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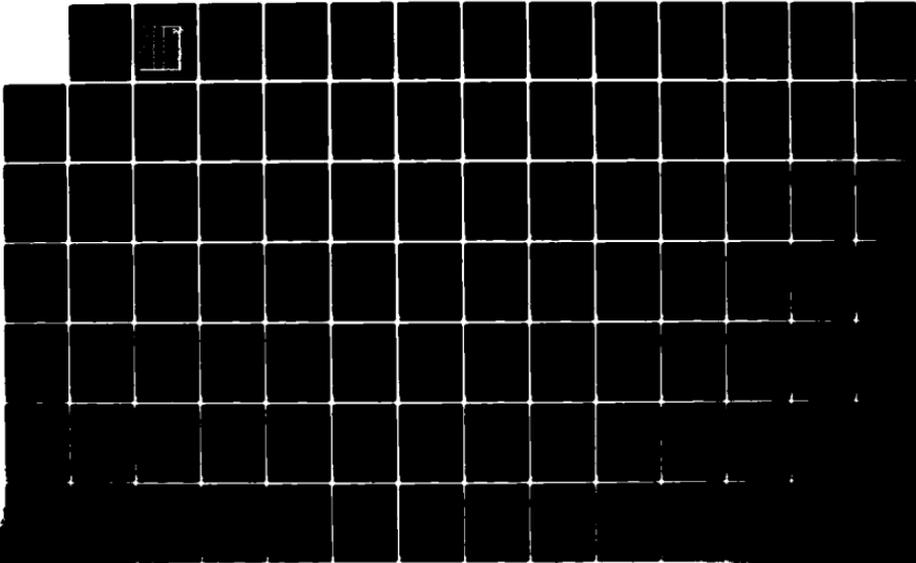
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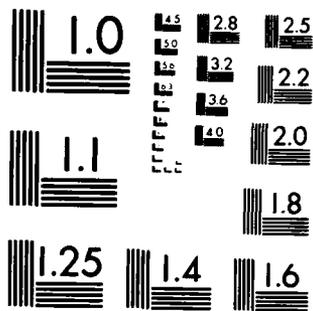
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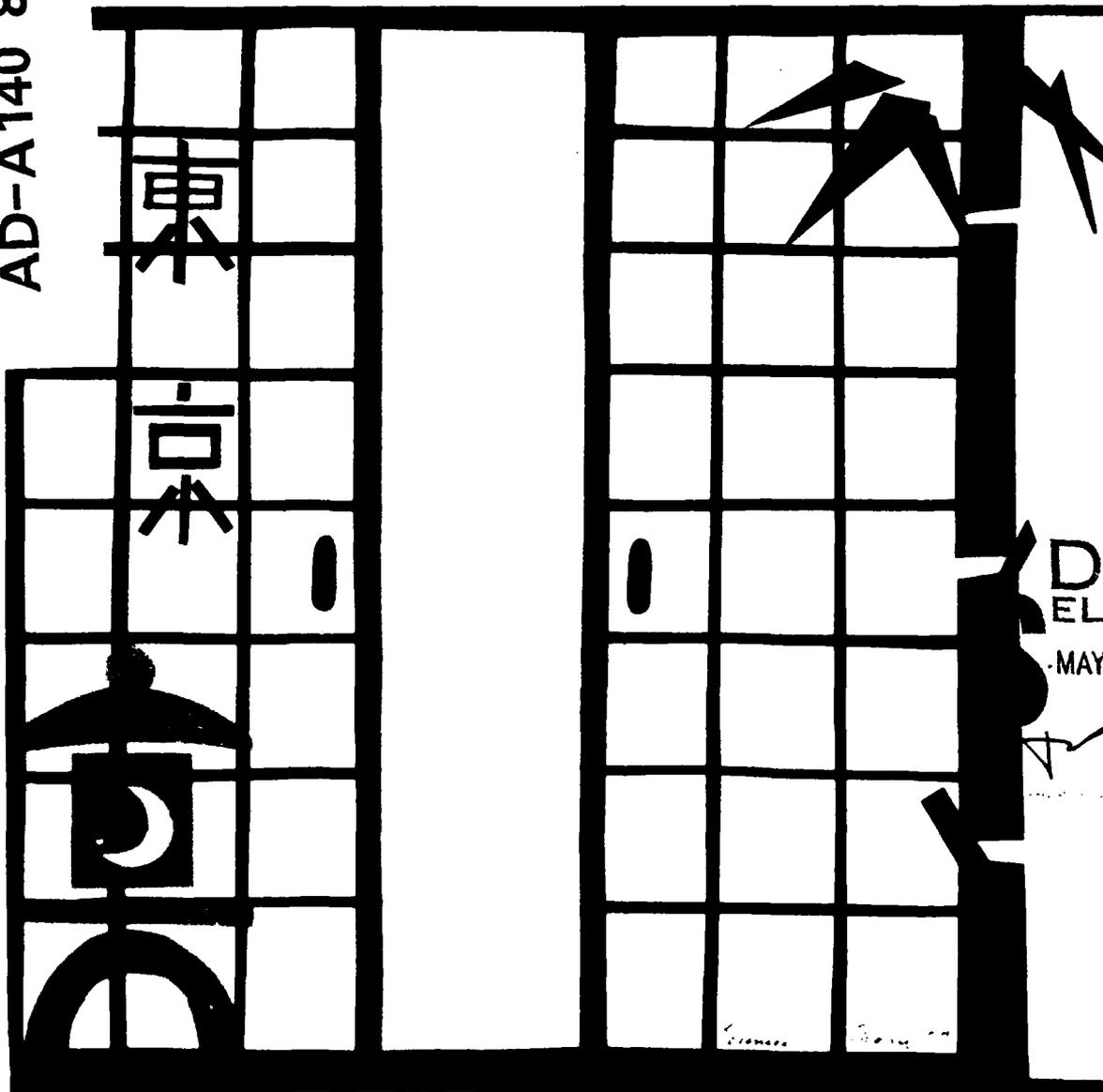
SCIENTIFIC MONOGRAPH



DEPARTMENT OF THE NAVY OFFICE OF NAVAL RESEARCH FAR EAST

JAPANESE RESEARCH INSTITUTES
FUNDED BY PRIVATE CORPORATIONS
COMPILED BY YOUNG B. KIM
AND SEIKOH SAKIYAMA

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ONR FAR EAST SCIENTIFIC MONOGRAPH SERIES

- ONRT M1 High Pressure Science and Technology in Japan,
by Earl F. Skelton, Naval Research Laboratory,
Washington, D. C., July 1978
- ONRT M2 Japanese Research Institutes Funded by the Ministry
of Education, compiled by Seikoh Sakiyama, Office
of Naval Research, Tokyo, January 1980
- ONRT M3 Research on the Multiple-choice Test Item in
Japan: Toward the Validation of Mathematical Models,
by Fumiko Samejima, University of Tennessee, April
1980
- ONRT M4 Japanese Research Institutes Funded by Ministries
Other Than Education, compiled by Seikoh Sakiyama,
Office of Naval Research, Tokyo, January 1981
- ONRT M5 An Overview of Microbiology Research in Japan,
With Notes on Medical History, Education and Health
Care, by Jeannine Majde, ONR Branch Office, Chicago,
Illinois, July 1981
- ONRFE M6 Japanese Research Institutes Funded by Private
Corporations, compiled by Young B. Kim and Seikoh
Sakiyama, Office of Naval Research, Tokyo, December
1983

Early monographs, which were authored in various
elements of the ONR organization, are listed here:

- ONR-28 Superconducting Technology in Japan, by Richard
G. Brandt, ONR Branch Office, Pasadena, California,
June 1971
- ONR-32 A Review of Some Psychological Research in Japan,
by Morton A. Bertin, ONR Branch Office, Chicago,
Illinois, November 1972
- ONR-34 Computer Science in Japan, by Richard L. Lau, ONR
Branch Office, Pasadena, California, June 1973
- ONR-36 Chemical Science in Japan, by Arnet L. Powell, ONR
Branch Office, Boston, Massachusetts, March, 1973
- ONR-38 An Overview of Materials Science and Engineering
in Japan, by George Sandoz, ONR Branch Office,
Chicago, Illinois, December 1977 (Reprinted in 1980)

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Research institutes Budget Parent companies Staff Private corporations R&D activities Addresses		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) > A major difficulty faced by visitors to Japan, and those trying to contact Japanese scientists, is the lack of a comprehensive listing of investigators and laboratories. An attempt to satisfy this need was begun earlier with two predecessor volumes, "Japanese Research Institutes Funded by the Ministry of Education," and "Japanese Research Institutes Funded by Ministries Other Than Education," compiled by Seikoh Sakiyama,		

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which were published as ONR Tokyo Scientific Monographs M2 and M4 (a similar listing of research institutes funded by the Ministry of Education was also published by the Japanese Society for the Promotion of Science). Copies of those volumes, ONRT M2 and ONRT M4, are still available from this office. The present volume completes the series and lists research institutes funded by private corporations.

In this volume, the name, address, telephone number, specialty field, and the size and scope of activity of 100 research laboratories as well as the parent companies are given. The statistical information on each research laboratory and its parent company is followed by a narrative description of the laboratory's R&D activities.

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PREFACE

This office has published listings of Japanese research institutes funded by government agencies: ONRT M2 published in January 1980 covers "Japanese Research Institutes Funded By The Ministry of Education," and ONRT M4 published in January 1981 covers "Japanese Research Institutes Funded By Ministries Other Than Education." In regard to these two volumes, the present volume, Office of Naval Research Far East Scientific Monograph M6, lists major research institutes funded by Japanese private corporations.

In this volume are given the name, address, telephone number, specialty fields, and the size and scope of activity of 100 research laboratories as well as that of the parent companies.

The size of each laboratory, in terms of staff and budget, is given for three fiscal years, 1979-1981, where available. (Please note that the Japanese fiscal year runs from 1 April to 31 March). In order to convert from yen to dollars, the following exchange rates existed on 1 April of each year:

1978	\$1	=	221.35
1979	\$1	=	209.30
1980	\$1	=	251.00
1981	\$1	=	213.00

The statistical information on each research laboratory and its parent company is followed by a narrative description of the laboratory's R&D activities. These sections are selected translations of serialized reports on Japanese industrial research laboratories that appeared in the *Nikkei Kogyo Shinbun*, one of the major Japanese technology daily newspapers, during the April 1981 to January 1982 period. As such, the reader is advised that the scientific and technical contents of the R&D activities sections are general in context and they should exercise prudence in their assessment of the respective laboratories.

We hope that this listing will be useful to those who are trying to identify and contact Japanese industrial laboratories.

December 1983

SACHIO YAMAMOTO
Director
ONR Far East



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AUTOMOBILES

LABORATORY NISSAN MOTOR COMPANY, LTD., CENTRAL ENGINEERING
LABORATORY

(Nissan Jidohsha Chuoh Kenkyu-sho)

Location Natsushima-cho 1-chome, Yokosuka, Kanagawa 237
Telephone 0468-65-1123

	1979	1980	1981
Manpower	-	-	1,400
Expenditure (Million Yen)	-	-	41,000

Activities

Research Planning Office

Administrative Office

Engine Laboratory

New Engine Laboratory

Vehicles Laboratory

Materials Laboratory

Mechanism Research Laboratory

Noise and Vibration Laboratory

Electronics Laboratory

PARENT COMPANY NISSAN MOTOR COMPANY, LTD.
Location 2, Takara-cho, Kanagawa-ku, Yokohama-shi 221
Telephone 045-441-1231

	1979	1980	1981
Manpower	55,747	56,702	56,284
Sales (Million Yen)	2,306,685	2,738,868	3,016,191
Net Profit (Million Yen)	65,466	87,457	85,911

Products Cars (passenger cars, trucks and buses).. 89%
Automobile parts and others..... 11%
(Export)..... (52%)

R & D ACTIVITIES

The Central Engineering Laboratories presently are placing great emphasis on research for greater fuel economy and lighter vehicles in the automotive industry. Nearly 50% of the R&D budget (about 3% of sales) goes into such research. It also conducts intensive research on new fuels with its main emphasis on alcohol-related fuel development. Studies on gas turbines and stirling engines are in progress. Gas turbine research in particular is being given the same importance and weight as alcohol-related fuel research. Taking advantage of the low cost of LSI circuitry, Nissan is applying electronics to the design of Japanese automobiles. In this particular field, it is leading the automotive industry.

Special mention should be made about research being conducted on the "Z engine" and the "ECCS" (engine computer control system). The Z engine is receiving attention from many countries as an energy-saving engine. The ECCS utilizes a full-fledged microcomputer control system which saves about 10% in energy costs.

The turbo-charge engine with a knocking sensor and the drive computer are also products being placed in Nissan vehicles that are technological developments of this laboratory.

The laboratories are expanding their R&D endeavors beyond the realm of automobiles. The newly developed "self-propelled rope transjet system" for in-plant parts transportation, the pilotless driving transport system which can easily be installed, and the gas turbine-driven power vehicle with an emergency private power supply are some of the research results deserving mention. The laboratory is making efforts to develop and manufacture cars suitable for women and elderly drivers.

CEMENT

LABORATORY ONODA CEMENT COMPANY, LTD., CENTRAL RESEARCH
LABORATORY

(Onoda Semento Chuoh Kenkyu-sho)

Location 1-7, Toyosu 1-chome, Koto-ku, Tokyo 135
Telephone 03-531-4111

	1979	1980	1981
Manpower	-	-	140
Expenditure (Million Yen)	-	-	2,000

Activities

Research Project Groups

Basic cement chemistry
Process engineering
System engineering
Analysis and technique
Cement and concrete
Construction materials
Inorganic materials
Soil engineering
Organic fluorine chemistry
Technical services

Onoda Subresearch Laboratory

Onoda Analysis Center

Patent Department

PARENT COMPANY ONODA CEMENT COMPANY, LTD.
Location 1-7, Toyosu 1-chome, Koto-ku, Tokyo 135
Telephone 03-531-4111

	1979	1980	1981
Manpower	2,766	2,810	2,807
Sales (Million Yen)	201,353	223,495	251,310
Net Profit (Million Yen)	4,859	2,663	3,319

Products Cement..... 79%
Ready-mix concrete and others..... 21%
(Export)..... (9%)

R & D ACTIVITIES

The Onoda Cement Company which began cement production as a relief measure for "samurai" who became unemployed at the time of the Meiji Restoration has, since then, striven for quality and technological improvement.

In basic cement chemistry research efforts have concentrated on various kinds of usable raw materials, the degree of powdering, baking conditions, composition of cement powder, and quality improvement. The laboratory is now considering hydration as a main research theme for the immediate future.

The cement-making process--such as grinding, baking, granulation and classification--is being considered from chemical engineering, mechanical engineering, and electrical engineering viewpoints.

Notable achievements have also been made in systems engineering regarding development of control techniques, including computerization, and analysis technologies. The Onoda Analysis Center, which has spearheaded this effort, also deals with analysis of exhaust gas and has recently started consulting services for the prevention of pollution. The basic and use-by-use development of mortar and concrete along with planning and consulting services for secondary product plants are strong interests of the Onoda Cement Company.

In regard to new building materials products, extrusion gypsum building materials, composite cement materials, and laminated panels have been successfully developed. Research and development efforts for the development of inorganic building materials, fireproof materials for kilns, wollastomite and composite materials are continuing.

In the field of soil engineering, the Onoda Cement Company has been pushing for the development of materials for improvement of soft ground and solidification of sludge, colloidal sediment, and matter containing harmful metals. With the application of organofluoric chemistry, a fire extinguishing agent (Onodahalon 1301) has been developed that is commercially effective and high polymer products are being developed as well.

This laboratory also offers technical services such as laboratory testing under contract, chemical analysis, technical advice and field tests where necessary. It is interesting to note that the quality control headquarters is located at the laboratory not at the plant. All industrial standards are set here, and technical guidance is given at job sites. Preliminary studies in the life sciences are also being conducted.

R & D ACTIVITIES

The three main areas of emphasis in research for the Research Institute of the Daicel Chemical Institute will be:

- a shift of research from that of material-centered development to that of a functional-centered development,
- emphasis on interdisciplinary fields and active participation in national projects relative to C chemistry and biotechnology,
- reinforcement of the production department in plastics, cellulose, organic synthesis, as well as improvement in the innovative production process.

The Planning and Information Office views the overall technological trends and from a long-range view decides on research and development directions such as the development of medical and agricultural chemicals from organic synthetic products and the development of useful chemicals from natural resources. The development of herbicides now under way is an example of environmental considerations. The Biochemical Laboratory, composed of 20 members, is interested in the development of pharmaceutical products (anticancer medicine, etc.) and the application of fermentation techniques to chemical reaction processes. At the same time, this section completed a bioreactor (application of an organic reaction) that combines conventional chemical production with biotechnology. The staff members are now investigating various bacteria that will provide for cheaper products.

The Synthetic Reaction Laboratory is engaged in the development of C chemistry. This includes the study of direct synthesis of acetic acid and the synthesis of 1-4 butanediol, the main material of polybutylene terephthalate (PBT) resin. The main focus is to find catalysts other than rhodium.

The three Functional Development Sections are concentrating their activities on development of functional products through the application of composite techniques.

- Section 1: development of an artificial kidney, and application of special films and acetic cellulose,
- Section 2: development of cellulose intermediates related to semisynthetic paste and carboxymethylcellulose (CMC),
- Section 3: the development of electronic materials such as electroconductive films.

The Analytical Physics Laboratory has received many requests for analyses and analytical data from other companies. The Engineering Laboratory is developing process improvements of acetic cellulose.

LABORATORY ISHIHARA SANGYO COMPANY, LTD., CENTRAL RESEARCH
LABORATORY

(Ishihara Sangyo Chuoh Kenkyu-sho)
Location 3-1, Nishi-shibukawa 2-chome, Kusatsu, Shiga 525
Telephone 07756-2-3574

	1979	1980	1981
Manpower	-	-	152
Expenditure (Million Yen)	-	-	860

Activities

- Metals Laboratory
Minerals, dressing, metallurgy, and testing
- Inorganic Chemicals Laboratory
Pigments, fertilizers, industrial chemicals, and chemical engineering
- Organic Chemicals Laboratory
Agricultural chemicals, synthetic chemicals, and field testing
- Biology Laboratory
Microbiology for industrial use
- Safety Laboratory
Safety testing and analysis
- Formulation Laboratory
Application research

PARENT COMPANY ISHIHARA SANGYO COMPANY, LTD.
Location 3-22, Edobori 1-chome, Nishi-ku, Osaka 550
Telephone 06-444-1451

	1979	1980	1981
Manpower	1,571	1,537	1,522
Sales (Million Yen)	37,299	44,164	47,625
Net Profit (Million Yen)	246	1,033	1,078

Products

Iron oxide pigments.....	71%
Organic pigments.....	16%
Iron rutile ore.....	5%
Others.....	8%
(Export).....	(26%)

R & D ACTIVITIES

The company introduced the manufacturing process of herbicide "2,4-D" in 1950 and the titanium oxide manufacturing process in 1953. The herbicide "2,4-D" was improved by the company so that it can also be used in water. Since the agriculture in this country is based principally on rice crops in paddy fields this improved herbicide was noted by the Patent Office as a significant development.

The Yokkaichi Research Institute was established in June 1958 and was renamed "Central Research Laboratory" in June 1963. The laboratory moved in March 1965 to its present address in Kusatsu City, Shiga Prefecture.

The budget of this laboratory is 5.6% of the company's gross sales.

The herbicide "X-G02" was developed for use in the initial stage of paddy field cultivation. The laboratory has developed many other herbicides which include:

- SL-49 (may be spread only once during the cultivation period),
- SL-236 (effective on grass),
- IKI-7899 (prevents the metamorphosis of insects).

The Biology Laboratory came into existence ten years ago as part of the company's research efforts in pure chemistry. The Microorganism Utilization Group of this laboratory is now investigating the development of antibiotics with carcinostatic substances and antibacterial substances. The developmental stage is now at the animal experimentation stage.

The company was awarded, in 1962, the 8th Ohkochi Memorial Technical Prize for the industrial use (production of ammonium sulfate) of waste acid generated from the titanium oxide manufacturing process. The company was also awarded the Technical Prize of Japan Coloring Material Association, in 1977, for a new yellow pigment (titanium yellow). The company has successfully developed synthetic rutile which has a low content of titanium.

LABORATORY KANEGAFUCHI CHEMICAL INDUSTRY COMPANY, LTD.,
BIOCHEMICAL RESEARCH LABORATORY

(Kanegafuchi Kagaku Kogyo Seibutsu Kagaku Kenkyu-sho)
Location 1-8, Miyamae-machi, Takasago-cho, Takasago, Hyogo 676
Telephone 07944-2-3181

	1979	1980	1981
Manpower	-	-	100
Expenditure (Million Yen)	-	-	1,000

Activities

- Yeast Research Group
- Antibiotic Research Group
- Amino Acid Research Group
- Biotechnology Group
- Fermentation Technology Group
- Food Research Group
- Chemical Synthesis Group

PARENT COMPANY KANEGAFUCHI CHEMICAL INDUSTRY COMPANY, LTD.

Location 2-4, Nakanoshima 3-chome, Kita-ku, Osaka 530
Telephone 06-208-6161

	1979	1980	1981
Manpower	3,071	3,156	3,232
Sales (Million Yen)	128,857	165,287	165,150
Net Profit (Million Yen)	1,655	4,005	2,823

Products	Synthetic resin.....	52%
	Chemical products.....	10%
	Foodstuffs.....	22%
	Electric wires.....	7%
	Synthetic fibers.....	9%
	(Export).....	(13%)

R & D ACTIVITIES

The Biochemical Research Laboratory focuses its research on pharmaceutical products, foods and livestock feeds based on fermentation technology, zymology, synthesis, and on a combination of zymology and synthesis processes.

The company started the development of pharmaceutical products around 1972 and in 1973, Glutachion, the base material of liver medicine, was developed by fermentation in yeast culture; in 1978, Ubidecalenon (Coenzyme Q10) the base material of Koikinon destined for Eisai and Erogosterol and the base material of Vitamin D were developed. In addition to these products, the company developed D-para-hydroxy-phenylglycine (HPG), the intermediate product of the synthetic penicillin, amoxyline. The company has established a new zymological process permitting the separation by microbiotic enzyme of D-bodies from synthesized HPG hydantoin. This process can reduce production costs by about 40% compared with the conventional process. In this process D-bodies are optically divided from D- and L-bodies of amino acid. This case is an example of the results occurring from the laboratory's microbiotic and high polymeric techniques that have accumulated over a period of time. This development was followed by the development of D-3-Acetylmelcapto-2-methylpropione (Ampa), the intermediate product of an antihypotensive medicine, Captopyl.

The laboratory is developing a new medicine that is an anticancer drug, Macromomycyne. It is, at present, at the Phase I clinical examination development stage in four domestic laboratories.

In the food industry it has produced, since 1951, bread yeast culture for domestic use in the largest plant of its kind in Japan. Its excellent zymological techniques are producing a ribonucleic acid protein (RNA-C).

The biochemical research and development activities are progressing in this laboratory. A 600.0 million yen investment has just been made to upgrade the laboratory which includes P III-class gene engineering facilities, a synthesis room, a clinical test room, and radioisotope facilities. A 10-member study team has been engaged in basic research of gene recombination for the past three years.

LABORATORY KYOWA HAKKO KOGYO COMPANY, LTD., TOKYO RESEARCH
 LABORATORY
 (Kyowa Hakko Tokyo Kenkyu-sho)
 Location 6-6, Asahi-cho 3-chome, Machida, Tokyo 194
 Telephone 0427-25-2555

	1979	1980	1981
Manpower	-	-	200
Expenditure (Million Yen)	-	-	2,000

Activities

Microbiology Group
 Fermentation Processing Group
 Molecular Level Breeding Group
 Usable Materials Search Group
 Animals and Plants Tissue Culture Group
 Biomass Group
 Chemical Laboratory
 Food Science Laboratory
 Information and Retrieval Group

PARENT COMPANY YOWA HAKKO KOGYO COMPANY, LTD.
 Location 6-1, Otemachi 1-chome, Chiyoda-ku, Tokyo 100
 Telephone 03-201-7211

	1979	1980	1981
Manpower	4,713	4,776	4,859
Sales (Million Yen)	173,526	201,156	206,471
Net Profit (Million Yen)	3,026	3,165	4,191

Products Chemicals and fertilizers..... 30%
 Alcohol and alcoholic beverages..... 14%
 Pharmaceuticals..... 34%
 Foods and seasonings..... 22%
 (Export)..... (9%)

R & D ACTIVITIES

This company developed the technology for the production of L-glutamic acid by zymotechnics in 1956. In 1958, it also invented a process for the manufacture of L-lysine (for condiments and pharmaceuticals) using the same method. The Tokyo Research Laboratory has greatly contributed to the development of the company whose goals are to use the "organic combination of fermentation and synthesis" for research development.

To attain this goal, the laboratory is involved in studies in

- separation, preservation and breeding of useful microorganisms,
- production of amino acid and nucleic acid-related substances,
- development of antibiotics, anticancer medicines and enzymes,
- research on fermentation and synthesis of physiological activators,
- plant and animal tissue culture.

It is also striving to acquire biotechnology knowledge by assigning top researchers to this field. By December 1980, it was equipped with a P-level laboratory for molecular breeding research.

R&D achievements include: the development and manufacture of mitomycin, and anticancer medicine, (1956); the development in 1969 of Sagamicin, an antibiotic, and Fortemicin, which is effective against resistant bacteria and various diseases: Asparaginase, which is effective in detecting infantile cancers or leukemia; and Oxidase, useful in measuring cholesterol.

This laboratory is also conducting contractual research. It has been commissioned by a government-led association for the research and development of new fuel oils and to develop a process for the manufacture of ethyl alcohol from biomass. Kyowa Hakko is a member of the Research Association for Chemical Technologies. The laboratory has received a grant from the Agency of Industrial Science and Technology to conduct research on the use of thermophilic bacteria. The laboratory has established a technology for making malic acid from fumaric acid by using a thermostable enzyme. In addition to the Tokyo laboratory, Kyowa Hakko has a pharmaceutical laboratory, a technical institute, a fisheries experimental station, and a food development center, Yokkaichi Synthesis Laboratory. Currently, the company invests 2-3% of its total sales in research and development activities.

LABORATORY MITSUBISHI CHEMICAL INDUSTRIES, LTD., RESEARCH CENTER
 (Mitsubishi Kasei Sohgo Kenkyu-sho)
 Location 1000, Kamoshida-cho, Midori-ku, Yokohama, Kanagawa 227
 Telephone 045-962-1211

	1979	1980	1981
Manpower	-	-	1,000
Expenditure (Million Yen)	-	-	16,000

Activities

Systems Engineering and Analytical Laboratory

Chemical Laboratory

Biosciences Laboratory

Agricultural Products Laboratory

Carbon and Inorganic Products Laboratory

Functional and Organic Products Laboratory

Specialty Products Laboratory

Plastics Laboratory

PARENT COMPANY MITSUBISHI CHEMICAL INDUSTRIES, LTD.
 Location 5-2, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100
 Telephone 03-283-6111

	1979	1980	1981
Manpower	8,314	8,000	7,918
Sales (Million Yen)	514,422	658,666	793,511
Net Profit (Million Yen)	2,289	6,385	8,478

Products	Petrochemicals.....	46%
	Carbon products.....	29%
	Agricultural chemicals and fertilizers...	12%
	Chemicals.....	12%
	Others.....	1%
	(Export).....	(13%)

R & D ACTIVITIES

This Research Center of Mitsubishi Chemical Industries is not only vast, but also indicative of the direction that the Japanese chemical industry is now pursuing, undertaking a wide range of research projects--including catalysts, medicines, agricultural chemicals, dyestuffs, and plastics.

The research staff members concentrates its efforts on the development of new materials and biochemistry focusing on natural resources, energy, and electronics. In the fields of resources and energy, C chemistry, coal liquefaction, separation of uranium from sea water, and isotope separation of lithium are being investigated; in the development of new materials, inorganic chemistry using rare-earth elements, silicon, and other electronic materials, conductive high polymers, jig materials for LSI are being pursued; in biochemistry research, the breeding of molecules, fusion of cells, new kinds of fertilizers, agricultural chemicals are being considered. This center, as a chemical research institute, prides itself on its quality and diversity of research interests.

The development of closed-type equipment for experiment water is also noteworthy. This equipment is capable of recycling 1,000 tons of such water per day. The center is also equipped with facilities for ion exchange resins, catalysts, basic experiments, fermentation experiments, and gas chromatography. The center can conduct two types of research--theoretical and applied. Research results are introduced at the monthly research meetings which any one in the Research Center can attend.

Recent achievements are:

- the production from coal of needle coke for electric furnaces,
- the development of technology for separating fructose and glucose,
- the establishment of a new steroid fermentation method, the development of a new kind of aggregate with a specific gravity of only 0.1,
- the development of a photosensitive nitrogenous fertilizer.

LABORATORY MITSUBISHI PETROCHEMICAL COMPANY, LTD., CENTRAL
RESEARCH LABORATORY

(Mitsubishi Yuka Chuoh Kenkyu-sho)
Location 1315, Wakaguri, Ami-machi, Inashiki-gun, Ibaraki 300-03
Telephone 02988-7-1010

	1979	1980	1981
Manpower	-	-	260
Expenditure (Million Yen)	-	-	2,200

Activities

- Synthesis Laboratory
- High Polymer Laboratory
- Biochemical Laboratory
- Biochemical Application Laboratory
- Technological Development Laboratory
- Chemical and Physical Analysis Laboratory

PARENT COMPANY MITSUBISHI PETROCHEMICAL COMPANY, LTD.

Location 5-2, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100
Telephone 03-283-5511

	1979	1980	1981
Manpower	4,240	3,873	3,778
Sales (Million Yen)	341,395	404,183	370,846
Net Profit (Million Yen)	4,112	3,445	-1,391

Products

- Ethylene products..... 46%
- Propylene products..... 24%
- Chemical fertilizers..... 4%
- Others..... 26%
- (Export)..... (5%)

R & D ACTIVITIES

Since the oil shock, the petrochemical industry has altered its course from one of mass production to the production of more diversified products of collateral value. Currently, the Central Research Laboratory of the Mitsubishi Petrochemical Company is involved in research in three main areas, the basic study of petrochemistry, research in fine chemicals, and the study of the application of chemistry in commercial endeavors.

The laboratory started research in biotechnology about ten years ago when it tried to produce SCP (single cell protein) from ethanol. At about the same time, the laboratory also began basic research in fine chemicals for which the effort has begun to pay off.

The laboratory was awarded the Production Technology Prize by the Japan Chemical Industry Association for its study on tetrahydrofuran which is used as a solvent for vinyl chloride. The laboratory is located in a favorable environment because it is located near the "Science City" of Tsukuba.

The Mitsubishi Petrochemical Company is the largest styrene monomer producer having an annual output capacity of 420,000 tons. The company employs selected personnel for its basic petrochemical research. The primary objective of this research is to develop new catalysts for use in the petrochemical industry. The primary target for research is the study of C chemistry under a large-scale nationally-promoted research and development project. Under this project, the company will study the production of ethylene glycol. The success of the research hinges on the development of a new catalyst that will be suitable for ethylene glycol manufacture.

LABORATORY MITSUI TOATSU CHEMICALS, INC., CENTRAL RESEARCH
LABORATORY

(Mitsui Tohatsu Chuoh Kenkyu-sho)

Location 1190, Kasama-cho, Totsuka-ku, Yokohama, Kanagawa 247
Telephone 045-891-1111

	1979	1980	1981
Manpower	-	-	280
Expenditure (Million Yen)	-	-	4,000

Activities

Basic Research Department

Applied Research Department

New Products Development Department

Analytical and Physical Research Department

PARENT COMPANY MITSUI TOATSU CHEMICALS, INC.
Location 2-5, Kasumigaseki 3-chome, Chiyoda-ku, Tokyo 100
Telephone 03-581-6111

	1979	1980	1981
Manpower	7,911	7,589	7,546
Sales (Million Yen)	304,642	405,874	418,153
Net Profit (Million Yen)	1,128	9,065	-6,977

Products	Chemical fertilizers.....	11%
	Industrial chemicals.....	41%
	Synthetic resin.....	25%
	Fine chemicals.....	13%
	Others.....	10%
	(Export).....	(10%)

R & D ACTIVITIES

The Fundamental Research Division of the laboratory has about 30 research workers and is conducting research on organic chemistry, inorganic chemistry, and biotechnology. Particularly in the area of inorganic chemistry, this division is stressing research in electronic materials including amorphous silicon. In biotechnological research, the recombinant DNA (deoxyribonucleic acid) laboratory of P₂ level was completed early in 1981 and research on DNA is continuing.

This division is also studying the technique for the production of amino acid with enzymes.

The Applied Technique Research Division studies the synthesis and fermentation of chemicals for medical supplies and agricultural chemicals. They also deal with the development of high molecular compounds, catalyzers, and their production process. This division has developed, in the area of high molecular compounds, engineering plastics, heat resisting resins special epoxy resins used as IC seals, and phenol resins. In the medical research areas, studies are being carried out on anticancer drugs (and have already been developed: Mifurool, a chemotherapy drug), nucleic acid-based medicines, and immunotherapy drugs.

The Company's R&D expenditure is 2.4% (about 10.0 billion yen) of its gross sales, 40% of which has been allotted to the laboratory.

LABORATORY SEKISUI CHEMICAL COMPANY, LTD., CENTRAL RESEARCH
LABORATORY

(Sekisui Kagaku Kogyo Chuoh Kenkyu-sho)
Location 2-1, Hyakuyama, Shimamoto-cho, Mishima-gun, Osaka 618
Telephone 075-962-8811

	1979	1980	1981
Manpower	-	-	160
Expenditure (Million Yen)	-	-	1,500

Activities

- Administration Section - research planning and administration
- General Affairs Section - general service, accounting, business coordination, machine shop, safety, security
- Tokyo Research Section - planning, research, and survey
- Development Planning Section - supporting plans, information service
- Basic Research Section - basic science, mathematical analysis
- Development Research Section - new products, new technology
- Functional Materials Development Project - new materials
- Medical Development Project - new products

PARENT COMPANY SEKISUI CHEMICAL COMPANY, LTD.
Location 4-4, Nishitemma 2-chome, Kita-ku, Osaka 530
Telephone 06-365-2111

	1979	1980	1981
Manpower	5,814	5,870	5,999
Sales (Million Yen)	236,073	298,674	302,191
Net Profit (Million Yen)	1,544	4,317	3,618

Products

Pipes.....	17%
Housing equipment.....	10%
Packaging products.....	13%
Resin products.....	12%
Unit house "Heim".....	37%
Others.....	11%
(Export).....	(2%)

R & D ACTIVITIES

The research investment of the Sekisui Chemical Company is around 5.0 million yen, which was 3% of the total sales in fiscal year 1981; its Central Research Laboratory's budget is about 1.5 billion yen. Research in medical areas, such as in the biochemical field, using highly sophisticated polymerization techniques for chemical products such as plasticizers, intermediates, and bonding material is a significant part of the company's research plan.

The Sekisui Clinical Laboratory is mainly engaged in clinical investigations such as blood analysis processes. In 1981, the laboratory completed a diabetes examination process. The laboratory is working on the development of a latex reagent, i.e., a latex in plastic solidified reagent grain. This new type of product will be used in the diagnosis of serum hepatitis; it also has many other applications.

Research is being carried out in plastics to develop a plastic container which will prevent blood from coagulating. The study of disposable medical products is planned for the future.

The other main research project of the laboratory is an energy-related one. The company is now participating in the Ministry of International Trade and Industry's new housing project using natural energy. The company's role in the project is to conduct tests by removing the stored solar energy using a calcium chloride ($\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$) process. Reliability tests are continuing.

The laboratory has been engaged in the development of air conditioning systems with metal hydrides in cooperation with the Research and Development Corporation. The important technical point is to obtain high energy from low solar heat. Rare-earth materials are to be used for this study. Also under investigation is to find which combination of metal hydrides will be best suited for heat exchange technology. This technological development will affect future thermal research especially in products for the home.

Plastics-related development activities are centered on plastics engineering and composite materials. The recent development of a plane heat generating element in which carbon fabric is "sandwiched" between FRP plates will be commercialized in 1982.

Future investigation activities will include studies on solar light power generation and biomass research.

LABORATORY SHOWA DENKO COMPANY, LTD., GENERAL TECHNICAL RESEARCH LABORATORY

(Showa Denko Sohgo Gijutsu Kenkyu-sho)
 Location 24-60, Tamagawa 2-chome, Ohta-ku, Tokyo 144
 Telephone 03-733-0151

	1979	1980	1981
Manpower	-	-	360
Expenditure (Million Yen)	-	-	3,000

Activities

Administration Department

Analysis Center

Physical properties, chemical analysis

Engineering Research Center

Process development, materials of construction, water treatment technology

Technical Information Center

On-line system, survey, search, analysis, and library

PARENT COMPANY SHOWA DENKO COMPANY, LTD.
 Location 13-9, Shiba Daimon 1-chome, Minato-ku, Tokyo 105
 Telephone 03-432-5111

	1979	1980	1981
Manpower	4,935	5,428	5,372
Sales (Million Yen)	373,941	443,228	384,490
Net Profit (Million Yen)	6,827	7,587	572

Products

Chemicals..... 67%
 Products made by electric furnaces..... 25%
 Engineering..... 1%
 Others..... 7%
 (Export)..... (10%)

R & D ACTIVITIES

The General Technical Research Laboratory is the R&D Center for the Showa Denko Company. The Analysis Center, one of the research centers of the laboratory, analyzes and evaluates the properties of materials that are required for new products. Research emphasis is being placed on microanalysis of ultrafine molecular combinations. A study on the crystallization of artificial graphite and alumina has recently been completed.

The Engineering Research Center develops new procedures related to process engineering, material engineering, and environmental engineering. This center has focused on energy saving technological research. Some developments have been: new industrialization procedures in process engineering; development of the prevention of metal damage and corrosion in material engineering; and the development of an oxygen biological treatment system and waste water treatment for system environmental use.

The laboratory is currently studying a new method of producing hydrogen for future energy needs through high-temperature and high-pressure water electrolysis. This study is under the consignment of the New Energy Development Organization. The company's hydrogen producing plant has upgraded its capacity from 4 Nm³/h to 20 Nm³/h.

The Technical Information Center is the repository for all technical information relevant to the company's technical and research developments. The center maintains a library of technical books, domestic and overseas reviews, magazines, patents, and in-company publications. The library holds 6,000 copies, and has a bookstack area of 450 m.

The Center is in contact with domestic and overseas information services and data banks.

LABORATORY SUMITOMO CHEMICAL COMPANY, LTD., INSTITUTE FOR BIOLOGICAL SCIENCE

(Sumitomo Kagaku Kogyo Seibutsu Kagaku Kenkyu-sho)
Location 4-2-1, Takatsukasa, Takarazuka, Hyogo 665
Telephone 0797-73-0221

	1979	1980	1981
Manpower	-	-	700
Expenditure (Million Yen)	-	-	10,000

Activities

Pharmaceutical Chemicals Department

Basic research, application research, materials research, development of quality control technology, analytical methodology, and chemical equipment

Agricultural Chemicals Department

Basic research, application research, materials research, development of quality control technology, analytical methodology, and chemical equipment

Biotechnology Department

Synthetic medication for hereditary disease

PARENT COMPANY SUMITOMO CHEMICAL COMPANY, LTD.
Location 15, Kitahama 5-chome, Higashi-ku, Osaka 541
Telephone 06-220-3891

	1979	1980	1981
Manpower	10,255	9,826	9,639
Sales (Million Yen)	550,611	673,867	640,760
Net Profit (Million Yen)	11,240	9,582	2,342

Products

Industrial chemicals and chemical fertilizers.....	56%
Plastics and synthetic rubber.....	21%
Dye stuffs and other chemicals.....	11%
Pesticides.....	7%
Pharmaceuticals.....	5%
(Export).....	(9%)

R & D ACTIVITIES

The Institute for Biological Science was established in 1971 absorbing the agricultural chemicals and pharmaceuticals research divisions of the Osaka plant of the Sumitomo Chemical Company. Hence, its contributions made in the area of agricultural chemicals especially organophosphoric compounds.

In the field of pharmaceuticals, the Sumitomo Chemical Company exported "Inteban" (an analgesic, and antipyretic) which is a "first" in the Japanese pharmaceutical industry. Other achievements include drugs such as "Indometacin," an indole as efficacious for inflammation treatment as the steroid agents; a pain killing ointment effective in treatment of rheumatism (estimated annual sales: 4 billion yen as compared to 5 billion yen for "Inbeban SP," an oral agent); "Gephanyl," a remedy for gastric ulcers; "Haridol," an agent for the improvement of cerebral blood flow to prevent thrombosis. Also on the list of new products are "Lipoclean," a cholesterol lowering agent, a semisynthetic penicillin, cephalosporins, and interferon.

The strong push and interest in future research efforts lie in biotechnology. The biotechnology staff will be increased from the current 30 to 50 in 1982. In regard to interferon, the institute intends to apply the interferon manufacturing technique to other products as well.

The research facilities for pharmaceuticals, agricultural chemicals, and biotechnology is expected to expand and be moved to the Osaka plant of Sumitomo Chemical in an attempt to link research and production. The president of Sumitomo Chemical is well-aware that people, money, and time should be concentrated on selected "promising future undertakings" because research and development is so costly.

LABORATORY **UBE INDUSTRIES, LTD., CENTRAL RESEARCH LABORATORY**
 (Ube Kohsan Chuoh Kenkyu-sho)

Location 1978-5, Kogushi, Ube, Yamaguchi 755
Telephone 0836-31-1111

	1979	1980	1981
Manpower	-	-	332
Expenditure (Million Yen)	-	-	4,100

Activities

- Chemical and Physical Analysis Laboratory
- Environmental Protection Laboratory
- Organic Synthesis Laboratory
- Agricultural Chemical Laboratory
- Cement Laboratory
- Metallic Materials Laboratory
- Atomic Energy Laboratory

PARENT COMPANY **UBE INDUSTRIES, LTD.**
Location 7-2, Kasumigaseki 3-chome, Chiyoda-ku, Tokyo 100
Telephone 03-581-3311

	1979	1980	1981
Manpower	9,921	9,916	10,027
Sales (Million Yen)	154,432	226,337	240,167
Net Profit (Million Yen)	1,743	4,123	2,651

Products

- Raw materials for nylon..... 11%
- Synthetic resin..... 13%
- Cement..... 26%
- Ready-mix concrete..... 6%
- Machinery and plants..... 23%
- Chemical products and others..... 21%

R & D ACTIVITIES

Ube's Central Research Laboratory has a broad spectrum of research including engineering processes, chemistry, biochemistry, building materials, metallurgy, machinery, and ceramics. For a chemical company, Ube Industries is the only one in Japan that includes metallurgical and machinery departments in its research laboratory.

Although Ube Industries started production of caprolactam and polyethylene based on technical know-how introduced from abroad, it has since developed new products of high performance based on the strength of its own technology and the process control systems developed by the Central Research Laboratory.

The high-pressure polyethylene produced by Ube Industries is noted as significantly improving the insulation performance of submarine coaxial cables. Ube Industries has succeeded in developing a diester oxalate process using the reactions of carbon dioxide, alcohol, and oxygen.

The development of Tecroffsaram for control of rice blight and the research in pharmacodynamics by Ube Industries is significant also as the laboratories are expected to contribute to the advancement of agricultural chemistry.

Ube Pol VCR is a synthetic rubber for radial tire use which has been developed by Ube's research laboratories by making use of a polymerization process. As the development of a new catalyst for polyethylene polymerization is well on its way toward production, it is possible that the marketing of linear low-density polyethylene (LLDPE) will not be far behind. As seen above, Ube research laboratories is intensifying its research and development efforts in the chemical sciences.

In the area of cement research, Ube's Central Research Laboratory has developed an oil well cement production process and a sulfate-resistant cement production process. So far as oil well cement is concerned, Ube Industries is the largest supplier in Japan.

In the area of machinery research, Ube Industries has developed a waste water treatment process using activated charcoal, charcoal rejuvenator, energy-saving activated sludge and a drying process which are already in use.

In regard to chemical analysis technology, Ube Industries has developed the Chemics-Ube system which can automatically determine the molecular formula of any given organic compound. In addition, its software technology has been provided to Hitachi, Ltd., in order to help develop a new system for chemical analysis.

COMMUNICATIONS

LABORATORY KOKUSAI DENSHIN DENWA (KDD) COMPANY, LTD., RESEARCH AND DEVELOPMENT LABORATORY

(Kokusai Denshin Denwa Kenkyu-sho)

Location 1-23, Nakameguro 2-chome, Meguro-ku, Tokyo 153
Telephone 03-713-0111

	1979	1980	1981
Manpower	-	-	179
Expenditure (Million Yen)	-	-	6,000

Activities

- Electronic Circuit Laboratory
- Materials and Components Laboratory
- Wire Communication System Laboratory
- Radio Communication System Laboratory
- Radio Transmission Laboratory
- Satellite Communication Laboratory
- Information Processing Laboratory
- Switching System Laboratory
- Terminal Equipment Laboratory
- Instrumentation and Measurement Laboratory
- Station Equipment Laboratory
- Special Laboratory I
- Technical Development Division
- Patent Division
- Coordination Division
- General Affairs Division

PARENT COMPANY KOKUSAI DENSHIN DENWA COMPANY, LTD.
Location 3-2, Nishi Shinjuku 2-chome, Shinjuku-ku, Tokyo 160
Telephone 03-347-7111

	1979	1980	1981
Manpower	5,859	6,462	6,686
Sales (Million Yen)	123,455	141,209	148,046
Net Profit (Million Yen)	9,778	16,788	15,583

Products Telegraph..... 47%
Telephone..... 53%

R & D ACTIVITIES

The KDD research and development program is established so as to pursue its three key objects: optical communication research by using optical submarine cable, further development of satellite communication via Intelsats and Intelsats systems, and development of new communication services such as the international data communications network which makes international communication possible through computers.

As for optical communication research, the main projects are in optical devices such as light sources for optical relay and optical detectors, remote infrared ultralow-loss fibers, optical magnetic memory, optical relay and the composition of optical communications systems. A development target for the future is a long-distance international submarine cable system using optical fibers.

In the field of communication via satellite, the staff members are engaged in the total research and development of satellite communication including satellite communication for Intelsats V and others, submillimeter wave transmitters, antennas for microwave and milliwave-bands, the characteristics of propagation, and maritime satellites.

The development of new communication services are being directed toward a computerized communication network, its switchover system, facsimile communication and other techniques covering a variety of consumers' needs. One of the important items, for example, is communication interface which enables allowances to be made for differences in language, time, and techniques inherent in international communication.

Group No. 4, of which their main project is instrumentation, is dealing with the development and measurement of instruments essential to innovation. A good example of this development is a submarine self-propelling cable search system which can detect a cable needing repair. Another study underway is on picture communication and digital transmission.

A great many achievements in development from this laboratory are: lasers made of indium, gallium arsenide semiconductors which oscillate within 1.3 microns-long waveband, software permitting efficient positioning of geostationary satellites, ternary element (gadolinium, terbium, iron) alloys, and an amorphous optical magnetic recording substance which is excellent for recording and reproduction use.

The technical level of the laboratory is ranked high among the communication industries in the world.

CONSTRUCTION

LABORATORY KAJIMA CORPORATION, KAJIMA INSTITUTE OF CONSTRUCTION TECHNOLOGY

(Kajima Kensetsu Gijutsu Kenkyu-sho)

Location 19-1, Tobitakyu 2-chome, Chofu, Tokyo 182

Telephone 0424-85-1111

	1979	1980	1981
Manpower	-	-	302
Expenditure (Million Yen)	-	-	2,300

Activities

Planning and Information Department

General planning and coordination for research and development, collection and analysis of information, diffusion and publicity of research results, collection of data and electronic computer services

General Affairs Department

General affairs, accounting, equipment, and materials

Civil Engineering Department

Investigation, research and development of materials, concrete construction techniques, structures, geology, rock, hydrography and chemistry, all related to civil engineering

Building Engineering Department

Structural systems, construction techniques, structures, earthquake ground motion and vibration of buildings, all related to building construction

Soil Mechanics and Foundation Engineering Department

Soil mechanics and foundation

Environmental Engineering Department

Environmental engineering and building equipment

Construction Equipment Research Department

Mechanical and electrical equipment, measurement and control

PARENT COMPANY KAJIMA CORPORATION

Location 2-7, Moto-akasaka 1-chome, Minato-ku, Tokyo 107

Telephone 03-404-3311

	1979	1980	1981
Manpower	12,326	12,380	12,303
Sales (Million Yen)	630,795	705,542	813,934
Net Profit (Million Yen)	13,503	14,340	16,048

Products Building construction(offices, factories, warehouses, housing, hospitals, educational facilities, others)..... 57%
Civil engineering(engineering work, railroad, water supply, sewerage system).... 39%
Development..... 4%
(Export)..... (4%)

R & D ACTIVITIES

The foresight of Kajima Corporation, especially in the field of ultrahigh building construction, atomic energy, and soil engineering has been noteworthy. This has been attributable to the efforts of the Research Institute of the Kajima Corporation.

In the future, the main theme of research will be in energy-related work of which the research investment totals on the average of 2.3 billion yen a year. The scope of the research effort includes nuclear power plants, oil storage bases, liquefied natural gas tanks, coal storage installations and underground power plants. The most important aspect of the design of these structures is proper earthquake-proof features.

Aseismic design is being studied using an earthquake simulator. The advanced aseismic system research is supported by a network of monitoring stations. Information processed at monitoring stations are immediately sent to an institute at Chofu, Tokyo for integrated analysis.

The institute intends to establish sufficient expertise for the construction of 100% earthquake safe nuclear power plants.

The soil test laboratory research efforts include development of methods that will ensure the safe construction of dams, long and large tunnels, underground power plants, and underground energy storage installations. The laboratory maintains, in special facilities, extremely cold internal temperatures in order to carry out many cold temperature tests. A test is being conducted in which -163°C is maintained in an underground tank so as to check the changes of the surrounding strata. The technology of soft ground improvement is another project of the institute. Some advances made in this research has permitted construction of buildings on various soft ground locations.

Another laboratory is being used on a large-scale for oceanologic and hydrologic tests, including tests of hydrologic cycles in the sea, in ports, on coasts, in rivers, dams, etc.

LABORATORY MISAWA HOMES COMPANY, LTD., INSTITUTE OF RESEARCH AND DEVELOPMENT

(Misawa Hohmu Sohgo Kenkyu-sho)
 Location 4-5, Takaido-Higashi 2-chome, Suginami, Tokyo 168
 Telephone 03-332-5111

	1979	1980	1981
Manpower	-	-	79
Expenditure (Million Yen)	-	-	1,000

Activities

Technical Development Division

Construction method laboratory
 New panels laboratory
 New products laboratory
 Housing facilities laboratory
 Industrial design laboratory
 Multipurpose materials laboratory
 Energy conservation laboratory

Public Relations Division

Administrative Division

PARENT COMPANY MISAWA HOMES COMPANY, LTD.
 Location 4-5, Takaido Higashi 2-chome, Suginami-ku, Tokyo 168
 Telephone 03-331-1111

	1979	1980	1981
Manpower	672	698	787
Sales (Million Yen)	62,156	90,322	106,277
Net Profit (Million Yen)	756	929	1,004

Products Construction materials..... 93%
 Houses..... 6%
 Others..... 1%

R & D ACTIVITIES

Misawa Homes established a research and development department in 1967, which was reorganized in 1969 and renamed the Misawa Homes Institute of Research and Development.

The Institute has three departments: the Technological Development Department, the Social Development Department and the Secretariat. Of them, the Social Development Department is quite unique, and philosophizes the relation between man and his home and calls it the search for a life of quality in the 21st Century under a project called, "Quality 21."

Recent developments by the Technological Development Department include a multifunctional ceramic-base incombustible material called "PALC."

The Institute is well-equipped and staffed. It is the only one in the world that has an all weather environmental testing system capable of simulating arctic cold of -30 C in desert heat.

LABORATORY MITSUI CONSTRUCTION COMPANY, LTD., TECHNICAL
RESEARCH LABORATORY

(Mitsui Kensetsu Gijyutsu Kenskyu-sho)

Location 18-1, Komaki 5-chome, Nagareyama, Chiba 270-01
Telephone 0471-55-0141

	1979	1980	1981
Manpower	-	-	60
Expenditure (Million Yen)	-	-	450

Activities

Administrative Office
Administration, patents, and library

Civil Engineering Division
Engineering geology, soil mechanics, structure and
construction methods, chemical research, equipment
and systems development

Construction Engineering Division
Structural engineering, aseismatic engineering,
environmental conditioning system, systems development

PARENT COMPANY MITSUI CONSTRUCTION COMPANY, LTD.
Location 10-1, Iwamotocho 3-chome, Chiyoda-ku, Tokyo 101
Telephone 03-863-3111

	1979	1980	1981
Manpower	4,454	4,372	4,962
Sales (Million Yen)	224,643	257,774	288,854
Net Profit (Million Yen)	1,272	1,235	1,827

Products Building construction (housing, offices, factories, and
warehouses, others)..... 51%
Civil engineering (land development, water supply, and
sewerage system, railroads, roads, others)..... 48%
Real estate..... 1%

R & D ACTIVITIES

The Technical Research Laboratory is mainly involved in the development of earthquake technology for the construction industry. One such development has been the installation of flexible walls and a floor that has been constructed in a large building used for earthquake simulation studies. These flexible walls and floors can support a maximum weight of 500 tons per meter and a total weight of 4000 tons. The building can withstand an earthquake two or three times the intensity of the Tokyo earthquake of 1923. A microcomputer is used in the monitoring and testing of the structure.

Research directed toward the development of new materials will include development of concrete that will be used in energy storage facilities. Concrete is a fundamental and essential material used in the construction industry. The laboratory has developed concrete that, when tested using rooms with various temperatures, maintained temperatures from 50 C (thermostatic room) to -30 C (low temperature room). This technology is significant for LNG and LPG tank construction, in construction of embedded precast concrete tunnels, and in precast barge construction.

The MCS (Mitsui Checkered System) has become known for the concept of construction of ultrahigh buildings. The laboratory is now hoping to improve on the MCS concept. The laboratory's development activities include the use of microcomputers in practically all aspects of research and development.

LABORATORY OHBAYASHI-GUMI, LTD., TECHNICAL RESEARCH LABORATORY
 (Ohbayashi-gumi Gijutsu Kenkyu-sho)
 Location 4-640, Shimokiyoto, Kiyose, Tokyo 180-04
 Telephone 0424-91-1111

	1979	1980	1981
Manpower	-	-	235
Expenditure (Million Yen)	-	-	2,000

Activities

Administrative Office
 Civil Engineering Laboratory
 Construction Engineering Laboratory
 Founding Soil Laboratory
 Structural Materials Laboratory
 Finish Materials Laboratory
 Structural Laboratory
 Vibration Laboratory
 Air Conditioning and Industrial Hygiene Laboratory
 Acoustics Laboratory
 Nuclear Power Laboratory
 Chemical Laboratory

PARENT COMPANY OHBAYASHI-GUMI, LTD.
 Location 3, Kanda Tsukasacho 2-chome, Chiyoda-ku, Tokyo 101
 Telephone 03-292-1111

	1979	1980	1981
Manpower	9,913	9,813	9,814
Sales (Million Yen)	482,280	543,438	649,404
Net Profit (Million Yen)	4,294	4,805	7,861

Products Building construction (factories and warehouses, housing,
 offices, shops and department stores, schools and
 educational facilities and others)..... 65%
 Civil engineering (land development, railroads, water supply
 and sewerage system, and others)..... 33%
 Real estate..... 2%
 (Export)..... (2%)

R & D ACTIVITIES

The predecessor of the Technical Research Institute which was founded in June 1948, was transferred to its present premises in December 1967, and was the start of the present organization. The institute has developed many testing facilities for use in various specialized field testing needs. The most significant of these is the prestressed concrete reactor vessel (PCCV) which the Kansai Electric Power Company used for special aseismic tests. This one-eighth scale reactor model is repeatedly used for aseismic experiments; it simulates an atomic power generation reactor in earthquake-prone areas. In the same location is a one-thirtieth scale reactor model of the Japan Atomic Power Company. Both of the models are promising prototypes for the Ohbayashi-gumi Technical Research Institute as greater emphasis is being placed on atomic power generation for future power needs.

In energy research, an important concern of the company, the coal silo has been one of the significant achievements in the process of revitalization of coal energy. The silo has a characteristic discharge port which contributes much to the conformity of coal storage and transport.

At the same time, the institute is actively pursuing the study of safe underground storage of liquefied natural gas (LNG), as well as efficient underground heat storage. In the field of earthquake-related research, a unique study is being performed on the purification of sewage and rainwater to be used as potable water in an emergency such as an earthquake. The water is recycled and purified through the use of bacteria and is now being used on a trial basis by employees' families.

Another project of the institute is an earthquake-free floor which can be used to protect computers from earthquake effects. The actual performance of this system was already been tested during the Izu earthquake; however, the institute is hoping to find applications other than "floor" use.

The institute's main office, completed in May 1982, was built using an ultrahigh energy-saving building design; energy consumption per square meter will be 98 megacalories a year compared with the average of 450 megacalories a year in conventional buildings. The solar collector which totally covers the roof and with complete glazing on the south side of the building are features of the building that will make the most use of solar energy.

LABORATORY SHIMIZU CONSTRUCTION COMPANY, LTD., RESEARCH
INSTITUTE

(Shimizu Kensetsu Kenkyu-sho)
Location 4-17, Ecchujima 3-chome, Kohtoh-ku, Tokyo 135
Telephone 03-643-4311

	1979	1980	1981
Manpower (Million Yen)	-	-	1,800

Activities

Materials Laboratory
Geological Laboratory
Structural Strength Laboratory
Construction Laboratory
Planning Laboratory
Environmental Assessment Laboratory
Oceanographical Laboratory
Material Technology Laboratory
Administrative Office
Library

PARENT COMPANY SHIMIZU CONSTRUCTION COMPANY, LTD.

Location 16-1, Kyobashi 2-chome, Chuo-ku, Tokyo 104
Telephone 03-535-4111

	1979	1980	1981
Manpower	9,593	9,537	9,645
Sales (Million Yen)	557,852	602,193	650,276
Net Profit (Million Yen)	7,423	9,223	10,828

Products

Building construction (offices, factories, and warehouses,
housing, shops, and department stores, others)..... 81%
Civil engineering (land development, roads, water supply, and
sewerage systems)..... 18%
Real estate..... 1%
(Export)..... (1%)

R & D ACTIVITIES

The main part of this research institute was completed in 1972. The research facilities encompasses the central laboratory, the large-scale experiments laboratory, the fire-resistance test laboratory, the sound laboratory, the wind tunnel laboratory, the frozen soil laboratory, and the environmental experiments room.

Of the institute's research activities, those of aseismatic planning deserves particular attention. They have developed a unique earthquake input system. When a seismic wave encounters underground structures, it is screened (or deflected) and only a part of it enters the structures. Such input loss can be analysed and measured by this system; a technological advancement which may help solve the mystery of earthquakes. Also the institute has been instrumental in the design of nuclear power plants, energy tanks, and skyscrapers.

By making use of its experience in the design of the No.1 reactor for the Tokai Power Plant of the Japan Atomic Power Company, the institute is developing aseismatic designs for multipurpose reactors and high-temperature gas-cooled reactors. The shielding work for the controversial atomic powered ship, "*Mutsu*," is also being done by the Shimizu Construction Company. The Shimizu Company was the first to introduce the Rockwell tank technology in Japan. Shimizu's aseismic technical experience and knowledge have contributed a great deal towards successful adaptation of imported technology to Japanese requirements. Research effort is also being expanded in regard to cryogenic characteristics in connection with the construction of LNG tanks. The Shimizu Company also possesses technology for cleaning diesel exhaust gases. This technology has been developed to ensure safety in tunneling construction projects. In regard to the desulfurization technology of heavy oil boilers, the Shimizu Company plays a significant role.

LABORATORY TAISEI CORPORATION, TECHNICAL RESEARCH INSTITUTE
 (Taisei Kensetsu Gijutsu Kenkyu-sho)

Location 344-1, Nase-cho, Totsuka-ku, Yokohama, Kanagawa 245
 Telephone 045-812-1211

	1979	1980	1981
Manpower	-	-	220
Expenditure (Million Yen)	-	-	2,000

Activities Construction Technology Laboratory
 Finished Materials Laboratory
 Construction Materials Laboratory
 Environmental Research Laboratory
 Acoustic Laboratory
 Steel Structure Laboratory
 Special Structure Laboratory
 Soil Foundation Laboratory
 Earthquake Prediction Laboratory
 Hydrological Laboratory
 Basic Foundation Laboratory
 Materials and Construction Method Laboratory
 Civil Engineering Laboratory

Supporting group
 - Planning Office
 - Library
 - Experimental Work Shop
 - Machine Shop

PARENT COMPANY TAISEI CORPORATION
 Location 25-1, Nishi-Shinjuku 1-chome, Shinjuku-ku, Tokyo 160
 Telephone 03-348-1111

	1979	1980	1981
Manpower	12,304	12,194	12,332
Sales (Million Yen)	654,035	652,747	787,747
Net Profit (Million Yen)	7,635	8,644	10,362

Products Building construction (offices, factories, and warehouses,
 housing, shops and department stores, hotels,
 others)..... 68%
 Civil engineering (engineering work, railroads, water supply,
 sewerage system, land development, others)..... 30%
 Real estate..... 2%
 (Export)..... (4%)

R & D ACTIVITIES

It is a well-known fact among Japanese people that the former Imperial Hotel, which was designed by Frank Lloyd Wright, the world-famous architect, provided evidence of its earthquake-proof design because it survived the Great Earthquake of 1923. The construction of the hotel was carried out by the Taisei Corporation (then called Nippon Doboku). The proven high aseismatic construction design is one of the main areas of interest of the Technical Institute of the Taisei Corporation.

Earthquake patterns are continually being studied through an observation network of 15 monitoring terminals located in various high buildings, tunnels, and underground tanks. One example is the monitoring point in the Shinjuku Center building of the Shinjuku metropolitan zone which was installed 100 meters below the ground prior to the construction of the building. Based on the data and information collected from the observation network, the institute is able to study the relationship between geological conditions and structures during earthquakes, and as a result of this study hopes to develop aseismatic construction technology.

It is common knowledge that aseismatic construction cannot be achieved without high-quality materials. Concrete is one of the superior building materials in which the institute is applying strong research efforts. Another important area of research for the institute is the soundproof design of future multiple family buildings as well as single family dwellings. Soundproof designing for houses is an approach to environmental protection. This technology can also be applied to the acoustic design of concert halls.

Other items of research at the institute include the study of the possibility of introducing robots into the building process itself in order to allow for the lack of skilled manpower. The area under study for robot implementation is in the prefabrication of construction material. However, as the standardization of building materials is not common, many problems remain before robot technology can be used in the construction industry.

LABORATORY TOBISHIMA CORPORATION, TECHNICAL RESEARCH INSTITUTE
 (Tobishima Kensetsu Gijyutsu Kenkyu-sho)
 Location 2514, Toda, Atsugi, Kanagawa 243
 Telephone 0462-28-5389

	1979	1980	1981
Manpower	-	-	40
Expenditure (Million Yen)	-	-	200

Activities

- Geological Engineering Laboratory
- Construction Laboratory
- Sound and Vibration Laboratory
- Concrete Research Laboratory
- Pavement Laboratory

PARENT COMPANY TOBISHIMA CORPORATION
 Location 3-28, Kudan Minami 2-chome, Chiyoda-ku, Tokyo 102
 Telephone 03-263-3151

	1979	1980	1981
Manpower	3,600	3,821	3,793
Sales (Million Yen)	201,806	255,314	313,328
Net Profit (Million Yen)	1,706	1,641	1,749

Products Civil engineering (land development, railroads, water supply,
 and sewerage systems, roads, others)..... 58%
 Building construction (housing, factories, and warehouses,
 offices, others). 41%
 Real estate..... 1%

R & D ACTIVITIES

The Tobishima Corporation, which is going to celebrate its centennial in 1983, regards the Technical Research Institute as a section of its Technological Division. This institute stresses basic research.

Tobishima Corporation which excels in tunneling technology has the edge in technology expertise in water supply and drainage, road, railway, and dam construction work. It is the first Japanese construction company that utilized the Austrian tunneling method. This method prevents the earth from loosening or sinking in the tunneling area making the most use of the pressure of the surrounding earth instead of using the conventional methods such as steel, timber, or thick concrete supports.

The technical staff has continued research and development efforts to best adapt this Austrian technology to the various land conditions in Japan. Today, the Tobishima Corporation has made significant progress toward increased efficiency, greater energy savings and better safety in the construction of tunnels for railways and motorways, flood ways, sewerages, and underground power stations.

The company is also developing new technology such as the "shield" method and the "caisson" method that are applied in difficult urban civil engineering projects.

Now a general contractor, Tobishima Corporation is active in a wide range of technological developments. Among its many technologies, the slip form method deserves special mention. It is useful for the construction of tall, towering concrete structures with ferroconcrete--such as chimneys, silos, towers, caissons, pressure vessels for nuclear power stations, and buildings. Tobishima itself has many patents for its own technological developments, however, the slip form technology originally came from West Germany and was further developed by Tobishima Corporation.

LABORATORY TOKYU CONSTRUCTION COMPANY, LTD., TECHNOLOGICAL RESEARCH CENTER

(Tokyu Kensetsu Gijutsu Kenkyu-sho)
 Location 13-9, Miyazaki 2-chome, Takatsu-ku, Kawasaki, Kanagawa 213
 Telephone 044-854-2111

	1979	1980	1981
Manpower	-	-	46
Expenditure (Million Yen)	-	-	300

Activities

Administrative Office

Architectural Building Structures Division

Computer analysis, seismological observation, structural experiments

Soil and Foundations Division

Land developing systems, chemical treatment of soil

Environmental Protection Division

Noise control, vibration control

PARENT COMPANY TOKYU CONSTRUCTION COMPANY, LTD.
 Location 16-14, Shibuya 1-chome, Shibuya-ku, Tokyo 150
 Telephone 03-406-5111

	1979	1980	1981
Manpower	3,619	3,674	3,734
Sales (Million Yen)	203,229	222,622	245,960
Net Profit (Million Yen)	1,662	2,143	2,668

Products Building construction..... 60%
 Civil engineering..... 38%
 Real estate..... 1%

R & D ACTIVITIES

The Technological Research Center of this firm has acquired substantial technical ability in the field of environmental engineering. In Japan there was a time when public opinion was against the construction of high rise apartments because of the associated wind and noise problems. The Center has made such significant contributions in solving these urban environmental problems that the Ministry of Construction and the Japan Highway Public Corporation rely on the Center for information concerning wind and noise pollution.

The Acoustic Laboratory specializes in the study of traffic noise. One of its main objectives is to protect city dwellers against traffic noise pollution. The company has acquired a substantial degree of expertise.

The company is investigating construction and structural methods relative to tunneling processes. For example, the New Austrian Tunneling Method (NATM) has greatly reduced construction time. At Hachimantai, on the Tohoku Superhighway construction project, a method utilizing a microcomputer at the site was used. In this method, the microcomputer system is linked to an automatic measuring system to read the topographic changes of the mountain so that supports of the tunnel may be reinforced according to topographical changes. Complicated data are recorded on a magnetic disk which is taken to the main office for further study.

In the area of railway construction, the firm has developed a new track construction method. Quite different from conventional methods in which sleepers and gravel are utilized, a reinforced concrete bed (serving as vertical sleepers) is constructed at the site and rails are placed directly on the bed. This method has significant advantages such as the reduction of construction costs, of manpower costs, and the elimination of maintenance.

To meet the trend toward the expansion of existing railway lines by constructing new lines directly above and below the existing ones, the firm has developed a new "exchange method" in which a special contrivance is incorporated in the juncture of the new line. This new method is attracting public interest because it does not require construction of a temporary line and eliminates noise and vibration.

Future plans include the development of construction techniques of large-sized underground hollow structures, marine structures, and power generating facilities.

COSMETICS

LABORATORY SHISEIDO COMPANY, LTD., SHISEIDO LABORATORY
 (Shiseido Kenkyu-sho)
 Location 1050, Nippa-cho, Kohoku-ku, Yokohama, Kanagawa 223
 Telephone 045-542-1331

	1979	1980	1981
Manpower	-	-	280
Expenditure (Million Yen)	-	-	6,000

Activities

- Cosmetic Research Laboratory
- Application Research Laboratory
- Products Development Laboratory
- Administrative Office

PARENT COMPANY SHISEIDO COMPANY, LTD.
 Location 5-5, Ginza 7-chome, Chuo-ku, Tokyo 104
 Telephone 03-572-5111

	1979	1980	1981
Manpower	12,949	13,100	12,969
Sales (Million Yen)	279,633	294,560	302,301
Net Profit (Million Yen)	10,271	10,671	10,201

Products	Cosmetics.....	86%	
	Soap and detergent.....	8%	
	Sundry goods.....	6%	
	(Export).....	(4%)	

R & D ACTIVITIES

In the development of cosmetics, it is essential to select good oil. Oil, which is the base material of cosmetics, must be smooth and easy to spread. Tests made in the laboratory have concluded that oils appropriate for cosmetics tend to stimulate the skin. Blanched ester oil is an important substance in this cosmetic development. The laboratory has discovered, through repeated experiments, the fact that healthy skin has a balanced moisture, which is a naturally occurring phenomenon through moisture-balancing material that is called the "natural moisturizing factor."

The development of high-safety cosmetic dye materials and perfumes is also an important task of research. One example is the search for natural perfume base materials that do not produce allergic reactions and inflammation.

An example of discovery of safe natural materials is "Hohobayu," which was originally used by Indians. As it is used in its original form by the Indians, Hohobayu it is very impure and very inflammatory. Shiseido's refinery techniques have transformed it into a safe form for cosmetic use.

"Squwaran," refined deep-sea shark liver oil, was once used as a natural cosmetic material. However, the natural form of Squwaran comes in too small quantities for production purposes so it has been chemically synthesized in the laboratory and with assistance from the Kurare Corporation's research facilities.

The company has emphasized chemical synthesis technology in various fields of chemical products other than cosmetics. The research and development investment accounts for about 6.0 billion yen or 2% of the total sales.

ELECTRONIC EQUIPMENT

LABORATORY FUJI ELECTRIC COMPANY, LTD., FUJI ELECTRIC CORPORATE
RESEARCH AND DEVELOPMENT
(Fuji Denki Sohgo Kenkyu-sho)
Location 2-2-1, Nagasaka, Yokosuka, Kanagawa 240-01
Telephone 0468-56-1191

	1979	1980	1981
Manpower	-	-	470
Expenditure (Million Yen)	-	-	4,400

Activities

R&D Technical Staff

Administration Department

Research Groups - research laboratory
- semiconductor laboratory

Development Groups - development laboratory
- high voltage power laboratory

Manufacturing Groups - manufacturing engineering laboratory

Fuel Cell Development Division

PARENT COMPANY FUJI ELECTRIC COMPANY, LTD.
Location 12-1, Yurakucho 1-chome, Chiyoda-ku, Tokyo 100
Telephone 03-211-7111

	1979	1980	1981
Manpower	14,075	13,854	13,307
Sales (Million Yen)	240,738	259,428	295,278
Net Profit (Million Yen)	2,767	3,796	4,126

Products Electrical machinery..... 44%
Standard electrical equipment..... 28%
Measuring instruments..... 16%
Vending machines and appliances..... 12%
(Export)..... (25%)

R & D ACTIVITIES

The Fuji Electric Company is a heavy electric machinery maker. This Research and Development Institute is an organization formally independent of the Fuji Electric Company. The predecessor of the institute began its activities in 1933 as a research section of Fuji Electric. In 1980, the present organization was established. The budget allotted to the institute amounts to about 4% of the total annual sales. The research items are classified largely into three areas: energy, electronics, and basic technology.

In energy research, amorphous silicon solar cells are under development. A vacuum glass tube-type solar collector has been developed in solar heat collection. In addition, wind power generation and wave activated power generation are being studied.

The fuel cell development now under way includes alkali-type cells and phosphoric acid-type cells.

In the superconducting field the company produced on trial in 1982, a superconducting synchronous phase modifier in a project for the Ministry of International Trade and Industry for use in the Mitsubishi Electric Corporation. Also, a superconducting generator was completed in a combined research project with Kyoto University.

Development in electronics are focused on semiconductors, sensors, and instrumentation with emphasis on systems engineering. The pocket-size microcomputer powered by amorphous silicon solar cells can work by using artificial home light. Other achievements are: the contact combustion city gas (LNG) sensor authorized by the Japan Gas Appliances Inspection Association; the oximeter, "ZIRCOMAT MINI," using zirconia ceramics for measurement of oxygen content in boilers and industrial furnaces; and the filter-condenser system of a waste water treating installation in a purifying station, and other developments which include medical electronic equipment.

The basic technology interests are in materials, production, analysis, evaluation, etc. Some areas under study include the study on fast breeder reactor (FBR) structural materials in a joint effort with the Power Reactor and Nuclear Fuel Development Corporation as well as a study being carried out on high-temperature nuclear reactors materials in cooperation with the High-temperature Structure Safety Engineering Research Association.

LABORATORY FUJITSU LIMITED, FUJITSU LABORATORIES LTD.
 (Fujitsu Kenkyu-sho)
 Location 1015, Kamiotanaka, Nakahara-ku, Kawasaki, Kanagawa 211
 Telephone 044-777-1111

	1979	1980	1981
Manpower	-	-	800
Expenditure (Million Yen)	-	-	10,000

Activities

Research Division

Integrated Communications Division

Telecommunications systems, lightwave communications, microwave systems, digital transmission on coaxial cable, coding and digital signal processing, digital switching and networks

Computer Systems Division

Computer technology, computer design and software, pattern recognition, printers, magnetic recording, bubble memories, plasma displays

Semiconductor Division

LSI's and semiconductors, LSI devices, fine pattern technology, future technology, semiconductor materials, microwave devices, optical devices

Components Technology Division

Materials Division

Medical Engineering Division

Kansai R&D Center

Technical Support

Technical information, materials analysis, machine shop

PARENT COMPANY FUJITSU LIMITED
 Location 6-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100
 Telephone 03-216-3211

	1979	1980	1981
Manpower	32,257	32,982	34,019
Sales (Million Yen)	440,921	501,000	581,678
Net Profit (Million Yen)	10,732	15,645	18,453

Products Electronic computers and data communications equipment... 66%
 Telephone exchange equipment and telephone sets..... 8%
 Radio and carrier transmission equipment..... 13%
 Electronic parts and other apparatus..... 13%
 (Export)..... (14%)

R & D ACTIVITIES

Fujitsu Laboratories is by legal establishment independent of Fujitsu Limited. In actual fact, however, the laboratory has close ties with the latter. Fujitsu Laboratories is wholly subsidized by Fujitsu Limited through research and development commissions, and its technological achievements are almost exclusively transferred to Fujitsu Limited. Personnel exchange between the two companies is active as technological transfer always accompanies the transfer of research.

Fujitsu Laboratories is promoting, among other things, the research and development of LISP machines and other highly intelligent computer systems along with relational data bases, software for natural language processing, pattern recognition processing systems, mass storage files, and plasma displays. One third of the research staff is carrying out research and development activities in this new technology. The development of LSIs and semiconductors is also actively undertaken to bolster the communication and computer divisions of Fujitsu Limited.

In the fields of system components, that is, parts and materials, research and development is steadily progressing toward the merchandising of bubble memories which are expected to take the place of floppy disks.

Fujitsu Laboratories, in close cooperation with Fujitsu Limited, has been a strong force in the advancement of technology. While the number of projects Fujitsu Laboratories has been pursuing independent of Fujitsu Limited is as small as 10% to 20% of the total, Fujitsu Laboratories maintains that its future hinges on its capabilities of research and development.

LABORATORY HITACHI, LTD., CENTRAL RESEARCH LABORATORY

(Hitachi Seisakusho Chuoh Kenkyu-sho)
 Location 1-280, Higashi-koigakubo, Kokubunji, Tokyo 185
 Telephone 423-23-1111

	1979	1980	1981
Manpower	-	-	1,150
Expenditure (Million Yen)	-	-	1,000

Activities

- Department 1 Chemical and new semiconductor materials, and solid state physics
- Department 2 Metallurgical, magnetic, and ceramic materials
- Department 3 Materials and production processes for LSI, VLSI center
- Department 4 Scientific instruments and illumination products, materials analysis center, branch laboratory at Naka Works
- Department 5 Telecommunications systems and devices, broadcasting devices, branch laboratory at Totsuka Works
- Department 6 Information processing equipment and computer peripherals
- Department 7 LSI device design
- Department 8 Computer architecture and applications, computing center, branch laboratory at Kanagawa Works
- Department 9 Medical engineering and life sciences, branch laboratory at Hitachi Research Laboratory

Prototype Development Department - Precise machining, machine shop
 Technical Administration and Information Services Department
 Business Administration Department

PARENT COMPANY HITACHI, LTD.
 Location 5-1, Marunouchi 1-chome, Chiyoda-ku, Tokyo 100
 Telephone 03-212-1111

	1979	1980	1981
Manpower	71,309	1,785	72,277
Sales (Million Yen)	1,509,445	,698,130	1,947,029
Net Profit (Million Yen)	37,538	53,088	61,846

- Products**
- Power systems and equipment..... 18%
 - Consumer products..... 21%
 - Information and communication systems,
and electronic devices..... 20%
 - Industrial machinery and plants..... 19%
 - Wire and cable, metals, chemicals and others..... 22%
 - (Export)..... (27%)

R & D ACTIVITIES

Nearly 50% of the budget of the Central Research Laboratory of Hitachi, Ltd., is directed toward independent research and development, and the remainder toward efforts in the company's various divisions, factories, and affiliated companies as well as for government subsidized research tasks. Thirty percent of the "self-motivated" research is directed toward commercial production that will extend over a five-year period; while another 30% is directed toward opening up new areas of production; 24% goes to "seeding" efforts which could be the basis for future science, and 16% toward basic research.

The Fine Technology, Energy, Electronics, and Life Engineering (FEEL) program of the Central Research Laboratory program places its greatest emphasis on electronics. About 70% of the researchers are assigned to undertake programs relating to VLSIs, Josephson junction elements, gallium arsenide semiconductors, and other new elements, optoelectronics including photochemistry, optics-applied systems, etc. The second priority of this program is research related to solar cells, fuel cells, life engineering, specifically medically-related technology, culture and growth control of plants.

The research set up is well-designed to very effectively and in a timely way link "research units" consisting of researchers in specialized fields with projects or tasks. This laboratory annually applies for 900-1000 patents and utility models, plus more than 140 overseas applications that now total to about 500 cases.

LABORATORY MATSUSHITA ELECTRIC INDUSTRIAL COMPANY, LTD., CENTRAL RESEARCH LABORATORY

(Matsushita Denki Sangyo Chuoh Kenkyu-sho)
 Location 3-15, Yagumo-nakamachi, Moriguchi, Osaka, 570
 Telephone 06-909-1121

	1979	1980	1981
Manpower	-	-	1,000
Expenditure (Million Yen)	-	-	20,000

- Activities
- Materials Research Laboratory
 - Energy Conversion Research Laboratory
 - Semiconductor Research Laboratory
 - Electronics Research Laboratory
 - Microcomputer Research Laboratory
 - Lighting Research Laboratory
 - Planning and Coordination Department

PARENT COMPANY MATSUSHITA ELECTRIC INDUSTRIAL COMPANY, LTD.

Location 1006, Kadoma, Kadoma-shi, Osaka 571
 Telephone 06-908-1121

	1979	1980	1981
Manpower	33,535	31,684	34,495
Sales (Million Yen)	1,734,463	2,015,298	2,346,296
Net Profit (Million Yen)	65,516	73,147	83,612

- Products
- Consumer electronic equipment and components..... 48%
 - Home appliances..... 24%
 - Communication, measuring, and special equipment..... 6%
 - Others..... 22%
 - (Export).....(40%)

R & D ACTIVITIES

The Central Research Laboratory is composed of the Materials Laboratory, the Energy Conversion Laboratory, the Semiconductor Laboratory, the Electronic Appliances Laboratory, and the Lumine Science Laboratory.

The following is a brief description of the research and development activities of each of these laboratories:

- The Materials Laboratory concerns itself with the research and development of solid electrolytes, optical communication, organic functional elements, sensors, and other basic materials; thin film processes, materials engineering technology, and testing and analyzing technology.

- The Energy Conversion Laboratory is pursuing research and development of primary cells, secondary cells, enzyme batteries, electrochemical technology, applied combustion technology, and new energy sources such as hydrogen.

- The Semiconductor Laboratory is promoting the research and development of VLSI technology, high-speed engineering technology using new structural elements, and common basic technology such as ion implantation.

- The Electronic Appliances Laboratory is expanding the development of equipment designed for VTR and microcomputer application and voice processing equipment.

- The Lumine Science Laboratory is promoting the research and development of technology concerning photometry and colorimetry, artistic lighting engineering, luminaire control, etc. The research and development concept focuses on basic technology and also on that technology which will take a long time to develop as well as technology which has comparative risk involved.

The Central Research Laboratory has produced substantial results. Last year, deposition-coated thin film magnetic heads, high-sensitivity humidity sensors, and deposition-coated microcassette tapes were developed. It is noteworthy that the deposition-coated microcassette tape has a magnetic flux density more than ten times as much as the conventional tape, and is presently being used to develop a compact VTR into which a camera can be integrated.

In early 1981, the Central Research Laboratory developed a still picture disc file with a single semiconductor laser capable of recording and reproducing 15,000 still picture frames.

LABORATORY MITSUBISHI ELECTRIC CORPORATION, CENTRAL RESEARCH LABORATORY

(Mitsubishi Denki Chuoh Kenkyu-sho)
 Location 80, Nakano, Minami-shimizu, Amagasaki, Hyogo 661
 Telephone 06-491-8021

	1979	1980	1981
Manpower	-	-	448
Expenditure (Million Yen)	-	-	19,700

Activities

- Administrative Department
- Projects Management Office
- Energy Science and Technology Department
- Advanced Device Technology Department
- Electromechanical Technology Department
- Systems Control and Information Sciences Department
- Microcomputer Education Center

PARENT COMPANY MITSUBISHI ELECTRIC CORPORATION
 Location 2-3, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100
 Telephone 03-218-2111

	1979	1980	1981
Manpower	49,282	48,288	47,875
Sales (Million Yen)	934,712	1,075,446	1,221,397
Net Profit (Million Yen)	14,502	25,106	23,191

- Products
- Electric home appliances..... 26%
 - Electronic and industrial equipment..... 32%
 - Heavy electrical machinery..... 25%
 - Standard electric equipment..... 17%
 - (Export)..... (19%)

R & D ACTIVITIES

During the 1980s, the Mitsubishi Electric Corporation aims to meet social and market needs with new products by making the most of modern technology in energy, electronics, and materials. The company will give attention to closer and more effective relationships between the plants, the sales division, and the laboratories linking the newly developed technologies with commercial enterprises. The premises of the central laboratories are, (1) to establish and improve basic and long-term technological foundations for development of new products as well as for qualitative betterment of existing products and, (2) to prepare for technology needed for the future.

The main R&D emphasis is on the development of optoelectronics, sensors, systems engineering, artificial intelligence, biotechnology, and superconductive technology.

Young researchers are given difficult assignments and responsibilities in order to develop their ability and creativity and, in due course, project team leaders will be selected from them.

The laboratories puts high value on team work rather than individual endeavors because the sophisticated technology mentioned above can not be developed without group effort. Another undertaking of the laboratories is to train engineers in the development of overall skills so that they can easily be rotated from one plant to another in order to work on various projects. This system greatly helps bring research and development and production closer and ensures the smooth transfer of technology. In fact, those engineers who have learned computer operations have been contributing a great deal to the improvement of production techniques and the development of new products.

LABORATORY NIPPON ELECTRIC COMPANY, LTD., RESEARCH AND DEVELOPMENT GROUP

(Nippon Denki Kenkyu Kaihatsu Gurūpu)
 Location 1-1, Miyazaki 4-chome, Takatsu-ku, Kawasaki, Kanagawa 213
 Telephone 044-855-1111

	1979	1980	1981
Manpower	-	-	800
Expenditure (Million Yen)	-	-	8,100

Activities R&D Administration Division
 R&D Planning and Technical Service Division
 Basic Technology Research Laboratories
 Optoelectronics Research Laboratories
 Computer and Communication Systems Research Laboratories
 Software Product Engineering Laboratory
 Resources and Environmental Protection Laboratory
 Scientific Computer Center

PARENT COMPANY NIPPON ELECTRIC COMPANY, LTD.
 Location 33-1, Shiba 5-chome, Minato-ku, Tokyo 108
 Telephone 03-454-1111

	1979	1980	1981
Manpower	31,106	31,625	32,800
Sales (Million Yen)	615,440	719,773	892,810
Net Profit (Million Yen)	7,612	13,131	18,045

Products Communication systems and equipment..... 39%
 Industrial electronic systems and computers..... 27%
 Electronic devices..... 25%
 Home electronics and others..... 9%
 (Export)..... (30%)

R & D ACTIVITIES

In meeting the challenges of the computer and communication age (C&C), the Nippon Electric Company (NEC) has regrouped its central laboratory into two parts: One part, the Research and Development Group, strives for further development of basic technology. The second, the Production Technology Development Group, pushes for the improvement of production technology.

The Research and Development Group's focus is to further the development of basic technology or "the day after tomorrow's techniques." The Production Technology Group continually strives toward improvement of today's production technology. Twice each year, these two groups hold technological strategy exchange conferences attended by representatives from each group to discuss technology and research in an effort to solve some of the problems encountered by each group.

The future research projects of the Research and Development Group in basic technology includes the development of VLSIs, compound semiconductors, superlattice devices, and other new functional devices. Research in communication will include image, data, and voice communication as well as the fundamental study on fifth generation computers with intelligence and information processing functions and a VLSI-incorporated computer system. The distributed data processing system configuration is also included in this research. Seemingly, from the age of microelectronic technology emerges the age of optoelectronics technology. The Optoelectronics Laboratory is now heavily involved in the optoelectronic device development.

LABORATORY OKI ELECTRIC INDUSTRY COMPANY, LTD., RESEARCH
 LABORATORY
 (OkI Denki Kogyo Kiban Gijutsu Kenkyu-sho)
 Location 550-5, Higashi-Asagawa-machi, Hachioji, Tokyo 193
 Telephone 0426-63-1111

	1979	1980	1981
Manpower	-	-	200
Expenditure (Million Yen)	-	-	2,000

Activities

- Materials Laboratory
- Electronic Parts Development Laboratory
- Telecommunication Laboratory
- Functional Device Laboratory
- Information Processing Equipment Laboratory
- Special Projects Laboratory

PARENT COMPANY OKI ELECTRIC INDUSTRY COMPANY, LTD.
 Location 7-12, Toranomom 1-chome, Minato-ku, Tokyo 105
 Telephone 03-501-3111

	1979	1980	1981
Manpower	12,317	11,868	12,000
Sales (Million Yen)	136,685	165,501	186,075
Net Profit (Million Yen)	1,380	3,061	3,909

Products	Electronic office equipment.....	37%
	Telephone and telephone exchange system..	22%
	Electric and electronic parts.....	14%
	Radio and transmission systems.....	8%
	Others.....	19%
(Export).....	(12%)	

R & D ACTIVITIES

The laboratory is conducting studies on the development of metal oxide semiconductors (MOS), integrated circuits (IC) using compound semiconductors such as gallium arsenide.

The respective research divisions are:

- The Material Research Division develops and evaluates material in chemical, electronic, and metallurgical research. This also includes proto-resistant materials for very large-scale integrated circuits (VLSI).
- The Parts Research Division is involved in the development of gallium arsenide semiconductors, laser oscillation of long wavelength bands for optical communication, and of short wavelength bands for data processing systems, and amorphous silicon studies.
- The Communication Device Research Division is developing various devices for electronic exchange systems in mobile telephones (car telephones, etc.) optical circuits, and optical exchange systems.
- The Functional Device Research Division deals with the devices used for terminals for computer-based communication. The printing head for the printer is one of the company's developments. This division is also engaged in the development of the current-driven-type magnetic bubble memory.
- The Information Processing Equipment Research Division is carrying out studies on the basic technology of device manufacturing. More specifically, this division is investigating techniques relative to voice synthesis, voice recognition, voice analysis, image recognition, graphic recognition, and graphic processing (facsimile) and the manufacture of the devices for testing purposes.

The most productive result of the laboratory's research efforts have been the heat sensitive recording system (thermal printer) and the light emitting diode (LED) printer using LED array. The latter development was in conjunction with the Nippon Telegraph and Telephone Public Corporation (NTT). These printers have high accuracy graduation and two-color print. Also, the microwave IC (MIC) for the mobile telephone is being well-received as a compact and highly efficient power amplifier.

LABORATORY OMRON TATEISHI ELECTRONICS COMPANY, CENTRAL
 RESEARCH AND DEVELOPMENT LABORATORY
 (Tateishi Denki Chuoh Kenkyu-sho)
 Location 20, Igadera, Shimokainji, Nagaokakyo, Kyoto 617
 Telephone 075-921-5111

	1979	1980	1981
Manpower	-	-	700
Expenditure (Million Yen)	-	-	8,000

Activities

- Electronic Parts Group
- Electron Device Group
- Electron Equipment Group
- Technical Center for System Development
 - Control equipment
 - Traffic station system
 - Banking system
 - Distribution system
 - Traffic control system

PARENT COMPANY OMRON TATEISHI ELECTRONICS COMPANY
 Location 10, Hanazono Tsuchido-cho, Ukyo-ku, Kyoto 616
 Telephone 075-463-1161

	1979	1980	1981
Manpower	4,618	4,569	4,575
Sales (Million Yen)	101,139	125,160	149,022
Net Profit (Million Yen)	2,747	5,055	8,312

Products

- Electronic control components systems.... 65%
- Information control systems (automatic traffic control systems and automated banking devices, etc.)..... 20%
- Retail systems..... 12%
- Medical and consumer products..... 3%
- (Export)..... (16%)

R & D ACTIVITIES

The Central Research and Development Laboratory of the Omron Tateishi Electronics Company is involved in new projects which it is hoped will meet the company's sales goal of 500.0 billion yen by the end of the 1980s. Its R&D efforts display a history of labor-saving technology which centers on cybernation developments, such as the automatic meal ticket vending machines and money exchangers (1963), the automatic ticket clipping machines (1965), the cash dispensers (1969), and the automatic deposit withdrawal machines (1978). Along with the progress made in producing these machines, significant work has been done on contactless switches, noncontactor relays, and coinage discrimination technology that the company developed during the period of 1955-1964.

Tateishi has extended automation to the field of medical electronics. Achievements such as the development of the automatic Oriental medicine physical therapy diagnostic machines (1965), the automatic cancer cell diagnostic machines (1967), the automatic blood cell analyzers (1977), the adoption of video systems for large-scale data processing in 1980 are notable.

Tateishi is applying integrated circuits (IC) systems widely to control equipment. Photoelectric switches, contactless switches, timers, and counters are the main R&D efforts of imparting artificial intelligence to control equipment. Efforts are also being applied toward the sophistication of sequence controllers by adding arithmetic functions. This laboratory is well-aware of the growing importance of full control systems (input - control - output); therefore, it is stressing the development of sensors. In addition to voice composition which is already feasible, voice recognition studies are being conducted.

INSTITUTION PIONEER ELECTRIC CORPORATION, ELECTRIC ENGINEERING
RESEARCH LABORATORY
(Pioneer Gijutsu Kenkyu-sho)

Location 2610, Hanazono 4-chome, Tokorozawa, Saitama 359
Telephone 0429-42-1151

	1979	1980	1981
Manpower	-	-	180
Expenditure (Million Yen)	-	-	2,000

Activities

Research Planning Office

Administrative Office

Research Division 1 - Acoustic materials and acoustic transducer

Research Division 2 - Electronic and mechanical complex technology

PCM (Pulse Code Modulation) Division

Patent Division

PARENT COMPANY PIONEER ELECTRONIC CORPORATION
Location 4-1, Meguro 1-chome, Meguro-ku, Tokyo 153
Telephone 03-494-1111

	1979	1980	1981
Manpower	5,722	6,184	6,683
Sales (Million Yen)	181,394	224,633	268,699
Net Profit (Million Yen)	12,138	15,081	16,242

Products

Home audio products.....	57%
General audio products.....	39%
Others.....	4%
(Export).....	(53%)

R & D ACTIVITIES

The Pioneer Electronic Corporation, a leading audio equipment maker and audio specialist, is becoming a general electronics maker launching into fields such as the manufacturing of video disks, CATVs, etc.

The R&D tasks which the company is presently focusing on are: research on PCM (pulse code modulation), digital audio equipment, electroacoustic transducers, PCM compact disks, speaker diaphragms, magnetic head materials, and optical materials.

For future projects, the company is studying various systems for CATV as well as systems for optical disk players and the peripheral technology.

The Electronic Engineering Research Laboratory of the Pioneer Electronic Corporation is not merely the crux of the company's R&D activities, but also is requested to play an important role in developing new technology. Noteworthy technological developments from this laboratory are many. To mention a few, the hipolymer piezoelectric device which uses polyvinylidene fluoride, a film which can reproduce sound from a sound source for headphone use; 1 mm-thick carbon graphite used as diaphragm material; ribbon line dust for head material which is superior to amorphous substances and is ready to be mass produced; vertical-type cassette decks operable from the front and not subject to the impact of gravity effects on bearings and motor. Pioneer has also successfully completed commercial tests of a two-way CATV system in the United States in collaboration with the Warner Cable Company.

LABORATORY SANYO ELECTRIC COMPANY, LTD., RESEARCH CENTER
(Sanyo Denki Chuoh Kenkyu-sho)

Location 1-18-13, Hashiridani, Hirakata, Osaka 573
Telephone 0720-41-1161

	1979	1980	1981
Manpower	-	-	300
Expenditure (Million Yen)	-	-	6,750

Activities

Research Center
Solar-related technology
Batteries
Video equipment
Information processing systems
Computers
Semiconductors
Electronic materials and components
Lasers
Precision engineering

PARENT COMPANY SANYO ELECTRIC COMPANY, LTD.
Location 2-18, Keihan Hondori, Moriguchi-shi, Osaka 570
Telephone 06-991-1181

	1979	1980	1981
Manpower	15,477	15,409	16,548
Sales (Million Yen)	584,056	680,590	752,403
Net Profit (Million Yen)	15,126	21,152	23,947

Products Electronic equipment..... 55%
Electric home appliances..... 31%
Commercial electric equipment..... 9%
Gas appliances and heating equipment..... 2%
Others..... 3%
(Export)..... (55%)

R & D ACTIVITIES

Since its inauguration in 1959, the Research Center of Sanyo Electric Company has placed emphasis on "originality" on which it bases its research. The Research Center includes a research and development division for mass production which is now used on an experimental basis. This division came into existence in order to link research results with mass production of marketable items.

The Kuwano Laboratory at the Research Center has captured worldwide attention with its successful development of an amorphous silicon solar battery (10 cm square with a conversion efficiency of 5%).

High hopes are being placed in the future use of fuel cells because of their high efficiency and nonpollution aspects. The Sanyo Electric Company started research on such cells in 1959 using hydrazine, but presently concentrates its efforts on phosphoric acid type cells.

The technology of lithium/manganese dioxide batteries, which this Research Center developed in 1975, is well-known internationally. In the field of semiconductors, the technology for nonvolatile memory using molybdenum gates was perfected by the Sanyo Electric Company.

The application of molybdenum is now becoming the key element for VLSI technology, and the Sanyo Electric Company plans to develop even more sophisticated technology in this particular field. The light emitting diode (LED), which gives forth different colors, (from green to red) was produced in 1980. In the LED field, the Sanyo Electric Company is well ahead in technological development. In regard to color facsimile which was developed in May 1981, the company has developed its own on-demand type color ink jet recording system.

The Sanyo Electric Company is now interested in the development of optical communication and medical equipment. It is presently engaged in developing nuclear magnetic resonance computer tomography. The company's technology headquarters also includes patent centers.

LABORATORY SHARP CORPORATION, ADVANCED DEVELOPMENT AND PLANNING CENTER

(Sharp Chuoh Kenkyu-sho)

Location 2613-1, Ichinomoto-cho, Tenri, Nara 632

Telephone 07436-5-1321

	1979	1980	1981
Manpower	-	-	370
Expenditure (Million Yen)	-	-	13,800

Activities

Materials Research Group	Development application of new materials, crystalization, and amorphous filming
Devices Research Group	Semiconductor lasers, new display devices, thin film magnetic elements, sensors, sensitive materials
Systems Development Group	Technology for new devices and studies of their application
Semiconductor Research Laboratory	LSI materials and devices
Production Technology Laboratory	New production methods, automation and ultraprecise processing, mechatronics, and system production

PARENT COMPANY SHARP CORPORATION
 Location 22-22, Nagaika-cho, Abeno-ku, Osaka 545
 Telephone 06-621-1221

	1979	1980	1981
Manpower	11,403	12,092	13,327
Sales (Million Yen)	339,635	395,246	501,402
Net Profit (Million Yen)	8,648	12,526	16,289

Products	Industrial equipment..... 34%
	Household electrical appliances..... 21%
	Electronic equipment..... 27%
	Audio equipment..... 18%
	(Export)..... (56%)

R & D ACTIVITIES

The Advanced Development and Planning Center (ADPC) is the unit responsible for developing products from "seed" with special emphasis on R&D efforts to develop new materials. Taking part in the MITI-sponsored "Sunshine Project," the Sharp Corporation displays its diversity in fields such as optoelectronics applied to the solar cell; the liquid semiconductor laser; optical fibers; liquid crystals; LED (light emitting diodes); and EL (electroluminescence).

The Sharp Corporation is also reputed for its technological base in microcomputers and CMOS for LSI and recently has succeeded in developing a 256 kB, high- ee AM with an N-well which forms the N field on substrates.

The most significant development in the Center's history, of about 20 years, is the development of the desk-top calculator. In 1963, the Sharp Corporation succeeded in mass producing solar cells, and in 1975, placed them in Japan's first satellite.

In the 1980s, development themes have rapidly proliferated. Hence, the Sharp Corporation has adopted the "urgent" project systems. When ADPC's new technology committee and the new life (business) committee reach mutual agreement on development of products to meet new needs then the "urgent" projects (now numbering 30) come into being. Usually one project is supposed to be completed within one year's time.

The ADPC is increasing its technology base and at the same time being cautious in selecting development themes. The Sharp Corporation is directing attention to energy and information processing technology with ADPC being fully prepared for new developments in the fields of semiconductors, computers, telecommunications, household and business data processing (specifically software).

R & D ACTIVITIES

Sony Corporation, the world pioneer in transistor radios, has been leading the field in "consumer electronics." The success of the Sony Corporation is due in some aspects to its Research Center. The Research Center was setup in 1969 absorbing the former research division. The purpose was to solidify the company's research foundation--both in name and in reality. Currently it is stressing research and development of gallium arsenide and other compound semiconductors. Magnetic recording and reproducing devices are Sony's developments. The company is also conducting intensive research in optical memory materials which are considered "postmagnetic" materials--such as optical disc, holography, etc. In the field of VTR, it is conducting research into various systems as well as its own, the Betamax. In the new materials area, R&D efforts are focused on optical materials and also on magnetic, inductive, organic, and amorphous metals.

Some of the recent achievements are: the CCD (charge coupled device), the color video camera, the bimorph cell piezoelectric material, the Tricon (image pickup tube), the surface acoustic wave device for tuning, the technology for ferrite monocrystal development through the floating zone high-frequency heating method, development of a triple roll quenching process for amorphous metals, and a new annealing process used for gallium arsenide to avoid surface defects caused by ion implantation.

The company maintains a measure of flexibility in R&D expenditures (4-5% of sales) and laboratory setup. The Research Center chief is convinced that good R&D results are born of a good, delicate balance between the vitality and creativity of researchers and strict quality control of the product.

LABORATORY TOSHIBA CORPORATION, TOSHIBA RESEARCH AND DEVELOPMENT CENTER

(Tokyo Shibaura Denki Sohoh Kenkyu-sho)
 Location Toshiba-cho 1-chome, Komukai, Kawasaki, Kanagawa 210
 Telephone 044-511-2111

	1979	1980	1981
Manpower	-	-	1,350
Expenditure	-	-	15,000

(Million Yen)

Activities Planning, Research Administration, Patent Operation, Coordinating Department, Engineering Service Department.

- Metals and Ceramics Laboratory - structural materials, functional materials
- Chemicals Laboratory - electric and electronic materials, organic functional polymers
- Materials Application Department - material construction, material evaluation
- Electron Devices Laboratory - semiconductor materials, semiconductor devices
- Integrated Circuits Laboratory - LSI devices, IC process technology
- Hybrid Functional Circuits Development Department - electroceramics, thin and thick film devices
- VLSI Application Department
- Electronics Equipment Laboratory - communication systems, medical electronics
- Information Systems Laboratory - computer hardware/software, Japanese language processing
- Recording Media and System Development Department
- Energy Science and Technology Laboratory - superconductor application and cryogenics, nuclear fusion
- Mechanical Engineering Laboratory - uranium gas centrifuge, mechanical engineering
- Special Studies Laboratory
- Sawazaki Research Laboratory

PARENT COMPANY TOSHIBA CORPORATION
 Location 1-6, Uchisaiwai-cho 1-chome, Chiyoda-ku, Tokyo 100
 Telephone 03-501-5411

	1979	1980	1981
Manpower	62,784	63,882	63,823
Sales (Million Yen)	1,240,023	1,427,670	1,547,611
Net Profit (Million Yen)	19,403	41,039	44,238

Products	Electric home appliances.....	35%
	Heavy electrical machinery.....	37%
	Communications and electronic equipment..	28%
	(Export)..... (23%)	

R & D ACTIVITIES

Energy and electronics (E&E), the essence of technological development for the 1980s, in which the Tokyo Shibaura Electric Company, (Toshiba) is placing its technology research priorities. The Toshiba Research and Development Center is increasing its research and development projects to meet this new impetus.

The push of the energy-related research projects of the Toshiba Research and Development Center include research on the safety of nuclear power systems and the development of new energy sources such as nuclear fusion, solar cells, geothermal power generation, and ocean-thermal power generation. The electronics research projects include the development of new technology as represented by VLSI, three-dimensional elements, superlattice devices, and other new functional devices. The optoelectronics research projects are focused on the development of optical devices.

The Center is also supporting various other research and development projects in the fields of home electronics and office automation.

Of the across-the-board research and development activities promoted by the Toshiba Research and Development Center, 45% is accounted for by on-going programs and the remaining 55% by those commissioned by the various departments of the company.

The Center pays special attention so that the promotion of L&E research and development projects be predicated upon the progress of materials science such as in ceramics, materials design, and engineering technology in order to develop materials of the performance and characteristics best suited to specific applications. These scientific applications include fabrication technology such as ultraminiaturization and ultrahigh precision machining that will provide substance and form to the advancement of electronics, and the productivity of systems software.

LABORATORY VICTOR COMPANY OF JAPAN, LTD., AUDIO ENGINEERING RESEARCH LABORATORY

(Nippon Victor Onkyo Gijutsu Kenkyu-sho)
 Location 1766-1, Otsu 1-go, Tsuruma, Yamato, Kanagawa 242
 Telephone 0462-74-2121

	1979	1980	1981
Manpower	-	-	90
Expenditure (Million Yen)	-	-	1,400

Activities

Recording Group

Playback Group

Deck Group

Materials Group

PARENT COMPANY VICTOR COMPANY OF JAPAN, LTD.
 Location 4-1, Nihonbashi Honcho, Chuo-ku, Tokyo 103
 Telephone 03-241-7811

	1979	1980	1981
Manpower	7,546	7,797	8,730
Sales (Million Yen)	187,383	254,047	361,795
Net Profit (Million Yen)	3,838	7,893	14,377

Products

Audio products (stereos, tape decks, radio cassette recorders, etc).....	30%
TVs.....	13%
VTRs and VCRs.....	50%
Electronic instruments (sound equipment, musical instruments, etc.).....	4%
Phonograph records and music tapes.....	3%
(Export).....	(65%)

R & D ACTIVITIES

The Research Laboratory was founded on the concept of "selling music" by establishing both hardware and software technology that meet changing musical tastes of the public which run the gamut of the audio processes of recording to audio reproduction. In fiscal year 1981, the company earmarked 14.5 billion yen for research and development activities (excluding equipment investment), 10% of which is allocated to this laboratory.

The CD-4 and related technology was developed for peripheral equipment and measuring instruments; for example, the "Shibata" stylus, developed for stable 4-channel sound reproduction. This technology has led to better disk-cutting styli. The adaption of a cutting stylus with a diamond (conventionally sapphire) can improve the range upward by 10 kHz. The CD-4 development has also given impetus to the development of various measuring instruments. Among them is the two-beam interference system developed to accurately determine how the 30 kHz carrier signal for the CD-4 differential signal is cut; the pulse train system which measures the phase and delay characteristics of demodulation signals of sound reproduction; the phase moire system for measuring the propagation of sound waves from speakers.

The technological development of this laboratory of peripheral equipment has led to the development of the automatic noise reduction system for tape recorders which adopts the Dolby-C system for various speaker systems, the zoom microphone, the turbo stabilizer turntable, the world's first PCM (pulse code modulation) compact cassette deck. Research in "biophonic" technology is being carried out by this laboratory. Technology for stereophonic reproduction of binaural programs has already been developed.

LABORATORY YASKAWA ELECTRIC MANUFACTURING COMPANY, LTD.,
RESEARCH AND DEVELOPMENT LABORATORY

(Yasukawa Denki Seisaku-sho Kaihatsu Kenkyu-sho)
Location 2346, Fujita, Yahata-nishi-ku, Kitakyushu, Fukuoka 806
Telephone 093-641-3111

	1979	1980	1981
Manpower	-	-	140
Expenditure (Million Yen)	-	-	2,000

Activities

Mechanical Technology Group
Rotary Machine Control Group
Automation Technology Group
Switch Control Group
Electronics Group
Prototype Development Group
Supporting Group
Analytical Laboratory

PARENT COMPANY YASKAWA ELECTRIC MANUFACTURING COMPANY, LTD.

Location 2346, Fujita, Yahatanishi-ku, Kitakyushu-shi 806
Telephone 093-641-3111

	1979	1980	1981
Manpower	4,592	4,441	4,403
Sales (Million Yen)	58,770	67,495	75,839
Net Profit (Million Yen)	-301	1,523	2,754

Products Heavy electric machines..... 41%
General-purpose electric equipment..... 20%
Electronic and labor-saving machines..... 24%
Others..... 16%
(Export)..... (19%)

R & D ACTIVITIES

This laboratory specializes in five mainstay products:

- variable-speed motors,
- servomotors,
- numerical control (NC) products,
- programmable controllers, and
- industrial robots.

The 60-year history of this company is studded with many achievements, but what is worthy of special mention is the MORTMAN, an industrial welding robot. The development of simple robots started around 1968, and the development of intelligent robots was completed in 1974. Since then the company has held the top position in the development of arc welding robots. In fiscal year 1981, it planned to manufacture 600 units, or double the 1980 figure. Development efforts are now also expanding beyond the welding field.

The Yasukawa Electric Company enjoys a 60% share of of the variable speed motors (VS Series) market, supplying over 20,000 units last year alone. More and more the tendency is for hydraulic servomotors to be used in machine tools and peripheral equipment for computers. The company is now making special efforts toward the development of brushless and linear servomotors

It has been more than a decade ago that industrial robots and servomotors were put to practical industrial use. The fact that these products are in the spotlight today means that researchers ought to be at least ten years ahead of the times--without fearing the "trial and error" process. A technical committee may be inaugurated to invite frank discussions and opinions from among researchers and engineers on future development plans. Yaskawa Electric Industries is also making preliminary advances to universities in order to establish an industry-university cooperation system.

LABORATORY YOKOGAWA ELECTRIC WORKS, LTD., RESEARCH AND DEVELOPMENT DEPARTMENT

(Yokogawa Denki Seisaku-sho Kenkyu Kaihatsu-bu)
 Location 9-32, Nakamachi 2-chome, Musashino, Tokyo 180
 Telephone 0422-54-1111

	1979	1980	1981
Manpower	-	-	?
Expenditure (Million Yen)	-	-	?

Activities

Fundamental Technology Department

- Component technology
- Analytical chemistry
- Semiconductor technology
- Electronic technology
- Materials handling technology
- Data processing technology

Measurement and Control Department

- Process control equipment
- Analytical instruments
- Digital and analog technology
- Measuring instruments
- Design automation
- Medical electronic equipment

PARENT COMPANY YOKOGAWA ELECTRIC WORKS, LTD.
 Location 9-32, Nakamachi 2-chome, Musashino-shi, Tokyo 180
 Telephone 0422-54-1111

	1979	1980	1981
Manpower	3,463	3,489	3,574
Sales (Million Yen)	60,288	69,392	78,358
Net Profit (Million Yen)	1,811	2,527	3,338

Products

Industrial process instruments.....	63%
Measuring instruments.....	19%
Medical equipment.....	17%
Design systems.....	1%
(Export).....	(18%)

R & D ACTIVITIES

The Research and Development Department is, in a sense, a central laboratory. However, the company does not call it a laboratory because the objective of the department is to carry out research activities in close association with production departments.

The department has made many contributions. The SQUID (superconducting quantum interference device) fluxmeter, which utilizes the Josephson junction developed in 1979, can sense extremely weak magnetic fields such as the pulsation of the human heart.

In 1977, the company produced the NQR (nuclear quadrupole resonance) standard thermometer as a result of applied computer technology. The NQR standard thermometer has undergone examinations by the Weight and Measurement Institute of the Agency of Industrial Science and Technology and the National Bureau of Standards of the U.S.A. with an error rate of 1.3 mK in the range of 90 to 396 K (absolute temperature).

For improving recording errors in measurements, the company has developed an ultrasonic position transducer. The position of a servocoder pen is detected and information is fed back by ultrasonic waves. The ultrasonic position transducer obtains an electric signal which represents the pen position by measuring and computing the time required for the ultrasonic wave pulse (generated by the pen position) to be propagated along the magnetostrictive line. The linearity error is as low as within 0.07% to a span of 150 mm.

The company has completed the development of a highly sensitive probe and dynamic filter for ultrasound diagnostic equipment. The probe has high reception capability to penetrate sound waves when placing the piezoelectric device near the acoustic impedance of the human body. The dynamic filter compensates for the fall of the echo frequency due to the propagation loss of sound waves.

LABORATORY YUASA BATTERY COMPANY, LTD., CENTRAL LABORATORY
 (Yuasa Denchi Chuoh Kenkyu-sho)
 Location 6-6, Johsai-cho, Takatsuki, Osaka 569
 Telephone 0726-75-5501

	1979	1980	1981
Manpower	-	-	85
Expenditure (Million Yen)	-	-	928

Activities

- Research Department 1
 Research on secondary batteries (excluding alkaline batteries)
- Research Department 2
 Research on primary batteries and alkaline batteries
 Instrumental measurement and chemical analysis
 Technology management and information control
- Research Department 3
 Research on chargers and power supply systems
- Patent Department
 Patent rights control

PARENT COMPANY YUASA BATTERY COMPANY, LTD.
 Location 6-6, Josai-machi, Takatsuki-shi, Osaka 569
 Telephone 0726-7-5501

	1979	1980	1981
Manpower	3,049	2,969	2,901
Sales (Million Yen)	53,324	62,534	62,225
Net Profit (Million Yen)	792	1,130	1,231

Products

- Lead batteries..... 73%
- Rectifiers..... 9%
- Alkaline batteries... 7%
- Dry batteries and others..... 11%
- (Export)..... (18%)

R & D ACTIVITIES

In 1920, the company started production of batteries for automobiles. Later, the laboratory developed an earthquake-proof battery where a glass fiber mat prevented lead powder from being removed from the grid framework. In 1930 and 1933 respectively, the company received commendations from the Empire Invention Society for this development. The battery was later developed into a clad-type battery that is protected by a glass fiber cylinder.

The laboratory was successful in its operation and display of an electric automobile equipped with its batteries at the Japan World Exposition in 1970. Currently, the laboratory is developing technology that is hoped will drive an electric bus using beta cell batteries. The laboratory has developed the microporous plastic separator, "Yumicron" that is used for batteries and extremely fine filters. Studies are also being carried out on silver batteries that are activated by sea water and on deep-sea oil-immersed batteries.

The laboratory has carried out research on the fuel cell that was developed from the caustic potash electrolyte and which later resulted in development of the beta cell battery. Future research will be centered around a second generation fused carbonate battery. Recently, under a large research project, the laboratory succeeded in developing a beta cell battery using sodium and sulfur. Attempts are being made at reducing the cost of the beta cell battery to that lower than the lead battery. The laboratory is also carrying out studies on electric automobiles and their commercialization.

Investigation is also underway on the accumulation and storage of solar and wind energy. The laboratory is now developing cells that will store excess electricity.

ELECTRIC POWER AND GAS

LABORATORY CHUBU ELECTRIC POWER COMPANY, INC., CENTER OF
TECHNICAL RESEARCH LABORATORY

(Chubu Denryoku Sohgo Gijutsu Kenkyu-sho)

Location 20-1, Kitasekiyama, Ohtaka-cho, Midori-ku, Nagoya, Aichi 459
Telephone 052-621-6101

	1979	1980	1981
Manpower	-	-	130
Expenditure (Million Yen)	-	-	850

Activities

- Administrative Office
- Electric Power Laboratory
- Electric Equipment Laboratory
- Mechanical Laboratory
- Chemical Laboratory
- Nuclear Power Laboratory
- Civil Engineering Laboratory
- Electric Application Laboratory

PARENT COMPANY CHUBU ELECTRIC POWER COMPANY, INC.
Location 1, Toshin-cho, Higashi-ku, Nagoya-shi, 461-91
Telephone 052-951-8211

	1979	1980	1981
Manpower	18,556	18,718	18,783
Sales (Million Yen)	886,453	996,540	1,495,001
Net Profit (Million Yen)	42,893	-24,053	89,934

Products	Industrial power.....	73%
	Lighting.....	23%
	Others.....	4%

R & D ACTIVITIES

Realizing the need for fuels that will replace oil and for technology that will reduce the cost of power generation, the Chubu Electric Power Company has targeted its development of technology relative to atomic power and coal-firing thermal power generation.

The Center of Technical Research Laboratory is placing emphasis on:

- the development of automation equipment and measuring instruments for operation of atomic power generating equipment and for the reduction of radiation doses,
- development of new flue-gas equipment at coal-burning power stations, and
- the production of lightweight artificial aggregate using a large amount of coal ash coming from coal-firing power stations.

As a member of the Central Electric Power Council, the company is involved in basic investigations into districts suitable for development of geothermal energy, technical studies on combined uses of different energy sources in households and factories in the future, and the conceptual drafting of practical-use MW transmission by fuel cells. The development of effective uses for other industries of hot waste water from power stations in cooperation with the MAFF (Ministry of Agriculture and Forestry and Fisheries) specialists; the solution of pollution problems such as exhaust gas, drain water, vibration, and noise are also items of interest to the company.

With a view toward better economics of investment and operations, the Center is investigating the use of large-capacity transmission lines and methods to determine optimum sizes for hydraulic power stations. For a stable power supply, this is being considered in order to raise the reliability of power systems by controlling steam valves in turbines by EVA (early valve actuation) at thermal power stations. The development of lightning bolt warning systems to minimize damage to power distributing equipment or power outages; the development of a technology for reuse of drain water from thermal power stations are also under study.

Among recent successful development projects are: the system for measuring floor surface contamination (jointly with Fuji Electric Company); the lightning bolt warning system; the practical uses of EVA (jointly with Toshiba and IHI); and the trial manufacture of the 100 kW phosphate electrolytic fuel cell system as a TV power source (jointly with Hitachi, Ltd.) using LPG.

All R&D results are put to practical use, and energy-saving data on electric machinery and equipment are made available to users in the Chubu district.

INSTITUTION CHUGOKU ELECTRIC POWER COMPANY, INC., TECHNICAL
RESEARCH LABORATORY

(Chugoku Denryoku Gijutsu Kenkyu-sho)

Location 4-32, Ohsu 4-chome, Minami-ku, Hiroshima 730
Telephone 0822-81-9491

	1979	1980	1981
Manpower	-	-	69
Expenditure (Million Yen)	-	-	621

Activities

Research Administration Office

Electric Research Group

Construction Research Group

Chemical Research Group

Civil Engineering Group

PARENT COMPANY CHUGOKU ELECTRIC POWER COMPANY, INC.
Location 33, Komachi 4-chome, Hiroshima-shi, Hiroshima 732
Telephone 0822-241-0211

	1979	1980	1981
Manpower	10,805	10,823	11,332
Sales (Million Yen)	432,537	478,298	785,799
Net Profit (Million Yen)	25,624	-15,963	40,817

Products Industrial power..... 69%
Lighting..... 25%
Others..... 6%

R & D ACTIVITIES

The laboratory, in order to carry out its research programs, has organized its research investigators into "teams" which in turn can be used for various research "themes" the laboratory is involved in. The proven flexibility of this method contributes highly to the laboratory's overall research and development program.

The laboratory has testing facilities for civil engineering, soil research, hydraulics, and testing for salt damage at Shimonoseki City. The test facilities are equipped with a 3000 kV impact voltage generating unit and other advanced equipment. Not a few machines have been developed by the laboratory, for laboratory use, after improvements were made through technical innovation.

The main areas of research are: the environmental assessment that has been allotted to this company from among the nine electric power companies in Japan, monitoring, hydraulic tests, the application of coal ash to asphalt pavement, the effective use of resources, and new energy saving studies such as solar power generation. Studies are also being conducted in the area of safety improvement of distribution line disconnection detection systems and the electric field under the distribution lines; as well as studies on a remote monitoring control system. In the area of fidelity upgrading, an analysis of ruptures in 500,000 V power lines is being conducted, and for improvement of customer services, studies on a submarine cable failure detection line is being conducted.

The research projects for fiscal year 1981 totaled 51 subjects among which special emphasis was placed on the utilization of coal ash and on energy savings. The submarine cable failure detecting line is to be made available for commercial use in 1982. The future research plans include the utilization of hot effluents, studies on industrial wastes, fuel cells, improvement in earthquake-proof measures, and studies on general automation of distribution lines. Some contributions that this laboratory has made to the public include an FM carrier current relay system, a dispersion-type flashover indicator system, a remote control system for urban distribution lines, and a system of dispersion reactor grounding of distribution lines.

The laboratory allows many of its staff members to visit local colleges and universities in order to facilitate scientific exchange with faculty members.

The company plans to, in the future, increase their common usage of facilities with the three other electric power companies in Japan.

LABORATORY KANSAI ELECTRIC POWER COMPANY, INC., TECHNICAL RESEARCH CENTER

(Kansai Denryoku Sohgo Gijutsu Kenkyu-sho)
 Location 1, Ichinotsubo, Nakohji, Amagasaki, Hyogo 661
 Telephone 06-491-0221

	1979	1980	1981
Manpower	-	-	145
Expenditure (Million Yen)	-	-	8,600

Activities

- Research Administration Section
- Equipment Efficiency Research Section
- Technical Development Research Section
- Energy Conservation Research Section
- Environmental Research Section
- Civil Engineering and Architectural Research Section
- Technical Analysis and Testing Section

PARENT COMPANY KANSAI ELECTRIC POWER COMPANY, INC.
 Location 3-22, Nakanoshima 3-chome, Kita-ku, Osaka 530
 Telephone 06-441-8821

	1979	1980	1981
Manpower	23,645	23,705	23,954
Sales (Million Yen)	1,116,769	1,222,411	1,771,488
Net Profit (Million Yen)	45,869	-18,767	95,661

Products Industrial power..... 74%
 Lighting..... 26%

R & D ACTIVITIES

Some recent achievements of the General Technical Research Laboratory are: the exhaust gas denitrification unit used for thermoelectric power plants; a pump-starting stationary thyristor startor for large capacity power generation; package power generation plants for smaller and lower-cost distribution substations; electric wires that can carry electric current double the capacity as conventional ones.

To be used as one of its research facilities, the company recently added the hydraulic test building which was completed in July 1980. The test building has slope-variable water conduits for hydraulic testing of dam floods, power plant intake and discharge ports; an irregular-wave generating unit for testing of coastal power plant protection breakwaters; and a hot water feed measuring unit. All the units are controlled by minicomputers so as to permit rapid treatment of measurement data.

The laboratory is promoting the development of local energy resources. In July 1981, a wind-power plant named Shiokaze No. 1 was constructed at Shionomisaki at the southernmost point of Japan. It is equipped with the two-vane Darius-type windmill which turns 100 times per minute to generate 6 kW of energy at the wind speed of 10 m per second. In solar light power generation research, the company is carrying out studies on the development of silicon semiconductors with Nippon Electric Company and gallium arsenide semiconductors with Sumitomo Denko. A phosphoric acid fuel cell power generating installation has been manufactured by Fuji Electric for tests at the Sakai Power Plant. The maximum output is 30 kW and is scheduled to be increased to 45% efficiency. The power storage system testing facilities are scheduled to start proof tests in 1984 which will be completed in three years. The facilities of maximum capacity of 1000 kW will enable the development of power storage systems which complement pumping power plants.

The company has also developed a lightning monitoring system with the use of optical fiber aerial wires.

LABORATORY KYUSHU ELECTRIC POWER COMPANY, INC., GENERAL
RESEARCH LABORATORY

(Kyushu Denryoku Sohgo Kenkyu-sho)
Location 497-1, Aizo, Shiobara, Minami-ku, Fukuoka 815
Telephone 092-541-0431

	1979	1980	1981
Manpower	-	-	91
Expenditure (Million Yen)	-	-	916

Activities

- Administrative Office
Research planning, patents, and administration
- Electric Power Laboratory
Research in power equipment
- Electronics Application Laboratory
Research on electronics application and power control systems
- Thermal Power Laboratory
Research in power generation by steam, internal combustion, geothermal, and nuclear energy
- Civil Engineering Laboratory
Research in civil and architectural engineering

PARENT COMPANY KYUSHU ELECTRIC POWER COMPANY, INC.
Location 1-82, Watanabe-dori 2-chome, Chuo-ku, Fukuoka 810-91
Telephone 092-761-3031

	1979	1980	1981
Manpower	14,174	13,919	14,238
Sales (Million Yen)	548,659	612,025	911,787
Net Profit (Million Yen)	20,188	-6,380	46,041

Products Industrial power..... 66%
Lighting..... 32%
Others..... 2%

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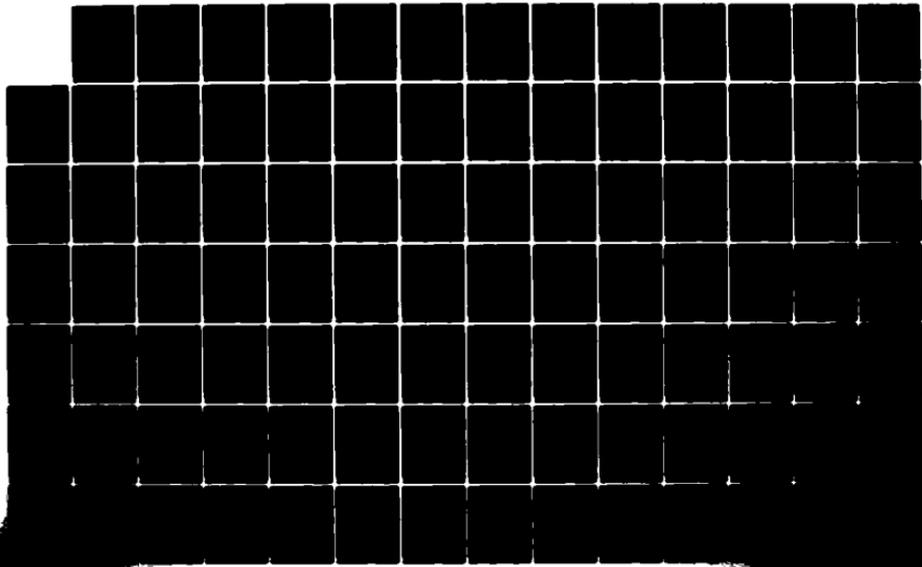
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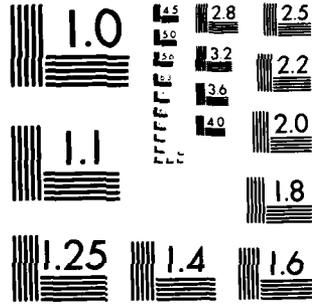
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MICROCOPY RESOLUTION TEST CHART
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R & D ACTIVITIES

One of the notable achievements of the long-term research activities of this laboratory is the control system for thermoelectric power generation plants. The new control system the laboratory has developed is a combination of analog and digital controls which provides for the stabilization of boiler steam temperatures. This system was first put into practical use in the Buzen Power Station No. 1 plant (500,000 kW output) which began operations in 1978.

This system, that combines the power plant control unit with digital computer operation, is able to read data every 30 to 40 minutes such as boiler change commands, the output steam temperature, and internal fluid temperatures. The system can modify boiler control signals by estimating future values of steam temperature and calculating the optimum operating temperature. As a result, load adjustment is improved and the load control of the power system can be achieved more easily with smaller operating losses and reduced steam temperature variation which corresponds to major changes in plant output.

The system is viewed from both industrial and academic groups as a typical application of modern control theory to real plant designing.

In the area of geothermal power generation, the company has made substantial contributions such as the hot water treatment process which has been in use for thirty years. The two geothermal power plants which total about 66,000 kW output are now in operation at the cities of Ohdake and Hatchobara of Ohita Prefecture. Studies are now being conducted in silica scale adherence. In cooperation with Mitsui Metal and Mining Company, a floating separation unit treating 50 tons of water per hour was installed in the Ohdake Power Station in 1981. In the present phase of study, treated hot water is returned to a reducing well in order to check the effects of the treatment.

Research projects for fiscal year 1981 include items such as the modernization of distribution systems, COM fuels, and effective utilization of coal ash. The laboratory is engaged in the effective utilization of coal ash in close cooperation with the other in-plant organizations.

LABORATORY OSAKA GAS COMPANY, LTD., RESEARCH CENTER
(Osaka Gasu Sohgo Kenkyu-sho)

Location 19-9, Torishima 6-chome, Konohana-ku, Osaka 554
Telephone 06-462-1451

	1979	1980	1981
Manpower	-	-	210
Expenditure (Million Yen)	-	-	2,500

Activities

Administration Team

Research Planning Team

Production Technology Team

Vaporization Heat Technology Team

Supply Technology Team

Environment and Safety Team

Materials Team

Chemical Analysis Center

PARENT COMPANY OSAKA GAS COMPANY, LTD.
Location 5-1, Hirano-cho, Higashi-ku, Osaka 541
Telephone 06-202-2221

	1979	1980	1981
Manpower	11,181	11,200	11,167
Sales (Million Yen)	378,956	423,523	572,595
Net Profit (Million Yen)	9,481	2,022	23,630

Products	Gas.....	73%
	Gas appliances.....	11%
	Gas piping.....	5%
	Coke, tar, tar products.....	11%

R & D ACTIVITIES

The company earmarked a total of 9.0 billion yen (fiscal 1981) for research and development. The sum is 1.5% of gross sales with the Research Center taking 2.5 billion yen.

Substitute natural gas (SNG) is the main development target of the Research Center. The development aim is to use light oil and heavy crude, and produce gas from coal, the biomass, and waste material. The gas produced from petroleum presently accounts for only 4% of total gas produced. Natural gas has become significant while coal is being considered as an alternative fuel. In this connection, the development of catalysts is important. Osaka Gas has developed superior catalysts such as RCC and CFC catalysts for gas production from light and heavy oils, SN-108 catalysts for methane gas, SN-208 catalysts for gasification, and hydrodesulfurization catalysts. The technology developed for processing of the heavy crude is the comprehensive heavy ends reforming refinery (CHERRY) and the SN Series. The CHERRY-P process produces methane gas from asphalt slurry. The pilot plant is scheduled to try this process in the autumn of 1983.

In the area of energy savings, air-conditioning systems using engine waste heat are being developed. R&D efforts are being concentrated on the development of lithium bromide refrigerants.

The Research Center has also been engaged for some time in the development of fuel cells that obtain electric power by using hydrogen gas (obtained through cracking natural gas) and oxygen reactants.

R&D activities are being conducted in water treatment technology. One development is the separation and extraction of oxygen from LNG latent evaporative heat and using it to aerate sewage. This technology reduces the amount of sewer mud by two-thirds. The use of LNG latent evaporative heat offers many interesting possibilities in food processing using freezing and refrigerating technology.

Recently this Center developed a new method of lyophilization which is combined with a microwave heat radiation method. This method can reduce freezing time by nearly 50% and subsequently the cost by 30-40%. The Center is also engaged in lyophilization of soybeans for bean curd production.

LABORATORY **SHIKOKU ELECTRIC POWER COMPANY, INC., GENERAL RESEARCH AND DEVELOPMENT CENTER**

Location (Shikoku Denryoku Sohgo Gijutsu Kaihatsu Kenkyu-sho)
Telephone 2109, Yashima-nishi-machi, Takamatsu, Kagawa 761-01
 0878-43-8111

	1979	1980	1981
Manpower	-	-	80
Expenditure (Million Yen)	-	-	1,485

Activities

- Research Planning Office
- Regional Development Laboratory
- Alternative Energy Laboratory
- Sunshine Project Laboratory
- Electric Power Laboratory
- Civil Engineering Laboratory
- Physical and Chemical Laboratory

PARENT COMPANY **SHIKOKU ELECTRIC POWER COMPANY, INC.**
Location 2-5, Marunouchi, Takamatsu-shi, Kagawa 760-91
Telephone 0878-21-5061

	1979	1980	1981
Manpower	6,317	6,494	6,568
Sales (Million Yen)	222,882	247,545	371,680
Net Profit (Million Yen)	11,536	857	19,164

Products

Industrial power.....	74%
Lighting.....	22%
Others.....	4%

R & D ACTIVITIES

The three main areas of interest to the Center and the Shikoku Electric Power Company are:

- the development of technology that will reduce oil dependency,
- the development of electric and civil engineering, physicochemical technology that will improve the efficiency and maintenance of power source units,
- the study of local power demands that is necessary for long-range management planning.

The Civil Engineering Laboratory of this company is unique. It does hydrologic testing which studies the effects of hot waste water from nuclear power plants on sea water, the effects of wave forces on coasts and seashores, and the effects of water on dams. The Center is also studying geological features that will help determine the design of better earthquake proof structures. The hydrologic test equipment has a tidal flow generator, a wave generator, and water passages that have variable grades to make investigations on the effects of various factors in the environment.

The Physical Chemistry Laboratory has an x-ray microanalyzer, an atomic absorption spectrometer, an autoanalyzer, and is engaged in studies on chemical technology, metal materials, electric materials and environmental preservation techniques. The Electric Power Laboratory has other equipment such as the 3,000 kV impulse voltage generator and a simplified anechoic chamber. Studies being carried out on lightning have measured, with photo fibers, precipitous waves of 1 per ms. The anechoic chamber is used to measure noise levels in order to develop controls on noise pollution from power plants and substations.

LABORATORY TOHO GAS COMPANY, LTD., TECHNICAL RESEARCH INSTITUTE

(Toho Gasu Sohgo Gijutsu Kenkyu-sho)
 Location 19-18, Sakurada-cho, Atsuta-ku, Nagoya, Aichi 456
 Telephone 052-871-3511

	1979	1980	1981
Manpower	-	-	97
Expenditure (Million Yen)	-	-	620

Activities

Komei Research Laboratory
 New technology team
 Production technology team
 Analytical and service team

Sakurada Research Laboratory
 Equipment operation team
 Equipment development team
 Improvement and quality control team

PARENT COMPANY TOHO GAS COMPANY, LTD.
 Location 19-18, Sakuradacho, Atsuta-ku, Nagoya, Aichi 456
 Telephone 052-871-3511

	1979	1980	1981
Manpower	3,461	3,558	3,636
Sales (Million Yen)	87,401	94,836	126,200
Net Profit (Million Yen)	2,555	737	4,836

Products
 Gas..... 75%
 Coke..... 10%
 Gas appliances and others..... 15%

R & D ACTIVITIES

The Technical Research Institute is involved in a variety of projects.

In order to utilize the low temperature technology brought about by LNG production, the institute is setting up a fine grinding plant where obsolete gas devices will be cracked at low temperatures to recover costly metals such as copper. There are plans also for a plastics pulverizing plant that utilizes low temperature technology. A test plant has also been constructed to test coke dry quenching (CDQ) processes and gather necessary data to study how to effectively utilize the waste heat from coke furnaces.

With a view to establishing techniques of producing city gas using material other than LNG, the institute is conducting studies on a "substitutional" natural gas production plant which will use naphtha, coke, coal, and heavy crude oil for gas manufacturing. Plans are also being made for the combined use of solar energy and city gas as power sources for air conditioners and hot water heaters.

In order to save energy, and improve the comfort of homes, a highly efficient heating and hot water supply system is being developed. The institute has joined in a project with other city gas producers and gas device manufacturers to develop a household gas cooling and heating system using a gas engine.

In order to utilize city gas as industrial energy, the institute is developing a new energy-saving type of industrial furnace to be used for melting, heat treatment, forging, drying and cutting. It is also developing safety devices that include cocks, connectors, and gas leakage sensors. Studies are also being conducted on an extensive energy supply plan in which generators and refrigerators will be driven by gas engines and waste heat from such gas engines will be efficiency utilized for various purposes.

The institute has developed the city gas air conditioner for small- and medium-sized buildings which has energy savings of about 35% as compared with the conventional ones; city gas leakage sensors, energy-saving slim hot water supply devices which can occupy small spaces, and a city gas forging furnace utilizing a high speed burner.

LABORATORY TOHOKU ELECTRIC POWER COMPANY, INC., GENERAL
RESEARCH AND DEVELOPMENT CENTER

(Tohoku Denryoku Sohgo Kenkyu-sho)
Location 2-1, Nakayama 7-chome, Sendai, Miyagi 980
Telephone 0222-78-0356

	1979	1980	1981
Manpower	-	-	75
Expenditure (Million Yen)	-	-	600

Activities

Research Administration Section

Operation Research Section

Electric Power Research Section

Application Research Section

PARENT COMPANY TOHOKU ELECTRIC POWER COMPANY, INC.
Location 7-1, Ichiban-cho 3-chome, Sendai, Miyagi 980
Telephone 0222-25-2111

	1979	1980	1981
Manpower	12,883	12,544	12,396
Sales (Million Yen)	538,039	600,468	943,558
Net Profit (Million Yen)	25,956	-8,069	49,450

Products	Industrial power.....	60%
	Lighting.....	35%
	Others.....	5%

R & D ACTIVITIES

The Research Center is focusing on research and development which can be put to practical use. One of its developments is the system that estimates noise emanating from power generating plants. This system (implemented in 1975) is designed to estimate the volume of noise at thermal power or atomic power stations and work out effective countermeasures for environmental control. Due to its high reliability, other power companies have shown significant interest in adopting the system for their plants.

The development of a system that locates trouble spots in transmission lines won the coveted Ohm Technical Award for 1980, and the system has now been adopted by other power companies. In 1979, the company won the Shibusawa award for its cable insulation degradation measuring equipment which can significantly prevent power cable accidents. The laboratory has, since its inception, won eight awards for R&D efforts related to power facilities.

The "Net Rainer" also deserves special mention. It is the dripping net-type equipment designed for heating and cooling greenhouses that require low temperatures for garden plants and mushrooms. This system can reduce greenhouse maintenance costs to one-fifth of that of the oil-burning hothouse heating and cooling system.

One unique R&D development result has been the farming of young abalones living in hot waste water from thermal power stations. The Sendai thermal power station ships out about 1.8 million young abalones per year. Exhaust gas desulfurization gypsum is also an interesting development, and it is now being used in tiles for interior decoration. This Center is well-equipped with various analyzers for R&D activities and also has facilities for river and seashore hydrologic experiments necessary for basic research.

LABORATORY TOKYO GAS COMPANY, LTD., RESEARCH AND DEVELOPMENT
INSTITUTE

(Tokyo Gasu Gijutsu Kenkyu-sho)
Location 16-25, Shibaura 1-chome, Minato-ku, Tokyo 105
Telephone 03-452-2211

	1979	1980	1981
Manpower	-	-	162
Expenditure (Million Yen)	-	-	3,100

Activities R&D Planning Office
Administration Office
Production and Analysis Laboratory
Gasification Laboratory
Piping Research Laboratory
Combustion Research Laboratory
Materials Research Laboratory
Metrological Laboratory

PARENT COMPANY TOKYO GAS COMPANY, LTD.
Location 2-16, Yaesu 1-chome, Chuo-ku, Tokyo 103
Telephone 03-273-0111

	1979	1980	1981
Manpower	13,034	13,093	13,047
Sales (Million Yen)	428,478	464,271	638,449
Net Profit (Million Yen)	13,296	1,749	26,643

Products Gas..... 79%
Gas appliances..... 11%
Gas piping..... 6%
Coke..... 4%

R & D ACTIVITIES

The use of liquefied natural gas is one of the major factors in Japan's energy supply mix. Now liquefied natural gas is utilized not only for cooking and heating but for industrial purposes as well. Therefore, much is expected from technical developments in this field. To meet these newly developed requirements, the Research and Development Institute is promoting activities which includes basic research and domestic and foreign joint studies.

New research requirements are discussed at management level to determine short-, medium- and long-term plans. The areas of research assigned to the institute are classified according to categories. Currently, fundamental research is classified into three categories.

First, is the study about the relative degree of safety of gas to that of electricity. Second, the value of gas energy is to be reviewed. This research is related to the techniques of conversion of latent energy and current developments in the industrial field. Third, investigations are being carried out on how to diversity gas resources to meet the worldwide shortage of resources. In this connection, the decomposition of heavy crude oil and the gasification of coal are being studied. This research is sustained through basic studies on measurement, analysis, and the study of conduits containing gas lines.

The institutes' studies on gas lines, which accounts for 60 percent of the firm's fixed assets, have achieved successful results. Once buried underground gas lines must remain in good condition for about one hundred years. Data on the deterioration characteristics of gas lines such as corrosion and corrosion resistance, and studies on subsidence are being analyzed. The study of the properties of gas lines and how they respond to the impact of earthquakes is a topic of worldwide interest which is also of strong interest to the institute.

The institute received the Ota Prize from the Japan Gas Association for three research areas in 1979 and for two research areas in 1980.

FILM

LABORATORY FUJI PHOTO FILM COMPANY, LTD., MIYANODAI RESEARCH LABORATORY

(Fuji Shashin Fuirumu Miyanodai Gijutsu Kaihatsu Sentah)

Location 798, Miyanodai, Kaisei-machi, Ashigara-kami-gun, Kanagawa 258
Telephone 0465-83-7111

	1979	1980	1981
Manpower	-	-	345
Expenditure (Million Yen)	-	-	9,000

Activities

Materials Development Group

Systems Development Group

PARENT COMPANY

FUJI PHOTO FILM COMPANY, LTD.

Location 26-30, Nishiazabu 2-chome, Minato-ku, Tokyo 106
Telephone 03-406-2111

	1979	1980	1981
Manpower	10,518	10,377	10,620
Sales (Million Yen)	312,226	404,579	446,807
Net Profit (Million Yen)	12,848	15,730	36,151

Products

Film..... 49%
Photographic paper and photochemicals.... 20%
Noncarbon duplicating paper..... 6%
Presensitized plates..... 7%
Cameras and optical products..... 12%
Magnetic tapes..... 6%
(Export)..... (32%)

R & D ACTIVITIES

The company earmarks about 6% of its total sales for R&D activities, a little over one-third of which goes to this laboratory.

This recently established laboratory emphasizes new development projects. In the field of materials, it is involved in research activities on semiconductors and their uses as image sensors. The development of systems will center on image electronic equipment, photography equipment, and measuring instruments. To cope with the need for larger storage space and memory banks, and more efficient retrieval of information, the laboratory has developed the "Fuji Film Laser COM System," which is based on laser diode film and laser scanning technology and is directly related to computerization.

In printing research, the laboratory is now developing a new scanner system for the direct photoengraving process.

The newly developed x-ray photography system has been highly evaluated for its clear pictures and low exposure doses. This system records and x-ray photographs; the picture is resolved into minute dots then shaded through the digital signal method, and reproduced through the aid of a computer. This system lowers the exposure rate and enables doctors to easily detect a nidus.

This laboratory will also continue to place emphasis on the development and manufacture of more sophisticated equipment for color film processing, x-ray processors, graphic processors, and microfilm equipment.

FOODSTUFFS

LABORATORY AJINOMOTO COMPANY, INC., CENTRAL RESEARCH
LABORATORY

(Ajinomoto Chuoh Kenkyu-sho)

Location 1, Suzuki-cho 1-chome, Kawasaki-ku, Kawasaki, Kanagawa 210
Telephone 044-222-1111

	1979	1980	1981
Manpower	-	-	583
Expenditure (Million Yen)	-	-	5,250

Activities Microbiological research
 Chemical research
 Analytic-chemical research
 Process engineering
 System analysis
 Information service
 Sensory test
 Food development
 Fat and oil research
 Life sciences laboratories

PARENT COMPANY AJINOMOTO COMPANY, LTD.
Location 5-8, Kyobashi 1-chome, Chuo-ku, Tokyo 104
Telephone 03-272-1111

	1979	1980	1981
Manpower	5,510	5,393	5,422
Sales (Million Yen)	339,637	352,658	374,294
Net Profit (Million Yen)	6,714	8,627	9,746

Products "Ajinomoto" and other seasonings..... 26%
 Oil products..... 23%
 Amino acids..... 9%
 Foodstuffs..... 35%
 Animal feed and others..... 7%
 (Export)..... (7%)

R & D ACTIVITIES

The Central Research Laboratory of the Ajinomoto Company has been conducting studies in biotechnology including genetic engineering for some time.

For example, the Microbiological and Chemical Study Section is involved in research in bacteria and yeasts and in gene recombination. The Analytical Study Section is involved in chemical studies that includes the development of new production processes and the collecting of effective ingredients from natural substances. The Analytical Study Section is also involved in developing safety factors in technology necessary to protect the inhabited environment.

Since its inception, the Ajinomoto Company has been a large glutamic acid producer. In December 1956, based on perceived competition from other firms in the commercial production of glutamic acid, Ajinomoto designed its own laboratory for conducting studies in the production of synthetically fermented glutamic acid. About one hundred researchers worked on the project and in three years time put glutamic acid production into operation.

The laboratories have taken a different approach in its technical development of a food seasoning powder. The laboratories did not resort to the introduction of foreign technology, but developed their own techniques. Now the Central Research Laboratory has reached the stage where they will be able to develop new research based on techniques already acquired.

LABORATORY KIKKOMAN CORPORATION, CENTRAL RESEARCH LABORATORY
 (Kikkoman Chuoh Kenkyu-sho)
 Location 399, Noda, Noda-shi, Chiba 278
 Telephone 0471-24-5151

	1979	1980	1981
Manpower	-	-	250
Expenditure (Million Yen)	-	-	4,000

Activities

Administrative Office

Research and Planning Office

Patent Office

Research Group

- soy sauce group
- mycological group
- pathological group
- food container and storage group
- fermented food analysis group
- fermented products basic research group
- animals experimental laboratory
- food development laboratory

PARENT COMPANY KIKKOMAN CORPORATION
 Location 339, Noda, Noda-shi, Chiba 278
 Telephone 0471-24-1111

	1979	1980	1981
Manpower	3,987	3,936	3,929
Sales (Million Yen)	122,842	123,887	128,881
Net Profit (Million Yen)	3,000	2,127	1,603

Products

Soy sauce.....	62%
Other sauces.....	5%
Foodstuff (tomato ketchup and juices)....	20%
Alcoholic beverages.....	12%
Others.....	1%
(Export).....	(1%)

R & D ACTIVITIES

It is generally said that "shoyu" (soy sauce) has a history of 1,000 years, or its history is Japan's history. The Central Research Laboratory of the Kikkoman Corporation began its research activities in soy sauce in 1904, and the present laboratory was set up in 1962. R&D efforts have centered on the development of quality products for mass production at low costs. One of their achievements is the NK-type protein treatment technique. It is a technology for turning soy beans into soy sauce, boosting the extraction rate from the conventional 60% to 80% without losing the flavor of soy beans.

It is the development of "Molsin," a mold pepsin, antienzyme amylase and other digestive enzymes and oral contraceptives made from cholesterol through the use of a microorganism which significantly brought about the Kikkoman Corporation interest in life sciences. The laboratory has also developed reagents which make diagnosis from blood or serums possible--such as "Maltapentaose" (phonetic) for pancreatitis, and a creatinine and sarcosine oxidase for kidney disease. "Uricase," a hydrolytic enzyme, has been found effective in the treatment of gout.

The Central Research Laboratory is placing increasing emphasis on research in the field of pharmaceuticals. It has already established technology for making, by zymotechnics, cyclic adenosine monophosphate from starch. (Cyclic adenosine monophosphate increases the flow of blood.) It also markets "S-9," a homogenate which is indispensable in checking carcinogenic chemicals. Making the most of fermentation and brewage technology, Kikkoman is also striving to develop antibiotics and anticancer medicines.

A fair amount of the small percentage of gross sales designated for the research and development budget is being earmarked for future research needs. The laboratory is equipped with P-level (possibly will be raised to P.) experimental facilities for DNA recombination research.

LABORATORY **NISSIN FLOUR MILLING COMPANY, LTD., CENTRAL RESEARCH
LABORATORY**

(Nisshin Seifun Chuoh Kenkyu-sho)

Location 177-3, Soto, Tsurugaoka, Ohi-cho, Iruma-gun, Saitama 354
Telephone 0492-61-1111

	1979	1980	1981
Manpower	-	-	210
Expenditure (Million Yen)	-	-	1,700

Activities

- Grain Science Laboratory
- Foods Processing Laboratory
- Animal Husbandry and Fishery Laboratory
- Animal Pathological Analysis Laboratory
- Chemical Laboratory
- Biological Laboratory
- Special Projects Laboratory
- Research Coordination Office
- Administrative Office

PARENT COMPANY **NISSHIN FLOUR MILLING COMPANY, LTD.**
Location 19-12, Nihombashi Koamicho, Chuo-ku, Tokyo 103
Telephone 03-660-3111

	1979	1980	1981
Manpower	-	-	91
Sales (Million Yen)	216,678	239,807	270,251
Net Profit (Million Yen)	4,592	4,272	4,479

Products

- Flour..... 61%
- Formula feeds..... 28%
- Cake, doughnut mixes, and others..... 11%

R & D ACTIVITIES

The Central Research Laboratory, in medical research studies, is attempting to produce vitamins E and K by utilizing chlorophyll. Chlorophyll is reported to be effective in treatment of ulcers, and a new drug called "Midoriamin" is being developed for ulcer retardant purposes. The laboratory has also succeeded in the synthesis of a new anti-inflammatory anodyne which they are now preparing for commercial production. The laboratory has also achieved the synthesis of a coenzyme called "Coenzyme Q40" which is effective for treatment of cardiac insufficiency. Formerly, the coenzyme itself could only be extracted from human internal organs.

The laboratory, in food research studies, is stressing research on raw materials used for processed food, e.g., the development of raw materials for soy sauce and soy paste production. This material is a mixture of fermentable malted rice (Koji) with soybeans that permits an easily producible soy sauce or soy paste. This is a departure from conventional food manufacturing. The laboratory is also studying the effective use of wheat. The research on "germ oil" which is valuable as a filler in animal feed is being done in order to determine its usefulness as a food. The laboratory has found that germ oil prevents arteriosclerosis and has put it in a food called "Livron" which, if used, can help in prolonging the aging process.

The laboratory concentrates its research on pharmaceuticals and food research studies. The Company's R&D expenditure is 0.5% of its total sales.

LABORATORY YAKULT HONSHA COMPANY, LTD., CENTRAL INSTITUTE FOR
MICRO BIOLOGICAL RESEARCH
 (Yakuruto Honsha Chuoh Kenkyu-sho)
Location 1796, Hoya, Kunitachi, Tokyo 186
Telephone 0425-73-1131

	1979	1980	1981
Manpower	-	-	210
Expenditure (Million Yen)	-	-	10,000

Activities

- Basic Research Group** - bacteria ecology, mycology, pharmacology, physiology, immunology, pathology, genetics, algology, enzymology, microbiology
- Application Research Group** - nutrition, toxicology, biochemistry, test animal culture strain storage
- Administration Group** - research coordination, library, administration
- Scientific Analysis Center** - physical, chemical, and biological analysis
- Products Development Group** - new products, new equipment, pilot plants

PARENT COMPANY YAKULT HONSHA COMPANY, LTD.
Location 1-19, Higashi Shimbashi 1-chome, Minato-ku, Tokyo 105
Telephone 03-574-8960

	1979	1980	1981
Manpower	3,165	3,039	3,280
Sales (Million Yen)	88,475	91,904	96,474
Net Profit (Million Yen)	3,422	4,742	4,982

Products

- Yakult material solution..... 16%
- Yakult products (soft drinks, etc.)..... 50%
- Cosmetics..... 8%
- Others..... 26%

R & D ACTIVITIES

Since its foundation in 1935, Yakult has lead the production of lactic products and is unequaled in the field of research and development concerning "aging and lactobacilli" and "cancer and intestinal bacteria." The vanguard of Yakult, the Central Institute, has many research and development projects including:

- the study of human intestinal bacteria,
- study of lactobacilli,
- the development of dairy products,
- the mass culture of pure chlorella,
- the applications of bacterial enzymes, and
- the retrieval of physiological activation materials.

The institute has revealed the pathological significance of intestinal bacteria, the effects of bacillus bifidus and lactobacillus on the digestion, and the synthesis of vitamins. It has developed an industrial engineering technology for mass production of useful bacteria developing new products for Yakult such as bifidus milk.

The institute has announced in a report that bifidus bacillus has the possibility of controlling cancer and staving off the aging process because of its high immunogenetic effects. The institute is expanding its activities to microbiotechnology research to provide a third dimension to its already strong bacteriology research.

The institute is staffed with 210 of which 160 are researchers. In 1975, the number of patents registered was 691, and in 1980 it rose to 1,771.

GLASS

LABORATORY ASAHI GLASS COMPANY, LTD., RESEARCH AND DEVELOPMENT DIVISION

(Asahi Garasu Kenkyu Kaihatsu-bu)

Location 1150, Matsubara, Hazawa-cho, Kanagawa-ku, Yokohama, Kanagawa 221
 Telephone 045-381-1441

	1979	1980	1981
Manpower	-	-	500
Expenditure (Million Yen)	-	-	6,600

Activities

- | | |
|--------------------------|---|
| Administration | Administration service group
Coordination and information group
Maintenance and service group |
| Planning | Planning group |
| Research and development | Halogen chemicals group
Urethane chemistry group
Water treatment group
Long-exchange membranes
FRP group
Glasses with various functions group
Electronic materials and components group
Engineering ceramics group
Ceramic building materials |

PARENT COMPANY ASAHI GLASS COMPANY, LTD.
 Location 1-2, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100
 Telephone 03-218-5555

	1979	1980	1981
Manpower	9,477	9,168	9,037
Sales (Million Yen)	392,972	471,875	473,976
Net Profit (Million Yen)	17,224	23,254	23,680

Products Glass (flat glass, TV glassware, others). 58%
 Soda and chemicals..... 37%
 Refractories..... 4%
 Others..... 1%
 (Export)..... (7%)

R & D ACTIVITIES

In 1915, the Asahi Glass Company was the first in Japan to succeed in producing plate glass and started, at the same time, research in soda which is an essential ingredient to glass manufacture. Since then, the company has been a pioneer in development of glass products; for example, glass fiber and color TV cathode ray tubes.

Some products that have been developed are: "Cerasorizer," a solder adhering directly to glass and ceramics; "Acron" a new fluorine acid, glass blur sensor; "ads," "Asahi Guard," a water and oil repellent liquid crystal display element; glass fiber reinforced plaster slag construction materials; and intermediates of 5-fluoro-uracil anticancer medicines. The main line of production developments, thermal ray reflecting glass, pressure- and earthquake-proof glass for the New Tohoku Railroad Trunk Line, aircraft dustproof glass, automobile composite glass, and electroconductive glass, are a few of the company's products.

The research specialists in this laboratory are in the fields of chemistry, metal engineering, electronics, and vitrics and have worked in composite and interdisciplinarian fields and have placed strong emphasis on functional materials, electronics, data processing, and energy-related research.

As for functional materials, the development of engineering ceramics, an important substitute for metals, is one of the main areas in a series of research and development plans aimed at research breakthroughs in brittle fracture problems, and improved processing and functional evaluation techniques. Other items under study include conductive resins, high-strength precision molded composite materials, and surface treatment of plastics.

In the electronic and data processing fields, the study of liquid crystal which has been developed mainly for industrial equipment and computers, will be further promoted in search of new electronic display elements and large-sized displays. In addition, development efforts will be exerted equally on integrated circuit-related materials through the application of electronic measuring techniques, optoelectronic elements.

As for energy-related development, the company is now studying a solar energy conversion system, and a solar energy application system based on the technology so far established for solar water heaters and heat-insulating glass plates.

The activities of this division is supported by an investment of two-thirds of the company's total research and development costs amounting to 10.0 billion yen, 2.1% of the overall sales.

LABORATORY NIPPON SHEET GLASS COMPANY, LTD., ITAMI RESEARCH
LABORATORY
(Nippon Itagarasu Kenkyu-sho)

Location 1, Gaidoshita, Kohnoike, Itami, Hyogo 664
Telephone 0727-81-0081

	1979	1980	1981
Manpower	-	-	130
Expenditure (Million Yen)	-	-	2,000

Activities

Research Group

Optical Fiber Group

High Polymer Group

Supporting Group

- testing section
- machine shop
- administration office

Product Engineering Group

Fiberglass Reinforced Cement (GRC) Group

PARENT COMPANY NIPPON SHEET GLASS COMPANY, LTD.
Location 8, Doshomachi 4-chome, Higashi-ku, Osaka 541
Telephone 06-202-1161

	1979	1980	1981
Manpower	3,533	3,681	3,740
Sales (Million Yen)	95,509	133,335	157,815
Net Profit (Million Yen)	2,562	4,809	4,603

Products Sheet glass and figured glass..... 17%
Float glass and other glass..... 58%
Building materials and others..... 25%
(Export)..... (4%)

R & D ACTIVITIES

This laboratory was set up back in November 1949, and moved to its present site in July 1968. Large-sized laboratory equipment presently in use at the laboratory include pressure anemometers (for designing glass strength for high rise buildings), sled impact testing equipment (for measuring the force of impact in car crashes), and reverberation chambers. The research facilities are used for nuclear magnetic resonance research, atomic absorption spectrochemical analysis, flame photometry, and surface analysis.

The laboratory was the first to develop the double-layer glass with air in between which has been used on the Shinkansen "bullet" trains. In 1968, together with the Nippon Electric Company, it developed focusing optical fiber glass (CELFOC). This glass has the characteristics of a uniform focal distance according to length despite the plane lens surface. At present, company and university cooperation is involved in R&D efforts to make an index of horizontal refraction for plane glass. Also, various devices for optical communications, such as branch circuits and switches, are also being developed emphasizing transmission. The laboratory is especially interested in the development of optical semiconductors. The laboratory is now considering placing research emphasis on:

- application of CELFOC and other technologies of optoelectronics and,
- the extension of coating technologies.

One of the laboratory's achievements in the field of coating is PELCOAT, a demister.

In the energy field, the laboratory has contributed to the development of an electroconductive membrane of tin oxide, called NESA glass. This product is highly reputed for its nonreflection and high permeability as a clear-surface electrode for the amorphous silicon solar cell. For solar energy power generation, this laboratory uses the technique that plates the back side of 0.75 mm thick blue sheet glass with silver and backs it with float glass. The laboratory continues to exert effort toward the development of composite materials as well.

INSULATORS

LABORATORY NGK INSULATORS, LTD., NGK HIGH VOLTAGE LABORATORY
 (Nippon Gaishi Cho-Kohatsu Kenkyu-sho)
 Location Tagami, Futaebori, Komaki, Aichi 485
 Telephone 0568-485-3121

	1979	1980	1981
Manpower	-	-	30
Expenditure (Million Yen)	-	-	350

Activities

High voltage insulator research using special facilities which are as follows:

- ac high voltage test hall
- ac 1650 kV high voltage source
- corona noise instrument
- dc 500 kV high voltage source
- high frequency voltage test facilities
- 4200 kV impulse voltage test facilities
- 2500 kV switching impulse voltage test facilities
- steel towers
- UHV ac insulator contamination test facilities
- 500 kV ac insulator contamination test facilities
- 200 kV ac insulator contamination test facilities
- 200 kV dc insulator contamination test facilities
- 30 mV A short circuit test facilities
- hot line insulator washing test facilities
- fire fighting laboratory

PARENT COMPANY NGK INSULATORS, LTD.
 Location 56, Sudacho 2-chome, Mizuho-ku, Nagoya-shi 467
 Telephone 052-882-7181

	1979	1980	1981
Manpower	4,792	4,740	4,676
Sales (Million Yen)	94,656	109,295	121,226
Net Profit (Million Yen)	3,463	3,754	4,014

Products

Insulators.....	61%		
Environmental equipment.....	13%		
Chemical equipment.....	10%		
Others.....	16%		
(Export).....	(25%)		

R & D ACTIVITIES

NGK Insulators, the largest insulator manufacturer in the world, regards its high voltage laboratory as the nucleus of its technological studies. To meet the future electrical power need for the one-million volt electric power transmission system, the laboratory has succeeded, after 13 years of R&D efforts, in developing UHV insulators, and concurrently equipment for insulator maintenance and prevention of power outages.

This laboratory has many unique facilities--including UHV alternating current insulator testers consisting of a cloud chamber (30 m long, 25 m wide, 30 m high) that can produce the least favorable fog and contamination conditions: a one-million volt transformer, a boiler capable of emitting 3.6 tons of fog per hour, and a 30 MV A short circuit generator as its electricity source.

The laboratory activities are divided into different groups, that is, high voltage and mechanics. This includes research and development related to electrical and mechanical characteristics of high voltage insulators, and the development of maintenance equipment. The laboratory also carries out research jointly with electric power companies, and provides technical services including the dispatch of engineers to foreign countries.

The laboratory has developed suspension insulators which are free from corona noise and can withstand 84 tons of tensile strength and 12 meter-long insulator tubes clear of other factors. These developments are indispensable for the one-million volt electric power transmission system.

The laboratory is now busy preparing itself for development of peripheral technology such as contaminants removal and disaster prevention equipment. In April 1982, it will be equipped with a 750,000 volt ac insulator tester and its staff will be increased to 35 members.

The NGK Laboratory is expected to continue to make contributions to technological advancements in the electric power utilities field.

IRON AND STEEL

LABORATORY DAIDO STEEL COMPANY, LTD., CENTRAL RESEARCH LABORATORY

(Daido Tokushu-koh Chuoh Kenkyu-sho)
 Location 2-30, Daido-cho, Minami-ku, Nagoya, Aichi 457
 Telephone 052-611-2511

	1979	1980	1981
Manpower	-	-	260
Expenditure (Million Yen)	-	-	1,500

Activities

- Division 1 - research on materials such as alloy design, cut, welding, etc.
- Division 2 - research on production technology such as nonsteel metals, methods of analysis, dissolution, etc.
- Shibukawa Laboratory - related research at Shibukawa plant
- Kawasaki Laboratory - related research at Kawasaki plant
- Ohji Laboratory - related research at Ohji plant

PARENT COMPANY DAIDO STEEL COMPANY, LTD.
 Location 11-18, Nishiki 1-chome, Naka-ku, Nagoya-shi 460
 Telephone 052-201-5111

	1979	1980	1981
Manpower	9,430	8,813	8,662
Sales (Million Yen)	235,301	268,059	289,612
Net Profit (Million Yen)	2,799	5,619	7,388

Products

- Special steel bars and wire rods..... 58%
- Steel forgings and castings 19%
- Industrial furnace..... 6%
- Steel bands and others..... 3%
- (Export)..... (4%)

R & D ACTIVITIES

The Daido Steel Company of Japan, is a leading manufacturer of special steels. Its Central Research Laboratory has been promoting research and development in order to meet the needs of the industrial market. The new products developed by the Central Research Laboratory are produced and marketed on a trial basis by the Production Department of the Daido Steel Company. The sales of trial products amount to about 400 million yen a year. In 1976, the Nippon Special Steel and Tokushu Seiko merged and formed the Daido Steel Company, and since that time, Daido's research activities have become more fully developed.

Unlike other manufacturers, Daido Steel Company has divided the research and development functions; for example, the Production Control Department performs the melting, rolling, forging, and heat treatment processes in order to produce the samples that the Central Research Laboratory analyzes and studies.

The research and development tasks undertaken by the laboratory include those concerning energy savings, improvement in production technology, research and development at the request of Daido's member factories, as well as research and engineering services commissioned by other users, and the development of future steel requirements.

The Central Research Laboratory has some 150 projects on hand ranging from priority projects such as the development of lightweight, handy steels for the automotive industry through innovative projects for the research and development of new materials for shipbuilding, oil exploration, aviation, and other major industries.

In conformity with its mid- and long-term plans for the development of new materials for the energy industry, which is expected to prosper in the 21st century, the laboratory has been pushing the development of high quality special steels, such as heat-resistant materials for nuclear power reactors, nuclear fusion reactors, and high-efficiency turbines.

In regard to superalloys, the laboratory has already achieved substantial results in the development of corrosion-proof materials made from titanium, molybdenum, niobium, and tantalum.

Recently, the Central Research Laboratory developed and installed a Daido ladle furnace (DLF) and a plasma arc induction melting furnace at Shibukawa Works.

The new products introduced last year include the "star cut SSS steel," a free machining steel used for gears and the "ultrafree machining stainless steel, DSR6F" which is by far superior in machinability and corrosion resistance than the conventional free machining steels.

LABORATORY KAWASAKI STEEL CORPORATION, RESEARCH LABORATORY
 (Kawasaki Seitetsu Gijutsu Kenkyu-sho)
 Location Kawasaki-cho 1-chome, Chiba, Chiba 260
 Telephone 0472-64-2070

	1979	1980	1981
Manpower	-	-	900
Expenditure (Million Yen)	-	-	11,500

Activities

Planning Department	Planning and administration section, general affairs section, experiment services section
Research Department I	Ironmaking laboratory, steelmaking laboratory, refractory materials laboratory, resources and energy laboratory
Research Department II	Plate laboratory, alloy steel laboratory, welding laboratory, corrosion laboratory, Chita laboratory
Research Department III	Sheet laboratory, silicon steel laboratory, coating laboratory, Kobe laboratory
Research Department IV	Metalworking laboratory, instrumentation laboratory, powder metallurgy laboratory
Research Department V	Physical metallurgy laboratory, analysis laboratory, environmental science laboratory

Mizushima Research Department

PARENT COMPANY KAWASAKI STEEL CORPORATION
 Location 1-28, Kitahonmachi-dori 1-chome, Chuo-ku, Kobe 651
 Telephone 078-221-4141

	1979	1980	1981
Manpower	35,899	35,068	29,563
Sales (Million Yen)	960,915	1,147,889	1,203,437
Net Profit (Million Yen)	17,428	50,089	57,140

Products	Steel plants, sheets and surface-treated sheets..... 64%
	Bars, rods and structural shapes..... 10%
	Pipes and tubes..... 15%
	Others..... 11%
	(Export)..... (34%)

R & D ACTIVITIES

The annual budget of this Laboratory is about 1% of the company's gross sales. This figure is rather reasonable when compared with the average of 1.1% of gross sales used throughout the steelmaking industry.

It is often said among foreign critics that the Japanese are imitative. Mr. Sasaki, Chief of the Institute flatly denies such views, saying "We have been too busy digesting technological developments to have enough time to develop our own abundant originality."

One example is the "Go-Stop System," the technological development of casting light on the so-called "black box" or the inside of a blast furnace. This system is designed to monitor, for information, all aspects of furnace conditions and classify them into categories of information, and then arrange, analyze, and publish information on the overall condition of the blast furnace.

Interest in this system was expressed by leading industries throughout the world giving credence to the creativity of the research staff and the production department of the company. The continuous casting process of steel manufacturing is a highly advanced technology. Kawasaki Steel has developed a number of operating innovations such as the completely oil-free blast furnace and the oxygen bottom-blasting converter.

Another development is a new type of steel that meets resource and energy shortages requirements; the development of a lightweight high-tension steel for lighter automobiles. Other types of new steel development that meets resource needs for energy conscious installations are: steel development for improvement of oil rigs exploration of submarine oil, and nonmagnetic steel for nuclear fusion reactors and cost reduction of storage tanks of "clean" fuels like LNG.

LABORATORY KOBE STEEL, LTD., CENTRAL RESEARCH LABORATORY
 (Kobe Seikoh-sho Chuoh Kenkyu-sho)

Location 3-18, Wakinohama-cho 1-chome, Chuo-ku, Kobe, Hyogo 651
 Telephone 078-251-1551

	1979	1980	1981
Manpower	-	-	350
Expenditure (Million Yen)	-	-	8,400

Activities

- Resources and Minerals Group
- Iron Production Group
- Steel Production Group
- Casting Group
- Iron and Steel Products Group
- Special Steel Products Group
- Nonferrous Materials Group
- Nuclear Reactor Materials Group
- Metal Processing Group
- Welding and Metallurgy Group
- Corrosion Preventive Materials Group
- Surface Processing Group
- Supporting Group

PARENT COMPANY KOBE STEEL, LTD.
 Location 3-18, Wakinohama-cho 1-chome, Chuo-ku, Kobe 651
 Telephone 078-251-1551

	1979	1980	1981
Manpower	32,367	31,132	30,443
Sales (Million Yen)	884,057	1,024,726	1,140,083
Net Profit (Million Yen)	13,686	25,652	26,253

Products	Iron and steel.....	58%
	Machinery.....	26%
	Aluminum and copper.....	16%
	(Export).....	(23%)

R & D ACTIVITIES

One of the noteworthy technological achievements in recent years is the electromagnetic mixing process. In the continuous casting process this technology is used for mixing molten metal with electromagnetic forces at three different levels; that is, die casting, secondary cooling, and solidification during the last stage. By using this process, impurities can be gathered in billets guaranteeing smooth surfaces and uniform elementary composition. This is particularly suitable for alloy steel, and it is now possible to make bearing steel with the same continuous casting process.

The Central Training Center of Kobe Steel's steelmaking group developed an out-of-furnace refining process for dephosphorization with a lime flux at the ladle stage which is instrumental in raising the operational efficiency of the converter. The same group also developed a control cooling technology which can nearly dispense with heat treatment for low temperature steel plates. A great deal of research is also being carried out on hydrogen which affects and leads to brittleness. The supersonic defect prevention heat treatment systems, the distribution calculation programs for the concentration of hydrogen in stainless steel, and the successful control of "restive" hydrogen in steel by removing stress from welded portions are worthy of special mention as important contributions made by the Kobe Steel Company's Central Training Center. In the area of metal fatigue, they have analyzed the mechanism of crack-widening in iron making rolls by giving directionality to enlarged carbide grains. By using the technology of atomized iron powder, this Center succeeded in developing powdered high-speed steel. This is an outstanding development in which two things can be achieved at once--quality improvement and simplification of the production process. Zircalloy used in the cladding tube for nuclear fuel is an example of top quality technology development.

Research on metal materials should be timely in order to keep abreast of new technology directions. For the development of new materials and compound materials, metallurgical studies are not sufficient. According to the head of the Central Training Center, the technology for covering the whole process of making metals from raw materials, to smelting, to the rolling process, needs to be developed.

LABORATORY NIPPON KOKAN COMPANY, LTD., TECHNICAL RESEARCH CENTER

(Nippon Kohkan Gijutsu Kenkyu-sho)
 Location 1-1, Mimami-wataruda-cho, Kawasaki-ku, Kawasaki, Kanagawa 210
 Telephone 044-355-1111

	1979	1980	1981
Manpower	-	-	1,520
Expenditure (Million Yen)	-	-	12,481

Activities

- Administration Department - general, technical, facility development, and engineering administration
- Research Department 1 Laboratory - coal and coke, iron and steelmaking, ceramics
- Research Department 2 Laboratory - shaping process, heat and fluid engineering
- Research Department 3 Laboratory - light flat rolled products, structural steels, tubular products, fracture engineering, welding
- Research Department 4 Laboratory - metallic coating, organic coating, rosiion, microbeam analysis, chemical analysis
- Research Department 5 Laboratory - aerodynamics and structure, civil ineering, architecture, pipe line transmission, pipe line and piping
- Systems and Control Research Laboratory - instrumentation, control engineering, mechanical automation

PARENT COMPANY NIPPON KOKAN COMPANY, LTD.
 Location 1-2, Marunouchi 1-chome, Chiyoda-ku, Tokyo 100
 Telephone 03-212-7111

	1979	1980	1981
Manpower	36,555	33,600	33,305
Sales (Million Yen)	1,156,129	1,311,447	1,423,271
Net Profit (Million Yen)	10,325	25,178	36,296

Products Iron and steel (bars, tubes, pipes, plates, sheets, semifinished steel products, slags ferroalloys, pig iron, fertilizer and others)..... 82%
 Heavy industries and shipbuilding..... 18%
 (Export)..... (33%)

R & D ACTIVITIES

The Technical Research Center is involved in several important research projects:

- Based on an analytical program developed by one division, a project on protective measures against earthquakes was initiated. Experts on this project serve as consultants to local governments in the Kanagawa and Shizuoka Prefectures where predictions are that the Tokai earthquake will occur.

- The Nippon Kokan Company is participating in the "Sunshine Project," a national project to develop new energy sources.

- The Center is investigating the coal liquefaction process by direct hydrogenation methods in cooperation with the New Energy Development Organization (NEDO).

Other research activities of this Center include work in the computerization of control systems for ships, steelmaking technique development, welded pipe production techniques for line pipes, and design of earthquake-proof structures.

LABORATORY NIPPON STEEL CORPORATION, FUNDAMENTAL RESEARCH LABORATORY

(Shin Nippon Seitetsu Kiso Kenkyu-sho)
 Location 1618, Ida, Nakahara-ku, Kawasaki, Kanagawa, 211
 Telephone 044-777-4111

	1979	1980	1981
Manpower	-	-	262
Expenditure (Million Yen)	-	-	?

Activities

- Fundamental Research Laboratory 1 - Strength and toughness
- Fundamental Research Laboratory 2 - Workability and plasticity
- Fundamental Research Laboratory 3 - Corrosion and heat resistance
- Fundamental Research Laboratory 4 - Raw materials and iron making
- Fundamental Research Laboratory 5 - Refining and solidification
- Fundamental Research Laboratory 6 - Coating
- Fundamental Research Laboratory - Special - Energy and new materials
- Measurement Research Laboratory - Measurement and new research procedures
- Analysis Research Center - Chemical and instrumental analysis
- Chemical Research Center - Composite materials, ceramics, and organic materials
- General Affairs Section - Personnel, budget, and purchasing
- Testing Service Section - Testing, maintenance of machines and buildings
- R&D Planning Section-Fundamental - Coordination of research activities, planning, patents, and library

PARENT COMPANY NIPPON STEEL CORPORATION
 Location 6-3, Ohtemachi 2-chome, Chiyoda-ku, Tokyo 100
 Telephone 03-242-4111

	1979	1980	1981
Manpower	74,149	71,669	69,533
Sales (Million Yen)	2,412,462	2,844,826	3,112,603
Net Profit (Million Yen)	45,221	105,767	71,062

Products Steel(steel bars and shapes, steel plates and sheets, special steel, steel tubes, pipes and secondary products)..... 87%
 Pig iron, steel ingot..... 1%
 Engineering and others..... 12%
 (Export)..... (34%)

R & D ACTIVITIES

The purpose of the laboratory is to conduct basic studies on the technological development associated with steelmaking. The laboratory is endeavoring to establish the technological basis for its future research and conducts fundamental studies that support the research and development departments.

The basic studies of the laboratory include a wide range of subjects. For example, the laboratory is participating in joint studies on heavy crude oil in a project under contract with the Agency of Industrial Science and Technology as well as in studies on nuclear power iron materials under a project with the Nuclear Power Iron Makers Association. The laboratory is also participating in the "House 55 Plan" which is under the direction of the Ministry of International Trade and Industry and the Ministry of Construction. However, the firm does not emphasize joint studies, but does emphasize independent studies such as the development of high tensile two-phase steel for automobiles which recently captured public interest.

In 1980, the research laboratory study on analysis of cracks in superhigh tensile cast steel slabs received the Tahara's Prize of the Nippon Steel Manufacturers Association.

A manager points out "There is little possibility of the appearance of new products due to the restrictions imposed by materials." New high tensile steels appeared about 1955-1960 brought about by steel developed by the U.S. Steel Corporation. Since then most studies, and research, have been concerned with achieving energy savings in steelmaking.

In conventional steelmaking techniques, heating and cooling are repeated in each process of melting, rolling, and annealing thus wasting energy. For this reason, the continuous casting process now prevails in the steelmaking industry. The Nippon Steel Corporation plans, in the near future, to increase the percentage of utilization of the continuous casting process from 60-70% to 80-90%.

LABORATORY SUMITOMO METAL INDUSTRIES, LTD., CENTRAL RESEARCH LABORATORIES

(Suimitomo Kinzoku Kogyo Chuoh Gijutsu Kenkyu-sho)
 Location 1-3, Nishinagasu-hondori, Amagasaki, Hyogo 660
 Telephone 06-401-6201

	1979	1980	1981
Manpower	-	-	896
Expenditure (Million Yen)	-	-	13,000

Activities

- Steelmaking Laboratory
- Metalworking Laboratory
- Automation Laboratory
- Mechanical Metallurgy Laboratory
- Nonferrous Materials Laboratory
- Welding Laboratory
- Applied Mechanics Laboratory
- Chemical Metallurgy Laboratory
- Metal Finishing Laboratory
- Physics Laboratory
- Fundamental Research Laboratory
- Kokura Laboratory

PARENT COMPANY SUMITOMO METAL INDUSTRIES, LTD.
 Location 15, Kitahama 5-chome, Higashi-ku, Osaka 541
 Telephone 06-220-5111

	1979	1980	1981
Manpower	9,200	29,947	29,675
Sales (Million Yen)	974,605	1,029,390	1,307,491
Net Profit (Million Yen)	15,248	38,953	46,533

Products	
Steel tubes and pipe.....	36%
Steel sheets and plates.....	38%
Steel bars and wire rods.....	9%
Others.....	17%
(Export).....	(39%)

R & D ACTIVITIES

The Central Research Laboratories of Sumitomo Metal Industries, founded in September 1959, has produced technology which supports the company's metal pipe manufacturing. In April 1963, the Central Research Laboratories began operations in nuclear research and succeeded in producing nuclear fuel cladding tubes of zircalloy. In the same year, they began the study of computerized process control systems. Sumitomo Metal Industries built a new laboratory, the Hazaki Research Center in April 1974, and the center is currently doing research in coal liquefaction and capsule tube transportation. Also the Kokura Research Laboratory, founded in June 1979 at the Kokura Iron Foundry, is putting considerable effort into research which is necessary to assist the makers of stripped steel and wire rods. The company stepped up its research into new metals, such as zircalloy and titanium, by establishing another laboratory for nonferrous material research.

At the Central Research Laboratories, sophisticated equipment and technology include a large sintering test system which has obtained excellent results in the process of automatic production as well as in energy savings; an experimental furnace to study an oil-less furnace and COM (coal-oil mixture); an experiment system to check the resistance of large structures against earthquakes; and a model testing system of 10,000 tons for the study of nil ductility of structural materials in the ocean. The laboratories techniques include the utilization of the coal-oil mixture for blast furnaces, the double blowing technique of a converter which produces a substantial yield, and horizontal continuous casting which is suitable for semisteel. The rolling control technique of stripped steel, which operates under zero magnetic force, improves systems from load cell to controlling software. The VC rolling technique, which increases accuracy in rolling because oil pressure expands the center part of steel, is in demand from abroad.

Looking ahead into the future, the continuous casting process will be important in order to save energy. The laboratories are trying to establish economical techniques in producing materials other than iron, such as titanium, carbon, and amorphous magnetic material.

The Central Research Laboratories will be emphasizing more basic research programs.

MACHINERY

LABORATORY CHIYODA CHEMICAL ENGINEERING AND CONSTRUCTION COMPANY, LTD., RESEARCH AND DEVELOPMENT CENTER
(Chiyoda Kakoh Kensetsu Sohgo Kenkyu-sno)

Location 3-13, Moriya-cho, Kanagawa-ku, Yokohama, Kanagawa 221
Telephone 045-441-1261

	1979	1980	1981
Manpower	-	-	150
Expenditure (Million Yen)	-	-	3,500

Activities

R&D (Production technology)

Process systems
Rotating machinery
Materials and welding
Civil and applied mechanics
Construction techniques

R&D (Process equipment, and chemicals)

Catalysts development
Pollution control
Others

PARENT COMPANY CHIYODA CHEMICAL ENGINEERING AND CONSTRUCTION COMPANY, LTD.

Location 12-1, Tsurumi Chuo 2-chome, Tsurumi-ku, Yokohama
Telephone 045-521-1231

	1979	1980	1981
Manpower	3,148	3,294	3,386
Sales	199,138	179,401	269,816
(Million Yen) Net Profit	2,329	3,682	1,127
(Million Yen)			

Products Oil plants..... 78%
LNG and LPG plants..... 13%
Petrochemical plants..... 4%
Chemical and other plants 5%
(Export)..... (48%)

R & D ACTIVITIES

For an engineering company, Chiyoda Chemical covers a broad range of activities which includes the planning and design of factories, procurement of equipment and materials, construction work, and trial and testing operations. Therefore, Chiyoda Chemical must provide a broad base of progress in technology which encompasses chemical engineering, electrical engineering, mechanical engineering, applied physics, and civil engineering.

The research and development activities of the Research and Development Center are largely classified into two areas; the first area is research that is directly involved with Chiyoda Chemical projects while the second area is the joint research efforts of Chiyoda Chemical with other corporations.

In regard to the research and development of Chiyoda Chemical's technological priorities, the primary focus is in the development of new chemical processes which are of vital importance to the progress and viability of the company.

In this connection, the chemical process related to the energy utilization of heavy crude oil is being investigated. This project is being supported in a large project sponsored by the Agency of Industrial Science and Technology in which both private and public research institutions are participating. Chiyoda Chemical's interest in this project lies in the production of olefin from heavy crude oil. Chiyoda is also promoting research and development of C chemistry which use is the underlying technological application for olefin production.

Chiyoda Chemical also has research and development projects which are promoted jointly with its clients. For example, it has cooperated with the Ajinomoto Company in order to develop a glutamic acid production process. It has also collaborated with the Kureha Petrochemical Company to produce vinyl chloride using a mixed gas process. Recently, Chiyoda Chemical, in a joint effort with Yurika Industries, developed an asphalt thermal cracking process called the Yurika Process.

Chiyoda Chemical's various other projects include work being carried out in fields such as microbiotechnology and civil engineering.

LABORATORY JANOME SEWING MACHINE COMPANY, LTD., JANOME
RESEARCH CENTER

(Janome Mishin Kogyo Gijutsu Kenkyu-sho)
Location 1463, Hazama-cho, Hachioji, Tokyo 193
Telephone 0426-61-3121

	1979	1980	1981
Manpower	-	-	107
Expenditure (Million Yen)	-	-	963

Activities

Research Laboratory 1

Design of sewing machine tables, and various attachments, sewing techniques, fashion trends

Research Laboratory 2

Design of motors and controllers

Research Laboratory 3

Basic studies of metals, chemicals, and other raw materials for developing electronics and mechanical technology

Administration Office

PARENT COMPANY JANOME SEWING MACHINE COMPANY, LTD.

Location 1-1, Kyobashi 3-chome, Chuo-ku, Tokyo 104
Telephone 03-277-2071

	1979	1980	1981
Manpower	3,483	3,381	3,269
Sales (Million Yen)	64,230	70,774	72,875
Net Profit (Million Yen)	2,842	2,736	2,594

Products	Straight stitch sewing machines for home use.....	3%
	Zigzag sewing machines for home use.....	84%
	Sewing machines for industrial use.....	2%
	Others.....	11%
	(Export).....	(16%)

R & D ACTIVITIES

To briefly trace the technical progress of sewing machines, the following explanation is given; the sewing machine designed for straight and lock stitching is known as first generation machines; the sewing machine designed for stitching in zigzag patterns with the oscillating needle bar and speed control with electronic application is called the second generation machine; and the machine designed for computer control is called the third generation machine. The Janome Sewing Machine Company developed the computer controlled sewing machine and put it on the market in April 1979. The Center played an important role in the development of this sewing machine.

In addition to research on the development of the sewing machine, the Research Center is also involved in research on development of peripheral technology. The Integrated Technical Research Center has a wide field of interest covering studies on the automation of production processes, chemical research on plating and corrosion prevention, and the development of future products other than sewing machines.

The Janome Sewing Machine Company was awarded a prize from the Science and Technology Agency in 1976 for its contribution of the full rotating hook mechanism which has many technical applications. In the area of materials research, the Center has made significant progress in die casting of aluminum which has greatly reduced the weight of sewing machine bodies. By using light alloys and resin, weight reduction of various mechanical parts of the machine has been achieved.

The current push of research and development is automation of the sewing machine assembly line. The Research Center is now developing robots that will perform assembly line functions. It is hoped that the result will be improvement of productivity and significant cost reductions.

LABORATORY TOKYO JUKI INDUSTRIAL COMPANY, LTD., RESEARCH AND DEVELOPMENT LABORATORY

(Tokyo Juki Kogyo Gijutsu Kenkyu-sho)
 Location 2-1, Kokuryo-cho 8-chome, Chofu, Tokyo 182
 Telephone 03-480-1111

	1979	1980	1981
Manpower	-	-	105
Expenditure (Million Yen)	-	-	1,000

Activities

- Home Sewing Machine Group
- Industrial Sewing Machine Group
- Home Electric Appliance Group
- Wool Knitting Machine Group
- Sewing Machine Peripherals Group
- Electronic Equipment Group
- Product Testing Group
- Basic and Materials Research Group
- Designing Group

PARENT COMPANY TOKYO JUKI INDUSTRIAL COMPANY, LTD.
 Location 2-1, Kokuryo-cho 8-chome, Chofu-shi, Tokyo 182
 Telephone 03-480-1111

	1979	1980	1981
Manpower	3,653	3,449	3,394
Sales (Million Yen)	51,323	54,014	57,545
Net Profit (Million Yen)	648	714	532

Products Sewing machines (for industrial use, 46%, for household use, 18%)..... 64%
 Home electrical appliances..... 17%
 Knitting machines..... 2%
 Electronic equipment and others..... 17%
 (Export)..... (32%)

R & D ACTIVITIES

The Tokyo Juki Industrial Company is one of the first companies to succeed in automation of the sewing process which had been very dependent on skilled labor. The Research and Development Laboratory of this company has developed a new product called the "Edge Control Seamer" which is a sewing machine equipped with a sensor and manipulator. The seam sensor can be set in relation to the edge of the material and can monitor the margin. The manipulator feeds the top and bottom portion of the cloth as well as controls the top and bottom edges of the material independently. This development won a gold medal at the Leipzig International Exposition in 1975 and the Automated Machinery Development Prize from the Japan Machinery Development Society for the laboratory.

The automation of the sewing machine is typical of Japan's "mechatronics," a combination of mechanics and electronics technology. Another automated machine developed by this laboratory is the self-detecting failure machine with an automatic thread cutting mechanism. The use of microcomputers has been incorporated in the automation development of the machine and can monitor more than 60 checkpoints and automatically displays machine failures.

The laboratory will continue to develop the automation of the sewing process. Other developments of this laboratory include: a material handling technique which feeds material automatically and the development of an easily operated sewing machine for part-time workers.

LABORATORY TOSHIBA MACHINE COMPANY, LTD., ENGINEERING
LABORATORY

(Toshiba Kikai Kenkyu-sho)
Location 2068-3, Ohoka, Numazu, Shizuoka 410
Telephone 0559-21-5240

	1979	1980	1981
Manpower	-	-	150
Expenditure (Million Yen)	-	-	1,500

Activities

- Chemical research on materials
- Research on new machine tools
- Research on metrological methods and equipment
- Research on industrial equipment
- Research on special machines and processing methods
- Development of automatic machine tools and equipment

PARENT COMPANY TOSHIBA MACHINE COMPANY, LTD.
Location 2-11, Ginza 4-chome, Chuo-ku, Tokyo 104
Telephone 03-567-0511

	1979	1980	1981
Manpower	3,703	3,650	3,667
Sales (Million Yen)	64,130	72,316	83,904
Net Profit (Million Yen)	924	2,018	3,013

Products

Machine tools.....	40%
Plastic machinery.....	22%
Industrial machines.....	24%
Hydraulic equipment and others.....	14%
(Export).....	(27%)

R & D ACTIVITIES

The Laboratory has been the mainstay of the Toshiba Machine Company for technical research and development for nearly forty years since its foundation in 1944. The R&D investment including labor costs is 2.1% of total sales.

Research is aimed at industrial application rather than theoretical disciplines. Research activities have often been displayed at production sites; the laboratory being used as a mobile laboratory.

Some examples of the variety of research are: the superhigh-performance laser-applied complex production system (FMC, flexible manufacturing complex); the electron beam drafting system (EBM, electron beam masking), the metal mirror processing machine, and the 5000-ton injection molding machines.

The laser-applied FMC, larger than the Flexible Manufacturing System (FMS) which attracted attention as an automatic processing system, is at present the most important item for the laboratory. This system is designed to permit on-line laser processing including material processing, automatic assembly and automatic product check, which greatly reduces processing steps through the combination of several processes. In multitype and small amount production, this system contributes to reducing processing time significantly compared with conventional machines. The laboratory, with the help of 20 other companies organized for this purpose, is completing (targeted for 1984) the development of the system.

Apart from the main target of FMC, future research efforts include improvement of control techniques based on superhigh-precision technology.

The laboratory is open to other institutes and universities, such as the Agency of Industrial Science and Technology, and the Electrotechnical Laboratory. This open door policy helps deepen cooperation between research organizations and also improves the capacity of the laboratory's own research staff.

LABORATORY TOYO UMPANKI COMPANY, LTD., RESEARCH AND DEVELOPMENT DIVISION

(Tohyoh Umpanki Gijutsu Kenkyu-sho)
 Location 3, Ryugasaki, Ryugasaki, Ibaraki 301
 Telephone 02976-4-3111

	1979	1980	1981
Manpower	-	-	50
Expenditure (Million Yen)	-	-	900

Activities

Laboratory 1 Control technology

Laboratory 2 Materials

Development Group

Administrative Group

Support Group

PARENT COMPANY TOYO UMPANKI COMPANY, LTD.
 Location 15-10, Kyomachibori 1-chome, Nishi-ku, Osaka 550
 Telephone 06-441-9151

	1979	1980	1981
Manpower	1,729	1,550	1,576
Sales (Million Yen)	52,201	57,576	60,447
Net Profit (Million Yen)	-976	961	1,448

Products Industrial vehicles..... 57%
 Construction vehicles..... 30%
 Machinery parts and others..... 13%
 (Export)..... (36%)

R & D ACTIVITIES

This Division started with a staff of young researchers in 1969. The R&D emphasis was on hydrostatic transmission, i.e., hydraulic operation and electrical control. The R&D budget is now 1.5% of the company's gross sales.

Critical demands were made on this division in 1974 for fork lifts, tractor shovels (earth-digging machines) and other industrial equipment that is durable but of low cost.

However, in recent years, research and development efforts are being directed toward transport systems that are pilotless and operated by microcomputers. Also efforts are directed towards the development of highly sophisticated systems such as guidance systems for pilotless vehicles, pattern recognition by sensors, and adaptive controls. Considering manual operation still indispensable from the standpoint of cost performance, this division continues to improve man-machine operations.

Future R&D plans of this division call for studies on biomechanics. For example, load hauling vehicles can not climb 15° angle slopes; studies are being conducted on the climbing principles used by insects in the hope that this principle can be applied to vehicles used for forested areas.

MUSICAL INSTRUMENTS

LABORATORY NIPPON GAKKI COMPANY, LTD., RESEARCH AND DEVELOPMENT
LABORATORY

(Nippon Gakki Seizo Gijutsu Kenkyu-sho)

Location 203, Matsunoki-jima, Toyooka-mura, Iwata-gun, Shizuoka 438-01
Telephone 0539-62-3111

	1979	1980	1981
Manpower	-	-	190
Expenditure (Million Yen)	-	-	2,400

Activities

- Planning Division
 - Administration office
 - Patent office
- Buildings and Acoustics Division
- Basic Materials Division
- Semiconductor Process Division
- Software Division
- Development Division
 - Development Project Group
 - Development Laboratory
 - IC Laboratory
 - Electronic Device Laboratory
 - Electronic Components Laboratory
 - Semiconductor Production Technology Laboratory in Kagoshima

PARENT COMPANY NIPPON GAKKI COMPANY, LTD.

Location 10-1, Nakazawa-cho, Hamamatsu-shi, Shizuoka-ken 430
Telephone 0534-65-1111

	1979	1980	1981
Manpower	16,189	15,592	15,834
Sales (Million Yen)	281,940	303,823	329,569
Net Profit (Million Yen)	6,041	6,720	6,934

Products	Pianos..... 30%
	Electronic organs..... 22%
	Other inusical instruments..... 18%
	Home utensils and sporting goods..... 12%
	Stereo equipment..... 8%
	Others..... 12%
	(Export)..... (19%)

R & D ACTIVITIES

The Nippon Gakki Company, the largest musical instrument manufacturer in the world is adapting modern technology, specifically electronics centering around integrated circuits, to its production process.

The Research and Development Laboratory, which was established in August 1980, has as its core the IC (integrated circuits) division which was established 11 years ago. This division is conducting research on the application of integrated circuits, the production and design process of VLSIs, and computer software. R&D activities also cover the physical properties of acoustic materials, mainly wooden and chemical, the trial development of materials using semiconductors and analysis of their acoustic characteristics, metallic materials for musical instruments, and materials for audio equipment. The company is divided into several production entities which include electronic musical instruments, computers, video, piano, and audio equipment. The main research and development targets, however, are integrated circuits, computers, electronic instruments and "home computers." Worthy of special note is the static induction transistor that the Nippon Gakki Company has developed. LSIs are already being produced and the laboratory is confident that they will produce random-logic type VLSIs in a few years. These LSIs have been developed specially for the company's products and therefore they are not available in the open market. LSIs for the company's general use are purchased from a semiconductor manufacturer.

During the past ten years this laboratory has procured modern research equipment (worth 4-5 billion yen) to include the electron beam exposure capable of direct exposure on a 1 micron rule pattern--which is indispensable to LSIs--epitaxial growth equipment that can deal with 21 four-inch wafers at a time, ion implantation equipment capable of 200-kilo electron volts, a CAD system, wafer stepper, and a high-speed LSI tester. This technology-oriented company applies for 500 to 1,500 patents every year. The annual number of patents possessed is 3,000 to 4,000 although they are constantly being consolidated.

NONFERROUS METALS

LABORATORY NIPPON LIGHT METAL COMPANY, LTD., NIPPON LIGHT METAL
RESEARCH LABORATORY

(Nippon Kei-Kinzoku Sohgo Kenkyu-sho)

Location 4540, Kambara, Kambara-cho, Ihara-gun, Shizuoka 421-32
Telephone 05438-5-2121

	1979	1980	1981
Manpower	-	-	210
Expenditure (Million Yen)	-	-	1,200

Activities

Research Center of Processes and Materials
R&D of processes, materials and products from mining
of ore to aluminium end products

Research Center of Products
Development of special end products

Engineering Design Center
Structural analysis, systems design and trial
manufacture of products

Analytical Center
Development of chemical and physical analytical
methods, analytical services

Planning Division
Information, administration, planning

PARENT COMPANY NIPPON LIGHT METAL COMPANY, LTD.
Location 3-5, Ginza 7-chome, Chuo-ku, Tokyo 104-91
Telephone 03-574-3211

	1979	1980	1981
Manpower	7,024	6,648	6,666
Sales (Million Yen)	221,122	265,285	297,426
Net Profit (Million Yen)	31	9,067	6,002

Products Alumina..... 46%
 Pressed products..... 19%
 Building materials..... 35%

R & D ACTIVITIES

The aluminum industry is, at present, in a depression mainly because of ever-increasing electric power costs in Japan. Taking the present situation into consideration, the company is strengthening its secondary and tertiary products. The laboratory is allotting nearly 60% of its resources to the development of processing techniques and processed products--the remaining research funds are used for testing and technical services.

Some significant developments are the nonporous die casting process and printing board setting process which have attracted attention both domestically and internationally. The first process is a cavity-free casting technique for alumina characterized by thermal treatability, weldability, and increased strength. Currently it is being applied to aluminum wheel production; many other applications will be found in the automobile industry which is actively seeking lighter automobile materials. The second process is the aluminum surface treatment technique which was achieved in collaboration with the Fuji Film Company. This process will contribute to improved film durability and better printing definition.

In close cooperation with the Alcan laboratory, various heat exchangers have been developed and partly commercialized with Alcan's application of the Nocolok aluminum brazing method.

The laboratory has offered to take part in any national development project of new aluminum refinery techniques; however, using blast furnace power methods rather than using high-cost electric power. Technical research will continue because aluminum can be combined with other material to form carbon fabric, silicon carbide, and ceramics that can be used in the electronics and biotechnology industries.

PAINTS AND INKS

LABORATORY DAI NIPPON TORYO COMPANY, LTD., PRODUCTS DEVELOPMENT CENTER

(Dai Nippon Toryo Seihin Kaihatsu Sentah)

Location 1-124, Nishi-kujo 6-chome, Konohana-ku, Osaka 554
Telephone 06-461-5371

	1979	1980	1981
Manpower	-	-	100
Expenditure (Million Yen)	-	-	600

Activities

- Planning Group
- Analysis Group
- Plastics Group
- Pigments Group
- Development Group 1 Construction
- Development Group 2 Corrosion (ships)
- Development Group 3 Automobiles
- Development Group 4 Paint-related technology and application
- Painting Technology Group

PARENT COMPANY DAI NIPPON TORYO COMPANY, LTD.
Location 1-124, Nishi-kujo 6-chome, Konohana-ku, Osaka 554
Telephone 06-461-5371

	1979	1980	1981
Manpower	1,516	1,462	1,218
Sales (Million Yen)	46,683	55,709	53,297
Net Profit (Million Yen)	-1,249	2,267	1,092

Products	Paint.....	91%
	Lead chemical products.....	6%
	Others.....	3%
	(Export).....	(1%)

RESEARCH RESULTS

This center is actively involved in the development of anticorrosion paints. The commercial development of super anticorrosion paints and organic-inorganic polymer ship paints are the main R&D tasks. Paints which will be corrosion-proof for ten years are being developed, and paints with a zinc base coat treatment will soon be commercialized.

This company has made progress in the development of organic exterior paints. It is now developing paints with a ten-year warranty. In four or five years time, however, a 20-year warranty will be required, and the company is now doing research on new paint materials to meet such a requirement.

Dai Nippon Teryo is the principle supplier of paints used on the bodies of Japanese National Railways "Shinkansen" trains and diesel locomotives. Such paints should resist wind pressure, frost damage, etc.

The development of metallic paint is now being emphasized for automobile parts. Paints that will be used for plastic materials is also being developed.

Dai Nippon Teryo is the only company in Japan that is involved in research on the practical use of slurry paints for use on electrical appliances and building materials. The ultimate target for slurry paints use is on automobiles. Slurry paint technology is derived from the wet powder coating idea. Dai Nippon Teryo is said to be superior to American and West German competitors in putting slurry paint technology to practical use. High corrosion resistance is one of the main features of this poration-free paint. Powder paints for high temperature resistance are also being developed for cast iron pipes. Inorganic electrolyte paints for electrical appliances and other equipment for special electric purposes are being developed. This center held as many as 177 patents in 1978, a significantly larger number in comparison to other companies. It has a good technical know-how with overseas manufacturers and has made agreements with them.

LABORATORY KANSAI PAINT COMPANY, LTD., TECHNICAL DIVISION
 (Kansai Peinto Gijutsu Honbu)
 Location 17-1, Higashi-hachiman 4-chome, Hiratsuka, Kanagawa 254
 Telephone 0463-23-2111

	1979	1980	1981
Manpower	-	-	240
Expenditure (Million Yen)	-	-	4,000

Activities

Patent Division

Powder Paint Development Division
 R&D on powder paint

Technical Laboratory 1
 R&D on ordinary temperature dry-type paint for ships, buildings, construction,
 automobiles, and home uses

Technical Laboratory 2
 R&D on heat dry-type paint for automobiles, home appliances, equipment and
 precoated metals

Synthetic Resin Laboratory
 R&D on synthetic resin for paint

Basic Research Laboratory
 Basic research on paint and dry paint film

PARENT COMPANY KANSAI PAINT COMPANY, LTD.
 Location 27, Fushimimachi 5-chome, Higashi-ku, Osaka 541
 Telephone 06-203-5531

	1979	1980	1981
Manpower	2,819	2,812	2,796
Sales (Million Yen)	86,342	96,701	110,598
Net Profit (Million Yen)	1,158	1,205	1,061

Products Synthetic resin paints..... 74%
 Thinners..... 8%
 Lacquers..... 3%
 Oil paints and others..... 16%
 (Export)..... (1%)

R & D ACTIVITIES

The research budget is 4.0-4.5% of the total sales of this company. Of that amount, basic research, studies in current technology, and engineering activities receive 11%, 23%, and 62% respectively. The remaining funds go toward support activities.

The Engineering Laboratory is mainly carrying out studies on synthetic resins as binder material. The Automobile Painting Engineering Division is involved in the development of chip-resistant undercoating paint. The division is also conducting research on maintenance-free corrosion-proof paint for ships which will last ten years or more. Studies on inorganic paint that will replace conventional organic paint is also being carried out.

The DIT (Development Innovation Technology) Laboratory is conducting studies which will provide the information necessary for future developmental needs. It is now attempting to develop a resin that will act as a fixing agent for yeast and enzymes.

Paints are the least likely product to be replaced by entirely new products. Therefore, studies are being carried out on improving present paint products. Until now, the function of paint has been to be presentable in texture, color, and to be corrosion-resistant. Studies are continuing to expand paint characteristics to additional dimensions. In this regard, studies in the field of electrochemistry, inorganic chemistry, and surface chemistry will be continued in conjunction with organic chemistry research.

LABORATORY NIPPON PAINT COMPANY, LTD., TECHNICAL CENTER
 (Nippon Peinto Gijutsu Sentah)

Location 19-17, Ikeda Naka-machi, Neyagawa, Osaka 572
 Telephone 0720-27-1111

	1979	1980	1981
Manpower	-	-	150
Expenditure (Million Yen)	-	-	1,700

Activities

- Research Group 1 Plastics
- Research Group 2 Technical evaluation
- Research Group 3 Stability of finished surfaces
- Research Group 4 Process control
- Research Group 5 New materials and their chemical nature
- Research Group 6 Corrosion resistance (nonorganics)
- Research Group 7 Corrosion resistance (organics)
- Research Group 8 Corrosion (electrodeposition)

PARENT COMPANY NIPPON PAINT COMPANY, LTD.
 Location 8-10, Fukushima 6-chome, Fukushima-ku, Osaka 553
 Telephone 06-458-1111

	1979	1980	1981
Manpower	2,392	2,394	2,457
Sales (Million Yen)	71,358	90,623	104,158
Net Profit (Million Yen)	865	931	1,202

Products	Synthetic resin paints.....	76%
	Lacquers.....	8%
	Oil paints.....	3%
	Others.....	13%

R & D ACTIVITIES

This technical center strives to maintain continuity and consistency in the quality control of paints. A significant development at the center is the photosensitive resin called "NAP." Another development, the corrosion rate meter, is designed to measure the amount of rust under a coat of paint. This research center is particularly interested in furthering the development of:

- analytical rating technologies for measuring instruments for viscoelasticity,
- hardness or cracking resistance methods of computer color matching (CCM) paint coats under different temperatures,
- instruments for tracing the thickness of paint coats and to investigate the changes in paint coats.

These developments will be instrumental in automating the painting process.

Some developments such as the optosetting paint and the ultraviolet ray setting paint have been significant in that, for example, the ultraviolet ray setting paint can permeate into pigmented paints; these paints can harden in three to ten seconds and are used on paper and plastic products.

One of the products still under development is a new material which is a copolymerization of acetylene and ethylene. The material is oxygen reactant and therefore is quick to dry. Organic paints which can be used in seawater are also being developed. The culture of plant cells is an interesting research area for the company. Efforts are being made to extract new ultraviolet absorbers from such cells. Culture techniques differ from plant to plant and the Technical Center attaches importance to the accumulation of such know-how. In the immediate future, R&D efforts will be directed toward the functional adaption of technology in the changing uses of plastics and other materials, the prevention of pollution, and energy conservation.

PETROLEUM

LABORATORY NIPPON OIL COMPANY, LTD., CENTRAL TECHNICAL RESEARCH LABORATORY

(Nippon Sekiyu Chuoh Gijutsu Kenkyu-sho)
 Location 8, Chidori-cho, Naka-ku, Yokohama, Kanagawa 231
 Telephone 045-622-1361

	1979	1980	1981
Manpower	-	-	336
Expenditure (Million Yen)	-	-	-

Activities

General Affairs Section

Research Planning and Coordination Division

Research and Development Division I - research groups

Research and Development Division II - research groups

Research and Development Division III - research groups

Testing and Analytical Section

Engine Testing Section

PARENT COMPANY NIPPON OIL COMPANY, LTD.
 Location 3-12, Nishi-shimbashi 1-chome, Minato-ku, Tokyo 105
 Telephone 03-502-1111

	1979	1980	1981
Manpower	2,948	2,960	2,955
Sales (Million Yen)	1,611,856	2,713,385	3,427,866
Net Profit (Million Yen)	5,988	11,162	45,674

Products	Gasoline.....	21%
	Kerosene and gas oil.....	18%
	Heavy oil.....	39%
	Lubricating oil.....	2%
	Others.....	20%
	(Export).....	(4%)

R & D ACTIVITIES

The Nippon Oil Company established its chemical laboratory at Kashiwazaki, Niigata Prefecture, in 1916. In the past, polyethylene was polymerized under 3,000 atm and 300°C, but this laboratory, together with the Nippon Petrochemicals Company, developed a new polymerization technology with which it became possible to produce polyethylene-half in thickness and the same in strength-at 10 atm and several tens of degrees centigrade. Now (as of 18 June 1981) the Nippon Petrochemicals Company is building a pilot plant with a planned yearly output of 2,000 tons which is scheduled for completion in the autumn of 1981. It is hoped that energy consumption can be reduced by as much as 75%. "Nisseki Neo Polymer" is a petrochemical resin that was developed by the Nippon Oil Company and commercialized in 1975. This chemical replaces pipe resin and is now very valuable in such products as paints, printing ink, and binding agents. Olefin and diolefin are the materials base for this product.

The future research targets of this laboratory are the development of a material to be extracted from heavy crude oil and the development of alternate fuels. As a member of the heavy crude countermeasure study association, Nippon Oil Company is engaged in a heavy crude cracking technology development project. This project aims to obtain kerosene and light oil, which tends to run short while the "C" heavy oil remains superfluous, from heavy crude by the use of the fluid catalytic cracking method. In fiscal year 1979, the pilot cracking plant was completed and since then has produced favorable test results. There are still some problems yet to be solved, such as the weakening activation and wear and tear of catalysts, but trial operations of the pilot plant on direct desulfurization, which is known to reduce the amount of nickel and vanadium which weakens the activation of catalysts, are continuing. A hydrogenation system will be produced and tests will be continued till fiscal year 1982.

Regarding the development of fuel alternatives the Nippon Oil Company, as a member of the above mentioned association, engages in the study of;

- a method for alcohol production by fixing microorganisms onto organic membranes and,
- synthesization of gasoline from carbon monoxide and water.

PHARMACEUTICALS

LABORATORY GREEN CROSS CORPORATION, CENTRAL RESEARCH
LABORATORY

(Midori Juji Ghuoh Kenkyu-sho)
Location 5-44, Miyakojima-nakadori 3-chome, Miyakojima-ku, Osaka 534
Telephone 06-921-5477

	1979	1980	1981
Manpower	-	-	150
Expenditure (Million Yen)	-	-	1,500

Activities

Basic Research Laboratories

Laboratory 1	Synthetic chemistry, physical chemistry production science
Laboratory 2	Biochemistry, immunological chemistry, protein chemistry

Cell Engineering Center

Laboratory 3	Genetic recombination, cell blending
Laboratory 4	Mass cell cultures

Pathological Laboratory

Radio Isotope Laboratory

PARENT COMPANY GREEN CROSS CORPORATION
Location 15-1, Imabashi 1-chome, Higashi-ku, Osaka 541
Telephone 06-228-0700

	1979	1980	1981
Manpower	1,678	1,804	1,954
Sales (Million Yen)	45,544	59,962	71,168
Net Profit (Million Yen)			

Products	Antibacterials and immune antibody agents.....	29%
	Hemostats and blood coagulating agents.....	21%
	Blood transfusion drugs.....	13%
	Plasma substitution.....	23%
	Others.....	14%
	(Export).....	(1%)

R & D ACTIVITIES

The company's R&D has centered on the effective use of plasma protein demarcation agents as pharmaceuticals. One of its achievements is Urokinase (1965), a thrombus resolvent. Urokinase, now known as a specific medicine for use in the treatment of cerebral thrombosis and myocardial infraction, is basically a protein enzyme contained in extremely small quantities and derived from the urine of a healthy human body.

Another great success is Venoglobulin which was marketed in 1976. Venoglobulin is the immunoglobulin (commonly called gamma globulin) contained in the blood plasma of a healthy human processed with plasmin (fibrinolysin) which is removed prior to lyophilization. This medicine is characterized by its high concentration in the blood for long periods and the possibility of using high dosages. Research efforts are being applied to artificial blood (oxygen-conveying plasma extender) development and interferon. Artificial blood "Fluosol DA" is a white-colored liquid which is made from fluorocarbons by a process of emulsification with a surface active agent and a stabilization process. It freezes at -10 to -20°C, and can be preserved for about two years. Artificial blood matches any type of blood without serum hepatitis. The laboratory is now developing new types of Fluosol DA which can be preserved at normal room temperatures and will not sediment in the liver or the spleen. They have already come up with a few compounds. Regarding interferon (IF), they have established their own production technology for white corpuscle IF and cultured lymph cell IF.

In the future, the laboratory will exert greater research efforts in the fields of cytoengineering and bioengineering. It has more than halfway succeeded in developing albumin and is a third of the way towards developing interferon. It also intends to produce Type B hepatitis vaccine by gene recombination.

LABORATORY MEIJI SEIKA COMPANY, LTD., GENERAL RESEARCH LABORATORY

(Meiji Seika Chuoh Kenkyu-sho)

Location 760, Morooka-cho, Kohoku-ku, Yokohama, Kanagawa 222
 Telephone 045-541-2521

	1979	1980	1981
Manpower	-	-	600
Expenditure (Million Yen)	-	-	6,500

Activities

Group 1 Materials and utilization research
 Antibiotics, enzymes and physiologically active materials which emerge during research in micro-organisms.

Group 2 Organic synthetic chemicals
 Studies on the effectiveness and safety of new pharmaceutical products, tests and experiments on animal-plant physiology and mechanical metabolism, while making pathological and pharmaceutical assessment studies.

Group 3 Life Sciences
 Agricultural chemicals, veterinary medicines, feed additives, etc. The range of its activities extends to the field of life sciences.

PARENT COMPANY MEIJI SEIKA COMPANY, LTD.
 Location 4-16, Kyobashi 2-chome, Chuo-ku, Tokyo 104
 Telephone 03-272-6511

	1979	1980	1981
Manpower	6,199	5,975	5,759
Sales (Million Yen)	175,219	165,707	177,829
Net Profit (Million Yen)	3,879	1,670	2,878

Products Foods..... 59%
 Medicines..... 40%
 Others..... 2%
 (Export)..... (6%)

R & D ACTIVITIES

The Meiji Seika Company, is greatly indebted to its Research Laboratories for it having been ranked among the world's largest manufacturers of antibiotics such as Kanamycin.

To prepare for an ever-aging society, the Meiji Seika Company has placed at the top of its research interests the establishment of its "Life Industry" which is involved in foods and pharmaceuticals research. The development of medicine for adult diseases, and the establishment of gene recombination, and the applied technologies for mass production of antibiotics are also included in the research projects. Undertaking all these research and development projects are the Research Laboratories where research efforts on pharmaceutical development is being carried out.

The Meiji Seika Company's Research Laboratories have been sending ten researchers a year to universities, both at home and abroad, for the promotion of technological exchange and to study advanced technologies in order to cultivate the necessary foresight that is the decisive factor in the development of new drugs. In order to effectively carry out research for the development of new drugs, pathological, physiological, and pharmacological studies are indispensable. The Research Laboratories is increasing its efforts toward the development of immunostimulators as well as toward drugs of proven pharmacodynamic effectiveness.

LABORATORY SANKYO COMPANY, LTD., RESEARCH LABORATORY
 (Sankyo Chuoh Kenkyu-sho)
 Location 2-58, Hirocho 1-chome, Shinagawa-ku, Tokyo 140
 Telephone 03-492-3131

	1979	1980	1981
Manpower	-	-	800
Expenditure (Million Yen)	-	-	8,100

Activities

- Research Planning Department - research planning and coordination, liaison with other companies, documentation
- Research Administration Department - general affairs, personnel, and budgetary management
- Chemical Research Laboratories - organic chemistry, medicinal chemistry
- Biological Research Laboratories - biological screening, pharmacology, pathology, chemotherapy, biochemistry, medical engineering, care of laboratory animals
- Fermentation Research Laboratories - microbiology, antibiotics and other natural products, fermentation technology, biotechnology, medical biochemistry
- Analytical and Metabolic Research Laboratories - physicochemical analysis, drug metabolism, administration of radioisotopes
- Laboratory Animal Science and Toxicology Laboratories - toxicology, laboratory animal science, care of laboratory animals
- Product Development Laboratories - synthetic chemistry, product formulation, analysis, pollution control, packaging, process development
- Agricultural Chemicals Research Laboratories - organic and environment chemistry, formulation, entomology, phytopathology, plant physiology

PARENT COMPANY SANKYO COMPANY, LTD.
 Location 7-12, Ginza 2-chome, Chuo-ku, Tokyo 104
 Telephone 03-542-3511

	1979	1980	1981
Manpower	5,139	5,175	5,233
Sales (Million Yen)	131,458	159,925	187,196
Net Profit (Million Yen)	3,131	5,432	6,841

Products
 Pharmaceuticals (tumor drugs and chemotherapeutics 23%, neurological drugs 13%, circulatory and respiratory drugs 15%, others 30%)..... 81%
 Agricultural chemicals..... 12%
 Others..... 7%
 (Export)..... (1%)

R & D ACTIVITIES

This laboratory has achieved much in the development of pharmaceuticals. Some of the more notable pharmaceuticals developed are: "Celenar," a tranquilizer which is an organic compound of benzodiazepin and oxazolidine; and "Cephanetazone," a cephamycin antibiotic which is a kind of cephalosporin. This antibiotic is effective against resistant bacteria and was the direct result of studies of bacteria discovered living in the soil at the Jumonji Pass on the border of Nagano and Saitama prefectures. At present it is being produced by synthetic methods only.

The laboratory also deals with cosmetics, foodstuffs, plastic materials, etc. Hence its research setup centers around biology and chemistry. The Biology Department I is involved with pharmacology and pathology; the Biology Department II, biochemistry and chemotherapeutics, and the Chemistry Department I, antibiotics, basic synthesis, and studies of the origins of plants. An inquiry section helps to furnish researchers with the latest information and data, while the analysis and metabolic research departments who specialize in chemical analysis or metabolic studies support efforts for development of new pharmaceuticals. The coordination section functions as a research coordinator. The immediate research targets are to develop carcinogen preventive substances, immunizing agents for adult and aging people, medicines for animals (poultry and pigs) and agricultural chemicals. The development of medicines for animals is regarded as necessary because the use of antibiotics for human beings tends to produce new resistant bacteria in animals. The Sankyo Company is also investigating, in depth, incurable diseases. In developing medicines, it is needless to say, researchers give the closest attention to any effects of new medicines on the human body.

LABORATORY TAISHO PHARMACEUTICAL COMPANY, LTD., RESEARCH CENTER
 (Taisho Seiyaku Sohgo Kenkyu-sho)
 Location 1-403, Yoshino-cho, Ohmiya, Saitama 330
 Telephone 0486-63-1111

	1979	1980	1981
Manpower	-	-	330
Expenditure (Million Yen)	-	-	3,155

Activities

- Organic Chemistry Laboratory
- Microbiological Laboratory
- Pharmacological Laboratory
- Pharmacometabolic Laboratory
- Analytical Center
- Production Process Laboratory
- Biopharmaceutical Laboratory
- Special Projects Laboratory
- Insecticides Laboratory
- Administration Office

PARENT COMPANY TAISHO PHARMACEUTICAL COMPANY, LTD.
 Location 24-1, Takada 3-chome, Toshima-ku, Tokyo 171
 Telephone 03-985-1111

	1979	1980	1981
Manpower	3,120	3,135	3,168
Sales (Million Yen)	69,289	77,034	86,422
Net Profit (Million Yen)	10,375	12,548	12,983

Products

- Tonic medicines..... 58%
- Medicines for the nervous system..... 17%
- Household and public hygienic medicines.. 10%
- Skin drugs..... 7%
- Others..... 8%
- (Export)..... (2%)

R & D ACTIVITIES

The Research Center of the Taiho Pharmaceutical Company functions as follows:

- In the Organic Chemistry Research Division, chemical substances are being synthesized, i.e., the development of anodynes, chemotherapy drugs, anti-tumor drugs, and steroid drugs for external application.

- In the Microorganism Research Division, new physiologically activating substances such as antibiotics, enzymes, and antienzymes are being developed from various species of microorganisms.

- The Pharmacology Research Division is checking to see whether these new compounds and physiologically activating substances being developed in these two divisions are really usable as medicines.

- In addition, there is the Safety Research Division carrying out the safety measures that are indispensable with research on drug effects.

- The Drug Metabolism Research Division, and the Mechanical Analysis Research Division are continuing their studies on the search for metabolic substances in the living body and the Pharmaceutical Research Division plays an indispensable role in the commercial production of medicines.

Through this research method, new drugs are being developed. One of the first to be developed was the anodyne to replace the anti-inflammatory anodyne, "Opainin." The second development was the remedy for skin diseases. The Research Center played a significant role in the development of "Koscarein," a specific drug used in the treatment of vitiligo. The laboratory has taken extracts from the herb, "Santokon" (Sopharazin) and succeeded in the synthesization of the extract which is used in the treatment of gastric ulcers. The Research Center will continue research on natural extracts for drug use as they are considered to have less side effects.

The development of chemotherapy drugs (antibiotics and anticancer drugs) is one of the Center's important activities. A research project on cephalosporins and macrolide antibiotics is now underway. In antibiotic research, the Center is developing polyester antibiotics which quickly fattens cattle.

Research on immunotherapy drugs are also of great importance. Further, the Research Center participated in the research project "E-64" which was under the direction of the Ministry of Health and Welfare and that is said to be an effective new development in the fight against muscular dystrophy.

LABORATORY TAKEDA CHEMICAL INDUSTRIES, LTD., CENTRAL RESEARCH
LABORATORY

(Takeda Yakuhin Chusho Kenkyu-sho)
Location 17-85, Juso-dori, Maechi 2-chome, Yodogawa-ku, Osaka 532
Telephone 06-301-1231

	1979	1980	1981
Manpower	-	-	1,000
Expenditure (Million Yen)	-	-	25,000

Activities

Laboratories Chemistry - synthetic organic chemistry, analytical chemistry
Applied microbiology - microbiology, fermentation
technology, pilot plant production
Biology - pharmacology, biochemistry, pathology, pathogenic
microbiology
Biotechnology - molecular biology, cell biology
Chemical development - process development, pilot plant
production, quality control
Pharmaceutical development - process and packaging
development, pilot plant production
Pharmacognosy - pharmacognosy, cultivation of medicinal plants
Drug safety evaluation - toxicology, drug metabolism
Food research - research on food products, additives,
and ingredients
Chemical products research - research on activated
carbons, polymers, and other synthetic chemicals
Agricultural chemicals research - studies on new
agricultural chemicals and formulation
Engineering research - development of production technology
Development Center - studies on medicines for animals and
feed additives

PARENT COMPANY TAKEDA CHEMICAL INDUSTRIES, LTD.
Location 27, Doshomachi 2-chome, Higashi-ku, Osaka 541
Telephone 06-204-2111

	1979	1980	1981
Manpower	11,268	11,171	11,023
Sales	373,091	429,510	459,853
(Million Yen)			
Net Profit	13,689	16,475	17,447
(Million Yen)			

Products Pharmaceuticals..... 58%
Foodstuffs..... 19%
Industrial chemicals and chemical products..... 19%
Agricultural chemicals..... 12%
(Export)..... (7%)

R & D ACTIVITIES

Takeda's Central Research Division is an integration of project-oriented laboratories, which, in spite of being established in a typical hierarchical corporate system, is operated in a manner that reinforces the lateral ties between fellow researchers in order to promote research and development activities. Takeda Industries, by virtue of a unique project team system in which the chemical researchers, who produce things, cooperate with the biological researchers, who process and organize information, has achieved the development of quality products.

Takeda Industries has successfully developed the use of special experimental animals that contribute much toward the promotion of geriatric research.

These animals include SHR (spontaneously hypertensive rats), KK (adult diabetes-prone rats), EXHC (rats susceptible to alimentary hypercholesterolemia), and fatty rats suffering from lipodosis. The four mentioned types of animals are inbred varieties of highly pathoporetic rats, and are used to obtain pathogenic data concerning hypertension and other diseases peculiar to old age. Also, these rats can be used for pharmacodynamic analysis. Takeda Industries has an experimental farm in Kyoto where about 3,000 species of medicinal herbs are grown.

Genetic engineering, which is referred to as "biotechnology," is of special interest to the Takeda Industries' Biological Laboratory.

Takeda Industries has signed an agreement with Nippon Roan Company, for joint research and development of interferon, and will start clinical experiments with interferon within a year or two.

While the development of new drugs is a costly and a time-consuming undertaking because the cost of safety engineering and the cost of manpower are increasing, Takeda Industries is sparing no effort in meeting the necessary requirements of quality control. The guidelines concerning the safety tests of drugs, as announced by the Ministry of Health and Welfare, is strictly followed by Takeda Industries.

PRECISION EQUIPMENT

LABORATORY CITIZEN WATCH COMPANY, LTD., TECHNICAL LABORATORY
(Shichizun Tokei Gijutsu Kenkyu-sho)

Location 840, Takeno, Shimotomi, Tokorozawa, Saitama 359
Telephone 0429-42-6271

	1979	1980	1981
Manpower	-	-	300
Expenditure (Million Yen)	-	-	30,000

Activities

Department 1	Development of new products
Department 2	Basic research on products
Department 3	Research and development on IC production technology and materials
Department 5	Development of new processing technology

PARENT COMPANY CITIZEN WATCH COMPANY, LTD.
Location 1-1, Nishishinjuku 2-chome, Shinjuku-ku, Tokyo 160
Telephone 03-342-1231

	1979	1980	1981
Manpower	3,111	3,072	3,058
Sales (Million Yen)	82,916	103,527	132,113
Net Profit (Million Yen)	4,320	5,019	5,934

Products	Watches and watch parts.....	90%
	Business machines.....	3%
	Machine tools.....	4%
	Others.....	3%
	(Export).....	(60%)

R & D ACTIVITIES

The Technical Laboratory was established in 1964 with its main R&D efforts being directed to watches and clocks. It is this laboratory which produced the world's first analog-type solar cell watch and the quartz watch of less than 1 mm in thickness.

During 1981 alone the laboratory produced four technological developments which include the temperature compensation system of using integrated circuits (IC). The crystal quartz watch has high accuracy, but the accuracy tends to be affected by body temperature that causes changes in quartz oscillation. The temperature compensation system solves this problem. With built-in integrated circuits capable of sensing even small (0.1°C) temperature changes, the system feeds back the temperature compensation signal to the oscillation circuit, and makes it possible to limit the errors of low-frequency crystal resonators to within ± 10 seconds per year.

The laboratory is also credited with technology related to precision instruments other than timepieces. The "Board Pecker" (phonetic), which was made available to the public in January 1981, can automatically fit or adopt a dozen electronic parts of many different shapes.

In the field of semiconductors, the laboratory has stressed the development of the complementary metal oxide semiconductors (CMOS). The laboratory is striving to develop thin film products. For in-house IC production, the laboratory is building IC assembly lines at the laboratory. In the future, emphasis will increasingly be put on the technological development of nontimepiece products.

PRINTING

LABORATORY DAI NIPPON PRINTING COMPANY, LTD, CENTRAL RESEARCH
INSTITUTE

(Dai Nippon Insatsu Chuoh Kenkyu-sho)
Location 12, Kaga-cho 1-chome, Ichigaya, Shinjuku-ku, Tokyo 162
Telephone 03-266-2111

	1979	1980	1981
Manpower	-	-	120
Expenditure (Million Yen)	-	-	1,700

Activities

- Administration Office
- Packing Research Center
- Building Materials Research Center
- Business Form Research Center

PARENT COMPANY DAI NIPPON PRINTING COMPANY, LTD.
Location 1-12, Kaga-cho, Ichigaya, Shinjuku-ku, Tokyo 162
Telephone 03-266-2111

	1979	1980	1981
Manpower	9,417	9,800	10,008
Sales (Million Yen)	206,853	423,176	481,473
Net Profit (Million Yen)	8,657	18,247	20,282

Products Commercial printing..... 44%
Book and periodical printing..... 20%
Special printing and paperware..... 36%
(Export)..... (4%)

R & D ACTIVITIES

The Central Research Institute is involved in research in image processing which will be an essential technology for use in the information industry. Upon completion of this technique, electronic printing will be possible, that is, one can prepare printed material by use of video equipment. The institute is also studying optical communications techniques for future use.

The development of the "shadow mask" which contributed much to the growth of the color television industry in Japan is a result of research carried out at this institute. The company now successfully mass produces an extremely highly accurate shadow mask having a pitch width of 0.2 mm. The institute is involved in efforts to develop a photomask for the production of integrated circuits (IC) and large-scale integrated circuits (LSI). The institute also plans to develop a color stripe filter for VTR devices using photoetching techniques.

The institute develops its own printing techniques. Some of these developments include "curved surface printing," which enables printing to be done on curved surfaces such as wooden bowls, telephones; the technique for printing relief patterns directly onto steel plate (ERIO Steel Plate); and "Air Relivo," which enables the printing of relief patterns to be done on cement. The institute has also developed the dry copy printing process, "Dry O-Print," which is capable of printing colorful patterns on acrylic fiber.

The institute is proceeding with other comprehensive research activities. The institute, in 1980, was subdivided into the Packing Research Center, Building Material Research Center, and the Business Form Research Center where specialized research is carried out. The company's research and development costs are 4% of its total sales.

LABORATORY TOPPAN PRINTING COMPANY, INC., CENTRAL RESEARCH INSTITUTE

(Toppan Insatsu Chuoh Kenkyu-sho)
 Location 5-1, Taito 1-chome, Taito-ku, Tokyo 110
 Telephone 03-835-5692

	1979	1980	1981
Manpower	-	-	65
Expenditure (Million Yen)	-	-	605

Activities

Product Divisions Backup Group

Image Processing Group

Future Technology Group - electronic parts
 - packaging materials
 - construction materials
 - related materials

PARENT COMPANY TOPPAN PRINTING COMPANY, LTD.
 Location 5-1, Taito 1-chome, Taito-ku, Tokyo 110
 Telephone 03-835-5111

	1979	1980	1981
Manpower	8,595	8,235	8,953
Sales (Million Yen)	315,196	363,442	412,147
Net Profit (Million Yen)	10,573	13,167	15,009

Products General commercial printing..... 62%
 Publication printing..... 26%
 Package printing..... 10%
 Securities printing..... 3%
 (Export)..... (3%)

R & D ACTIVITIES

The Toppan Printing Company reproduces information on paper, film, or any suitable surface with advanced printing technology, and by so doing plays an important role as an intermediary between clients and consumers. Hence, Toppan is able to develop new printing technology through collaboration with their clients.

The company's two laboratories approach printing from the viewpoint of printing engineering. In March 1971, they began developing hardware and software at the Toppan Idea Center. From this organization, the Central Research Institute came into existence.

The details of research and development results are not available, but the Braille printing system, the man-made (polyconcrete) receptacle for fish using recycled plastics, and packing materials for medical use are among Toppan's many achievements.

The budget for the Central Institute is not large, only 0.1% of the total sales. Total expenditures for research and development, however, are not small. In addition to the Central Institute, the technical institute, respective business divisions, and the Toppan Idea Center have R&D budgets. The Central Institute is the nucleus for combining the overall R&D needs for the entire organization.

The printing industry is calling for a greater application of electronics, smaller lots of printed matter, and the preparedness for diversification of needs. Toppan has already developed various precision electronic parts including photomasks for ICs and multiplayer printed wiring boards.

PULP AND PAPER

LABORATORY RENGO COMPANY, LTD., CENTRAL LABORATORY
 (Rengoh Chuoh Kenkyu-sho)
 Location 1-186, Ohiraki 4-chome, Fukushima-ku, Osaka, Osaka 536
 Telephone 06-465-5068

	1979	1980	1981
Manpower	-	-	41
Expenditure (Million Yen)	-	-	450

Activities

Administrative Office

Research Laboratory

New packaging materials
 Adhesives

Packaging and Design Laboratory

Packaging design
 Packaging systems design
 Packaging machines

PARENT COMPANY RENGO COMPANY, LTD.
 Location 18, Hirano-machi 4-chome, Higashi-ku, Osaka 541
 Telephone 06-202-2371

	1979	1980	1981
Manpower	3,068	3,018	3,038
Sales (Million Yen)	135,946	171,450	189,910
Net Profit (Million Yen)	1,861	2,039	2,988

Products Corrugated board..... 25%
 Corrugated boxes..... 63%
 Others..... 12%

R & D ACTIVITIES

The Central Laboratory has contributed significantly in the development of new packaging materials. The materials are, "RP corrugated paper," "Green Pack," and "Colflex."

The RP corrugated paper is produced by the emulsion polymerization of natural pulp to which 20% polyethylene is added. It is water resistant, lightweight, and costs little to produce.

The Green Pack is packaging material that has been designed to prevent fruit spoilage during transport. The company has developed a chemical agent that removes the ethylene gas discharged by ripening fruit during transport. In this corrugated paper, the size of pores in the activated carbon have been made even and the surface area has been enlarged for improved reaction to ethylene gas which assures an absorption ability of 100 times higher than conventional paper. Colflex is printed corrugated paper that is extremely strong because the paper is printed when it is in the form of liner paper before corrugation. It has an extremely good appearance.

Future development plans are to increase the strength of the existing materials and to automate the production system to reduce manpower costs. In addition to advanced development, the company finds it important to recycle used paper without degrading the paper quality.

RAILWAYS

LABORATORY KINKI NIPPON RAILWAY COMPANY, LTD., TECHNICAL
RESEARCH LABORATORY

(Kinki Nippon Tetsudo Gijutsu Kenkyu-sho)
Location 344, Ko, Amagatsuji-cho, Nara, Nara 630
Telephone 0742-33-8631

	1979	1980	1981
Manpower	-	-	50
Expenditure (Million Yen)	-	-	200

Activities

Group

Basic Research Group
Application Research Group
Development Research Group
Technical Service Group

Projects

Innovational research on transportation systems
ATS (automatic train stop) automatic check device
Ergonomical research on driver's seat
Research on motion and movement of vehicles
Research on video information systems

PARENT COMPANY KINKI NIPPON RAILWAY COMPANY, LTD.
Location 1-55, Uehommachi 6-chome, Tennoji-ku, Osaka 543
Telephone 06-771-3331

	1979	1980	1981
Manpower	12,542	12,529	12,724
Sales (Million Yen)	116,884	123,451	133,606
Net Profit (Million Yen)	5,368	5,814	5,506

Products

Railway transportation..... 76%
Bus transportation..... 6%
Others..... 18%

R & D ACTIVITIES

The research principles of the Laboratory are future-oriented, system engineering-related and interdisciplinary. In 1965, an automated ticket barrier system was developed from research carried out in this laboratory. The system has three main mechanisms: a ticket transfer mechanism, an infrared passenger detecting system, and a gate on-off mechanism. The main mechanisms of the system has been adopted by the Japan Railway Engineering Association (JREA).

The unmanned ticket vending system has been developed, i.e., a multifunctional ticket vendor was put into operation in 1979 and an on-line picture transfer commutation ticket vending system is now in operation at 80 stations. In addition, an interactive dialog vending machine is nearing completion. Based on these improvements, unmanned stations, which now number 40 of the total 338 stations, will increase to about 100 unmanned stations. Improved sound synthesis and recognition techniques will contribute to labor-savings and improved passenger services.

In the field of human engineering, 1.0 billion yen has been invested in order to standardize dashboards. Industrial robots and artificial intelligence and other leading techniques are being studied.

In the sphere of energy research, tests are being conducted to determine practical uses for the energy-saving solar cell heating system. Studies on wind generating energy systems and studies on the recycling of waste heat from hotels and other large buildings are being conducted.

Future research in energy stockpiling of low-cost nighttime electric power through the medium of superconducting coils is planned.

In the age of microelectronics, the laboratory is also putting great emphasis on the development of applications equipment of microcomputers, minicomputers, and of software.

REFINING

LABORATORY MITSUBISHI METAL CORPORATION, RESEARCH INSTITUTE
(Mitsubishi Kinzoku Chuoh Kenkyu-sho)

Location 1-297, Kitabukuro-cho, Ohmiya, Saitama 330
Telephone 0486-41-5111

	1979	1980	1981
Manpower	-	-	267
Expenditure (Million Yen)	-	-	3,702

Activities

- Resources and Environmental Laboratory - mineral exploration, physical beneficiation, industrial waste treatment, environmental investigation
- Metallurgy Laboratory - hydrometallurgy, pyrometallurgy, uranium metallurgy
- Metals and Alloys Laboratory - nuclear reactor alloys, heat resistant alloys, corrosion resistant alloys, copper-lead-zinc alloys, surface treatment
- Powder Metallurgy Laboratory - tool materials, machine and structural materials, friction materials, magnetic materials
- Fine Chemicals and Electronic Materials Laboratory - chemical instrumentation, fine chemistry, electronic materials
- Nuclear Energy Laboratory - nuclear fuel engineering, nuclear chemical processing, nuclear fuel cycle engineering, nuclear ceramics
- Materials Science Laboratory - material science, material testing, analytical chemistry
- Planning Division - research management, library
- Administrative Division - clerical section, maintenance and engineering section, clinic
- Technical Center - measurement service

PARENT COMPANY MITSUBISHI METAL CORPORATION
Location 5-2, Ottemachi 1-chome, Chiyoda-ku, Tokyo 100
Telephone 03-270-8451

	1979	1980	1981
Manpower	4,642	4,713	4,846
Sales (Million Yen)	202,884	339,119	317,087
Net Profit (Million Yen)	-1,088	1,687	2,000

Products	1981
Copper.....	273
Processed metal products.....	227
Gold and silver.....	20
Zinc.....	73
Lead.....	39
Others.....	5
(Export).....	(100)

WORK WITH US

The Resource and Environment Section of the Institute is doing research on geothermal resources. Upon construction of the Orinda Geothermal Power plant, which has the capacity of 19,000 kW, new geothermal site survey techniques which include the computerized multivariate analysis system that uses various underground elements were developed. The multivariate analysis system has been employed as part of the Ministry of International Trade and Industry (MITI) construction project of a 29,000 kW geothermal power plant in Kyushu.

The Metallurgy Section is involved in many studies ranging from fundamental thermodynamic and kinetic studies to engineering studies of practical devices that save resources and energy and control pollution. The section has developed a new process of producing titanium oxide (from which white pigment is made) from titanite ore.

The Metal Material Section deals with reactor materials, heat-resistant, and corrosion-resistant materials and surface treatment. The section has taken the initiative in the development of the zircalloy fuel cladding tubes used for nuclear power and high temperature gas turbine materials. They have also developed nickel cobalt material that is resistant to corrosion and wear and (it is suitable for turbines) low cobalt wear-resistant material. The development of these new materials requires new processes of melting, casting, plastic working, welding, and surface treatment.

The Powder Metallurgy Section is planning to develop cutting tool and *drilling* tool materials using tungsten carbide and ceramics. They have already developed sintered slider material which has been adopted as collection material for the pantograph of the New Express Line (Shinkansen), high rpm sintered oil-sealed bearings, and sintered heat resistant alloys which are widely used for hydrostatic hot presses.

The Chemical Material Section is developing optocommunication materials such as fine ceramics and pure silica glass for optical fibers and for gallium arsenide semiconductor materials.

The Nuclear Power Section has succeeded in the recovery of underwater uranium. This section is involved in various nuclear power problems which include high temperature gas turbine control material and disposal of radioactive wastes.

LABORATORY SUMITOMO METAL MINING COMPANY, LTD., CENTRAL LABORATORY

(Sumitomo Kinzoku Kohzan Chuoh Kenkyu-sho)
 Location 18-5, Naka-kokubu 3-chome, Ichikawa, Chiba 272
 Telephone 0473-72-7221

	1979	1980	1981
Manpower	-	-	103
Expenditure (Million Yen)	-	-	1,000

Activities

Administrative Office

Analysis Center

Project Group

- magnetic materials team
- ceramics team
- environmental team
- catalyst team
- electrochemical team
- physical property team
- metals team
- metal processing team
- electronic materials team
- synthetic construction materials team

PARENT COMPANY SUMITOMO METAL MINING COMPANY, LTD.

Location 11-3, Shimbashi 5-chome, Minato-ku, Tokyo 105
 Telephone 03-436-7711

	1979	1980	1981
Manpower	3,144	3,113	3,229
Sales (Million Yen)	171,930	284,982	283,782
Net Profit (Million Yen)	260	3,547	4,848

Products	
Electrolytic copper.....	24%
Electrolytic gold.....	20%
Nickel.....	15%
Construction materials.....	5%
Zinc.....	5%
Others.....	30%
(Export).....	(6%)

R & D ACTIVITIES

The organization of the Central Laboratory is made flexible so as to allow the formation of task-oriented research groups whenever necessary.

Recently such a group has developed a new process of producing silver peroxide. In this process, the silver peroxide electrode, which until now has been chemically unstable, is stabilized by suppressing the decomposition of oxygen. This has prolonged the cell life greatly. Also, the physical properties of semiconductors made from cadmium sulfide and cadmium selenide are being studied. Scientific information is exchanged with other companies such as the Matsushita Electric Industrial Company. In the future, the firm plans to manufacture solar cells for energy use.

The magnetic materials team is involved in many areas of research. It is attempting to develop new products utilizing samarium, cobalt, and other magnetic materials as well as magnetic films for memory elements and single crystals for bubble memories.

The efforts of the catalyst team's studies center around desulfurization, denitration, and deodorization research. The catalyst team is participating in the coal liquefaction project which is part of the "Sunshine Project," and is working on the development of a catalyst for direct hydrogenation.

The ceramics team is engaged in the development of ceramics for electronic and special-purpose materials. The metal team is part of the metal machining division which contributes to the individual metal sections including nickel alloy casting production and special welding materials.

The electrochemical team is conducting studies in the plating processes. The team has succeeded in plating lead frames that are used for electronic materials.

The environmental team was originally set up for studies on pollution control associated with silver refining. The technique of processing the precious metal waste water developed by this team is a valuable aid in environmental protection.

The physical property team has developed techniques and equipment for the analysis of physical properties of materials used in machines and other devices. In these eight years, the number of machines and devices examined by this team has increased by eightfold. The team is equipped with an electronic microscope and other instruments necessary for heat analysis. The physical property team has also made contributions to the processing of uranium fuel.

RUBBER

LABORATORY BRIDGESTONE TIRE COMPANY, LTD., TECHNICAL CENTER
 (Bridgestone Taiya Gijutsu Sentai)
 Location 2800-1, Ogawa-cho, Kodaira, Tokyo 187
 Telephone 0423-41-1111

	1979	1980	1981
Manpower	-	-	1,400
Expenditure (Million Yen)	-	-	20,000

Activities

Products Development Division

- Development Control Department
- Patent Department
- Laboratories - science and technology information group
 - golf ball development group
 - ocean products development group
 - noise pollution protection group
 - industrial materials group
 - building materials group
 - tire recycling group

Tire Technology Development Division

Tire Design Division

PARENT COMPANY BRIDGESTONE TIRE COMPANY, LTD.
 Location 10-1, Kyobashi 1-chome, Chuo-ku, Tokyo 104
 Telephone 03-567-0111

	1979	1980	1981
Manpower	17,799	17,557	17,809
Sales	434,301	517,635	514,041
(Million Yen) Net Profit (Million Yen)	25,318	24,487	14,184

Products Tires and tubes..... 85%
 Industrial rubber products and chemical products..... 15%
 (Export)..... (32%)

R & D ACTIVITIES

The Technical Center was established in 1962 to support the production of the Bridgestone Tire Company. Furnished with ultramodern research equipment, the company has produced over 3800 kinds of tires. The highly sophisticated equipment includes automatic drafters capable of instantly drafting complicated tire patterns, large-scale vibration testers which have made great contributions to the development of low-noise tires by measuring the noise of running tires, and tendrum testers to check the characteristics of rotating tires by pressing the tire onto the drums at high speed. The drum tester can reproduce as much as 90% of the actual heat, pneumatic pressure, maneuverability and damage as a tire would sustain in motion.

The research staff at the center has increased to 1400 members of which 60% are researchers in mechanics and physics fields, and 40% are researchers in the chemistry field. In recent years, researchers have been hired for basic research purposes in an attempt to make a breakthrough in conventional technology. Specialists in electron microscope and mass spectrometry are investigating the phenomena of tires at the microscopic level. It is hoped that these investigative approaches will lead to the development of new types of tires.

In the past it had been difficult to resolve the two conflicting requirements for the good quality tire design; to attain fuel economy by reducing the rolling friction of the tire, but the reduction of friction also reduces the road gripping needed for safety. However, these antinomic tasks, researched at the microscopic level, did not prove insurmountable. The result: the development of a 1981 model radial tire that achieves 20-30% fuel economy and at the same time maintains an acceptable level of safety.

LABORATORY JAPAN SYNTHETIC RUBBER COMPANY, LTD., TOKYO
 LABORATORY
 (Nippon Gohsei-Gomu Tokyo Kenkyu-sho)
 Location 7569, Ikuta, Tama-ku, Kawasaki, Kanagawa 214
 Telephone 044-966-6111

	1979	1980	1981
Manpower	-	-	?
Expenditure (Million Yen)	-	-	3,250

Activities

Research Department

Basic research on synthetic rubbers and resins
 (conversion of raw materials, processes, polymeric
 reactions, data collection, compiling documents, etc.)

Development Department

Quality improvement of the existing products, commercialization of a product developed by the Research Department, development of production processes and facilities involved, and practical applications

Technical Service Department

Customer service (visit customers to solve problems and exchange technical views)

Quality Control Department

PARENT COMPANY JAPAN SYNTHETIC RUBBER COMPANY, LTD.
 Location 11-24, Tsukiji 2-chome, Chuo-ku, Tokyo 104
 Telephone 03-541-4111

	1979	1980	1981
Manpower	2,598	2,567	2,584
Sales (Million Yen)	107,580	135,524	165,661
Net Profit (Million Yen)	1,376	3,157	1,743

Products Synthetic rubber..... 64%
 Emulsion..... 18%
 Synthetic resin..... 18%
 (Export)..... (10%)

R & D ACTIVITIES

The company's research and development expenditure is about 2.4% of its sales, this figure being slightly above the average for companies in the chemical industry. The company tends to stress the development of new products. The Tokyo Research Center has developed the high molecular compound "1, 2 - polybutadiene" which has the properties of plastics and rubber. The high molecular compound is capable of 15-30% crystallization. This process can be used in injection molding of rubber and plastics.

The development of "pressurized electric conductive rubber" is another result of its research activities which launched the company into the field of electronics. This rubber is made by combining silicone rubber with granulated metal. This rubber is used for camera shutters and as a touch-switch for audio sets, electronic musical instruments, transmitters, and receivers. It is also used as a high density key board for office computers, word processors, etc.

The Center has developed the sensitive resin "CBR" for use with photoresistors for integrated circuits (IC) and thin film insulation materials. The cyclized butadiene based negative-type photoresistor is the first using butadiene rubber. The research activities in the electronics field is the fourth major research area for the company.

The Research Center is also developing applications of high molecular compounds for medical purposes. Latex that has a uniform grain size distribution is a result of some of the development activities. Plastic particles have been developed as fine as 0.7 to 0.2 μm for use in clinical diagnostic medicine. The Center has also developed the nonhydrated soft contact lens. The contact lens is of the type quite different from the conventional type contact lens in that it has the softness of hydrated soft contact lens and a characteristic peculiar to the nonhydrated soft contact lens which is resistant to bacteria. In addition, the Center has developed adhesives and bonding agents.

SHIPBUILDING

LABORATORY HITACHI SHIPBUILDING AND ENGINEERING COMPANY, LTD.,
TECHNICAL RESEARCH INSTITUTE
(Hitachi Zohsen Gijutsu Kenkyu-sho)
Location 3-22, Sakurajima 1-chome, Konohana-ku, Osaka 554
Telephone 06-463-7111

	1979	1980	1981
Manpower	-	-	240
Expenditure (Million Yen)	-	-	4,000

Activities

Administration Department
Material Research Laboratory
Strength Research Laboratory
Fluid Dynamics Research Laboratory
Machinery Research Laboratory
Combustion and Heat Transfer Research Laboratory
Chemical Research Laboratory

PARENT COMPANY HITACHI SHIPBUILDING AND ENGINEERING COMPANY,
LTD.
Location 6-14, Edobori 1-chome, Nishi-ku, Osaka 550
Telephone 06-443-8051

	1979	1980	1981
Manpower	17,854	16,794	16,625
Sales (Million Yen)			
Net Profit (Million Yen)	3,748	1,009	3,223

Products

Shipbuilding and repair.....	51%
Ocean development machinery.....	9%
Marine engines and machinery.....	12%
Steel structures and environmental development equipment.....	14%
Plants.....	11%
Castings, forgings, and others.....	3%
(Export).....	(58%)

R & D ACTIVITIES

In 1982, the Technical Research Institute reorganized its research laboratories by disciplinary classification instead of product line classification adding a production engineering center. This was to avoid time and money loss by duplication of interdisciplinary fields and hiatuses in far-flung research activities. The synectics grouping will be put in operation case by case to offset the demerits of the new research system.

The main achievements of the respective laboratories are as given below:

- **Material Science and Technology Laboratory:** This laboratory is involved in the pronounced development of HZ alloy highly resistant to sulfuric acid and other corrosive materials and the production of low hyroscopic aggregate from pelletized coal ash. A study of long-term protection of maritime structures from corrosion is underway.

- **Strength Research Laboratory:** This laboratory is engaged in basic research important to every department. One example is the high-temperature and high-pressure vessel located at Ariake Works. Since the change in hull construction philosophy from that of design by rule of thumb to that of design by analysis, analytical projects are on the increase. An anechoic chamber has also installed for studies of vibration and noise.

- **Hydrodynamic Laboratory:** The research and development activities are centered on the operation of ships and the anchorage of maritime structures including ocean oil storage, transport by capsules, and other offshore and onshore items.

- **Machinery Laboratory:** The main interests are machine elements such as hydraulic equipment; diesel engines, high-speed rotary machines, gears and bearings.

- **Combustion and Heat Transfer Laboratory:** The study of coal pulverization is being pursued. The company has succeeded in removing up to 99% of the ash contained in coal, generally in the amount of 15 to 20%, through the medium of water and oil.

- **Chemical Laboratory:** Catalysts for denitration and desulfurization are being sought. A life science related development is the fermentation of cellulose which, although the studies have just begun, has strong possibilities for future use.

- **Processing and Control Laboratory of the Production Engineering Center:** The main push of mechatronics research is toward oil rig welding robots, the automation of ship operations, and a variety of other developments. In future shipbuilding operations, "The goal is for completely unmanned plant operations with the ships requirements and efficiency construction techniques taken into consideration," said Mr. Nishi, Chief of the Institute. The company has long been seeking other markets than shipbuilding, though 70% of the research and development investment is in land-based technology.

LABORATORY ISHIKAWAJIMA-HARIMA HEAVY INDUSTRIES COMPANY, LTD.,
RESEARCH INSTITUTE

(Ishikawajima Harima Jukohgyo Kenkyu-sho)
Location 1-15, Toyosu 3-chome, Kohtoh-ku, Tokyo 135
Telephone 03-534-3300

	1979	1980	1981
Manpower	-	-	650
Expenditure (Million Yen)	-	-	5,785

Activities

- General Advisory Staff
- Research Planning Department
- Administration Department
- Computer Application Technology Center
- Applied Science Department
- Aseismic Designs Development Department
- Structure and Strength Department
- Metallurgy Department
- Machinery Department
- Industrial Machinery Department
- Heat and Fluid Dynamics Department
- Turbomachinery Department
- Energy Technology Department
- Ship Propulsion Department
- Ship Dynamics Department
- Ship Strength Department
- Fundamental Chemical Technology Department
- Chemistry Department
- Chemical Process Technology Department
- Welding Technology Department

PARENT COMPANY ISHIKAWAJIMA-HARIMA HEAVY INDUSTRIES COMPANY,
LTD.

Location 2-1, Ohtemachi 2-chome, Chiyoda-ku, Tokyo 100
Telephone 03-244-6496

	1979	1980	1981
Manpower	27,403	26,221	26,202
Sales (Million Yen)	698,147	91,337	681,126
Net Profit (Million Yen)	1,960	3,808	6,031

Products

- Iron and steel manufacturing equipment... 8%
- Chemical plants..... 15%
- Material handling machinery..... 11%
- Boilers and marine engineering 13%
- Standardized machinery and others..... 21%
- Aircraft engines..... 7%
- Ship building..... 19%
- Repairing ships..... 6%
- (Export)..... (37%)

R & D ACTIVITIES

The Ishikawajima-Harima Heavy Industries' products range from heavy machines, and chemical plants, to ships and aircraft. This wide variety of products is a direct result of the basic technical research of its research institute. The institute staffers are now placing special emphasis on development of jet engines, high-power laser equipment, and new materials as well as on the reduction of fuel consumption in diesel engines.

In recent research, particular emphasis has been placed on coal-related technology. A trend to substitute coal for oil has been occurring, in particular, in power companies, and in steel and cement industries. The increased use of coal has accordingly brought forth new and significant problems of environmental protection relating to dispersion of coal dust in the living area around coal storage installations.

The "NS Group System" that is unique to this institute combines the needs of the sales divisions and the needs of the institute in solving critical technical problems.

An NS team composed of three staffers assigned by a manager has the special task of clarifying the research subjects and selecting the appropriate research personnel to solve specific technical problems. The research personnel so selected work on a special project on a part-time basis-several hours a day-while maintaining their on-going research work. The NS teams have been particularly effective in product development and improvement.

LABORATORY MITSUBISHI HEAVY INDUSTRIES, LTD., NAGASAKI RESEARCH INSTITUTE

(Mitsubishi Ju-kohgyo Nagasaki Kenkyu-sho)
 Location 1-1, Akunoura-machi, Nagasaki, Nagasaki 850-91
 Telephone 0958-61-2111

	1979	1980	1981
Manpower	-	-	570
Expenditure (Million Yen)	-	-	8,800

Activities

Ship R&D Group	Ship form, hull vibration, propellers, hull strength
Prime Mover Group	Boiler and combustion, steam turbine, heat transfer, diesel engines, plant automation, supercharger
Basic Technology Group 1	Materials, welding, strength, chemical natures
Basic Technology Group 2	Blade vibration, metrology, rotary shaft, lubrication science, noise, basic internal combustion engines
Application Technology Group	Cryogenics, wind stability, high-temperature gas furnace, slurry transport, smoke diffusion

PARENT COMPANY MITSUBISHI HEAVY INDUSTRIES, LTD.
 Location 5-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100
 Telephone 03-212-3111

	1979	1980	1981
Manpower	63,716	59,209	58,228
Sales (Million Yen)	1,274,862	1,349,269	1,325,621
Net Profit (Million Yen)	9,671	11,697	12,197

Products	Shipbuilding and steel structures..... 19%
	Power systems..... 28%
	Chemical plants and engineering..... 5%
	Machinery..... 17%
	Construction machinery, precision machinery, engines, refrigerators and air conditioning machinery..... 21%
	Aircraft and special vehicles..... 16%
	(Export)..... (33%)

R & D ACTIVITIES

The research and development projects of the Nagasaki Research Institute range from basic and elementary technology relating to materials, mechanics, chemistry, rheology, and tribology to production engineering and integrated plant control technology.

The Institute has five departments and fifteen laboratories with a total of 570 researchers, of whom some 50 are dispatched to the various ongoing projects sponsored by the Mitsubishi Group, universities, and private as well as government agencies.

The institute is a center for research and development not only within the Mitsubishi Group, but also with private and public institutions in Japan and even for foreign corporations who commission research and development projects. The Nagasaki Research Institute has been able to develop an energy-saving vessel, a super ore/coal carrier (200,000 DWT) which consumes half as much fuel as the conventional carrier of the same size. Incorporated into the vessel is an up-to-date hull form, a high-performance exhaust gas recovery turbine generator, and a reaction tin which improves propulsion efficiency. The Nagasaki Shipyard will observe a keel-laying service for this new vessel shortly.

Known for its high state-of-the-art achievements in technology, the Nagasaki Technical Institute is receiving a growing number of requests from foreign companies and international institutions for joint research and development projects. These inquiries include research subjects such as the development of low-pollution burners, supertankers fit for icebound sea voyages, the development of revolutionary blades for steam turbines, submarine manganese nodule collecting and transporting system as well as supercritical pressure boilers. The institute is steadily accumulating both technical and developmental know-how.

LABORATORY MITSUBI ENGINEERING AND SHIPBUILDING COMPANY, LTD.,
AKISHIMA LABORATORY

(Mitsui Zohsen Akishima Kenkyu-sho)
Location 1-59, Tsutsujigaoka 1-chome, Akishima, Tokyo 196
Telephone 0425-45-3111

	1979	1980	1981
Manpower	-	-	70
Expenditure (Million Yen)	-	-	1,457

Activities

- Planning and Coordination Department
- Marine Hydrodynamics Research Section
- Marine-structure Dynamics Research Section
- Performance Research Section
- Structure Aerodynamics Research Section
- Manufacturing and Testing Section

PARENT COMPANY MITSUBI ENGINEERING AND SHIPBUILDING COMPANY, LTD.
Location 6-4, Tsukiji 2-chome, Chuo-ku, Tokyo 104
Telephone 03-544-5151

	1979	1980	1981
Manpower	12,790	11,025	11,607
Sales (Million Yen)	254,747	291,181	267,133
Net Profit (Million Yen)	-9,371	-256	4,673

Products Shipbuilding and ship repair..... 45%
Ocean development facilities, steel structures..... 15%
Marine machinery, construction machinery, industrial
machinery, chemical machinery and plants..... 40%
Contracts..... 5%
(Spot)..... (6%)

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JAPANESE RESEARCH INSTITUTES FUNDED BY PRIVATE
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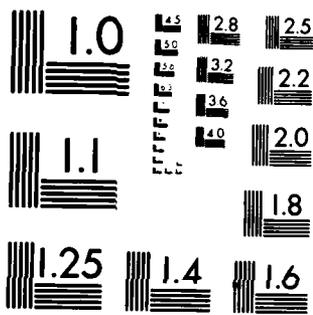
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R & D ACTIVITIES

The research areas that the Akishima Laboratory is now involved in can be largely classified into three groups: ship, marine equipment, and bridge construction. As for building ships, emphasis is being placed on the development of new ship designs in view of faster and less fuel-consuming vessels.

Currently, the need for new ship design has changed based on energy conditions, i.e., from tankers to LNG vessels and coal ships. For example, customers request coal ship designs which has design specifications to contain coal and is also suitable for shallow water. One main study item is the development of energy-saving ships. This research has progressed in various areas, such as in ship construction and engines. In order to keep pace with the development of ships, the study of marine equipment has been necessary. The important subjects are petroleum rigs, the performance of marine structures in waves, and wave-activated power generation. The research on bridge building has increased with the construction of the Honshu-Shikoku Relay Bridge. Other research subjects in this field include studies on the wind-resistant stability of large-sized structures on land or at sea such as containers and petroleum rigs.

About ten project teams in the laboratory are engaged in the development of energy-savings in ship design; half-sunk catamarans; and LNG vessels. Some of the projects have been successful. One example is the "marine duct equipment." This energy-saving new gear is mounted in front of the propeller of a ship to reduce resistance to the hull and improve propeller efficiency. In the case of an ultralarge 200,000 or 300,000 ton ship, as much as 7 to 12% energy costs can be realized. The half-sunk catamarans which attracted public attention last year is also an achievement of this research project. In this unique ship, the torpedo-shaped hull is combined with the upper structure by a streamlined sectioned strut. The ship can run with little undulation even in high seas.

TETRAPODS

LABORATORY NIPPON TETRAPOD COMPANY, LTD., APPLIED HYRDAULICS
LABORATORY

(Nippon Tetrapoddo Ohyo-Suiri Kenkyu-sho)
Location 2-7, Higashi-nakanuki-cho, Tsuchiura, Ibaraki 300
Telephone 0298-31-7411

	1979	1980	1981
Manpower	-	-	60
Expenditure (Million Yen)	-	-	450

Activities

 Technical Development Division
 Experimental research on tetrapods in harbors, bays and
 on the coast

 Environmental Division
 Development of oil recovering equipment

 Applied Hydrodynamics Laboratory
 Development of experimental and mathematical methods

PARENT COMPANY NIPPON TETRAPOD COMPANY, LTD.
Location 7-1, Nishi Shinjuku 2-chome, Shinjuku-ku, Tokyo 160
Telephone 03-342-0151

	1979	1980	1981
Manpower	445	511	494
Sales (Million Yen)	19,280	21,691	23,893
Net Profit (Million Yen)	423	550	587

Products Tetrapods..... 100%

R & D ACTIVITIES

This laboratory is involved in the testing related to consulting services so independent research plays a small role in their overall research and development program.

The consulting services include every aspect relating to the action of water in motion: conducts surveys, analysis, planning, designing, execution; the control and environmental assessment regarding harbors, fishing ports, airports, rivers; maritime civil engineering; maritime recreation; and artificial seaside reclamation. The test subjects of the laboratory are hydraulic model tests concerning disposition and breaking effects of breakwaters; the function and stability of seaside and harbor structures which includes littoral drift and seashore protection; tests for turbidity dispersion, dispersion of hot and cold effluents, and tidal currents; hydraulic analysis including tidal estimates, wave spectral calculations, irregular current calculations, and beach transformation simulations.

The main product of the company is tetrapods. Early in 1981, a precast concrete armor unit of 64 tons each was developed. The upright wave dissipation structure, named "Igloo," was designed to dissipate waves and to be used for mooring ships. In addition, the study of an effective valve-type breakwater which is being subsidized by the Ministry of Transport is now underway. This study is aimed at the removal of polluted sea water inside bays so as to meet a variety of requirements which include the prevention of pollution disasters and to provide environmental protection.

In the future, plans are to introduce large-sized computers and emphasize software development for use in studies that involve the development of seashore structures. This research area will concern both fisheries and civil engineering problems. Research and development projects in seashore engineering including breakwaters and other seashore installations, of necessity, will include collaboration with fishery laboratories.

TEXTILES

LABORATORY	KANEBO, LTD., RESEARCH INSTITUTE (Kaneboh Kenkyu-sho)		
Location	3-80, Tomobuchi-cho 1-chome, Miyakojima-ku, Osaka 534		
Telephone	06-921-1231		
	1979	1980	1981
Manpower	-	-	400
Expenditure (Million Yen)	-	-	4,000
Activities	<p>Basic Research- Basic research laboratories, systems laboratories, industrial property center, products testing center</p> <p>Textiles - Cotton products development laboratory, wool technical development laboratory, wool products development laboratory, handknitting yarn development laboratory, silk products development laboratory, filament products development laboratory, staple products development laboratory, fiber and textile research laboratory, sericultural laboratory, Kanebo Fashion Research, Ltd.</p> <p>Cosmetics - Cosmetics laboratory, beauty culture laboratory</p> <p>Pharmaceuticals - Pharmaceuticals laboratory, Chinese medicines laboratory, cancer laboratory</p> <p>Foodstuffs - Foodstuffs laboratory</p> <p>Housing, Environment, Industrial Materials - Industrial materials laboratory, Kanebo-NSC research laboratory, Kanebo synthetic chemical laboratory, Kanebo fiberglass development laboratory</p>		

PARENT COMPANY	KANEBO, LTD.		
Location	2-2, Umeda 1-chome, Kita-ku, Osaka 530		
Telephone	06-348-5541		
	1979	1980	1981
Manpower	5,522	5,395	5,364
Sales (Million Yen)	264,734	248,754	255,793
Net Profit (Million Yen)	27	90	-639

Products	Cotton.....	9%
	Wool.....	13%
	Silk.....	2%
	Nylon.....	13%
	Ester.....	17%
	Acrylics.....	9%
	Cosmetics.....	25%
	Pharmaceuticals.....	4%
	Others.....	8%
	(Export).....	(18%)

R & D ACTIVITIES

An important innovation this institute has achieved is the Unmanned Automatic Dyeing System which received a Textile Machinery Society Prize in 1965. The system fully automated the Suzuka Works complicated dyeing process of wool tops.

The Textile Machinery Society awarded a prize in 1976 to Kanebo for its computerized knitting pattern data processing system. In the area of synthetic fiber technology, the process of direct continuous polymerization from medium-purity terephthalic acid won the 1975 Ohkochi Production Prize. This achievement was a result of the company's pilot plant's process of nylon-polyester melt spinning. This plant's technology is scheduled to be exported to Shanghai, China.

Kanebo is a latecomer in this field, but it developed, in 1965, a conjugated yarn, a combination of nylon and polyester and it was commercialized as "BELLSAME" which was followed by "BELLTRON" an electroconductive fiber.

The Pharmaceutical Department of the company was opened in 1966. After the establishment, the department announced its first success at independent research and development. It was a birth canal softening adenocortical hormone named "MYRIS." A considerable amount of development funds are allotted to the Pharmaceutical Department.

The Cosmetics Department of the company entered the market cautiously and has now established a secure footing. Making the most of synthetic silk yarn technical development, the company established a powdered silk foundation makeup for market in the fall of 1980.

The Food Department of the company commercialized nonfried instant noodles for the first time in the industry. This type of instant noodles is most popular. The research and development costs of the company in 1980 amounted to 1.5% of the total sales.

LABORATORY TEIJIN, LTD., CENTRAL RESEARCH INSTITUTE
 (Teijin Chuoh Kenkyu-sho)

Location 4-3-2, Asahigaoka, Hino, Tokyo 191
 Telephone 0425-81-4321

	1979	1980	1981
Manpower	-	-	300
Expenditure (Million Yen)	-	-	8,000

Activities

Basic Research Division

Biochemistry

Gene recombination
 Physiological activators

Thin Film Research Division

New functional film
 Multilayer coating
 Vacuum evaporation
 Sputtering
 Plasma resolution

PARENT COMPANY TEIJIN, LTD.
 Location 11, Minamihonmachi 1-chome, Higashi-ku, Osaka 541
 Telephone 06-268-3003

	1979	1980	1981
Manpower	7,446	7,247	7,262
Sales (Million Yen)	337,109	403,347	449,132
Net Profit (Million Yen)	2,232	7,209	6,020

Products	Tetron.....	56%
	Nylon.....	13%
	Other fibers.....	1%
	Chemical products.....	27%
	Others.....	3%
	(Export).....	(2%)

R & D ACTIVITIES

Teijin, Ltd. is a pioneer in Japan's synthetic fiber industry and has succeeded in the development and industrialization of the rayon industry in Asia. Beside the fibers industry the company also deals with chemicals such as found in plastics and medicines. Teijin is now undertaking a new project which will be a fourth major effort of the company.

Since last April Teijin's Central Research Laboratory, which is responsible for developing new technology, has been considering the technology of gene recombination as a new research project.

For this new project, the Laboratory has divided the members into two project teams, namely the Basic Research Team and the Thin Film Research Team. The Basic Research Team investigates scientific areas related to the life sciences, such as biochemistry, gene recombination, and physiological activators. The Thin Film Research Team has developed a new type of film which is produced by layering inorganic and organic thin films of ten to several thousand (one Å is 10^{-8} cm) onto macromolecular film. The team has also begun studies in multilayer coating techniques (i.e., vacuum evaporation, sputtering, and plasma resolution) which are necessary for the complete development of this new film. The film will be the precursor to the transparent conductive film which, it is hoped, will be marketable as material for the electronics industry. The Thin Film Research Team, using funds supplied by the Ministry of International Trade and Industry (MITI), for the "development of advanced techniques," (1978-80) has developed a transparent film which cuts off radiant heat. This film (1/10,000 mm) which is made with layers of metal and metallic oxide on the surface of polyethylene film can be used in freezers and refrigerators and windows of buildings and its usage saves energy in air conditioning systems. Since 1980, the Central Research Laboratories has also been involved in research on film solar batteries which are composed of several layers of organic film and amorphous silicon.

In order to heighten efficiency in research, the Central Research Laboratory seeks the aid of other laboratories within the company, such as the Production Technique Laboratory, the Plastic Laboratory, the Biomedical Laboratory, and the Fiber Process Laboratory. The cooperation of these laboratories and the organization of the co-project team is a company-wide effort.

LABORATORY TORAY INDUSTRIES, INC., BASIC RESEARCH LABORATORY
 (Tohre Kiso Kenkyu-sho)
 Location 1111, Tebiro, Kamakura, Kanagawa 248
 Telephone 0467-32-2111

TORAY INDUSTRIES INC.

	1979	1980	1981
Manpower	-	-	200
Expenditure (Million Yen)	-	-	2,200

Activities

Group

- Organic chemicals group
- High polymer group
- Catalyzer group

Projects

- Synthetic fibers
- Plastic resins and films
- Synthetic suedes and carbon fibers
- Basic and intermediate materials
- Processing technology
- Electronic measuring instruments
- Information processing system
- Photopolymer printing plates
- Medical products
- Pharmaceuticals
- Flavors and fragrances
- Food and feed additives
- Waste water and exhaust gas treatment systems

PARENT COMPANY TORAY INDUSTRIES INC.
 Location 2, Nihombashi-muromachi 2-chome, Chuo-ku, Tokyo 103
 Telephone 03-245-5111

	1979	1980	1981
Manpower	14,052	13,665	13,604
Sales (Million Yen)	403,808	480,976	530,708
Net Profit (Million Yen)	8,441	13,913	12,321

Products

Nylon.....	23%
Polyester.....	38%
Toraylon.....	7%
Plastics.....	17%
Chemicals.....	6%
Others.....	9%
(Export).....	(28%)

R & D ACTIVITIES

The Basic Research Laboratories had its beginnings in the organic chemistry laboratory and the physicochemical laboratory of Toray Industries. These laboratories developed the efficient production of synthetic fiber materials, and founded the Kawasaki Factory of Toray Industries.

The laboratories are undertaking technical development of new chemicals and processes. Currently, about fifty scientists at Toray Industries are engaged in interferon research. The laboratories produce four billion units of interferon per month. Interferon is hoped to be used as an effective treatment in cancer and viral diseases.

The laboratories intend to begin full-fledged long-term research on technical development associated with energy saving processes, on biochemical problems, and on gene recombination problems.

The character of the laboratories has been changed by intense competition and the pursuit of newly-developed processes so that the laboratories have put more emphasis on purpose-oriented research. Currently three research groups, the organic chemistry group, the polymer chemistry group, and the catalytic chemistry group are doing research in the four areas of catalyst chemistry, organic chemistry, polymer chemistry, and biochemistry. Since 1971, in conjunction with this research, and as mentioned above, the laboratories have been conducting studies on interferon. The laboratories have also been engaged in joint and assigned studies.

Toray Industries expects much from this laboratory and as a result, the research funds have been increased by 10 percent in biochemistry and other related fields. The research funds of the laboratories new accounts for 20 percent of the total R&D funds of Toray Industries (10 to 12 billion yen).

LABORATORY UNITIKA, LTD., RESEARCH AND DEVELOPMENT CENTER
 (Yunichika Chuoh Kenkyu-sho)
 Location 23, Kozakura, Uji, Kyoto 611
 Telephone 0774-25-2200

	1979	1980	1981
Manpower	-	-	220
Expenditure (Million Yen)	-	-	3,000

Activities

- Laboratory 1 Research in organic and polymeric synthesis science
- Laboratory 2 Research in synthetic fibers and rapidly quenched metal wires
- Laboratory 3 Research in biochemistry
- Laboratory 4 Research in polymeric materials, structure, and properties analysis
- Laboratory 5 Applied research and development in nontextile fields
- Laboratory 6 Research in engineering systems

Research Administrative Office
 General Affairs Office

Developing department for U-polymer
 Developing department for Unicellex
 Laboratories for basic research in textile processing
 Textile treatment and processing technology department
 Research center for sewing technology

PARENT COMPANY UNITIKA, LTD.
 Location 68, Kitakyutaro-machi 4-chome, Higashi-ku, Osaka 541
 Telephone 06-252-6111

	1979	1980	1981
Manpower	6,943	6,547	6,843
Sales (Million Yen)	181,097	196,231	215,117
Net Profit (Million Yen)	156	578	881

Products	Nylon.....	26%
	Polyester.....	27%
	Cotton.....	10%
	Wool.....	6%
	Rayon.....	2%
	Others.....	29%
	(Export).....	(10%)

R & D ACTIVITIES

Established in 1939, the Central Laboratory consists of six laboratories staffed with 220 researchers. Its annual research and development investments amount to about 1% of the annual sales of Unitika.

Laboratory No. 1's main study is functional polymers as represented by chelating resins which selectively absorb mercury, uranium, gallium, and indium. It also is studying hot-melt adhesives, and photosensitive polymers.

Laboratory No. 2 is studying the development of primary materials (mainly nylon and ester) and their production processes, and is regarded as the pivot point of the Central Laboratory.

Laboratory No. 3 has about ten years of history in the study of biochemistry, and is currently pushing the development of a bioreactor for the purpose of extracting and fixing enzymes from thermophiles. It also is studying the enzymes used in the reactivation of ATP (adenosine triphosphate) and the synthesis of polypeptide enzymes from amino acids in an attempt to provide new dimensions in the production of hormones, antibiotics, medical and agricultural chemicals.

Specializing in advanced instrumentation and analysis, Laboratory No. 4 has developed an interferometric system of measuring the thickness of running film.

Laboratory No. 5 is involved in medical engineering, and has developed an antithrombotic venous catheter which will be used in artificial organs and artificial hearts. The chelating resin technology of Laboratory No. 1 will assist Laboratory No. 5 with the development of diaphragms and valves.

Laboratory No. 6 is involved in energy and environmental research. In regard to energy, the development of solar heating systems and amorphous silicon solar cells are primary areas of concentration. With regard to environment, this laboratory has recently developed a dry process of removing chlorine from the flue gas of garbage incinerators.

As the textile industry here has reached zero growth stage in terms of quantity, the Central Laboratory is helping to diversify the company's business into nontextile fields. The Central Laboratory places 80% of its efforts on "needs" and 20% on the development of the "seeds" of research in accordance with policies that dictate intensive investment of money and human resources.

LABORATORY WACOAL CORPORATION, CENTRAL LABORATORY
 (Wakohru Chuo Kenkyu-sho)
 Location 29 Nakajima-cho, Kishoin, Minami-ku, Kyoto 601
 Telephone 075-681-1171

	1979	1980	1981
Manpower	-	-	29
Expenditure (Million Yen)	-	-	400

Activities

Groups

Ergonomics Group
 Industrial Engineering Group
 Quality Control Group

Projects

Application research on physical nature of new materials
 Development of new dyeing methods
 Preventive research on skin disorders caused by clothing
 Quality control of materials and products
 Ergonomical research on materials and cloths

PARENT COMPANY WACOAL CORPORATION
 Location 29, Kishoin Nakajima-cho, Minami-ku, Kyoto 601
 Telephone 075-681-1171

	1979	1980	1981
Manpower	3,915	4,323	4,452
Sales (Million Yen)	74,381	84,947	94,210
Net Profit (Million Yen)	6,348	7,157	7,346

Products

Foundation garments..... 37%
 Lingerie..... 32%
 Night wear..... 16%
 Wear for children..... 5%
 Others..... 10%

R & D ACTIVITIES

The Laboratory announced in 1965 a challenging revelation that, for the Japanese, the proper proportion of body to head ratio is 7.3 and not 8. The theory was based on anatomical statistics of some 5000 females surveyed under the guidance of an authority on human engineering. Anthropometry research is being undertaken by the Human Engineering Section which systematically measures some 1,000 people a year; the total number of people measured so far has reached 16,000.

The somatometry used is Martin's pelvimetry in which measurements are taken with reference to the bones and covers no less than 158 body parts which include the height and girth of bust and hip. The Human Engineering Section is staffed with eight men and seven women who have applied themselves to these basic studies. In 1981, the Laboratory compiled somatological features of teen-agers and concluded the Japanese woman is at her slimmest at the age of 12. In 1980, the Laboratory measured Korean women and in 1981 will measure women from Thailand.

The Laboratory hopes to be able to conduct somatological surveys in Europe and the United States in the future.

TRANSPORTATION EQUIPMENT

LABORATORY KAYABA INDUSTRY COMPANY, LTD., TECHNOLOGY AND RESEARCH CENTER

(Kayaba Kogyo Gijutsu Kenkyu-sho)

Location 1805-1, Asamizodai, Sagamihara, Kanagawa 228
Telephone 0427-45-8111

	1979	1980	1981
Manpower	-	-	65
Expenditure (Million Yen)	-	-	400

Activities

Materials Laboratory

Metal and high polymer materials, chemical analysis, data bank, and technical consulting

Basic Research Laboratory

Basic research on noise, vibration, contermination of hydraulic equipment, and mechanical nature of hydraulic systems

Application Research Laboratory

Industrial robots, ocean developing equipment, railroad equipment, sewing machines, and new equipment development

PARENT COMPANY KAYABA INDUSTRY COMPANY, LTD.
Location 4-1, Hamamatsucho 2-chome, Minato-ku, Tokyo 105
Telephone 03-435-3546

	1979	1980	1981
Manpower	4,038	4,167	4,350
Sales (Million Yen)	89,029	88,284	99,438
Net Profit (Million Yen)	838	1,278	1,088

Products	Hydraulic equipment.....	87%
	Marine equipment.....	5%
	Special-purpose vehicles.....	5%
	Aircraft components.....	3%
	(Export).....	(8%)

R & D ACTIVITIES

The Technology and Research Center's developmental activities include the "Radial Hydraulic Motor," the "HST" (hydrostatic transmission) and the "Cloth End Profiling Automatic Sewing Unit FCS 150." The FCS 150 is a sewing machine that is able to sew pieces of material ends together after being aligned by a servo mechanism.

In addition, the Center has joined in cooperative research efforts with the Japan National Railways to develop yard equipment; and in joint research with the Small Business Promotion Corporation performed technical research on the systematization of sewing parts. These cooperative research projects have resulted in significant product improvements.

In technical development research areas, the Center is accumulating basic data for the improvement of shock absorber performance, research on sliding parts and materials, and on the fatigue strength of materials. The research is intended for the improvement and development of products with a view to achieving resource conservation and energy savings. The Center also succeeded in developing pumps, motors, and valves for use with high water bearing fluid (HWBF) which is to be used in place of oil. The equipment is controlled accurately and efficiently by using an electric/hydraulic servovalve.

Future research plans call for the continuation of development of inexpensive, highly reliable control valves and research on electronic control methods. The development of simulation techniques for hydraulic systems and noise reduction of hydraulic equipment will also be investigated.

WIRES AND CABLES

LABORATORY FURUKAWA ELECTRIC COMPANY, LTD., CENTRAL RESEARCH LABORATORY

(Furukawa Denki Kogyo Chuoh Kenkyu-sho)
 Location 9-15, Futaba 2-chome, Shinagawa, Tokyo 142
 Telephone 03-781-7121

	1979	1980	1981
Manpower	-	-	200
Expenditure (Million Yen)	-	-	1,200

Activities

Research Groups

- optical fibers and related technology
- semiconductors
- metals and alloys development
- applied metallurgy
- plastic fabrication
- organic chemistry
- inorganic chemistry
- electrochemistry
- applied electric engineering
- physics and electronics
- mechanical engineering
- chemical analysis
- x-ray/electron beam analysis
- material testing

Administrative Department

PARENT COMPANY FURUKAWA ELECTRIC COMPANY, LTD.
 Location 6-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100
 Telephone 03-286-3001

	1979	1980	1981
Manpower	5,562	5,441	5,442
Sales (Million Yen)	305,304	387,820	406,051
Net Profit (Million Yen)	4,208	3,371	3,400

Products

- Wires and cables (bare wires, aluminum wires, insulated wires, magnet wires, cables, other wires)..... 55%
- Resistor products..... 13%
- Appliance products..... 25%
- Other products..... 7%
- (Export products)..... (9%)

R & D ACTIVITIES

The Central Research Laboratory came into existence in 1918 as the Ohi Experimental Station, the predecessor of the present Furukawa Electric Company and established its present setup as the Central Research Laboratory in 1972.

Research activities center on energy, information processing, and many new projects. Energy research has the following four themes:

- Superconductivity

Research in superconductivity has a history of 15 years. Superconductivity technology is an indispensable tool for nuclear fusion and high energy development. This laboratory is also involved in the development of superconductive wire rods for the Japanese National Railways' linear motor system.

- Heat pipes

Heat pipes are important from the standpoint of energy or resource conservation. The heat recovery system that was developed in 1975 for exhaust gas desulfurization continuously moves 250,000 cubic meters of exhaust gas per hour and recovers 2,110,000 kcal of heat per hour. Until March 1981, this laboratory was also engaged in studies of a rotary heat exchanger with heat pipes for power cables at power stations.

- Solar energy

In 1978, this laboratory developed black chrome which absorbs solar energy and radiates no heat itself. In the development of batteries this laboratory's research and development efforts are continuing in large-sized zinc and chlorine batteries as well as its lighter, corrosion-resisting batteries.

- Optoelectronics

Information-related research centers on optoelectronics. Research began in 1973 and from 1975, 20% of the staff was assigned to the project. Optoelectronics will play an important role in the Nippon Telegraph and Telephone Public Corporation's ongoing programs, electric power utilities, railways, office automation, direct image transmission, direct induction of external light (to solve the sunlight obstruction problem), etc.

New projects include the development of "Futaballoy" for metal tape audio decks and the opening up of new avenues of use for the nickel titanium alloy. The Furukawa and the Suwa-Seiko Sha Company have jointly developed, and marketed, intermetallic alloy spectacle frames. This alloy is costly but excels in resisting wear and tear and corrosion.

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