing Internationalization of Industrial Development

Together with their effort to strengthen their steel sales system, NKK embarked upon an industrial internationalization policy as a strategy with which to pursue New Japan Steel.

The two best examples of this effort are the 50-percent investment in National Intergroup's National Steel Company, the 7th largest steel producer in the American market, in August of 1984, and the January 1985 joint venture with the American firm Martin Marietta which established National Light Metals.

The investment in National Steel Company (NSC) was the first Japanese steel manufacturer's major investment in the United States, according to NKK Advisor Makita, "A model for Japan-U.S. industrial cooperation." So seen, these moves are of immeasurable importance for NKK's long-term strategy.

NSC is a steel manufacturer that specializes in sheet steel with factories in Michigan, Illinois, and Indiana. It is a top-level American steel maker employing about 12,000 people, with raw steel production of 5-million tons.

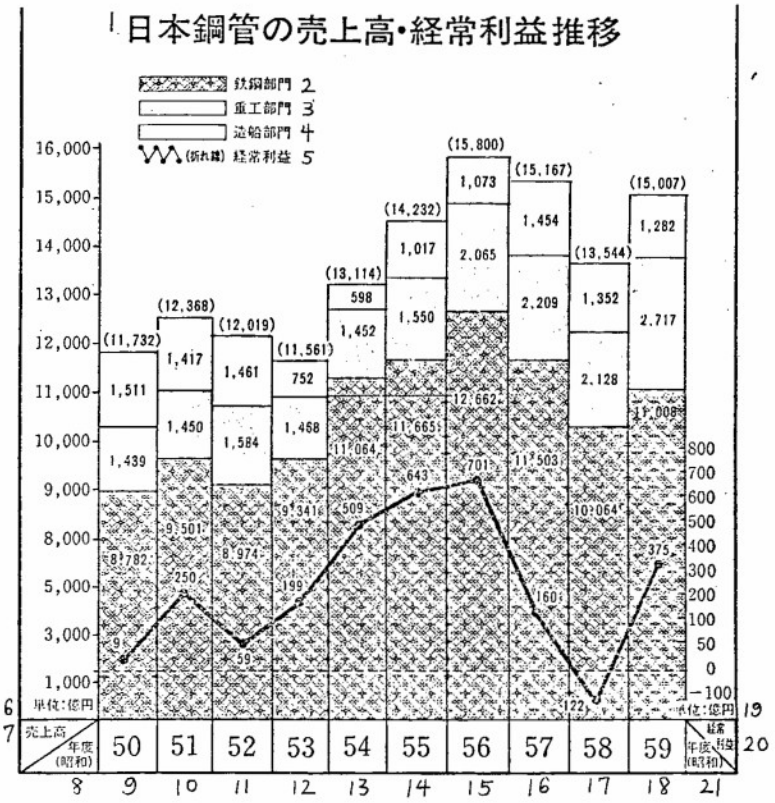
The two companies have had a technology exchange relationship for about 20 years, and this venture moves joint Japan-U.S. steel industry management one step along. Through this investment in NSC, NKK hopes to increase its share of the American sheet steel market, heretofore a weak point for NKK. As is well known, steel exports to the United States have been under severe restrictions since this spring. And even if NKK is unable to increase its exports, with this investment in NSC, it will be able to increase profitability through NSC's increase in sales. Of course, in order to accomplish this they will have to make NSC into a more competitive steel maker. But this won't be so difficult since NKK can supply NSC with their advanced knowhow, such as sheet steel technology and EGL (electrical galvanization equipment).

Already they are assigning management staff to NSC, such as Yukio Tani (an NKK Director) as Executive Vice President, and from last autumn they have permanently assigned a research team of 13 specialists to the company. They have selected talented individuals from various fields for supervisory work. NSC too is saying that "With NKK's capital and technical assistance we hope soon to become a steel maker producing world-class quality, advanced products."

The steel import restrictions have very little chance of solving the U.S.-Japan trade friction problem at present. NKK foresaw this and before the restrictions were imposed established a beach-head in the United States, demonstrating praiseworthy foresight.

As part of their internationalization strategy in the field of new materials, another noteworthy move was the formation of the joint venture company, International Light Metals (ILMC) with the Martin Company. The Martin Company is a famous American maker of air and space-related machinery. NKK has taken over the personnel and equipment of the Torrance (California) plant of Martin Marietta Aluminum, a wholly owned subsidiary of the Martin Company. They supply a wide range of the aircraft and auto industry with aluminum and titanium alloy extrusions and forged products.

NKK sees the possibility of moving into the new materials field after steel, and the formation of this joint venture is the key to strategy to get directly involved in the metallic new materials field. And in this field, a significant area is titanium alloys. The Japanese air and space market for titanium is not yet developed, still at about 7,000 tons per year, small compared with that of the United States.



Key:
1. Changes in NKK's Current Sales and Profits
2. Steel Division
3. Heavy Industry Division
4. Shipbuilding Division
5. (broken line) Current Profits
6. unit= Y100-million
7. Sales
8. Fiscal year
9. 1975
10. 1976
11. 1977
12. 1978
13. 1979
14. 1980
15. 1981
16. 1982
17. 1983
18. 1984
19. unit= Y100-million
20. Current Profits
21. Fiscal year

However, they are sure that it will expand at a rapid rate in the future with the development of new fields such as spacecraft and maritime. Already among the blast furnace steelmakers, Sumitomo Metals has formed a joint venture with an American steel maker and established a sales company in the United States. Kobe Steel is receiving rolled steel consignment orders from the same RMI company. And New Japan Steel too has created a titanium department, establishing the infrastructure to move directly into this same field. NKK's joint ventures were instituted in response to the moves of other companies which were earlier off the mark. At the same time, they can be seen as moves in the direction NKK hopes to go in the future. Without the acquisition of titanium and aluminium alloy technology, NKK would be unable to achieve their objective of becoming a comprehensive materials maker.

Further, this October they reached basic agreement with GE (General Electric) in the United States to purchase a polycrystalline silicon plant. They bought the Great Western silicon plant of GE's silicon division for about Y3.5-billion. It will start production as a wholly owned NKK subsidiary from January of next year. The plant produces 200 metric tons of polycrystalline silicon per year. Since polycrystalline silicon is the upstream material from which is made single crystal silicon, the material used in silicon wafers, NKK has moved considerably closer to the semiconductor field.

Last autumn NKK undertook joint technical development and basic research on polycrystalline silicon with GE, following the example of Kobe Steel and Tokuyama Soda.

After obtaining polycrystalline silicon manufacturing technology in the United States, within two or three years at the earliest they plan to build a full-scale factory in Japan capbale of producing 1,000 tons per year. At present

domestic demand for polycrystalline silicon is about 3,000 tons. So once built, the company will pursue market leadership with the output from this factory. And from this base, through the expansion of production of single crystal silicon and silicon wafers, the company hopes to gain a foothold in the semiconductor industry.

"For some time now since NKK has become a world player, they have been promoting a number of joint ventures which involve foreign investment, such as the investment in National Steel. Industrialization of industry is proceeding at a somewhat more rapid pace, and NKK has grouped together a number of talented and prominent people in Japan. They have tightly packaged every necessary asset, which leads to the effect of riding together, an important source of energy which should lead to the next step."

A new image of NKK was inspired in President Yamashiro's mind of a 21st century industrial group ready to implement a series of policies that included the internationalization and diversification of business. Just at that time the company should have its chance to pursue and even out-distance their arch-rival, New Japan Steel.

High Expectations for the Machinery Department: 100 Billion After 5 Years

"There is ample opportunity for this industry to expand, and it must." So President Yamashiro expressed his expectations for the Machinery Division. Among steel makers, NKK has made progress toward diversification. But considering the machinery field alone, they are still weak when compared with Kobe Steel Works which has led the way in machinery. Concerning this, even Executive Director Hisanobu Nishiyama, the man in charge, said as is already known, "I suppose that this division should have Y100-billion as an objective, but at present it is only at Y15-billion, and this fiscal year we will only do around Y20-billion. We've got to get those figures up."

Concerning this jump to the Y100-billion level, Executive Director Nishiyama stated the objective of "In the next few years achieving large increases of between 20 and 30 percent, making haste to push sales to the Y70 to Y80-billion level. Then, with single-digit increases, we will achieve our goal of Y100-billion at least within five years, by fiscal year 1990."

According to Nishiyama, "The point of NKK's diversification program is the expansion of the machinery division, and I believe that the whole company's expectations, including those of the President, are in that direction."

At present the most important products of the machinery division are transportation equipment, such as cranes and engines, mainly deisel engines and boiler turbines. NKK is maintaining its share of the market in fields such as presses, stamping machines, and steel silos. But they still have a ways to go before they have sufficient product diversity to be considered a comprehensive machinery maker. As a comprehensive machinery maker, there is a large industry-medium-small industry gap between NKK and companies such as Sogo Juki and Kobe Steel. But their goal is both to diversify their product line and increase sales to the point equal to those of the other heavy equipment manufacturers.

They are aiming at that objective through lateral development of their currently existing product lines and through promotion of a higher value-added product mix through a shift from separate products to the sale of complete systems.

The driving force at present behind the machinery industries division is motor driven electrical generation plants. NKK is producing and selling low-speed diesel engines through a technical cooperation agreement with the Swiss firm Sulzer, and medium-speed diesel engines through a cooperative agreement with the French firm SEMT. From last year they became affiliated with the medium and small size deisel engine producer, Fuji Diesel, establishing themselves as an integrated supplier of such engines from large to small size.

Recently they have combined the PC engine of the SEMT company and the small engine of Fuji Diesel with a turbine and generator, and are selling it abroad as an electrical generator plant. They hope to sell them in areas in less developed countries such as Southeast Asia and the Middle East. All of them are small and medium sized plants and self contained electrical generating equipment for factories. They already have 30 orders, and they are very confident that they will sell well. They intend to put some effort into the development of the market for small-scale electrical generating equipment for the small towns of isolated islands and remote mountain villages.

They are also interested in China. In China at the present time they are proceeding on plans to construct large-scale coal-fired electrical generation plants that will make use of that nation's abundant coal resources. But there has been some movement toward establishing diesel electrical generating plants for home use in areas distant from coal producing and coal burning areas. To date there have been orders for two units to be used as self contained power generating plants for the polyester factories of Kuang Dong and Xin Hui Xian in China. Development of the Chinese market is some ways off, but once this comes on line, the sales of generators alone suddenly would expand sales from the three to four-billion yen level to the Y10-billion level.

A product of interest in the future is the dual fuel engine that can be run on both heavy oil and natural gas. Already, through cooperative research with the SEMT company, they are hoping to operationalize a dual fuel engine that will develop 1,200 horsepower from each cylinder based on the NKK-SEMT 6 PC engine.

Calculating from one engine, it seems as though this will become the first effort to operationalize the this high-powered engine that can produce from 7,200 to 21,600 horsepower, for use as the main engine for LNG transport ships used to export LNG from Western Australia to Japan. If it could operate as a gas engine using the boil-off (vaporized) gas from the LNG ship as fuel, they are eager to sell the idea on the significant merit of its cost effectiveness over current steam turbine loading ships. Further, they also will sell this engine to electrical generating plants that use high efficiency gas engines in natural gas producing countries. It has the advantage of a dual fuel engine for large gas electrical generating plants in Southeast Asia and the Middle East. It can be run on oil during the early stages of development when gas

production is insufficient, and once gas production begins, it can be shifted to run on gas.

The crane business too is well on track with a joint venture with the Australian Reefer Carrier Co., which established Japan Reefer Carrier Co. for the sale of container cranes. They have established a position in the metropolitian port market at which they were aiming with recent orders for two machines, one in the Port of Yokohama, and another bound for Motomaki Pier, after establishing a record as a container crane in the Port of Osaka. Hereafter they plan to expand into fields such as deck cranes, rigging cranes, and mobile cranes.

They are also moving quickly into the press field with press brakes for laminated metal presses developed from a technical cooperation agreement with the Cincinatti Company of the United States. Demand for large hydraulic presses is declining, and sales of smaller presses are increasing. They are thinking about later getting involved in the manufacture of FMS-related machine tools. Just in case, they are now exploring possibilities for collaboration with a manufacturer specializing in that field.

In a different area there is the steel silo division. In the past Japanese silos were mostly made of concrete. But steel silos have been increasing rapidly in number due to economic factors such as the maintenance and construction costs of concrete. For the past thee years the large steel makers have been participating in that market on the basis of their knowledge of welding technology. They already have more than 70 percent of the domestic steel silo market. They plan to link this steel silo technology to food processing and cold storage, and already have succeeded in obtaining an order from the Seipan Company of Yokohama for its breadmaking plant.

Executive Director Nishiyama has made the following inspirational statement: "I do not believe that any other machine manufacturer has bested us in the areas of technology and development. Our learning period has ended. We intend to become a 21st century machine manufacturer producing a wide variety of products. In that sense, this fiscal year should be remembered as the founding year of our machinery industries division," encouraging his group to work together with himself at their head.

The New Materials Division: Evidence of the Vestiges of a Basic Materials Maker

One of the fields slated for more rapid development and commercialization as the fourth pillar of NKK is new materials. Through many years experience in steel, first of all, and then shipbuilding and heavy industry, NKK has estensive technological capability and knowhow concerning raw materials. They intend to activate this knowhow in their effort to move rapidly into the field of new materials, a future growth industry. NKK is now in the midst of an important shift from large and heavy to light and small industry. In a sense, demand for this large steelmaker's main product has been eroded by these new materials. President Yamashiro has expressed his strong expectations for the new materials field saying, "No matter how popular 'small is beautiful' becomes, I don't believe that demand for steel will disappear. However, it is

certain that we cannot be optimistic about any increase in demand for steel with the gradual development of new materials. Hereafter, we must move into new materials in order to function fully as a broad-gague basic materials manufacturer."

As NKK moves into new materials, in a basic effort to promote this industry, this January they carried out a reorganization which established a new materials division. This new division includes all organizations which had been involved with new materials development, such as the New Materials Development Center, the Iron Alloys Department, and the Industrial Development Department. Executive Director Shigesaka Horie was named as its head.

The idea that the present age is the age of a materials revolution is behind NKK's decision to emphasize the new materials field. From 1990 to the year 2000 beginning with electronics, industries including air and space and robot services will grow rapidly in response to changes in social structure. As electronics and biotechnology become the industries of the 21st century, new materials will emerge from the resulting change in industrial structure. And it can be predicted that these, once again, will encourage the development of other leading edge technologies.

Even including the supply of ferro-alloys to the company's steel division, sales of new materials are still only Y40-billion per year. Compared with NKK's total sales of Y1.5-trillion, this division doesn't measure up. But the head of the operation, Managing Director Horie, has stirred up controversy with comments like "Hereafter, the existing automobile and machinery fields will grow to at least Y400- to Y500-billion after ten years, encouraging the development of new materials with which to respond to the original high-growth fields of electronics, electrical machinery, and air and space."

And, as industrial development leading toward the new materials field, there is the ferro-alloy of the chrome family, indispensible in the production of specialty steels, such as stainless and ferro-alloys of the magnesium type. This is used as a de-sulpherizing and purifying agent for molton steel by the old metal alloys division. In the old industrial development division they have been handling cold casting products such as hollow slabs and steel shapes.

Further, in 1983, they established the New materials Research Center, and introduced HIP (hot isotropic press) manufacturing technology from the Aseya company in Sweden. They are now working on production of this equipment in Japan, and its use in the development of ceramic materials. In addition, it is promoting the development of helium gas, products derived from tar, synthetic products, electrical equipment, titanium and aluminum alloys.

The basis of this series of new materials developments has been the technology that NKK has acquired in the steel, heavy industry, and ferro-alloy industries, such as refining, rolled production, by-product disposal, and machinery manufacturing. While planning to strengthen their powder sintering, casting and forging, chemical reaction, synthetic processing, and systems technologies, they are also making every effort to develop new materials.

At the Toyama Works, the first factory in Japan to produce ferro-alloys, in the field of new materials, they have begun work on the production of fireproof materials and ceramic powder, and they intend to move later into boron alloys and the commercialization of new ceramic powder.

The chemical division is promoting projects that rely on the byproducts of the steelmaking process, such as gas and tar. Since NKK has been using these by-products for the plant's fuel and direct reduction material since around 1955, they had withdrawn temporarily from the chemical industry. But, improving upon their own technology, they have decided to re-enter the chemical industry field, and their first project is the sale of high purity helium. They have begun sales through a joint venture with Nihon Sangyo.

Refining and distilling the tar that comes from steel plants, they have begun to commercialize products derived from tar such as napathalene for use in chemical manufacture, carbolic acid, high quality electrode materials, and carbon fibers. They are already in the midst of constructing a pilot plant able to produce 200,000 tons per year at the Fukuyama Works. After this, they will construct a tar derivitive plant with a 300,000 ton annual capacity, and plan to begin actual sales from the spring of 1987.

Executive Director Horie's dream has broadened to include the "C1 and BTX chemical fields in the future." At the Kawasaki Plant, the High Polymer Materials Division has moved into the production and sale of polyethylene pipe for use in gas distribution. Through the combination of high polymer materials technology, synthetic resin and complex resin materials technology, they have commercialized a variety of types of heat moldable resin pipe and heat sclerotic resin FRP pipe. Executive Director Horie confidently states "Up to now our steel pipe has been pushed out by these sorts of products. But from now on we will turn the tables by entering that field too."

As NKK moves further into the new materials field, they will focus their efforts on the development of ceramics as the "material of the 21st century" from the medium and long-term perspective. At present, NKK is making a strong effort to carve out an important place for their company in the ceramics field, using HIP and other manufacturing equipment and advanced sintering technology with ceramics powder of materials the ceramics division is dealing with, like nitrogen, silicon, molten silica, and zirconium.

They are also looking at electronic materials. In order to increase production of fused silica ceramic powder, which is used in various types of fireproof materials, they are in the midst of increasing production to meet growing demand through construction of a special factory with a monthly capacity of 3,000 tons at the Niigata Steel Works. In the future, looking toward the semiconductor industry, they have big plans for participation in the IC packaging, and in the market for sealing materials for parts in heavy industry.

With the decline in the demand for steel and the spectacular rise in importance of plastics and other new materials, NKK had no choice but to enter the field. But with their earnest drive in recent years into the new materials field, one can feel an enthusiasm about the leap from steel to all

metals, chemicals, high polymers, and ceramics to become a "comprehensive basic materials maker."

The Marine and Steel Construction Industries Division Caught up in Reorganization

The Marine and Steel Construction Industries Division was where NKK began its effort in earnest to expand the scope of their industrial effort with a restructing of the basis of their business when the Heavy Industries Division was reorganized under Yamashiro's new system. The sales and orders of this division had gone through difficult times for the past few years, an unavoidable situation given the impact of the long recession in the shipbuilding industry. Approximately 7,700 people are employed at the three plants actually engaged in the business at Tsurumi, Shimizu, and Tsu. Executive Managing Director Kosei Ishiwara, the man in charge of that division, has said, "We are responsible for the employment of all of these people. And since the outlook for the shipping industry itself is not so promising, the only way we can manage is through industrial diversification and the shift to higher value-added products."

As a result of looking again at industry, with the persons responsible for all of the sections, including technology, design, manufacturing, and planning, in that division, they decided to re-structure along the basic theme of the following six points. That is, in the shipping section they intend to move to higher value-added vessels, to put an effort into frozen sea construction equipment, the development of new marine fields, oil and gas related development, the nuclear energy field, and other new industries.

First of all, in higher value-added vessels, at present they are hoping to receive an order for an LNG (liquid natural gas) transport vessel. In contrast to the order price for new vessels in which price cutting is very severe, said to be between Y60,000 to Y70,000 per ton, LNG transport vessels require a high level of construction technology, and are therefore quite profitable. And the specific order on which they have the best chance is discussion about the construction of seven LNG vessels to carry LNG produced in Western Australia to Japan's electrical power and gas companies. NKK has moved into the field of membrane-type LNG vessels, using technology from the French firm Technigaz. But to date they haven't had a single order. However, together with Technigaz they have already developed an improved type of tank (the Mark III), and already have a record of constructing seven LNG tanks for land use.

Further, they have developed an automatic welding machine that reduces the cost of constructing LNG tanks. Concerning this first order, it was said, "Given the balance between energy supply and demand, LNG vessels will not be built hereafter one after another. But future business talks will be influenced by whether or not we get this order. The membrane method is now in the mainstream of LNG vessels around the world, and we certainly hope that Japan too will build one."

Accomplishments such as the conversion of the Japanese Antartic survey ship, "Soya," to an artic vessel, the construction of the "Fuji" and the "Shirase,"

and also the icebreaker support ship ordered by Canada in 1983, all attest to the high level of NKK's artic technology.

"Beaufort Sea I," is a mobile man-made island used in exploratory oil drilling in Northern Alaska's Beaufort sea. Its total weight is about 58,500 tons. This man-made island is of the concrete and steel combination type, made up of a base that rests on the very bottom of the sea, a concerte portion above that, and the uppermost deck portion. NKK calls these man-made islands which are made out of a combination of concrete and steel CIDS (concrete island drilling systems). This man-made island which scrapes, digs, and drills at the bottom of the sea in water 50 meters deep is made to work in extreme cold of the artic ocean where ice is two meters thick, temperatures are 30 degrees below zero, and wind velocities reach 50 meters per second. The level of NKK's arctic technology was evidenced when in 1984 the "Sea I," the first in the world to meet such specifications with such capabilities, received both the Petroleum Association's prize for the advancement of technology and the Civil Engineering Association's technology prize.

The development of this arctic technology was supported by the completion of the arctic test tank at the Tsu Works in September of 1982. This first private-sector test tank is 20 meters long, six meters wide and 1.8 meters deep. And just like the arctic sea, it can reproduce various flat, hilly, and broken belt ice conditions. Further, there is steel for use in low temperatures that was developed from the technology of a steel manufacturing company. In 1980 NKK was first in the world to succeed in the creation of the low temperature steel used in man-made islands and icebreaker vessels.

They have begun work on the development of the "next generation man-made island." This version will be used on the bottom of deep seas, in water from 150 to 200 feet in depth. They began work on the project based upon the idea that at present, sea drilling in Hokkaido and other places is done at around the 50-foot level, but one of these days they will begin to work in deeper areas. They have already put together a new basic concept with the American Odeko [phonetic] Company. It is an "AMDP" (Arctic Mobile Drilling Platform). This huge man-made island has a base 200 meters wide. They plan to receive orders for one or two within the next two to three years. Construction plans at the dock in Tsu that specializes in large marine steel construction is just waiting for the go-ahead.

NKK is also making an effort to get orders for passenger ships. Japan is the world's most prominent shipbuilding nation, building about half of the world's vessels. But the European makers have been monopolizing the market for passenger ships. The price of passenger ships is quite high, and for NKK which is aiming at higher-value added products, it is an attractive area for exploration.

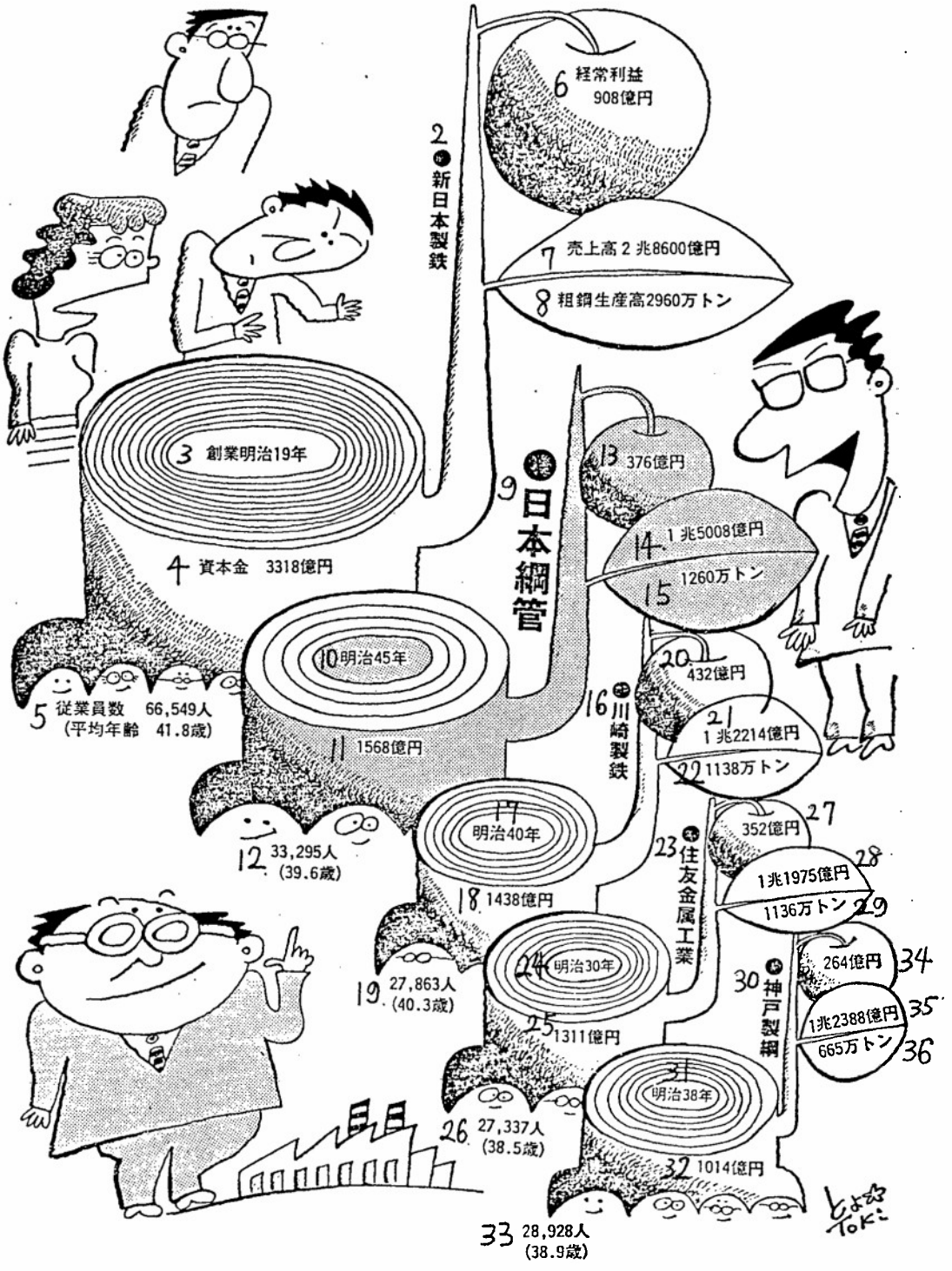
Their first order came from the Royal Netherlands Group, which last year ordered a large luxury ferry, "The North Sea Ferrys." This ferry, which is to be completed in 1987, within two years from the date of order, will sail between the Dutch EuroPort and Hull in England. It will surpass the usual concept of a ferry, and be more of a luxury passenger ship. With the idea that "In the near future the world will see the arrival of the marine leisure

age," they have begun development of large-size crusiers together with Norway's (Ikomaritime). These large-scale crusiers, based upon the concepts of both companies, amount to one large-scale marine leisure center that in addition to guest cabins are equipped with such luxury facilities as pools and gardens. This equipment, called by the company the "New Marine Area," is for use in the coastal sea, within 200 nautical miles from the water's edge.

Based on the proposal of Advisor Noboru Takeuchi (a former vice president), from ships for work in harbors, such as bucket dredgers and suction cutters, they plan to move hereafter into suction dredges, plant barges, floating hotels called "marine hotels," and waste disposal ships.

It was "the spirit of challenge" which has supported NKK in iron and steel, now seen in the shipbuilding and heavy industry division. This may come from the uncompromising spirit NKK has developed from the company's fate of being the "second son" of the steel industry which has to always walk one step behind New Japan Steel. In any event, generally speaking NKK's spirit of challenge in the past has created and developed new areas of enterprise, acknowledging a free spirit. Facing the turbulent decade between 1985 and 1995, NKK once again is fostering new enterprises one after another, with internationalization and diversification. When NKK gets these new enterprises on track and realizes its true strength, the time will have come for the company to free itself from being referred to as the steel industry's "perpetual second son."

■特集：鉄鋼大手5社比較


2 新日本製鉄
6 経常利益 908億円
7 売上高 2兆8600億円
8 粗鋼生産高2960万トン
3 創業明治19年
4 資本金 3318億円
5 従業員数 66,549人 (平均年齢 41.8歳)
9 日本鋼管
10 明治45年
11 1568億円
12 33,295人 (39.6歳)
13 376億円
14 1兆5008億円
15 1260万トン
16 川崎製鉄
17 明治40年
18 1438億円
19 27,863人 (40.3歳)
20 432億円
21 1兆2214億円
22 1138万トン
23 住友金属工業
24 明治30年
25 1311億円
26 27,337人 (38.5歳)
27 352億円
28 1兆1975億円
29 1136万トン
30 神戸製鋼
31 明治38年
32 1014億円
33 28,928人 (38.9歳)
34 264億円
35 1兆2388億円
36 665万トン

1. Special Issue: A Comparison of the Five Large Steel Companies.
2. Nippon Steel.
3. Founded in 1886
4. Capitalization: Y331.8-billion.
5. Employees: 66,549; (Average Age: 41.8).
6. Profits: Y90.8-billion.
7. Sales: Y2.86-trillion.
8. Crude Steel Production: 29.6-million tons.
9. NKK
10. Founded in 1912.
11. Capitalization: Y156.8-billion.
12. Employees: 33,295; (Average Age: 39.6).
13. Profits: Y37.6-billion.
14. Sales: Y1,500,800,000,000.
15. Crude Steel Production: 12.6-million tons.
16. Kawasaki Steel
17. Founded: 1907.
18. Capitalization: Y143.8-billion.
19. Employees: 27,863; (Average Age: 40.3).
20. Profits: Y43.2-billion.
21. Sales: Y1,221,400,000,000.
22. Crude Steel Production: 11.38-million tons.
23. Sumitomo Metals.
24. Founded: 1897.
25. Capitalization: Y131.1-billion.
26. Employees: 27,337; (Average Age: 38.5).
27. Profits: Y35,2-billion.
28. Sales: Y1.1975-trillion.
29. Crude Steel Production: 11.36-million tons.
30. Kobe Steel.
31. Founded: 1905.
32. Capitalization: Y101.4-billion.
33. Employees: 28,928; (Average Age: 38.9).
34. Profits: Y26.4 billion
35. Sales: Y1.2388 billion
36. Crude steel production: 6.65 million tons

SOME COMPARATIVE DATA ON THE PRESIDENTS AND DIRECTORS OF THE FIVE MAJOR STEEL COMPANIES

PRESIDENTS

Company:	Japan Steel	NKK	Kawasaki Steel	Sumitomo Metals	Kobe Steel
Name:	Yutaka Takeda	Yoshinari Yamashiro	Yasuhiro Yagi	Noribumi Kumagai	Fuyuhiko Maki
Date of Birth:	1/6/14 (71)	2/7/23 (62)	2/15/20 (65)	11/30/15 (69)	12/2/22 (62)
Univ.:	Tokyo Law	Tokyo Law	Tokyo Engineering	Tokyo Law	Tokyo Law
Entered	4/39	2/47	10/43	11/71	3/48

Company:				(Entered upon retirement from MITI as Vice Minister)	
Appointed President:	6/81	6/85	6/82	6/78	6/83
Hobbies:	Archery, Golf, Fishing	Attending sporting events, "Karaoke" singing	Go, Golf	Gardening, Reading	Go, Traditional singing.

THE DIRECTORS

Company:	Japan Steel	NKK	Kawasaki Steel	Sumitomo Metals	Kobe Steel
Univ,:	Tokyo 31	Tokyo 25	Tokyo 16	Tokyo 15	Tokyo 12
	of which:	of which:	of which:	of which:	of which:
	Mg.Dir 2	Mg.Dir. 6	Mg.Dir. 9	Mg.Dir. 8	Mg.Dir 3
	Tech. 14	Tech. 16	Tech. 11	Tech. 6	Tech. 4
	Kyoto 7	Waseda 4	Kyoto 12	Kyoto 8	Osaka 7
	of which:	of which:	of which:	of which:	of which:
	Mg.Dir 0	Mg.Dir 1	Mg.Dir 1	Mg.Dir 1	Mg.Dir 0
	Tech. 2	Tech. 0	Tech. 6	Tech. 3	Tech. 6
	Tohoku 5	Kyoto 3	Kobe 4	Osaka 4	Kyoto 4
	of which:	of which:	of which:	of which:	of which:
	Mg.Dir 0	Mg.Dir 1	Mg.Dir 0	Mg.Dir 0	Mg.Dir 1
	Tech. 1	Tech. 2	Tech. 0	Tech. 4	Tech. 1
	Hitotsu- 3 bashi	Kyushu 3	Tohoku 1	Kobe 3	Kyushu 3
	of which:	of which:	of which:	of which:	of which:
	Mg.Dir 0	Mg.Dir 0	Mg.Dir 1	Mg.Dir 0	Mg.Dir 0
	Tech. 0	Tech. 2	Tech. 0	Tech. 0	Tech. 3
	Kyushu 2	Tohoku 2	Osaka 1	Osaka Met. 2	Kobe 3
	of which:	of which:	of which:	of which:	of which:
	Mg.Dir 0	Mg.Dir 0	Mg.Dir 0	Mg.Dir 1	Mg.Dir 1
	Tech. 1	Tech. 0	Tech. 1	Tech. 0	Tech. 0
	Hokkaido 1	Keio 2	Hitotsu- 1 bashi	Tohoku 1	Hitotsu- 1 bashi 1
	of which:	of which:	of which:	of which:	of which:
	Mg.Dir 0	Mg.Dir 0	Mg.Dir 0	Mg.Dir 0	Mg.Dir 1
	Tech. 1	Tech. 0	Tech. 0	Tech. 1	Tech. 0

Osaka 1 of which: Mg.Dir 0 Tech. 0	Osaka 1 of which: Mg.Dir 0 Tech. 0		Nagoya 1 of which: Mg.Dir 0 Tech. 1	Tokyo Tech. 1 of which: Mg.Dir 0 Tech. 1
Tokyo Tech 1 of which: Mg.Dir 0 Tech. 1	Gakushuin 1 of which: Mg.Dir 0 Tech. 0		Nihon 1 of which: Mg.Dir 0 Tech. 1	Nagoya 1 of which: Mg.Dir 1 Tech. 0
Kyushu Tech 1 of which: Mg.Dir 0 Tech. 1	Chuo 1 of which: Mg.Dir 0 Tech. 0			Kyushu Tech 1 of which: Mg.Dir 0 Tech. 1
Keio 1 of which: Mg.Dir 0 Tech. 0				Tokyo Met. 1 of which: Mg.Dir 0 Tech. 1
				Ehime 1 of which: Mg.Dir 0 Tech. 1
				Wakayama 1 of which: Mg.Dir 0 Tech. 0
				Kansai Gakuin 1 of which: Mg.Dir 0 Tech. 0
				Army Academy 1 of which: Mg.Dir 0 Tech. 0
Total Number: 53 (21 tech)	44 (20 tech)	35 (20 tech)	35 (16 tech)	38 (20 tech)
Average Age: 58.9	58.8	59.1	60.0	58.5

NKK's Group of Affiliated Companies

Tokyo ZAIKAI TEMBO in Japanese Dec 85 pp 154-162

[Article by Kyosuke Sugimoto]

[Excerpts] NKK, sometimes called "the genius of the steel industry," is surprisingly cautious in its behavior. Subsidiary companies are likely to follow suit when the parent company sets such a tone. The overall impression that they convey is quite unfavorable when compared with the affiliated companies of NKK's competitors. Yet, in the past, this "parent company" too broke precedent to take aggressive action, and its group of affiliated companies too became quite visible. This article attempts to assess how the NKK group will be trying to change in the future.

In the past NKK has been considered to be a defensive sort of steel maker that does absolutely nothing of a flashy nature. Even considering the construction of the Ogishima Steel Works, the replacement for the Keihin Works with its urban location, which required the enormous sum of Y1-trillion, it cannot be said that the company hasn't made at least one aggressive decision, driven to it as a strategy of survival. Based upon their keen assessment of the industrial environment, they went so far as to be called "more like New Japan Steel than New Japan Steel itself."

This perception has begun to change as NKK has begun to move a step ahead of the psychological influence of New Japan Steel. At first, the most significant move was the investment of the huge sum of $2.92-billion for 50 percent capital participation in National Steel, the seventh largest U.S. steel maker. After that they announced the establishment of a joint venture with Martin Marietta, a leading American air and space company, for the manufacture of aluminium and titanium alloys in the United States. Then in October of this year, they reached basic agreement on the purchase of a silicon manufacturing plant from the American company General Electric for $16-million.

These related activities have made a strong impression within and without the industry concerning NKK's aggressive character. President Yoshinari Yamashiro has said that "A company cannot develop very well with defensive measures alone. When it is time to attack we will do so forthrightly. When we do not have the means to succeed within the company we will join forces with outsiders, covering the shortage through measures such as capital participation." Naturally, NKK's new direction has had a strong impact on the actions of the whole NKK group.

The Manufacturing Industry's Slump May Thwart Them

NKK produced 12.6-million tons of crude steel in 1984, garnering 11.8 percent of the domestic market, topped only by New Japan Steel, and enjoying 5th place in world crude steel production. Also, NKK's share in other heavy industrial fields, such as shipbuilding, plants, and machinery, has been relatively high. The company hopes to become a diversified, comprehensive manufacturer, from the basic material of steel to completely processed manufactures.

In a comparison with New Japan Steel as a comprehensive manufacturer, the NKK Group is quite disappointing in terms of scale. There are 168 companies related to New Japan Steel, employing 118,286 people, comprising a huge family. Total sales volume for fiscal year 1984 amounted to Y6.5705 trillion, 2.3 times the volume of the parent company (Y2.86-trillion). The NKK Group, on the other hand, has 66 companies, employing a total of 18,000 people. Total group sales volume was Y784-billion, 52.3 percent of the parent company volume (Y1.5008-trillion).

It is not necessarily true that "big is better." But the NKK Group is pulling the legs out from under the parent body in the field of profits as well. In contrast to the generally stable business of the non-manufacturing sector, the manufacturing sector related to steelmaking and shipbuilding showed a downturn for five periods running since fiscal year 1979. It recovered somewhat during fiscal year 1984. But even so, among the eleven companies running deficits, eight were manufacturers.

The companies affiliated with NKK are made up of 15 related to the manufacture and processing of steel, 11 selling and distributing steel, 13 in the field of raw materials and steel subsidiary fields, 14 in the heavy industrial field, including shipbuilding, and 13 in general areas.

Although the NKK Group doesn't have the scope of that of New Japan Steel, the guiding principle for its development has been establishment of one company in each field, for each product and geographic region. There are quite a few related companies that were newly established and made part of the group by breaking off one division of a larger enterprise to either create a more specialized operation or to increase efficiency as a means of dealing with the expansion of NKK's production, sales, and distribution during Japan's period of rapid economic growth.

For example, Kokan Drum and Nihon Kokan Light Steel were established in 1959 at the Mizunoe Steel Works as manufacturers of processed goods that would maintain their position in the expanding market. They entered the sheet steel market in earnest once installation of steel rolling equipment was completed. Also, since commencement of construction of the Fukuyama Steel Works in 1963, Fukuyama Kyodo Karyoku, Fukuyama Kyodo Kiko, and others, were established. To strengthen their steel distribution system, the NKK group has established an affiliated two-company sales system with two trading companies, Fuji Shoji and Ito Soji Shoten, and they are expanding into the warehousing field as well with NKK Steel Storage and other companies.

Also, since completion of the Ogishima Steel Works in 1976, and the onset of slower economic growth, they have done their best to avoid building overcapacity in related industries. Rather, they have channeled their activities into establishing new companies, or bringing existing companies into the NKK Group that meet the changing needs of society, such as such as the steel manufacturing technology consulting firm of NK-Techs, and Kokan Densetsu Koji for the design and operation of electrical generating plants.

It is said that the NKK Group's "steel teamwork" concept, with the parent

company at the core, and each affiliated company established with a clear concept of its purpose, is superior in that respect even to New Japan Steel. Nearly all of the companies were established since the period between 1955 and 1965, so there hasn't been time for a group of elite personnel to develop. It seems that one of the factors that strengthens the group's unity is the sense of camaraderie that develops from the feeling among the managers of the group's companies that they are all eating from the same bowl as the current NKK management.

However, this sense of camaraderie is vividly expressed in the vertical relationship between the parent and subsidiary companies. Essentially, when putting together an industrial group of companies, it makes sense to establish an industrial system in which related enterprises in various fields are allowed to develop independently and increase their earnings. That is not to say that there isn't a tendency within the NKK Group for the subsidiary companies to depend too heavily upon the parent firm.

The support of the parent company is very important when the group begins to develop in a new area. Assistance in the fields of information and technology is always necessary. The companies in the group were either established or affiliated with NKK for a relatively short time, so it is understandable that the majority of the affiliated companies are around 20 years old, or the age of adulthood. There has been a call for a review of the policies for affiliated companies with an eye to revisions that would tend to strengthen their independence.

Interest in Strengthening the Independent Spirit of Affiliated Companies

It is natural that a basic materials manufacturer with a management policy that emphasizes extension and expansion of its activities would actively promote the formation of new subsidiary companies and inclusion of existing companies in its group, promoting the development of new materials such as titanium and silicon, or chemical products related to coal. The development policies of the parent and subsidiary companies must change In order to respond to changing social needs.

However, the company cannot focus all of its effort on the up-and-coming areas alone. They also must try to improve those sectors not enjoying as much success. The question of how companies already affiliated with the Group should be reorganized and strengthened is equally important.

Steelmaking and manufacturing companies have an especially important position within the NKK Group. Among them, with the exception of Nihon Galvanizing, Fukaiya Steel Products, Kawasaki Steel Pipe, they were all either affiliated with the group or established as new companies around the period from the mid-1950s to the mid-1970s. These companies are facing hard times since it is unlikely that we will see any remarkable increase in demand for their steel products for the time being, because of increasing restrictions on steel imports imposed by the developed nations, and because of competitive sales pressure from the developing nations. Among them, the sales volumes of Toshin Seiko, Goju Steel Works, Tokyo Shearing, and NKK Light Steel, are quite large, but all of them are showing only small profits.

The ratio of high value-added products such as silicon plate steel and specialty steel at NKK is low, so the average unit price of their products is low when compared to other blast furnace steel makers. The company has been aware of the need to move toward higher quality steel products for some time. Since the inclusion of the two large electric hearth steelmakers Toshin Seiko and Goju Steel Works into the group in 1955 and 1956, they have been moving away from the production of steel bars and and wire rod with its extremely volatile market.

Toshin Seiko is a large electric hearth steelmaker, the top manufacturer of steel shapes. They began production of large H shapes in December 1982 at the time of the installation of the Buremu [phonetic] continuous casting equipment. Further, NKK is producing on order some of the larger steel shapes used in the ships they are manufacturing and selling, and in steel towers, both increasing their rate of capacity utilization and diversifying their product line.

They also implemented a reduction in staff of over 500 people in 1983, but still continued to suffer losses. At the end of 1984 the losses amounted to more than Y3.5-billion. The probability of heavy indebtedness in the current period is becoming more likely. They are moving into the flat steel market with upgraded equipment, and they are making an effort to reduce costs through introduction of new equipment to produce oxygen. However, the electric hearth steel industry is suffering from an excess of production facilities and is being pressed toward rationalization. It will be difficult for Toshin Seiko to recover on its own. So inclusion of this company in the Group in order to meet the increased business available during the period of rapid economic growth has worked against NKK's interests.

Goju Steel Works, which makes a variety of steel products, also has suffered losses since the period ending in March 1983, including an accumulated loss in the previous quarter of Y300 million. Further, the outlook for the current period is a loss of around Y2.8 billion. However, there are still some possibilities in the future for Goju Steel Works.

After 44 years of operation, plant antiquation at the Goju Steel Works in Chiba has become quite noticable. Also, there are no electric furnaces at the Chiba works. They rely instead on Sendai Steel Works and NKK for their raw steel. Only a spiral steel pipe and basic shapes factory will be left in Chiba, and production facilities for various kinds of steel will be concentrated in Sendai. Y26 billion has been invested on equipment, and construction has begun with plans to begin operations by the spring of 1986. Efficient production through integrated operations from the electric furnace, reduction in transportation costs, and diversification of products, are anticipated as a result. They also plan to improve production and storage management through an on-line system.

Within the NKK Group, Goju Steel Works is recognized as a producer that specializes in various types of steel, with an emphasis on higher quality

products. So its recovery may come earlier than expected.

Tokyo Shearing, which specializes in the cutting and processing of sheet steel, is said still to be rather weak. But for the first time in three years in fiscal year 1984 they turned in an operating surplus through application of self help effort. During a four-year period they reduced total employment by 150 people, one-fourth of their overall work force. They also improved their situation with the acquisition of new facilities, such as precise cutting machines and cranes. NKK Light Steel is the second largest producer of engineering and public works equipment. Improvement there is anticipated due to their program of rationalization.

The primary product of Japan Cast Iron Pipe is cast iron pipe for use in gas and water systems, products for which demand is slack. There has been discussion of development into new fields, and profitability has been maintained through rationalization measures such as slower advancement of personnel. Japan Casting, a manufacturer of steel and iron castings, is rationalizing its operation with personnel reductions and exploration of new fields, such as angled pipe couplings and precision processing, reducing the level of their deficit. They are likely to break even in fiscal year 1986.

As mentioned, steel production and processing related companies so far have expanded in a high-growth environment under which there was room for development. But nowadays the trend away from basic materials is obvious, and quantitative increases in demand are unlikely. So the prospects for progress are limited. Therefore, rationalization and a shift to higher value-added products must be planned in cooperation with the steel section of the parent company.

This effort makes a defensive posture unavoidable. Yet, the slowdown in the business of steel-related companies cannot be blamed solely on changes in the environment. It is important to foster a spirit of self reliance. Even in the case of Toshin Steel, the new president, Jiro Shiromatsu, was transferred from NKK. He served as vice president for three years, and observed the operation of the electric furnace industry. Even while they seek NKK's cooperation, it is hoped that they themselves rapidly will prepare a concrete plan for their recovery.

MAJOR COMPANIES AFFILIATED WITH NKK: NO. 1.
(* = major companies; @ = dual appointments; # = sent from NKK)

Company Name, Address, Capital Y1-mil	Chief Executive	Sales Y1-mil	Percent of stock held by NKK	Line of Business
*Toshin Seiko Chiyoda-ku, Tokyo Y3,558	Jiro Shiramatsu	133,976	42.0	Common steel ingots, steel shapes, irregular bars and fence, other manufactured products.
*Goju Steel Works Chiyoda-ku, Tokyo Y2,700	Kenkichi Yamaji	77,085	41.4	Wire, steel bars, spiral pipe.
*Tokyo Shearing Chuo-ku, Tokyo. Y1,010	Tatsuo Yamaguchi	35,040	46.6	Steel plate, shearing and fusion, crude steel, press products.
NKK Light Steel Kumagai-shi, Saitama-Ken Y800	Heizo Momosaki	28,676	100.0	Guardrail segments, other light steel shapes, production & installation of steel processing products, bridge equipment
Kokan Kenzai Yokohama-shi Kanagawa,ken Y400	# Shozo Watanate	11,658	67.5	Seam welded steel pipe for general structure and machinery.
Kokan Drum Chuo-ku Tokyo Y400	# Hajime Toyokura	8,121	51.0	Steel drums.
Kawasaki Kokan Kawasaki-shi Kanagawa-ken Y45	# Taro Nakamura	3,860	93.7	Small dimension thick seam welded steel pipe, for plumbing and machines.
Kokan Aen Tokin	# Roku Shibayama	6,552	100.0	Melted lead paint processing, painting of steel

Ichikawa-shi Chiba-ken Y450				pipe, paint processing.
Nippon Galvano Ichikawa-shi Chiba-ken Y200	@ Arikazu Hirano	2,617	50.0	Refining and processing of various steel pipes and production of lead-plate products.
Fukaya Koki Fukaya-shi Saitama-ken Y75	# Nobuo Aoki	1,992	100.0	Iron and steel products for construction and construction-related product
*Nihon Chuzo Kawasaki-shi Kanagawa-ken Y2,016	# Hisao Yamada	12,753	34.7	Steel and iron castings rolled steel, casting molds, flags, valves structural steel
Nihon Kokan Keishu Kishiwadashi Osaka-fu Y480	# Kinnosuke Yoshimura	17,880	40.3	Plumbing connectors and pipe connectors for oil, gas, water, electric cables.
*Nihon Chutetsukan Chiyoda-ku Tokyo-to Y1,600	@ Masaharu Oryu	10,510	33.1	Cast iron pipe.
NK Kinzoku Kako Kawasaki-shi Kanagawa-ken Y400	# Hiroshi Horiguchi	36,040	59.0	Flanges, rings, forged products, axles, machine parts, precision machine processing.
Toyo Kokan Kogyo Kawasaki-shi Kanagawa-ken Y36	# Takeshi Tsubaki	1,538	100.0	Pipe for cooling systems, pipe bending, coated steel pipe.
Fuji Shoji Chuo-ku Tokyo Y300	# Kinji Kamijo	57,614	51.8	Sales of steel pipe, pipe materials, general steel materials, structural steel.
Ito Soji Shoten	# Atsushi Fujii	12,259	90.0	Sales of construction materials products

Chuo-ku Tokyo Y100				
Ishibashi Kosan Chuo-ku Tokyo Y100	@ Kazuyoshi Nakagawa	7,207	90.0	Sales of steel pipe, steel materials, pipe connectors and valves.
NKK Soko Osaka-shi Osaka-fu Y1,200	# Osamu Kano	4,373	55.0	Harbor, transportation, storage, steel materials processing, auto-related products.
NKK Nagoya Pier Tokai-shi Aichi-ken Y700	# Osamu Kodama	3,146	73.1	Same as above.
NKK Oigawa Pier Shizuoka-shi Shizuoka-ken Y200	# Shinji Nikaido	537	50.0	Same as above
NKK Ichikawa Pier Ichikawa-shi Chiba-ken Y1,180	# Yukio Hanawa	5,775	100.0	Same as above.
NKK Sendai Pier Sendai-shi Miyagi-ken Y100	# Motoyasu Sato	566	100.0	Same as above.
Fuyo Kaiun Kawasaki-shi Kanagawa-ken Y306	# Masujiro Nagai	17,990	43.6	Intersea marine transport, harbor transport, customs.
Nissan Sempaku	Daijiro Ishii	9,812	45.0	Intersea marine transport, leasing of container

Chiyoda-ku Tokyo Y248				transport equipment, automobile transport
Nichiei Unyu Soko Kawasaki-shi Kanagawa-ken Y495	Ejiro Takawu	14,899	50.1	Cargo auto transport and storage.
Kokan Kogyo Chiyoda-ku Tokyo Y568	# Koji Nemoto	36,620	70.9	Development of steel production raw materials and sales, procurement of raw materials on contract salvage and sales.
Kokan Kikai Kogyo Kawasaki-shi Kanagawa-ken Y99	# Tadashi Ishii	8,694	100.0	Production, repair, and sales of industrial machines; production of iron structures, and contracting.
NK Green Service Kawasaki-shi Kanagawa-ken Y40	# Yasuomi Katsube	3,169	100.0	Cleaning, sanitation, gardening, distribution of printed matter, inter-company printing.
Fukuyama Kyodo Karyoku Fukuyama-shi Hiroshima-ken Y5,000	Masayoshi Sugiyama	69,826	50.0	Coal power generators.
Fukuyama Kyodo Kiko Fukuyama-shi Hiroshima-ken Y200	# Junichiro Namachika	15,719	50.0	Repair machinery, electrical equipment, calculating machines.
Fukuyama Rinkai Tetsudo Fukuyama-shi Hiroshima-ken Y30	# Yutaka Minayoshi	850	100.0	Special railway equip. small-gauge rail operation
Kokan Sanso	Natsuo Ishizawa	18,958	40.0	Production and sales of industrial gas, such as

Center Fukuyama-shi Hiroshima-ken Y90				oxygen and nitrogen.
Fukuyama Port Service Fukuyama-shi Hiroshima-ken Y60	@ Gennosuke Mitsui	1,900	51.0	Harbor management, service incoming ships, marine route partol.
Kokan Fukuyama Green Service Fukuyama-shi Hiroshima-ken Y10	# Hitoshi Takamatsu	582	100.0	Cleaning, sanitation, gardening, fire prevention facilities inspection
NK Techs Chiyoda-ku Tokyo Y10	@ Kozo Yamada	343	100.0	Iron, steel technology consulting services.
Kokan Keiso Kawasaki-shi Kanagawa-ken Y30	# Teruo Shimotsuma	285	100.0	Environmental measurement for pollution.
Kowa Sangyo Nihata-shi Toyama-ken Y4	# Hiroshi Kosugi	471	82.5	Toyama steel works related contracting, environmental problems at steel plants.
Koshin Sangyo Niigata-shi Niigata-ken Y32	# Yoshiro Yamagishi	1,480	97.8	Niigata steel works contracting, maintenance sales of oil products.

HEAVY INDUSTRY

Company Name, Address, Capital Y1-mil	Chief Executive	Sales Y1-mil	Percent of stock held by NKK	Line of Business
NKK Koji Yokohama-shi Kanagawa-ken Y1,260	#Naosuke Ozawa	60,712	100.0	Installation of gas, water and seabed pipe, plant and steel construction
Nihon Blast Machine Daito-ku Tokyo Y50	#Tsutomu Uno	942	30.0	Manufacture and sales of blast machines, shot/grit
NK Engineering Yokohama-shi Kanagawa-ken Y61	#Keizo Homma	878	100.0	Construction and plant engineering
NKK Heavy Industries Services Yokohama-shi Kanagawa-ken Y40	#Kenzaburo Sugihara	3,776	100.0	Maintenance, repair and operation of waste incinerators.
Nihon Rotary Nozzle Kawasaki-shi Kanagawa-ken Y20	#Senzo Wakabayashi	4,064	50.0	Development and sales of rotary nozzles.
Koei Unyu Kiko Yokohama-shi Kanagawa-ken Y40	#Susumu Tajiri	1,361	68.0	Automobile freight.
Kokan Densetsu Kogyo Yokohama-shi Kanagawa-ken Y30	#Fumio Okamura	2,642	100.0	Design & supervision of various electrical construction projects.
Hinshitsu Kensa Yokohama-shi Kanagawa-ken Y40	#Yukio Kido	450	50.0	Non-destructive inspection.

Tohoku Shipbuilding Shiyogama-shi Miyagi-ken Y253	#Toru Fukudome	9,946	82.9	Construction and repair of small and medium-sized vessels, and other steel construction.
Yokohama Yacht Yokohama-shi Kanagawa-ken Y100	#Noboru Shimizu	2,999	100.0	Construction and repair of small specialty vessels, construction of wooden equipment for the hulls of medium-sized mine-sweepers for the Defense Agency.
Nihon Marine Engineering Yokohama-shi Kanagawa-ken Y10	#Mitsuo Ishihara	703	100.0	Ship design.
NK Tsurumi Service Yokohama-shi Kanagawa-ken Y15	#Yasushi Hara	1,577	100.0	Cleaning, gardening, cafeteria, distribution of printed matter necessary for factory operation; maintenance & repair of Plant equipment & facilities
NK Shimizu Service Shimizu-shi Shizuoka-ken Y4	@Ryuji Shiyota	550	100.0	Factory maintenance services; blueprints; maintenance & repair of tools and instruments.
NK Tsu Kiko Tsu-shi Mie-ken Y20	@Yoshito Doi	878	100.0	Maintainance and repair of plant equipment and facilities.

(* = major companies; @ = dual appointments; # = sent from NKK)

GENERAL INDUSTRY

Company Name, Address, Capital Y1-mil	Chief Executive	Sales Y1-mil	Percent of stock held by NKK	Line of Business
NKK Systems Service Kawasaki-shi Kanagawa-ken Y50	#Hiroshi Yamamoto	2,121	100.0	Machine automation planning and office automation & service.

NK Coal Center Chiyoda-ku Tokyo Y50	#Jun Ohka	3,123	100.0	Transport of imported coal among domestic recipients; marine transport representation.
Kokan Development Chiyoda-ku Tokyo Y40	@Hisao Makita	163	60.0	Operation of leisure and health facilities Oku Kusatsu Kokan; development of surrounding underpopulated areas.
NK Sports Development Chiyoda-ku Tokyo Y10	#Kenji Masuda	415	100.0	Tennis club management and other sports facility management; sales of sports equipment.
NK Home Shibuya-ku Tokyo Y300	#Tokushiro Sakata	16,090	100.0	Design, construction and sales of residential houses.
NKK Real Estate Chiyoda-ku Tokyo Y1,400	#Kenji Masuda	10,019	100.0	Sales, leasing, brokerage of real estate; club management & damage and insurance representation.
NKK Building Chiyoda-ku Tokyo Y20	#Hiroshi	1,013	100.0	Operation and maintenance of equipment in NKK buildings; distribution of printed matter, cleaning, etc.
NKK Hospital Services Kawasaki-shi Kanagawa-ken Y10	#Kyunosuke Hirano	749	100.0	Maintenance, management and cafeteria services for hospital; general cleaning.
Kokan Construction Chiyoda-ku Tokyo Y400	#Makoto Ueno	5,144	98.0	Contracting, planning, design, maintenance of construction projects.
Nekosu Yokohama-shi Kanagawa-ken Y30	#Aotoshi Omachi	4,000	100.0	Production of various chairs.

Yokohama High-tech Yokohama-shi Kanagawa-ken Y30	@Kazuyuki Maahiko	22	49.0	Development and sales of compound products for industry.
Fuji Diesel Tateyama-shi Chiba-ken Y270	#Akira Nishioka	7,481	70.0	Production and sales of diesel engine for ships and power generating plants.
NK Lease Chiyoda-ku Tokyo Y300	#Haruo Horikiri	estab. Mar '85	50.0	Lease, installment sales, cash loans, bond sales, purchase of financial instruments; loan and credit sales bonds
		OVERSEAS		
National Steel Pennsylvania U.S.A. $500 mil.	R.D. MacBride	Venture Sep '84	50.0	Integrated steel works; Crude steel capacity of 6 million tons.
International Light Metals California U.S.A. $1,000 mil.	M.M. Haggerty	invest. Jan '85	40.0	Integrated production of aluminum and titanium products.

Shift to Soft and Service Industries

As of March 1985, NKK sales were 73 percent in the Steel Division, including alloy steel, and 27 percent in the Heavy Industries Division that includes plant and shipbuilding. NKK has a plan to shift within ten years to 50 percent steel, 25 percent heavy industry, and 25 percent new industries. The plan of course includes the development of new materials such as silicon and coal-related chemicals, but it should also be noted that it has as its focus the development the Heavy Industries Division.

The expansion of the Heavy Industries Division includes the processing of steel materials and development of end products as part of their high value-added strategy. NKK reorganized the Heavy Industries Division effective July 1 of this year, creating three operational departments: Engineering, Machinery, and Maritime-Steel. The Heavy Industries Division was established in May of 1979. It has been managed so far as a single division. But with the expansion of its operations, three headquarters were set up within the Division. The diversification and expansion of the its business led to the current reorganization.

Their effort even included granting the executive directors responsible for the engineering and machinery divisions representation on the board. The Maritime-Steel Industries Division, which is the shipbuilding division, cannot expect much of an increase in demand for their products. But the Engineering and Machine Industries Divisions plan to strengthen and expand their operations. This naturally will influence the management of the Group.

There are five Group companies In the shipbuilding field, including Tohoku Shipping and Yokohama Yacht. Their record is not especially impressive. On the other hand, last December NKK purchased a 70 percent position in Fuji Deisel, and added it to their Group. NKK is moving into the field of medium- and large-scale deisel power generation equipment with capacity of over 10,000 kw, acquiring the small-scale deisel electric generation technology through Fuji Deisel, all in an effort to increase the depth of their product offerings. A number of Heavy machinery companies are making an effort to move into the deisel generating equipment field. And with this investment, NKK is making a concerted push to expand the Machinery Division.

NKK is also working to promote factory automation and machine tool production. President Yamashiro stated "Examples similar to Fuji Deisel may be seen in the future."

In addition, this March NKK, in a joint investment with the Group's real estate firm, NKK Real Estate, established NK Lease Company and entered the lease business in earnest. NKK Real Estate Company has been in leasing business since 1978 as part of its program of diversification. They have limited their business to NKK itself and members of the Group, leasing mainly products such as computers and other office equipment.

NK Lease will continue to handle those products and gradually add NKK's major products such as steel processing equipment, civil engineering equipment, ships, marine construction equipment. They also plan to expand their customers to include companies outside the Group. Within the steel industry Kawasaki Steel Industries, part of the Kawasaki Steel Group, is involved in

the leasing business. In addition, Kobe Steel and New Japan steel have established leasing companies within their groups. Since it is a fast growing industry, the entry of the NKK Group came as no surprise.

In addition, among the recently established companies within the group, Yokohama High Tech was added in September of last year with a 49 percent investment. It was established in the form of a joint venture with the small- and medium-sized industries developing in the Kanazawa Industrial Park located in Yokohama. The industrial park covers approximately 100 hectares and includes approximately 400 companies. Knowhow acquired from NKK's factory engineering was used in the development of this industrial park. The idea of establishing Yokohama High Tech came from the close relationship that developed between NKK and the companies within the industrial park in the process of constructing the park.

Yokohama High Tech's business includes the development, production, and sales of the complex range of products included in the diverse group of enterprises within the industrial park, and the development energy saving devices and automation equipment. They also design and implement various construction projects. NKK expects to accumulate the technology and development capabilities of the vengure industries within the industrial park.

In addition, last March a non-destructive inspection business for quality control was established. These newly established companies are concentrating on the soft and service industries. We can see a new mode of group development, different from the period between 1955 and 1965 during which activity centered around heavy, large-scale production.

Is There Any Danger in Steel's Advance to the United States?

Let's now cast our gaze abroad. The investment in National Steel occurred against the background of NKK's sense of stricter American import restrictions. According to Vice President Haruki Kamiya, "This investment means a great deal in terms of establishing the NKK brand in the huge American market."

National Steel's objective, however, was to attract capital and Japanese manufacturing technology for the reconstruction of their steel division. National Steel established a special company and shifted its focus of operations toward the more profitable businesses of finance and aluminum, strengthening their tendency to move away from steel. It is thought that the bulk of the funds earned from the sale of stock to NKK was used for development of those diversified industries.

Of course, new electric welding facilities were added to the steel division, and major renovation has been decided upon that will include introduction of the continuous casting process. In the United States joint ventures and cooperative agreements are appearing one after another, such as Kawasaki Steel and California Steel, Sumitomo Metals and the LTV Corporation, Nisshin Seiko and W.P. Company. All of these are focused on the production of sheet steel for automobiles, leading to unavoidable keen competition in the future.

U.S. Steel has already anticipated the penetration of the Japanese industry and begun to cut prices. It is widely predicted that the U.S. steel industry is rushing toward a severe reorganization, one that will also involve Japanese manufacturers. Under such conditions it is premature to conclude that in the near future NKK will reap dividends above the interest she earns on her investment in the joint venture.

On the other hand, International Light Metals, a joint venture with Martin Marietta, expects to turn a profit from the beginning of this year. But NKK is more interested in acquiring technology from this venture than they are in gaining dividends from the investment. The aluminum and titanium market is in the United States. But the rolling of some titanium for special order is being investigated within Japan. Their objective clearly is the acquisition of technology, so this joint venture does not present any danger.

Also, conclusion of agreement on the purchase of GE's multiple crystal silicon plant indicates that NKK's main purpose is the acquisition of technology. In the future they are planning to construct a plant in Japan capable of producing 1,000 tons per year. It is not unusual for a steel company specializing in smelting metals to move into the multiple crystal silicon business. Specialists are of the opinion that GE's silicon technology is widely spread throughout the world, and includes nothing very new. The Great Western plant which had been offered for sale was established as a joint venture between Fairchild Industries, the semiconductor manufacturer, and Applied Materials, a venture company. It was bought by GE four years ago. At that time, the impression in the semiconductor industry was that it sold for a good price.

Competition in the silicon industry is very keen. Domestically, with the exception of the industry leader, Shinetsu Semiconductor, the first four companies, including Nippon Silicon, have been running in the red for most of their period of operation. Also, just within the steel industry, New Japan Steel and Kawasaki Steel are among the companies wishing to enter the silicon field. Should NKK, beginning with multiple crystalization, actually plan to expand in the future into the single crystalization and wafer business, they should be prepared to accept deficits of around Y10 billion.

In this case there is considerable doubt about whether or not in terms of technology the purchase of the GE plant was a good buy or not.

NKK became involved in the construction of both the Fukuyama and Ogishima Steel Works and went through a difficult financial experience. Their position presents quite a contrast from that of other blast furnace producers which are expected to make drastic improvements in their facilities in the future. This is yet another reason why NKK can proceed with the development of new areas more positively.

NKK Group strategy has always had as one of its basic policies the avoidance of duplication of enterprises in their operations. Especially in relation to companies newly included in the Group, a period during which they develop with support in all areas of operations, such as capital and technology is required.

However, it becomes a problem if they rely on the parent company for too long. It is essential to foster the spirit of self reliance as they position themselves clearly within the group. Times change very rapidly, and there is no guarantee that those fields which are advanced today will not slacken in 10 or 20 years. I have no intention to oppose the current diversification strategy for the advancement of the NKK Group which takes it out of the framework of steel. But, a clear management policy and flexibility are essential in order to avoid repeating the mistakes of many of the Group's manufacturing companies focusing on steel.

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FY86 MITI TECHNOLOGY-RELATED POLICIES, FUNDING DISCUSSED

Overview

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 1-2

[Text] Forty years after World War II, our country's GNP is 317.6 trillion yen (1985) which is number two in all the world. However, when we look at the international economic society, and the international trade and financial system, which were the foundations of development for the post-War economic society, we see they have shifted considerably. Because Japan has rapidly reached a strong economic state and has a large trade surplus, Japan is expected to participate more directly in international society.

Meanwhile, technological strength, which was the foundation of this economic power, has reached competitive equality with European countries and the United States in the level of products. However, when we look at technology import versus export, export is valued at 277.5 billion yen and import is valued at 281.4 billion yen: import is slightly more than export. If we look only at new contracts, export is more than import. The difference between export and import in technology exchange overall is getting smaller. However, when we look at leading technology fields such as electric machines, transportation equipment, etc., finished product export is much more than import, and technology import is more than export. This means that Japan is stronger at the finished product level, but not at the technical level.

However, new industrial fields which will bloom in the 21st Century, such as electronics, biotechnology, and new materials, are rising in importance in our country. To establish a foundation for our long-term economic society, with a clear prospect of the 21st Century, we must promote true internationalization. We must play a major role, not only in the economic field, but also in the technological field, to pursue stability and prosperity for the world.

This means that joint research and development projects must be promoted between advanced countries, and research personnel and engineers must be exchanged for advanced research in fields of industrial technology; technology transfer, training for engineers, and joint research projects must be promoted for underdeveloped countries. Furthermore, basic fundamental research and development must be expanded and strengthened, since Japan has been behind in these fields. Original research and development, which would be the showcase

of future science history, must be accomplished on an international basis.

The budget for technology of the Ministry of International Trade and Industry (MITI) is focussed on our international participation for the advancement of technologies.

One goal is to reestablish basic investigation to advance cooperative research projects with advanced countries and reinforcement of the international industrial technological research project (ITIT Project). In addition to this, Japan has to establish a new central organization to reinforce the development of jet engines for use in commercial aircraft (V2500) and commercial air transportation (YXX) which are being developed jointly with advanced countries.

Another goal is reinforcement of basic research. The MITI has nine research laboratories in Tsukuba and seven research laboratories in other locations. In those laboratories, basic research has been done for industrial technology and is now being reinforced. The next generation of industrial technological development includes bio-elements. Large scale projects include development of a super-advanced processing system. These are planned for development.

In October, 1985, the Basic Technology Research Promotion Center, which is a specially chartered corporation, was established to promote technological development for our commercial companies. This center is scheduled to start operating from 1986. To accomplish this, the operational foundation is to be reinforced and the budget from a special account for industrial investments was greatly increased to make the business investment successful.

(1) 昭和61年度通商産業省技術開発関係予算案

(2)(百万円)

(3)事項	(4)昭和60年度予算案			(5)昭和61年度予算案		
(6)	(7)一般会計	特別会計	(8)計	(9)一般会計	(10)特別会計	(11)計
(12)技術開発関係予算合計（産投会計は含まない）	74,247	114,425	188,672	70,507	126,550	197,057
(13)1. 技術開発の強力な推進						
(14)うち(1) 次世代産業基盤技術研究開発の推進	6,445	0	6,445	5,644	869	6,513
(15) (2) 大型工業技術研究開発の推進	7,698	6,437	14,135	5,275	8,694	13,970
(16) (3) 資源・エネルギー技術開発の推進						
(17) ①サンシャイン計画	3,022	36,791	39,813	2,378	35,263	37,641
(18) ②ムーンライト計画	1,385	9,706	11,091	1,026	11,245	12,271
(19) ③石油関連	0	16,873	16,873	0	19,683	19,683
(20) ④原子力関連	17	20,827	20,844	8	24,092	24,099
(21) ⑤石炭関連	0	11,007	11,007	0	13,576	13,576
(22) ⑥その他の資源・エネルギー技術開発	71	8,902	8,973	65	8,868	8,933
(23) (4) 高度情報化社会実現のための技術開発の推進	4,890	0	4,890	4,604	0	4,604
(24) (5) 航空宇宙開発の推進	5,488	3,203	8,681	5,122	5,655	10,777
(25) (6) 海洋開発の推進	5	1,420	1,426	8	1,496	1,505
(26) (7) 試験研究所における先導的・基盤的技術開発の推進	7,766	0	7,766	7,744	0	7,744
(27)2. 民間の技術開発推進のための環境条件の整備						
(28)うち(1) 産業活性化等技術研究開発費補助	1,906	0	1,906	1,366	0	1,366
(29) (2) 石油代替エネルギー関係技術実用化開発費補助	0	2,007	2,007	0	2,007	2,007
(30) (3) 新発電技術実用化開発費補助	0	236	236	0	236	236
(31)3. 産・学・官の連携による研究開発体制の整備						
(32)うち(1) 官民連帯共同研究	(157)	(0)	(157)	(226)	(0)	(226)
(33) (2) 重要地域技術研究開発	246	0	246	245	0	245
(34)4. 国際協力の積極的推進						
(各種国際協力プロジェクト等関連予算を含む)	(1,176)	(17,960)	(19,136)	(1,304)	(15,029)	(16,333)
(35)5. 工業標準化行政の推進	582	0	582	539	47	586
(36)6. 中小企業の技術開発基盤の整備	4,366	(500)	(4,866)	4,544	(500)	(5,045)
(37)7. その他						
(38)うち(1) 医療・福祉機器研究開発の推進	689	0	689	682	0	682
(39) (2) 環境保全・防災対策の充実	244	(532)	(767)	210	(600)	(810)
(40) (3) 住宅の質の向上	239	(348)	(587)	268	(681)	(949)
(41) (4) 造水促進対策	110	0	110	96	0	96
(42) (5) アルコール専売事業研究開発	0	219	219	0	459	459
(43) (6) その他	28,742	0	28,742	30,163	16	30,179
(44)基盤技術研究促進センターの事業の充実（産投会計）	0	10,000	10,000	0	20,500	20,500

(45)注1 ( )内の数字は他の事項との重複を含む。

(46) 2 四捨五入の関係で端数の合わないことがある。

Key: 1. 1986 MITI's Budget Plan for Technological Development
2. Million Yen
3. Items
4. Budget plan for 1985
5. Budget plan for 1986
6. General account
7. Special account
8. Total
9. General account
10. Special account
11. Total
12. Budget total for technological development (total for industrial investments is not included)
13. Strong promotion of technological development
14. Promotion of the next generation industrial foundation for technological research and development
15. Promotion of large-scale industrial technological research and development
16. Promotion of resource and energy technological development
17. Sunshine project
18. Moonlight project
19. Oil related
20. Nuclear power related
21. Coal related
22. Other resource and energy technological development
23. Promotion of technological development for a society with advanced technology information
24. Promotion of aircraft and space development
25. Promotion of marine development
26. Promotion of leading and fundamental technological development at research laboratories
27. Organization of environmental conditions to promote commercial level technological development
28. Supplemental funding for technological research and development to activate industries
29. Supplemental funding to develop actual use of technology related to oil substitute energy
30. Supplemental funding to develop the actual use of new electricity generating technology
31. Organization of a joint research and development system of industry, schools, and government
32. Joint research by government and commercial companies
33. Technological research and development of important locations
34. Positive promotion of international cooperation (the budget includes different international cooperative projects and related projects)
35. Promotion of a policy to standardize industry
36. Preparation of a technological development foundation for small companies
37. Others
38. Promotion of research and development of medical and welfare equipment
39. Reinforcement of the protection of the environment and solutions to problems created by emergencies
40. Improvement of the quality of home construction

41. Promotion of a policy to create water supplies
42. Research and development on an alcohol producing industry
43. Others
44. Reinforcement of the business of a fundamental technology research center (industrial investment account)
45. Notes 1. Numbers in parenthesis includes the number of other items
46. 2. Sometimes the least significant digits do not match because of rounding errors

Next-Generation Industry-Oriented Basic R&D

Tokyo KOGYO GIJUTSU in Japanese Apr 86 p 3

[Text] 1. This system is to rapidly advance research and development on fundamental technology, which is very important to the establishment of the next generation of industry, which is expected to be developed in the 1990's. (1) innovation is great, (2) widespread repercussion, (3) research and development risk is large; these were considered, and 13 themes were selected from 3 fields, such as new materials, biotechnology and new function elements. The research and development of this system has been progressing under the joint efforts of industry, schools and the government.

2. In 1986, while the research and development of 12 themes will be encouraged, research and development of bio-elements will begin. The research and development of fine ceramics will develop a basic technology to make ceramic turbines used to manufacture coal gas.

An Outline of Themes is Presented Below:

(1) Fine ceramics (12 year project)
To develop structural materials which have characteristics such as resistant to extremely high temperatures, corrosion resistant, high precision machinability and hardness.
(2) High efficiency macromolecular membrane separating material (10 year project)
To develop a membrane which can be used to separate and refine gases and liquid mixtures efficiently.
(3) Electrically conductive high molecular weight material (10 year project)
To develop a material which is corrosion resistant, easy to process, has electrical conductivity similar to metal.
(4) Highly crystalline high molecular weight material (10 year project)
To develop a high molecular weight structural material which is easy to process, light, corrosion resistant and as strong as metal.
(5) High performance crystal controllable alloy (8 year project)
To develop an alloy with heat resistance and hardness beyond that of present alloys.
(6) Multi-component material (8 year project)
To develop a multi-component structural material which is lighter than aluminum alloys and stronger than iron.
(7) Material reactive to visible light (8 year project)
To develop a material which can change molecular structure and order physically and chemically by the energy of visible light. The change can

still be controlled.

(8) Bioreactor (10 year project)
To develop the technology to industrially and effectively utilize the bioreactions of enzymes and microorganisms.

(9) Mass production of cell culture technology (9 year project)
To develop culture technology of animal cells which is efficient and does not require expensive natural culture media.

(10) Utilization of recombinant DNA technology (10 year project)
To establish industrial production processes to make useful materials, by creating useful microorganisms utilizing recombinant DNA technology.

(11) Super lattice component (10 year project)
To develop components which utilize new electrical phenomena which occur in a structure of very thin crystal layers of different semiconductors laminated together.

(12) Three-dimensional circuit component (10 year project)
To develop a three-dimensional circuit component which has alternating layers of semiconductor integrated circuits and insulating material.

(13) Bio-elements (research and development period still unplanned)
To develop new materials technology and new element technology which will discover the information processing capabilities of living organisms, and using biochemical reactions create a man-made imitation which is a concrete expression of it.

1986 Next Generation Industrial Basic Technology Research and Development System Budget Plan (units are millions of yen)

Research and Development	1986 Budget Plan	1985 Budget
New materials	3,572 (868)	3,593
Biotechnology	1,220	1,252
New performance element	1,542	1,585
Total (including administrative expense and facility expense)	6,513 (869)	6,445

Note: The numbers in parentheses are in a special account.

'Big Project R&D'

Tokyo KOGYO GIJUTSU in Japanese Apr 86 p 4

[Text] A large scale industrial technology research and development system (large scale project) is for large scale industrial technology which is needed immediately and is very important to the national economy. For this research and development, large amounts of capital, long lead times and acceptance of large risk are required; therefore, the government is to supply the necessary capital for commercial industries, which cannot achieve total development by themselves. Under a close cooperative system with industries, academe, etc., research and development on technology which is revolutionary and advanced, such as these resource developments, development of environmental protection technology, and development of a technology to improve peoples lives and

welfare, must be encouraged with good planning and implemented with skill.

The research and development on this system is sponsored by MITI's Agency of Industrial Science and Technology. The selection of themes is approached under a system to connect the research and development capabilities of research laboratories which belong to industries, academe, or related Ministries. This selection and decision on each research and development project, and actual annual projects, are to be referred to the Large Scale Technological Development Committee of the Industrial Technology Council which acts as an advisory organ to MITI's minister whenever necessary. To proceed with the actual research and development of a project, a communication meeting which consists of people academically trained and people who are in charge of research and development, etc., is established and wholeheartedly encouraged.

This system is 20 years old in 1986. It has developed 23 projects prior to 1985, and has been very successful in improving Japanese technological standards.

In 1986, in addition to the projects which are continuing from 1985, research and development on an ultra-advanced processing system as a new project will begin.

Ultra-advanced processing system (new theme)

To process machine parts with ultra-high precision and high performance, which will be required in advanced industrial fields such as aircraft and aerospace, electronics, energy, precision machinery, etc., research and development will be begun on process technology which is combines the technologies of the new high-powered excimer laser, high density ion beam and ultra-high performance process machinery. In 1986, the total project for research and development has been decided, and at the same time basic research and conceptual planning for equipment technology for ultra-advanced processes, ultra-advanced process technology, support technology and total system has started.

<Budget>

Large scale industrial technology research and development

<Budget total> 15,176 million yen (14,678 million yen)
(New) Ultra-advanced processing system
<Budget> 20 million yen (0)
Production methods of basic chemicals produced from carbon monoxide
<Budget> 1,022 million yen (1,725 million yen)
Manganese nodule mining system
<Budget> 958 million yen (1,075 million yen)
High-speed calculation system for scientific technology
<Budget> 2,889 million yen (3,016 million yen)
Automatic sewing system
<Budget> 1,340 million yen (1,221 million yen)
Limited-operation robot
<Budget> 2,405 million yen (1,896 million yen)

Observation system for resource investigation
<Budget> 4,391 million yen (2,063 million yen)
Water recycling system
<Budget> 1,072 million yen (20 million yen)
Shared database system for electronic computers
<Budget> 831 million yen (20 million yen)

Energy-Related Technology Development

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 5-8

[Text] Promotion of the Sunshine Project

This project started in 1974 to improve the Japanese insufficient energy supply structure by developing a new energy technology. Presently, the main project has gone through the basic research stage, and now has progressed to the pilot plant development stage.

In 1986, the total budget is 42,963 million yen (previous year, 43,776 million yen). Main areas of research and development:

(1) Solar energy 8,241 million yen (9,169)

1. Technology for power generation from sunlight 7,185 million yen (7,870)

As for solar cell production technologies, low cost purification technology for polycrystalline silicon, high efficiency chemical cell technology and amorphous solar cell production technology are developing. As for sunlight power generation utilization technologies, experiments are being run at schools and factories on independent type and centralized type systems, and system interconnection control technologies have been developed

2. Solar systems for industry 507 million yen (488)

Cascading heat process type, advanced heat process type, long-term heat storage technology and fixed heat process type for drying processes have been developed.

(2) Geothermal energy 5,976 million yen (7,336)

1. Geothermal energy investigation and extraction technology
2,736 million yen (3,250)
Four representative types of possible geothermal energy sources will be investigated and thoroughly evaluated. Mines in rocky areas will be investigated, and high performance geomagnetic and earth current technology will be developed.

2. Power generation system using heated water 1,944 million yen (1,295)

Heated water resources in possible areas will be investigated. Down-hole pump will be developed. Heated water production, recycle research and lost water technology will be developed.

3. High-temperature rock power generation system 661 million yen (727)

IEA joint research at Fenton Hill in the United States, and water pressure fracture technology will be developed.

(3) Coal energy 27,061 million yen (25,654)

1. Coal liquefaction technology 20,207 million yen (20,770)

Bituminous coal liquefaction technology is used for basic and detailed planning of an experimental plant which will produce 250 metric tons per day, and to run and research a support plant which produces 1 metric ton per day. Brown coal liquefaction technology will be used to run a first hydro-liquefaction experimental plant which will produce 50 metric tons per day, and to construct a second hydro-liquefaction plant at Morwell, Victoria State, Australia.

2. Hydrogen production technology using coal 1,350 million yen (0)

Technological development to produce hydrogen for fuel from coal has started. In 1986, basic and detailed planning and basic construction for a 20 metric ton per day experimental plant will begin.

3. High calorie gasification technology 434 million yen (1,484)

An experimental plant was tested and researched, and development was completed.

4. Composite cycle power generation by coal gasification
4,570 million yen (2,839)

For the fluidized bed type, a 40 metric ton per day experimental plant has been evaluated. Environmental protection technology has been developed and basic planning for a 100,000 kilowatt plant has been started. For the jet bed type, development for a 200 metric ton per day experimental plant has started.

(4) Energy from hydrogen 228 million yen (256)

In addition to a solid high molecular weight electrolysis and a water electrolysis method, research has begun on a high temperature vapor electrolysis method. The technology for saving and utilizing hydrogen will continue to be developed.

(5) General studies 1,283 million yen (663)

1. Wind power generation system 181 million yen (250)

Large scale component technology and a 100 kilowatt experimental plant will be analyzed and researched.

2. Marine temperature difference power generation 125 million yen (150)

The systems and individual component technology will be researched.

3. High performance partition seal composite methane gas production equipment
751 million yen (0)
Technological development to effectively change sewage and industrial wastewater to methane gas has started.

(6) Promotion of international cooperation 72 million yen (71)

Moonlight Projects

A. In order to deal with the insufficient Japanese energy supply structure system, and to promote energy conservation, research and development for energy conservation will be very important. Therefore, in 1986, Moonlight Projects are concentrating on large scale energy conservation technology and appropriate policies will be strongly promoted for research and development.

B. For large scale energy conservation technology, presently 5 projects are under development. Their outlines for 1986 are as follows:

1) For high efficiency gas turbines, a pilot plant was proven and is running, and component equipment for a prototype plant will be experimentally run and researched.

2) For a new battery-based energy accumulation system, a new 10 kilowatt battery will be manufactured and tested for mid-term evaluation. Also, a 1000 kilowatt system will be under study and experiment.

3) For fuel cell batteries, a phosphoric acid type 1000 kilowatt plant will be run for study, and components research for on-site type will be started. Moreover, a fused carbonate fuel cell will be developed.

4) For a general use Stirling engine, an applicable engine and utilization system will be researched for an experimental run. A study for different types of fuel will be begun.

5) For a super heat pump energy integrated system, component equipment of a super high performance compression heat pump, a system of chemical reaction heat storage technology will be studied, and a total system will be studied.

C. For technologies besides large scale energy conservation, in addition to 9 themes related to MHD coal combustion, new research and development on high efficiency power conversion technology will be begun. In addition, as a supportive theme for commercial energy conservation technology development, a new heat pump for very cold areas will be developed. To emphasize international cooperation, we will join an Annex implementation agreement of IEA for an improved heat pump, in addition to two other Annex programs. A special assignment to establish and investigate energy conservation technology is to forecast the future regarding equipment related to superconductive generation and material technology. The technical and economic feasibility of coal gas utilization in the next generation high performance generation system

will be investigated. In addition, standardization of energy conservation for construction materials and public welfare equipment will be investigated and researched.

<Budget item>	(in million yen)
1. Large scale energy technology	11,815 (10,464)
(1) High efficiency gas turbine	1,880 (1,207)
(2) New battery power storage system	3,170 (2,201)
(3) Fuel cell power generation technology	3,190 (4,776)
(4) General Stirling engine	2,231 (1,673)
(5) Super heat pump and energy integrated system	1,345 (607)
2. Advanced energy conservation fundamental technology	195 (227)
3. Projects for international research cooperation	25 (20)
4. Investigation to establish energy conservation technology	88 (69)
<Investigation for feasibility of superconductive power generation related equipment>	<80>(<60>)
5. Assistance for commercial energy conservation technology development	123 (195)
6. Standardization of energy conservation	23 (32)
7. Others (administrative expense)	57 (139)
Total	12,326 (11,146)

Oil related

Oil is the main portion of the Japanese primary energy supply. To obtain a steady supply is very important for the improvement of Japanese life and economic development. Therefore, it is important to promote oil storage for self-development and in case of emergency. To respond to a change of oil demand structure, policies for heavy oil are to be provided.

A. Oil storage related technology

A safe and economical oil field underground storage method will be established based on the conditions of Japanese geology and hydraulics. An underground storage method for oil gas will be considered, too.

<Budget> 245 million yen

B. Oil development related technology

(1) Development technology for oil shale, which is expected to hold great promise for future energy
(2) secondary and tertiary recovery technology to improve the percentage of petroleum recovered from oil fields
(3) component technology and optimum system technology
(4) development of a very economical small scale oil field development system
(5) component technology for production facility development which can be used in oil fields at high temperature and with corrosive gases
(6) high purity evaluation technology of oil layers which were difficult to evaluate by old methods
(7) analytical process technology of reservoir rocks of petroleum formations to correctly understand the location of petroleum reservoirs

(8) technology to check the structure and characteristics of oil layers in three dimensions continually.
(Budget) 6,953 million yen

C. Oil purification related technology

(1) heavy oil analytical technology in response to the increased use of middle and light ends of oil production in the supply and demand structure
(2) city gas and inexpensive hydrogen technology production to use heavy end residue effectively
(3) new fuel technology for effective utilization of the cracked fraction
(4) production and purification technology for new fuel oil to introduce a technology for new liquid fuels, such as from biomass
(5) technology to develop new uses of light end fractions in response to the overproduction of naphtha
(6) technology to stimulate oil industries by utilizing a large portion of oil production, improving the utilization of unused resources, and improving the quality of oil production, to make oil industries stronger
(Budget) 10,927 million yen

D. Oil distribution related technology

(1) development of safety controls technology, such as integrated monitoring system equipment, for a steady supply of LPG (2) investigation of technology to improve oil supply locations, such as three dimensional usage of oil supply location facilities
(Budget) 423 million yen

Nuclear Energy Related

Nuclear energy is the most promising substitute for oil-produced energy. It is very important for Japan to vigorously promote its development and utilization to obtain a steady energy supply. In doing this, it is of primary importance to consider total safety, and it is important to improve the dependability and economic nature. Furthermore, it is important to establish an independent nuclear cycle and to promote research and development for new reactors, such as the fast breeder reactor.

A. Safety and improved credibility of nuclear power generation.

(1) improved technology for a light water reactor, to improve location suitability, to conserve uranium resources, to improve the economic nature and dependability of the light water reactor, which will be the predominant nuclear power generation type in the long run
(2) technology for a high efficiency light water reactor which has longer life and higher availability factor
(3) advanced technology for testing using ultrasonic waves
(4) operational robots to check and repair plants at actual nuclear power generation facilities
(5) technology for nuclear reactors and waste reactors with high dependability
(Budget) 13,526 million yen

B. Establishment of an independent nuclear fuel cycle

(1) production technology for a centrifugal separator for uranium enrichment to nationalize uranium enrichment
(2) technology for reprocessing main equipment and processes to improve the dependability and availability factor of second reprocessing factories
(3) acceptance technology for foreign reprocessing solidification of used nuclear fuel
(Budget) 6,234 million yen

C. Encouragement of the development and utilization of new reactors

To prepare for the future of nuclear power generation

(1) application investigation for a fast breeder reactor and new converter reactor which makes it possible to effectively utilize plutonium
(2) construction of a new converter reactor and proof reactor
(Budget) 3,852 million yen

Coal related

Demand for coal as an important oil substitute will increase steadily and rapidly because coal is found in rich, localized deposits, and is relatively inexpensive. Therefore, research and development will be continued for technologies of production and utilization. Utilization of coal for coal power generation is very important, as there are many different types of electric resources, and the technology to promote the utilization will be developed.

A. Coal production technology

Technology for large-scale mining equipment for open pit mining, to automate and reduce labor, to save energy in drilling and transportation, and for remote control, will be developed for coal mine development in local and domestic areas.
(Budget) 1,832 million yen

B. Coal utilization technology

Technical development for effective utilization of ash, fluidized bed incineration, high density slurry and a coal cartridge system, will be encouraged to expand coal utilization. As an expected development in the mid-term, gasification and liquefaction technology will be developed.
(Budget) 30,870 million yen

C. Coal power generation related technology

To utilize coal for power generation, technologies will be developed for high efficiency coal power generation, a desulfurization dry process, high performance dust collection, and oil power COM exchange technology.
(Budget) 2,847 million yen

Marine-related Developments

There are many rich marine resources, such as oil. It is important to systematically activate a wide range of technologies to develop the large future possibilities of the ocean.

A. Marine oil development

(1) technology for production and support systems to automate and improve marine oil production
(2) technologies of high performance automatic drilling to deal with increased depth
(3) related technology of an economical tension leg method platform
(Budget) 1,033 million yen

B. Deep submarine mineral resources

Related technologies will be developed for investigation of submarine hot water beds composed of metal sulfate materials, including copper, lead, zinc, gold and silver, which were created by submarine hot water geysers.
(Budget) 8 million yen

C. Dissolved uranium

Technology for a system to recover uranium (about 4 billion metric tons) dissolved in the ocean will be established.
(Budget) 1,140 million yen

Information Technology Development

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 9-10

[Text] In order for the Japanese economy to continue with steady growth in the near future, the information society is expected to expand in industrial applications and in everyday life. For this, it is important to prepare the basics for expanded information, such as training people, development of software, building databases, and considering many different kinds of needs in industry and society.

General policy to facilitate software supply

1. Policy of education for information and training people

(1) Training people for industry

Presently, engineers experienced in the field of information are not available in sufficient quantity or quality. To deal with this situation, at the Information Processing Promotional Industry Association (IPA), CAI (computer aided instruction) techniques are being used to effectively train very good information-field related engineers. A high information technology educational system (including the results of the sigma project) will be developed which is to be considered as a standard curriculum, and the

activities of many commercial information processing technology educational organizations will be supported.

(2) Promotion of computer utilization in school education

Basic technology development, which is a very important conditional preparation to promote computer utilization in education, will be worked on with the Ministry of Education.

(General account)

Information Processing Promotional Industry Association
- in general account project Investigation of the basic technology of educational information processing

210 million yen (0)

(Investment)

Projects to be promoted to develop people for information-related education (investment to industry)

400 million yen (0)

2. Policies for software

(1) Projects to promote development and distribution of general-use programs

To enlarge the distribution of general program development, the Information Processing Promotional Industry Association (IPA) will develop good quality programs which concentrate on very important areas, and will promote the distribution and dissemination of these programs.

(2) Projects to industrialize software production (sigma project)

To dramatically improve the productivity and reliability of Japanese software, the Information Processing Promotional Industry Association will create a system to industrialize software production which is basically databases of software (tools, modules) to allow computerized software development. With this, nationwide services will be developed.

Database preparation policy

In the leading technologies, such as fine ceramics and new materials, industries, schools and government will cooperate to build important databases (Four Themes for 1986). Project investigation for the development (needs investigation, "seed" investigation and consideration of system concept) will be begun again. At the same time, basic preparation for a database and information supply service, such as a database and information supply related investigation and preparation of a database ledger, will be begun.

(General account)

Preparation and promotion of a database and information supply service

76,479 thousand yen (11,727)

Promotion of the development of information related technology

1. Development of basic technology for computers (research and development of the Fifth Generation computer)

Old computers (von Neuman type) are based on simple hardware; complicated processes are ordered by means of programs and processed one command at a time. Therefore, large, complicated programs are required and a tremendous amount of processing time is taken, so it is difficult to build computers with such power. Because of this, aiming at the beginning of 1990, it is very important to develop a new generation computer (the Fifth Generation computer, which is considered a revolutionary technology) to be used for such purposes as artificial intelligence and high-level simultaneous processing.

Next year is the second year of mid-term (1985 to 1988) research and development of the Fifth Generation computer; capability and detail planning to build a reasoning sub-system, knowledge based sub-system, etc. will be started (planned from 1982 to 1991).

(General account)
Development of basic technologies for computers
4,500,950 thousand yen (4,779,480 thousand yen)

2. Inter-operable database system

3. New performance elements

4. High-speed computer system for scientific technologies (supercomputers)

5. Diagnostic assistance system

By giving necessary information immediately for a doctor's diagnosis, the diagnostic assistance system (constructed with an electronic charting system, a picture diagnostic system, and a consultation system) will continue to be developed to assist in medical decisions, disposition and treatment.

(General account)
Development of a diagnostic assistance system
102,615 thousand yen (110,403 thousand yen)

International development of an information-oriented society

To plan the international development of an information-oriented society, positive cooperation with underdeveloped countries, including Pacific areas, will be begun.

International computer network services, which are expected to be more versatile and of higher quality in the future, will be investigated. The present situation of domestic and local problems, and future directions, will be considered.

(General account of the Commerce Policy Bureau)
General information-oriented vision for ASEAN countries of general development planning and investigation project.
30,671 thousand yen (0)
International information-oriented cooperative center project subsidized by technical cooperation project expense
239,156 thousand yen (212,204 thousand yen)
Basic investigation for research cooperation project for underdeveloped countries and research and development of computer-assisted translation systems among nearby countries
35,152 thousand yen (0)

Aviation and Space Development

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 10-11

[Text] (5) Promotion of Aircraft and Space Development

Technical Developments in the Aircraft Field

1. The YXX Project is a commercial air transport vehicle development project following after the YX: a commercial jet transport vehicle with 150 seats, low noise and low fuel consumption, which is expected to be in large demand in the second half of the 1990's, and will be developed as a joint international effort. In March 1984, an agreement in principle was made between Japanese industry and the Boeing Aircraft Company to proceed with a future joint project, and a letter of understanding was signed in Seattle, United States of America (the Japanese share is about 25 percent).

In 1986, considering the successes to date and using the newest related technologies, development and investigation will begin jointly with the Boeing Aircraft Company.

(General account)
Commercial transportation aircraft development
713,560 thousand yen (1,371,499 thousand yen)
(Grant to promote international aircraft joint development is included)

2. Promotion of development of jet engine (V2500) for commercial aircraft

Concerning jet engines for commercial aircraft, an engine will be developed for the 150-seat aircraft, which are expected to be in large demand during the latter half of the 1980's. From 1980, international joint development has been promoted between Japan and England. In March 1982, the first and second engines for ground operational tests were completed, and operational tests were started in both countries.

This project was expanded to a five-country joint project by adding the United States, West Germany, and Italy. In March 1983, the joint project contract agreement between the five countries was signed.

The engine, which will be jointly developed by the five countries, is a high quality engine with low fuel consumption, low noise and the newest 11 metric ton thrust which was a successful result of joint development of Japan and England. Japan has a 23 percent share, following after the United States and England (the United States, 30 percent; England, 30 percent; West Germany, 11 percent; Italy, 6 percent). The V2500 engine will be used for the Airbus Industries Company A320 and the McDonnell-Douglas MD89.

Presently, we are putting all our effort into getting type approval for Spring 1988. In 1986, continuing from 1985, an experimental engine for ground testing will be designed, built and tested. At the same time, construction on an experimental engine for type approval will be started.

3. New Scheme for aircraft development funds

For the two projects mentioned above, a central organization (a corporation assigned by the Minister of International Trade and Industry) is set up to help establish an efficient funding system because development start-up capital requirements increased dramatically from 1986 and financial limitations became stricter. This central organization will help the commercial spirit to perform optimally. The funding to a central organization is from a general account. From this organization, new schemes for funding, such as subsidies and interest replenishment, will be introduced.

(General account)
Funding to promote joint international aircraft development
706,681 thousand yen (0)

(Financed)
Promotion of joint international aircraft development
(Investment to open banks) From 56 billion yen for promotion of industrial technology (0)

Technological development of space

1. Unmanned space testing system (free flyer)

The unmanned space testing system (free flyer) will have different types of automatic experimental equipment. In the microgravity of space, different types of tests will be done automatically over a long period of time. Those test results, test materials, and the whole system, are to be returned after the mission.

To proceed to actual utilization of industrial technological development in a space environment, an unmanned space testing system should be developed. For this, using the space science lab of the Ministry of Education, which has research and development plans for a small space platform for similar study of science and engineering testing, a launch will be planned for 1992, and the research and development of an unmanned space testing system (free flyer) will be started.

In 1986, planning for the whole system and related developments and investigation will be started.

(General account)
Development of unmanned space testing system
181,020 thousand yen (0)

2. Earth resources satellite (ERS-1)

3. Remote sensing technique for resources

New Materials Development

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 12-13

[Text] New Inorganic Materials - Fine Ceramics

Fine ceramics have good characteristics and capabilities, which metallic and organic materials do not have. They are used not only in resource and energy consumption equipment, but also in the aircraft manufacturing industry, the bio-industry and the electronics industry, which are the leading technological industries for the 1990's. They are expected to improve and activate existing industries, such as the basic materials industries. Fine ceramics are considered to have created a new leading technology.

However, as materials and an industry, fine ceramics are still in their infancy. Therefore, there are many technical problems to be solved. The base for technological development, such as test methods for the evaluation of materials and data for physical properties, has not yet been established. In addition, information exchange between related industries is not sufficient.

In response to the needs of the business community, and to remain competitive internationally in leading technological industries, reliability of materials, strength and precision machinability should be improved. In addition, new technical developments should be promoted to utilize special capabilities, such as application to the electronic, optical and biochemical fields. At the same time, a base of technological development must be prepared.

In 1986, research and development in "fine ceramics" for the next generation of industrial basic technology, and research and development in "conductive inorganic compounds" for technologies to activate industries, will be actively promoted. The capabilities of the Fine Ceramics Center, which was established in 1985 to create a database of fine ceramics, will be enlarged and strengthened.

To promote technical development of new glasses and new diamonds which have great future possibilities as new functional inorganic materials, a new glass forum and a new diamond forum will be given assistance and guidance.

<Main budget>

Fine ceramics from research and development projects for the next generation

of industrial basic technology
973 million yen (961 million yen)

Inorganic conductive compounds from research and development projects for technology to activate industry
from 480 million yen (from 621 million yen)

Metals and Macromolecules

The advantages of the new materials policy are:

(a) In innovative technological developments, which are now being made in the fields of energy, information, aircraft and space, the utilization of existing materials has many limitations. Therefore, technical advance is dependant on the development of new materials that can respond to the requirements for better capabilities. (b) It will help to improve production of automobiles and home electric products. (c) The new materials field is the one to most efficiently utilize talented labor, technology, know-how and data that have been accumulated by the basic materials industries. This will activate the basic materials industries by developing a new industry.

This new material policy is an important subject that should be urgently promoted by both government and society, as the social advantages are great and the benefits of technical developments are widely applicable. Furthermore, the risks and development costs are large, and there are many difficulties to overcome prior to successful development.

In 1986, to promote the positive application of new materials development, besides the research and development projects for the next generation of industrial basic technology and the research and development projects for technology to activate industry, funding is planned for work on important themes, such as materials development for a light water reactor. In addition, tax system and financial investment incentives will also be considered.

(Main budget)
Vigorous promotion of national technological development of new materials
From research and development on the next generation of industrial basic technology
Five themes, such as optically reactive materials
2,011 million yen (2,022 million yen)
From money in trust for proof testing of technology to improve a light water reactor
Materials for a light water reactor
1,360 million yen (132 million yen)
Funding to promote new commercial materials technological development
From a subsidy for technological development expenses to activate industries
Two themes, such as aluminum powder metallurgy
160 million yen (169 million yen)

From a subsidy for the technological development of the same basic type of substitute energy
Technology to control high-efficiency heating by using enzyme enrichment membranes
291 million yen (554 million yen)
Assistance to develop and apply new materials
Research to standardize new materials
Organic and metallic new materials
40 million yen (19 million yen)

Bioindustry

Tokyo KOGYO GIJUTSU in Japanese Apr 86 p 13

[Text] Biotechnology is developing very rapidly because of developments in modern molecular biology. The possibilities will be increased greatly. The utilization of biotechnology is being considered in many industries, and in the near future "bioindustries" will be formed. This will help to improve the Japanese industrial structure and everyday life.

Although bioindustries are expected to bloom profusely in the 21st Century, in order to insure healthy growth in the future, there are many problems; for example, preparation of a systematic framework, which is very important to the development of new technology, and promotion of technological development. Therefore, it is important to work on these problems comprehensively and efficiently.

For this, guidelines to insure safety during the industrialization of biotechnology will be established, and at the same time, a policy to insure safety for the natural environment will be considered. Several policies to apply the developed technologies, such as recombinant DNA, will be enthusiastically developed.

After establishing an organization that will connect industries, schools and government (such as universities and public testing and research institutes), and assembling a wide range of technologies, such as the chemical industry, computer analysis and calibration, consideration will be made on research and development to be begun on bio-active macromolecule design and synthesis technologies (protein engineering) (which is expected to expand in electronics, medical and agricultural systems).

(Main budget)
Project and planning for bio-industries
115 million yen (100 million yen)
Promotion of technological development
From basic technological development of the next generation industries
Four themes, such as recombinant DNA technology
1,280 million yen (1,252 million yen)
Biomass related technological developments
Four themes, such as alcohol-for-fuel technology
1,312 million yen (1,247 million yen)

Promotion of international cooperation
Research cooperation to produce physiologically active materials
187 million yen (148 million yen)

Government Test Lab Technology Development

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 14-15

[Text] Important points of research at testing institutes

National testing research institutes are supposed to advance the leading technologies that will be the basis of future technological innovation, such as new materials, biotechnology, electronics and information. Both ordinary and special research will be promoted in response to administrative needs, such as standardizing industries, measuring variables and standardization and testing; and to social requirements, such as earthquake prediction and pollution control. Furthermore, it is important to join industry, schools and government, and to work more efficiently. "Circulating research" [personnel from diverse organizations gathered together to work on a short-term specific project] and joint work by government and corporate personnel will be improved. Research institutes in local blocks of the Board of Industrial Technology will communicate to industries, schools and government, and promote technical development in response to local needs.

(Budget) (Units - million yen)

	1986 Plan	1985 Actual
Special research expense for testing institutes		
General account	2,568	(2,568)
Ordinary research expense for testing institutes		
General account	3,482	(3,500)
Expense of equipment and preparation for testing institutes		
General account	594	(682)
Expense to build new depository center for patented microorganisms		
Special patent account	512	(272)
Expense of technical research and development of national institutes (appropriations of the Small Business Agency)		
General account	56	(56)
Research expense of pollution control of national institutes (appropriations of the Environmental Agency)		
General account	1,404	(1,499)
Research expense of nuclear testing of national institutes (appropriations of the Science and Technology Agency)		
General account	774	(743)
Application of "Circulating" research		
General account	20	(19)
The research committee for important subject study	1	(1)
Meetings for integrated promotion of studies	2	(2)

Outline of Special Research at Testing Institutes of the Board of Industrial Technology

Testing Institute	1986 Budget	Main New Subjects of Special Research for 1986
Measurable Variables Institute	250,983	1. Research on instrumentation for particulates in the air and calibration technology 2. Research on elemental technology for nanometer instrumentation 3. Research on calibration technology for pollution instrumentation equipment using absorptiometric methods
Machine Technology Institute	309,182	1. Research on abnormal diagnostic technology for power transmission equipment 2. Research on analysis and design technology of fixtures for processing, based on data models 3. Research on technology to improve materials using powder-forming methods.
Chemical Technology Institute	286,549	1. Research on production of lipid hybrids and segregation enrichment 2. Research on the surface design of metallic zeolite catalysts 3. Research on technology to control ultra-high temperature occurrences by high frequency thermal plasma
Osaka Industrial Technology Testing Lab	198,457	1. Research on halide glass 2. Research on high conductivity graphite fill 3. Research on technology to design catalysts using particulates and membranes
Nagoya Industrial Technology Testing Lab	146,764	1. Research on compound ceramics containing strong fibers 2. Research on development of metallic compound materials for function apportionment
Microorganism Industrial Technology Institute	81,257	Research on development and utilization of biofunction by gene conversion (new) 1. Research on synthesizing saccharine from plant biomass using microorganisms (continuing) 2. Research on materials to adjust cell capabilities (continuing)
Fiber Macromolecular Material Institute	137,838	1. Research on heat sensitive macromolecular material 2. Research on the development of a CAD system for designing apparel

Geological Survey Institute	510,192	Research on activity evaluation of dislocations by accurate measurement of age (new) 1. Research on potentiality evaluation of deep mineral resources (continuing) 2. Research on geological and geochemical study regarding earthquake prediction (continuing)
General Electronic Technology Institute	1,435,298	1. Research on composite materials by reaction process control 2. Research on creation of new surface layer materials from activated particulates 3. Research on a self-generating process for a knowledge base
Production Science Institute	154,642	Research on chemical sensors copied from the senses of taste and smell (new) 1. Research on performance evaluation of cellars (continuing) 2. Research on human engineering of sensor display equipment
Pollution Resource Institute	640,390	1. Research on production of carbon materials using vapor phase cracking 2. Research on production of liquid fuel from natural gas 3. Research on mine safety technology (fire policy and evacuation system)
Hokkaido Industrial Development Testing Lab	80,505	1. Research on development of hydrometallurgy chemical process for rare metals 2. Research on energy conversion technology and technology to convert peat to powder form
Kyushu Industrial Technology Testing Lab	71,915	1. Research on technology to improve material by using the powder molding method 2. Research on the development of a variable resonance muffling device
Shikoku Industrial Technology Testing Lab	70,755	1. Research on biochemical pulp technology using non-wood resources (continuing) 2. Research on non-metallic flame coatings by laser (continuing) 3. Research on disposal technology for wastewater containing pectin (continuing)
Tohoku Industrial Technology Testing Lab processing	32,380	1. Research on technology for segregation and purification of active components from biomass 2. Research on technology for the evaluation of material by residual stress instrumentation

Chugoku Industrial Technology Testing Lab	218,713	1. Research to collect useful elements and to make resources using capabilities of refined algae 2. Research on technology to systemize sewing designs
Total	4,625,822	

Joint research of government and industry 225,200 thousand yen
* note- details of the budget are special research, small industry research, nuclear uses for peace technology and pollution control technology. The units are 1000 yen.

Promoting Private Technological Development

Tokyo KOGYO GIJUTSU in Japanese Apr 86 p 16

[Text] (1) Improvement of the Basic Technology Research Promotion Center

About 70 percent of Japanese export of research and development has been from the commercial sector, and there has been a tendency for the commercial sector to put emphasis on research and development that is easy to industrialize. To secure the continuing development of the Japanese economic society, and to participate in the development of the international economy, improvement of basic research is essential, and promotion of basic research for the commercial sector is extremely important.

Considering this, in June 1985, a law to facilitate technological research was passed; in October 1985, following that law, the Basic Technology Research Promotion Center was established. This Center provides funding, and invests in experimental research by supplying necessary risk capital. It also provides joint research with commercial industries and national testing research institutes. It invites researchers from foreign countries using commercial research trust funds and charitable trust funds (Japan International Research Cooperation Trust Project), investigates, collects and disseminates research information.

In 1985, project capital of 2 billion yen each for contributions and investment was appropriated. For 1986, in response to increased capital demand, 12.5 billion yen for contributions and 5.7 billion yen for investment, are budgeted.

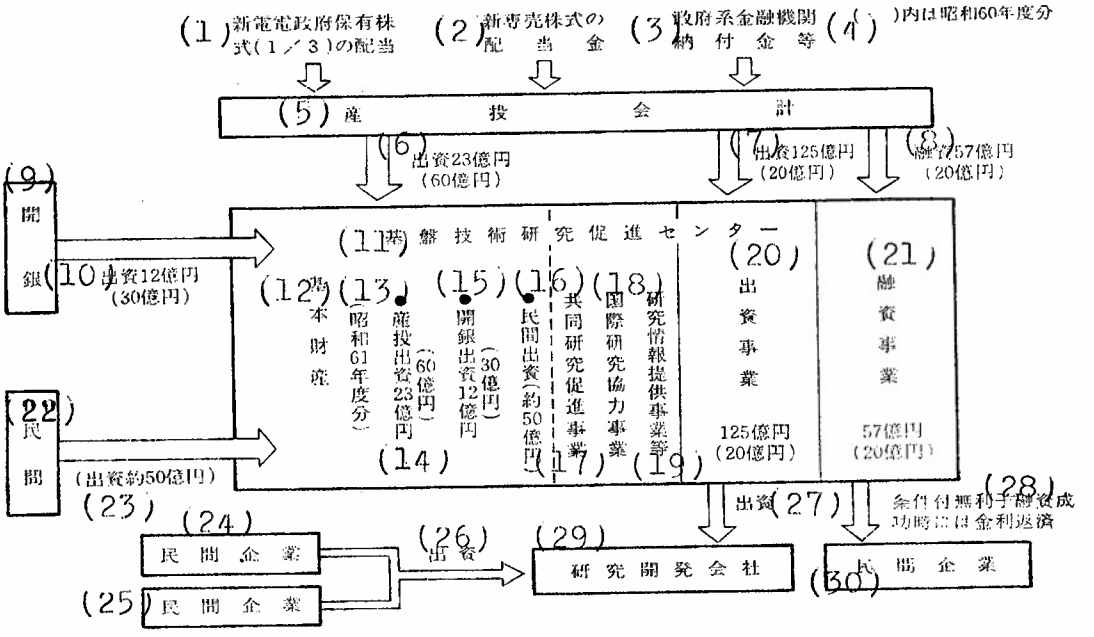
From 1986, the actual work of the Center, to provide joint research, will begin. To strengthen the administration of the foundation and improve the content of projects, basic assets are to be increased.

<Financial investments>

Special account contributions for industrial investment
Contribution to basic assets 2,300 million yen (6,000 million yen)
Contribution to financed enterprises 12,500 million yen (2,000 million yen)

Special account for industrial investment
 Investment in enterprises 5,700 million yen (2,000 million yen)
Contribution to Japanese Development Bank
 Contribution to basic assets 1,200 million yen (3,000 million yen)

Flow of Capital Related to Basic Technology Research Promotion Center



Key:
1 Dividends from government holdings of stock of New Telegraph and Telephone Company (one-third)
2 Dividends from stocks of New Tobacco and Salt Public Corporation
3 Credit from government financial organization
4 In parentheses for 1985 figures
5 Account for industrial investment
6 Contribution of 2.3 billion yen (6 billion yen)
7 Contribution of 12.5 billion yen (2 billion yen)
8 Investment of 5.7 billion yen (2 billion yen)
9 Development bank
10 Contribution of 1.2 billion yen (3 billion yen)
11 Basic Technology Research Promotion Center
12 Basic assets
13 (for 1986)
14 Contribution from industrial investment of 2.3 billion yen (6 billion yen)
15 Contribution from development bank of 1.2 billion yen (3 billion yen)
16 Commercial contributions (about 5 billion yen)
17 Joint research promotion project
18 International research cooperation project
19 Projects to provide research information

20 Contribution projects 12.5 billion yen (2 billion yen)
21 Investment project 5.7 billion yen (2 billion yen)
22 Commercial
23 (contribution of about 5 billion yen)
24 Commercial companies
25 Commercial companies
26 Contribution
27 Contribution
28 Profit is to be returned at the success of interest-free investment with condition
29 Research and development company
30 Commercial companies

Industry, University, Government Cooperation

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 17-19

[Text] Tax System

1. Increased testing research expense tax deduction system and tax system to promote basic technology research and development

2. Tax system relating to the metals industrial technology research union

For the metals industrial technology research union, there is favorable treatment as listed below. (Effective to March 31, 1987)

a. Special repayment of disbursements to union members to obtain municipal property for research.

b. Compression entry up to one yen of research capital gained from dues.

c. Municipal property tax is being reduced to 75 percent for 3 years after obtaining the municipal property.

3. Others

- Special case of losses of money contributed to testing research corporations
- Special case of repayment period of depreciation of assets for research and development

Outline of the Tax System

Subjects	Corporations and individuals as blue color applicants
Structure	Income tax deductible amounts for corporations (1) 20 percent of the amount by which the current year's research expenses exceed the previous year's research expenses (present increased testing research expense tax deductible system) (2) 7 percent of the assets for basic technology development research (tax system to promote basic technology and development, this is newly added to tax deductible subjects) (3) 6 percent of research expense for current year for small companies (tax system to strengthen small companies technological foundation, companies may choose (1) or (3))
Limitations Deductible	Tax deductible amounts are limited to 15 percent of corporate on income tax (10 percent for (1) above) Amounts
Assets for Basic Ministry.	On March 30, 1985, the 207 provisions with 126 items were assigned by an official announcement (47) of the Finance Technology Development Research Expense
Effective Period	From April 1, 1985 to March 31, 1988 (the effective period of the increased testing research expense tax deduction, which is supposed to expire at the end of 1985, will be extended two more years)
Simultaneous Utilization of other Systems is Not Allowed	Depreciable assets which can be applied under the tax system to promote basic technology research and development, cannot be applied under other tax deduction systems, such as other special repayment systems, extra repayment system, tax system to promote investment for energy conservation, and tax system to encourage investment in small companies developing new technologies.
Treatment Under Local Tax Laws	In corporate property taxes (prefecture, city, town, and village taxes), the corporate tax of a standard assessment, which relates to a corporate tax discount, is the corporate tax amount which is already deducted according to the tax system to promote basic technology research and development and the tax system to strengthen small companies' technical foundation. (However, tax deductible amounts according to tax deductible system for increased testing research expense cannot be treated as above, which means the corporate tax amount before deductions is the corporate property tax base.)

Financial Investments

Development bank investment system to promote industrial technologies

This system provides necessary capital with a low interest charge to create companies which will contribute high technologies to the Japanese industrial structure.

<Financial investments> 56 billion yen (53 billion yen)

From the above amount, invested in the Basic Technology Research Promotion Center

1.2 billion yen (3 billion yen)

Outline of Financial Investments

	New Technological Developments			Joint Development of International Aircraft
	Industrialization	Development	Research Facility	
Expense of Construction for Investment	@ Construction of production lines The expense needed for machine equipment, land, building, building materials, and other facilities @ Development of heavy machinery *1 Necessary expense for heavy machinery structures and main components	@ Construction of a demonstration plant Necessary expense for machine equipment, land, buildings, building material and other facilities @ Machine equipment experiments *1 Necessary expenses for experimental machines which will be needed by experimenters (under government involvement, non-facility capital is to be invested also)	Necessary expense for building materials and buildings which have special structure facilities for basic research and application studies of high technology, and machine equipment and other attached facilities	Under consideration by Machinery and Information Industries Bureau
Investment Ratio	About 50 percent of construction expense for investment			
Interest (as of 1 Jan 86)	6.8 percent			

Investment Period	Basically less than 15 years (determined after consideration of legal repayment period of facility, prospect of income of the business and the speed of technological development. Normally, about 10 years.)
Period of Deferment	Basically about 2 or 3 years
1986 Budget	56 billion yen *2

*1 Treated by Machinery and Information Industries Bureau
*2 Including 1.2 billion yen investment in Basic Center

Budget

1. Subsidy for technology research and development expense to activate industries

To promote the development of important technologies, such as technologies to activate industries (for vigorous activation of basic materials industries), and untapped new technologies, which will be an important part of the next generation technological innovations, commercial technological development has been funded. (Subsidy for technology research and development expense to activate industries and subsidy for important technology research and development expense are combined.)

2. Promotion of oil substitute energy technological development

Utilizing commercial vitality and creativity, to promote oil substitute energy technological development, a subsidy for application development expenses of oil substitute energy related technology and a subsidy for application development expenses of new electric power generation technology will be funded to commercially based research and development.

<Budget>

1. Technology to activate industry

Subsidy for research and development expenses
1,434 million yen (2,046 million yen)

Breakdown of subsidy		
Technology to activate industry	481 million yen	(622 million yen)
Important technologies	953 million yen	(1,424 million yen)

2. Oil substitute energy

Subsidy for development expenses of applications of related technologies
2,007 million yen (2,007 million yen)

3. Subsidy for development expenses of applications of new electric power generation technology 236 million yen (236 million yen)

(1) Government-Industrial Joint Research System

Japanese technological development of commercial industries has been mainly proceeding toward applications and developmental studies to industrialize and begin production by using technology from foreign countries. However, if we look at the standard of technology and development potential of today, we must put more emphasis on basic research and development.

Especially if Japan is to be active as a technology developing country in the future, it is important to improve basic research in the leading and fundamental fields. Commercial industries have been improving their research and development capabilities; however, research and development on fundamental and basic fields, which have large technological and financial risks, has been relatively unsuccessful.

The research laboratories of the Agency of Industrial Science and Technology have been successful in basic research since they were established. Therefore, their research potential is extremely high.

To promote efficient basic research, it is important to utilize the basic potential that has been established at research laboratories of the Agency of Industrial Science and Technology as much as possible; and joint research should be started commercially with skilled personnel and financial research potential. This is the reason for that government-industrial joint research.

Outline of the System

The joint research system is supposed to support commercial research and development by the National Research Labs. Their job is not to exchange researchers nor use facilities jointly, but to do their own research. Besides the reasons mentioned above, because there is no special budget provided by the government, the system has not been fully utilized.

The characteristics of this system are:
(1) to jointly utilize the facilities which are owned by the research laboratories of the Agency of Industrial Science and Technology, and to provide a place where commercial industries can set up their own research facilities
(2) products of joint research are owned jointly by government and industry; this encourages government and commercial joint research.

(1) Research themes

This is the theme for necessary fundamental research to establish an industrial foundation. There is great need for joint research by commercial industries and the research laboratories of the Agency of Industrial Science and Technology, and there is potential for great public benefit.

(2) Selection of themes

The needs for joint research, research potential of technology, skilled personnel and finance should be understood. The necessary information will be

provided to both government and industries. After consideration of proposals from research laboratories of the Agency of Industrial Science and Technology and commercial industries, themes will be chosen. Among those themes, research themes which are considered to have great public benefit will be determined by the Agency of Industrial Science and Technology.

(2) Technological Research and Development of Important Areas

The progress and promotion of the technology of closely related localities are very important for their policy to promote locations and to activate the economy.

There are difficulties in proceeding with technological developments locally, as there are problems of developmental expense, research risk and danger. Therefore, it is important to establish a technological development system in conjunction with government and the local area, or government and industry research potential.

In 1982, the Agency of Industrial Science and Technology established the "technological research and development system for important areas". As for the important technological development themes, which are closely related to the needs of local society and the local economy, local branches of national research organizations will be the center of joint research with local public research organizations and commercial industries.

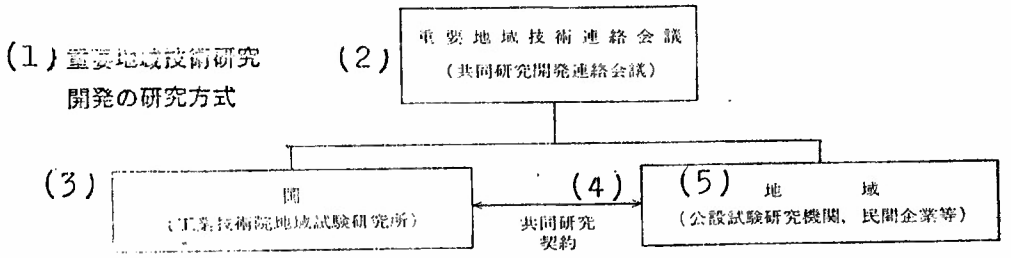
The point of this system is to establish an efficient research structure. Therefore, the government will provide the entire plan (for several years), assign tasks to the joint researchers, and participate in the research and development. The figure below shows the assigned joint research system involved with public research organizations (Hokkaido, Kyoto, Osaka and other prefectures) and commercial industries.

In 1986, continuing from 1985, projects will be proceeding in six areas: Hokkaido, Tohoku, Chubu, Kinki, Shikoku and Kyushu.

Assisting with the above projects, in 1984, a "promotion project to exchange local technologies" was established to introduce leading industrial technologies to local areas. It consists of: (1) local technology research exchange, which is joint research on fundamental technology in advanced technology fields which should be quickly started (research and development of leading general areas of technology) (2) teaching local technology and spreading knowledge to train local researchers and engineers, and to transfer technologies efficiently (3) development of information networks of research and technologies to correct the imbalance of information between central and remote locations (4) making a survey called "Survey for Application of Leading Industrial Technology" after processing leading technological information and know-how of seven local research labs of the Agency of Industrial Science and Technology.

<Budget>	Million yen
Technical research and development of important areas	245 (246)
(1) General processing technology for aqueous process wastes in very cold areas (Hokkaido area)	39 (39)
(2) Technology to make biochemical pulp from non-wood resources (Shikoku area)	35 (35)
(3) Technology to efficiently utilize low-quality raw materials for the pottery industry (Kyushu area)	35 (37)
(4) High efficiency casting production technology which produces many different products in small quantities (Chubu area)	35 (40)
(5) Processing technology of composite fiber with high capabilities and many applications based on suitable characteristics for evaluation (Kinki area)	37 (31)
(6) High efficiency segregation and purification technology for rare metals (Tohoku area)	30 (10)
(7) Others (projects to promote local technical exchange)	34 (32)

( ) indicates 1985 budget



1 method of technological research and development for important areas
2 meetings to communicate important local technology (meeting to communicate joint research and development)
3 Government (local research laboratories of the Agency of Industrial Science and Technology)
4 Agreement for joint research
5 Local areas (public research organizations, commercial industries)

International Cooperation

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 20-21

[Text] (1) International Research Cooperation

Through research cooperation to improve Japanese technical standards, Japan will make a strong contribution to the world economy.

"Promotion of research cooperation with advanced countries"

Japan will promote research cooperation among advanced countries in order to enlarge the frontier of the world's economy, develop the Japanese economy and to improve everyday life.

<Budget>

	Million yen	
	1986 Budget	1985 Budget
1. Promotion of cooperation with advanced countries		
(1) Summit international cooperation project from Sunshine Project		
Sunshine power generation (special account included)	7,293	(8,357)
from technical research for large scale industries		
Robots for work in hazardous environments (special account included)	2,405	(1,896)
(2) International cooperation project of energy technology research and development		
general account	97	(91)
Japan-Australia coal liquefaction special account	12,992	(16,470)
High temperature rock power generation system special account	661	(727)
(3) Expense for international technological exchange		
general account	74	(62)
including special international joint research projects	36	(24)
(4) Industrial cooperation and technological exchange center (appropriated by the Trade Agency) including a project to promote international industrial technological development		
general account	34	(37)

"Promotion of research cooperation with underdeveloped countries"

We will contribute to improve the research and development capabilities, and promote the social and economic development of underdeveloped countries, using results of research. For this, we will start general research cooperation, such as the International Industrial Technological Research Project (ITIT Project).

2. Promotion of cooperation with underdeveloped countries

(1) International Industrial Technological Research Project (appropriated by the International Trade Policy Bureau)

general account	178	(178)

(2) Trust for project to promote research cooperation (appropriated by the International Trade Policy Bureau)

	490	(349)
1) research cooperation for production of physiologically active material (Malaysia)		
general account	172	(148)
2) research cooperation for a solar power generation system for medium size villages (Indonesia)		
general account	112	(66)
3) research cooperation for utilization of unused rare metals (Thailand)		
general account	126	(121)
4) research cooperation for light-weight building material production using chaff ash (Malaysia)		
general account	80	(15)

(3) Basic investigation of research cooperation project for underdeveloped countries

general account	35	(0)

(4) Subsidy for project expense of research and development cooperation (appropriated by the International Trade Policy Bureau)

	54	(81)
1) project to industrialize utilization of tropical resources for multiple purposes		
general account	39	(81)
2) project to develop film for special agricultural purposes		
general account	14	(0)

(5) Project to support technological cooperation with underdeveloped countries (appropriated by the Trade Agency)
including projects to promote industrial development of underdeveloped countries

general account	8	(9)

(6) Large-scale technological cooperation project (cooperation to desalinate seawater in Saudi Arabia (appropriated by the International Trade Policy Bureau)

general account	46	(170)

(2) Technological Cooperation

This technological cooperation means general "software" cooperation, such as providing technology and know-how for underdeveloped countries. This includes sending specialists and accepting trainees, which is a "software" transfer, and giving advice on making policies for the industrial development of underdeveloped countries.

In 1986, we will expand the different kinds of technical cooperation policies, such as "cooperation to create skillful workers" (which is part of a trainees acceptance program), cooperation for plant renovation and research cooperation.

(1) Investigation project for foreign development plan

This is a project to cooperate with underdeveloped countries in making plans for development. Feasibility investigations for metal industries and the energy field, plant renovation investigations to reactivate current plants, and large-scale technological cooperation, such as technology to utilize Indonesian "bunko" coal, will be started.

<Budget> 4,260 million yen (4,207 million yen)

(2) Investigation project for a general development plan

The investigation to complete a general development plan for metal industries and related fundamental preparation will be started.

<Budget> 92 million yen (91 million yen)

(3) Basic investigation project for resource development cooperation

An investigation of resource development, investigation of mineral resources typical drawing, investigation project for marine resources and a large-scale investigation project will be started.

<Budget> 2,714 million yen (2,634 million yen)

(4) Cooperation project with international organizations

As a part of the Asian Productivity Organization (APO) project, trainees and productivity observers will be accepted and specialists will be sent.

<Budget> 319 million yen (310 million yen)

(5) Training project to accept engineers from foreign countries

This project is to support a trainee acceptance program from underdeveloped countries, a training project in underdeveloped countries and a trainer training project. Especially in 1986, besides increasing the number of trainees accepted, construction will begin on a new Yokohama training center,

and necessary machine components for training on how to run a coal power generation plant will be prepared.

<Budget> 4,079 million yen (3,687 million yen)

(6) Project to provide commercial specialists

This project is to help register, train and send our technical and administrative specialists to underdeveloped countries.

<Budget> 1,153 million yen (1,129 million yen)

(7) Technological cooperation project for small foreign industries

This project is to help investigate the feasibility of establishing small-scale industries.

<Budget> 156 million yen (148 million yen)

(8) Foreign cooperation center project

This center is to help the project of training people, which the Thailand-Japan Cooperative Economic and Technical Promotion Association is now doing.

<Budget> 60 million yen (61 million yen)

(9) Foreign consulting promotion project

This project is to support sending scouts to underdeveloped countries to investigate projects, and training specialists on development.

<Budget> 196 million yen (202 million yen)

(10) Contribution to the United Nations Industrial Development Organization

This contribution is for training projects of the United Nations Industrial Development Organization.

<Budget> 201 million yen (185 million yen)

(11) Project to advance research cooperation

This project is to establish pilot plants in underdeveloped countries and begin joint operational research on application stage research themes.

<Budget> 490 million yen (349 million yen)

(12) Basic investment project for underdeveloped countries research cooperation project

This project is to start a basic investigation regarding the needs of research cooperation projects, and an efficient application system of research cooperation in underdeveloped countries.

<Budget> 35 million yen (0)

(13) Research and development cooperation project

This project is to support an investigation on demonstration stage research themes and research and development. From 1986, a new film development project for special agricultural purposes will begin.

<Budget> 54 million yen (81 million yen)

Industrial Standardization

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 22-23

[Text] With social and economic changes, there have been many requirements for projects to standardize industries, such as for quality improvements of metal products, better productivity, rationalization of productivity, development of new technologies, information related technology, promotion of diffusion of information, protection of consumers, improvement of the quality of life, protection of the environment, contribution to resource and energy conservation, organization of industrial foundations, etc.

Furthermore, to internationalize our market and to establish better relationships in international trade, it is important to proceed with the internationalization of our projects to standardize our industries. For this, we must fulfill our obligation to follow the GATT standard code ("agreement on technological interference of trade"), to take steps to implement a "program of action to improve market access", and to make positive contributions to establish international standards. In 1986, considering a "proposal to decide a long-term plan for industrial standardization", which was addressed to the Minister of International Trade and Industry in July 1985, we will try to have smooth operation of industrial standardization projects, and put emphasis on policies listed below.

(1) Promotion of standardization of new technology and information technology

Information technology, new materials, "mechatronics", biotechnology and new energy were early technological innovations. To promote standardization in those fields as a supportive foundation for technological development, we will have to have information-related equipment, secure interactive operation characteristics of systems, and to establish test and evaluation methods. Thus, we will strengthen research for promotion of standardization of new technology and information.

(2) Promotion to internationalize JIS and the JIS certification mark system

This policy is to continue advancing the conformity of JIS with international standards, to spread the JIS certification mark system to foreign countries, and to internationalize this system by utilizing data from foreign inspection organizations which inspect to approve the JIS certification mark system.

(3) Positive response to international standardization projects, such as ISO (International Standardizing Organization) and IEC (International Electric standards Conference)

In the international standardization activities of IEC and ISO, whose chairman is Isamu Yamashita (Vice chairman of the Federation of Economic Organizations), Japan will make positive contributions to establish international standards. To remove international friction caused by the international standards, a standard two countries conference for European countries and the United States will be held. Standardization of a technical cooperation system will be organized to teach standardization projects in underdeveloped countries.

(4) Development of ISONET on-line system

ISONET (ISO Information Network) is an international standards information exchange network developed by ISO. We will continue to develop a system which can collect, control, and utilize unitary standards information of both domestic and foreign countries, and to participate in ISONET positively.

<Budget> Necessary expense to enforce laws of industry standardization

Total General account 536 million yen (582 million yen)

Energy consumption standardization
General account 23 million yen (32 million yen)

(refer to Moonlight project)
Research related to new power generation systems
Special total 47 million yen (0)

1. To strengthen the fundamental organization for industry standardization
General account 251 million yen (278 million yen)
Including 1) Research for standardization of new technology and information technology
79 million yen (84 million yen)
2) Research on conformity with international standards
61 million yen (69 million yen)

2. To operate the Japanese industrial standards investigation committee
General account 114 million yen (118 million yen)

3. To promote diffusion of standards, mark certification of JIS and approval system
General account 92 million yen (87 million yen) Including
1) Expense for JIS mark relief policy
16 million yen (10 million yen)
2) Expense to control JIS standards
8 million yen (8 million yen)

4. To promote international standardization projects
General account 81 million yen (98 million yen) Including
1) Standards conformity information control system
36 million yen (36 million yen)
2) ISONET on-line system
13 million yen (13 million yen)

Technological Capabilities of Smaller Firms

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 23-24

[Text] The environment around small and medium size industries has been changing drastically, as technical innovation has been advancing and peoples needs have been increasing. This kind of environmental change puts severe pressure on small industries, but also gives the opportunity for small and medium size industries to enlarge in the "many kinds-small quantity" production field. Utilizing this opportunity, small industries must improve their technology, to act as an important part of the future Japanese economy. For this, in 1986, we will try to smoothly enforce laws that were enacted in May 1985 for temporary actions to promote technological development for small and medium size industries. By improving the furtherance of technological development and striving for environmental improvement to promote technological development, the technology of small and medium size industries will be improved. Policies listed below are especially important.

<Budget>
Policy to improve technology of small and medium size industries
7,078 million yen (6,479 million yen)
(special account is included)

(1) To enlarge a subsidy to improve the technology of small and medium size industries

In May 1985, a law for temporary action to promote the technological development of small and medium size industries was enacted. According to the law, a technological development plan was made. Subsidies for technological developments to improve union member's technical level will be enlarged. (40 to 55 unions)

<Budget>
Subsidy to improve technology of small and medium size industries
440 million yen (320 million yen)

(2) To enlarge the technological development project of local systems

By letting small and medium size industries participate in systems of large scale and high level that will be needed to strengthen the foundation of local small and medium size industries, "technological development project of local system" to increase the ability for technological development in large scale technology of local small and medium size industries will be enlarged. (From 5 to 10 local areas.)

<Budget>
Technological development project for local systems
457 million yen (185 million yen)

(3) To establish a technological pioneer training project

To train engineers who will be able to do their creative research and development with local industries, a "technological pioneer training project" will be established to carry out ORT (On the Research Training) as a step toward a long-term engineer training plan (which Tokyo, Hokkaido, Osaka, Kyoto and other prefectures have established).

<Budget>
Technological pioneer training project
289 million yen (0)

(4) To enlarge consulting and teaching projects for technological exchange

In 1985, the Small and Medium Industries Project Group established a "Technological Information and Communication Center for small and medium size industries (TICC)" as a hub of technical information transfer and technical communication project among different types of industries (technical communication plazas in prefectures). The TICC will expand their services.

<Budget>
Consulting and teaching projects for technical communication
54 million yen (30 million yen)

The industrial ownership system is very important as a foundation of technological development. Therefore, it is very important for for Japan to drastically strengthen the system, if Japan hopes to become a technologically independent country. The environment of the industrial ownership system has been changing greatly. The biggest change is that the investigation period was extended. Because application for ownership (annual total is more than 700,000, applying under 4 industrial ownership laws: patent, applicable new plan, design and trademark) has been increasing, the content of applications has become more technical and complicated, and the degree of investigation required has become greater, the investigation period has become longer and longer. If this situation continues, the investigation period will be

increased from the current 3 years, to 7 years by 1993. We can predict that this will have an adverse influence on Japanese technological developments. The next biggest change is the requirement for internationalization of industrial ownership administration as the Japanese economy is becoming internationalized. Japan has been contributing positively to an internationalized industrial ownership system. However, it is important to react to correct systems, such as improving the multinominal system, in a more positive manner. The third biggest change is the establishment of a system which is able to easily access the greatly increasing amount of patent information, which contains valuable information concerning rights and technology, and which has become an important foundation for advancing technological development.

In response to such environmental changes around the industrial ownership system, we will have to consider quick and proper investigation and judgement as an administrative basic subject. Emphasizing construction of a paperless system, industrial ownership administration will be advanced for the internationalization, the patent information system will be improved, policies for small and medium size industries will be improved and the general policies will be developed.

<Budget> Total of special account for patents Units - million yen
45,041 (40,140)

(1) Promotion of mechanization of patent administration
8,339 (8,335)

By promoting patent administration processing by use of computers, such as promotion of the paperless project, investigation, judgement and administrative processing will be more efficient. Including: 1) general mechanization of application administration process
1,890 (1,673)

Expense to establish an efficient system for general administrative work by use of computers, such as application documents handling

2) General mechanization of investigation, judgement and administrative processing of patents 2,980 (3,333)

Expense to establish an efficient search system by use of computers, such as for subjects of investigation

3) Rental fee of computers 2,781 (2,610)

(2) Construction of new general bureau building 1,871 (609)

The current bureau buildings are located in different areas, are cramped and are old; therefore it is impossible to promote a paperless project there. A new general bureau building will be constructed. In 1986, old buildings will be torn down and new construction started.

(3) Promotion to internationalize industrial ownership administration
175 (169)

By joining the activities of international organizations, cooperating with advanced countries, cooperating with underdeveloped countries and reacting positively to solve international patent disputes, industrial ownership administration will be internationalized and industrial ownership information will be communicated internationally.

(4) Improvement of patent information supply system 337 (319)

Reference building and local reading rooms will be established.

(5) Improvement of policies for small and medium size industries
89 (66)

Guidance and consulting will be provided.

Medical Equipment Technology R&D

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 24-25

[Text] In July 1975, the Research and Development Committee of the Industrial Techniques Council made a report on medical welfare equipment which is safe, useful and inexpensive. To develop this kind of equipment, in 1976, the Technological Research and Development System for Medical Welfare Equipment was established. Fourteen themes of research and development have been completed. In 1985, eight themes had started. (One of the eight themes finished in 1985.)

In 1986, adding to the continuing seven themes, two new themes will be started. One is "hyperthermia equipment for cancer treatment" (development period is 4 years, the expense is about 500 million yen), to treat cancer with heat. The other is "equipment to produce artificial limbs" (development period is 4 years, expense is about 200 million yen), to automatically manufacture sockets to connect artificial limbs to the body.

<Budget> Units - million yen

Items	1986	1985
Medical Equipment	398 [31	(304) (14)]
1. Medical general equipment	153	(171)
(1) Diagnostic system for psychological disturbances and treatment support systems	64	(82)
(2) Blood processing equipment for immune system diseases	89	(89)

2. Equipment for cancer	245	(133)
	[31	(14)]
(1) Diagnostic and treatment equipment for cancer - photochemical reaction	114	(101)
	[8	(8)]
(2) Diagnostic equipment for cancer - immunology	96	(33)
	[8	(6)]
(3) Hyperthermia equipment for cancer treatment (new)	35	(0)
	[15	(0)]
Welfare Equipment	279	(379)
	[33	(24)]
(1) Reading equipment for the blind	95	(114)
	[3	(3)]
(2) Movable equipment to help the physically handicapped	98	(99)
	[13	(11)]
(3) Automatic thermostat to control body temperature	61	(94)
	[7	(8)]
(4) Manufacturing equipment for socket for artificial limb (new)	25	(0)
	[10	(0)]
(5) Support equipment for walking therapy (finished in 1985)	0	(72)
	[0	(3)]
Administrative Expense	5	(5)
Total	682	(689)
	[64	(38)]

[ ] represents the number for National Research Lab

Regional Technology Promotion

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 25

[Text] To establish an attractive local economic society, local economic promotion policies for improving the technical level will continue to be developed. The policies are listed below.

1) Local technological promotion policy

By establishing local technology promotion meetings (at offices of the Ministry of International Trade and Industry), which consist of knowledgeable people from local industries, schools and government, local technology promotion plans that show basic direction of local technology promotion will be developed. To consider actual methods to try to work on local technical topics, local project investigation will be started.

<Budget> 4 million yen (10 million yen)

2) Projects related to the technopolis concept

To improve the technological standards of technopolis areas, new public research organizations will be established and enlarged, and joint research projects of industry-school-government and venture businesses will be encouraged.

<Budget> 1,883 million yen (2,392 million yen)

3) Subsidy for design expense to establish facilities related to new a industrial society

This is to help design the fundamental concept for an organization which can provide high industrial capabilities, such as capability for research and development, information capability and capability to create engineers in central cities of local areas.

<Budget> 80 million yen (new)

4) Promotion of the "technomart" concept

This is to promote the preparation for a "technomart" (technology market) which will be a new technological information distribution system, and will make technological information transfer to local areas smoother.

<Budget> 19 million yen (22 million yen)

Environmental Protection

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 25-26

[Text] A. General pre-investigation for industrial pollution

In areas where large scale industrial development will be started, general pre-investigation (of air and water) for industrial pollution will be started, according to the laws of factory location. Based of the results of the investigation, local community organizations and industries will be told what to do.

<Budget> 262 million yen (299 million yen)

B. General pre-investigation for environmental protection against inland industrial development

To protect against industrial pollution which accompanies the industrial development of inland areas, general subjects such as air, water, and waste material will be pre-investigated for main inland industrial parks.

<Budget> 11 million yen (14 million yen)

C. Investigation of environmental influence in areas where coal is to be brought

In areas where coal will be brought, the investigation of air pollution will be entrusted to Tokyo, Hokkaido, Kyoto, Osaka, and other prefectures. Based on the results of this investigation, necessary guidance will be provided, and pollution prediction methods will be developed.

<Budget> 60 million yen (54 million yen)

D. Investigation for development of a pollution prediction system

A pollution prediction system is being developed in response to a plan regarding new additions made to factories or construction areas after consideration of the results of a general pre-investigation for industrial pollution. A prediction system for coarse particulates will continue to be developed.

<Budget> 18 million yen (11 million yen)

E. Development of prediction techniques for industrial pollution investigation

A prediction technique using an internal production model will be developed to predict eutrophication

<Budget> 9 million yen (11 million yen)

F. Technological development for protection against pollution caused by mining

To reduce the expense of processing wastewater from mines, an ore deposit sealing technique, underground de-oxidation technology for neutralizing deposits, technology to extract metal from mine water, and processing technology for organisms in wastewater from mines, will continue to be researched.

<Budget> 136 million yen (161 million yen)

G. Investigation of environmental influence caused by marine oil development

To protect against marine pollution, such as accidental oil leaks which accompany marine oil development, a system to protect against the spread of oil slicks will be researched.

<Budget> 30 million yen (30 million yen)

H. Policy to secure safety against chemical materials

The safety of new chemicals which are listed in "regulations for chemical inspection" will be pre-inspected, safety of current chemicals will be examined, and necessary research to operate a system to authorize first-rate labs and to secure safety will be started.

<Budget> 246 million yen (253 million yen)

I. Policy to secure a steady supply of chemicals to be used for advanced industries

Insurance of a steady supply of chemicals to be used for advanced industries, and insurance of safety will be considered for the future.

<Budget> 5 million yen (3 million yen)

J. Policy for internationalization of safety information on chemicals

In response to an international safety policy for chemicals, information on safety will be collected and analyzed, and a data bank of safety of chemicals will be operated.

<Budget> 8 million yen (9 million yen)

K. Promotion of a policy for industrial response to earthquakes

To establish an earthquake policy to cover general industrial facilities with conformity, a manual for response to earthquakes will be created.

<Budget> 6 million yen (9 million yen)

L. High-pressure gas safety policy

To construct an earthquake-proof facility for high-pressure gas, investigation and consideration, and research and development of earthquake-proof design will be started.

<Budget> 4 million yen (31 million yen)

M. Investigation of safety technology for mines

Research on confirmation of stress relief, seismic exploration technology which is required to avoid gas discharges, fire policy in mines, and a policy to stop rock burst, will be started. Safety technology for deep mines will be established.

<Budget> 600 million yen (523 million yen)

Technological Assessments

Tokyo KOGYO GIJUTSU in Japanese Apr 86 pp 25

[Text] (4) Promotion For Technological Investigation Activities

Technological development has been changing the environment at a high speed. This technological development has to be adjusted to society and then advanced. To develop a healthy Japanese economic society, activities such as technology assessment, investigation of conditions which promote technological development, and investigation and development of a management system for

domestic and foreign research, will be enthusiastically advanced. After gaining an understanding of technological development policies and measures, steps to propagate the information will be taken.

<Budget>
To strengthen technological investigation and propagation activities
21 million yen (22 million yen)
Promotion of social evaluation of industrial technology
10 million yen (10 million yen)
Investigation and development of a management system for domestic and foreign research
6 million yen (6 million yen)

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