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25 OCTOBER 1989

JPRS Report

Science & Technology

Japan

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Space Development News Reported

Training of Space Experiment Crews Outlined

43062059 Tokyo NASDA NEWS in Japanese Feb 89 pp 3-7

[Text] The National Space Development Agency [NASDA] has been conducting all sorts of training of the space experiment crew (PS) responsible for the carrying out of the First Material Processing Test (FMPT). The training began in November 1985 and will continue until directly before the July, 1991 launch.

The following is an outline of this training. The training of the PS is divided into five subjects: general education training, training on the experiments, study in the United States, environmental response training, and flight preparation training. Its details are as follows:

Table 1. PS Training Schedule

Training contents	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991
General education training; FMPT test training	Domestic training						Launching (scheduled for July)
Research training in the United States			United States				
FMPT test training, English language training			Domestic training				
Training at NASA						Training in the United States	

(1) General Education Training

To obtain the knowledge and technical skill needed to accomplish the mission, the PS are receiving training in such general subjects as space science, space engineering, and space medicine in summary fashion by means of lectures. The PS also need training to improve their ability in English.

(2) Experiment Training

Lectures are given by the researchers of each experiment with regard to the significance and the contents of the FMPT experiments. Moreover, they are receiving lectures on the specifications and treatment of the experimental devices, as well as training in the operation of the experimental devices. The training of these topics is being carried out inside Japan. In the United States, training is being conducted on the overall operation of the Spacelab System at NASA's Marshall Space Flight Center.

(3) Research Training in the United States

Research training activities are being carried out at United States research organizations which have a wealth of experience in space experiments with the objectives of raising the level of experience and technical skills of the PS in the specialized fields relating to the space experiment as well as aiming to maintain the ability in English.

(4) Environmental Response Training

At training conducted at NASA, they will train in maintaining and increasing their ability to respond to the space environment in a space shuttle flight, particularly the weightless environment. Low pressure chamber training, jet transport (KC-135) training, and jet trainer (T-38) crew training is being devised at NASA's Johnson Space Center.

(5) Flight Preparation Training

This training which is being implemented at NASA's Johnson Space Center and Kennedy Space Center, involves the space shuttle and space lab knowledge that the PS needs as the crew of a space shuttle. It consists of safety, crew system, and flight operations training.

The above was an outline of the training of the PS right up to the launch.

At present, three PS are finishing their studies in the United States and with a view towards a launch 2.5 years from now are conducting experimental training within Japan according to schedule.

(Space Environment Uses Promotion Office)

Launch of TR-I Number 2 Rocket Used for Experiments a Success

43062059 Tokyo NASDA NEWS in Japanese Feb 89 p 4

[Text] At 0800 hours on January 27, 1989, NASDA launched Experiment Rocket Number II (TR-I) for the development of the H-II rocket from the Johnson Space Center. It has a launch angle of 73 degrees and a launch direction of 108 degrees from Tanegashima Space Center.

The rocket burned its fuel normally for about 50 seconds as planned, and at about 48 after launch, the ignition of the separation motor and the separation of the dummy SRB were carried out. Furthermore, about 63 seconds

after launch, the separation of the recovery portion of the upper part of the dummy SRB was carried out.

The core part of the rocket achieved maximum height of 90km and then fell into the sea east of Tanegashima.

On the one hand, the recovery portion which separated from the dummy SRB parachuted to earth about 340 seconds after launch, and was recovered at sea 150km east of Tanegashima.

This second launch, which followed on the heels of last September's launch of the first rocket, acquired technical data concerning the various space forces and sounds needed in the development of the H-II rocket, and carried out confirmation of the functioning of the SRB separation mechanism which uses the dummy SRB.

Moreover, the second launch performs confirmation of the new deviation control material and acquire the requisite data.

In the future, the technical data acquired by this second launch will be analyzed in detail and will be reflected in the development of the H-II rocket.

(Rocket Development Office, Launch Control)

NASDA 1989 Draft Budget Outline Reported

43062059 Tokyo NASDA NEWS in Japanese Feb 89 p 5

[Text] NASDA's FY1989 draft budget was put together at the end of January. The following is its outline:

(Unit: one million yen, the figures in parentheses are from last year's budget, and the word, "debt," indicates debt liability actions).

(1) Overall Total

Treasury Disbursement Basis (Government Investments and Subsidies) (Debt) 83,620 ((Debt) 102,457) **106,757 (96,534)** Percentage greater than last year: 110.6 percent.

Enterprise Cost Basis (added to the enterprise revenue above) (Debt) 85,133 ((Debt) 11,623) **122,175 (113,701)** Percentage greater than last year: 107.5 percent

(2) Major Items

(a) H-II Rocket Development (Debt) 37,242 ((Debt) 50,189) **35,557 (34,333)**

(b) Experimental Technology Satellite VI (ETS-VI) Development (Debt) 10,442 ((Debt) 22,357) **5,745 (4,949)**

(c) Earth Resources Satellite 1 (ERS-1) Development (Debt) 13,272 ((Debt) 3,839) **7,995 (3,610)**

In addition, the budget has guaranteed that the following programs will proceed according to their respective development schedules: Geostationary Meteorological Satellite 4 (GMS-4) and Marine Observation Satellite 1 (MOS-1), which are scheduled to be launched in 1989, and Broadcast Satellite 3 (BS-3), Geostationary Meteorological Satellite 5 (GMS-5), the development of the space station, and First Material Processing Test, all of which are existing programs. The work for 1989 can be expected to move smoothly.

(Accounting Office)

H-II Rocket Inertial Guidance Device Tested

43062059 Tokyo NASDA NEWS in Japanese Feb 89 pp 5-6

[Text] From July, 1988 to the beginning of February this year, NASDA carried out a system experiment (on land) of a technical experimental model of the H-II rocket inertial guidance device at the Tsukuba Space Center and ended with the required objectives achieved.

The inertial guidance device consists of an inertial sensor unit, an inertial guidance computer, an inertial guidance program, a data interface unit, an electronic controller, and a lateral acceleration measurement device. The design and test manufacture experiments of the technical experiment model have been carried out since 1986, and the system test is being carried out as part of that evaluation.

The objective of the system test is the acquisition of data which will be reflected in the confirmation of its function as an inertial guidance device, the confirmation of its suitability as an interface among equipment, the design and manufacture of the prototype model and the flight mode, and its operation at the real equipment stage.

(1) Simple test: the simple test will confirm the basic function and performance, and conductivity and insularity, at the simple level of the hardware equipment.

(2) Hard assembly test: This test will conduct the timing of the interface signal when the various equipments are assembled and the measurement of the voltage level, and the confirmation of the data transfer function.

(3) Soft/hard assembly test: This test will conduct the confirmation of the function when the inertial guidance program and the hardware equipment are assembled, and the measurement of the period of the inertial guidance program.

(4) System integration test: This test will carry out a flight simulation by combining all the hardware equipment and the inertial guidance program, and will confirm the guidance control function in the inertial guidance device.

An especially important aspect of the system integration test is that it will confirm the initial alignment function by means of the inertial guidance program and that it

will confirm the strap-down navigational guidance function by a signal from a laser gyro, which is the output of the inertial sensor unit. Consequently, the former simulated the movement of the rocket at the point of firing by carrying an inertial sensor unit in an oscillation test device. Moreover, the latter conducted tests of the inertial sensor unit on top of the flight table by causing flight simulated movement at the propelled flight phase of the rocket, its inertial flight phase, and its spin phase.

The results of the tests obtained the confirmation of the guidance control function of the inertial guidance device and the suitability of the interfaces among the various pieces of hardware of the inertial guidance equipment and between the hardware and the software. These results have been provided for the design of the prototype model that is currently moving forward and the test and operation of the rocket at the assembly plant and the launch site. Following these test, preparations are being made in anticipation of carrying out a system test (flight) in May which will carry the inertial guidance device on board an aircraft.

(Rocket Development Office)

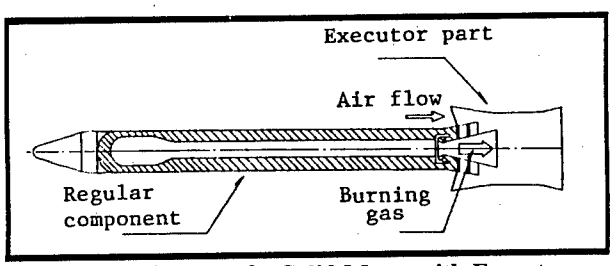
Propulsion Technology Advances Reported

43062059 Tokyo NASDA NEWS in Japanese Feb 89 pp 6-7

[Text] Propulsion technology is a major component controlling the performance of the space transportation vehicle. In order to study the H-II rocket, Experimental Technical Satellite VI (ETS-VI), and space transportation vehicles after the space station is established, there is a need to make known its performance, functions, key technology, and development outlook. Consequently, NASDA has been carrying out research and study of candidate propulsion devices and basic tests of the same since 1985, including joint research with the Aerospace Technology Research Institute.

This research takes as its subjects a hydrocarbon engine, liquefied air cycle engine, and an air suction solid motor as the candidate engines for the rocket to succeed the H-II rocket, and an ion engine as the candidate propulsion device for the future upper stage of the rocket and as the orbital transportation device.

Below is the status of these propulsion devices:



Concept Diagram of a Solid Motor with Executor Attached

(1) Hydrocarbon engine

By using low cost, high density hydrocarbon derived from hydrogen as the fuel, it is possible to build a rocket with a compact body and to cut launch costs. As far as future issues are concerned, an understanding of the combustion characteristics of high density fuel and confirmation of the refrigeration capacity of hydrocarbons. Basic tests have been conducted concerning these issues, such as a combustion test with a 50 Kgf thrust and a refrigeration test using liquefied methane and liquefied natural gas (the electric heating test), and significant data have been obtained.

(2) Liquefied air cycle engine

A liquefied air cycle engine is an engine that supplies an oxide agent from the atmosphere and obtains a comparatively high thrust by means of freezing and liquefying, from extremely low heat fuel, air absorbed from an air intake.

In order to verify that concept, trial manufacture and tests of the elements are proceeding. The trial manufacture of a heat exchanger and confirmation of the percentage of liquefied air has been carried out up to now. In addition, a turbo pump trial manufacture and test was carried out. Furthermore, trial manufacture and tests of the combustion chamber and system combustion tests are scheduled for successive years.

(3) Status of study of a solid propulsion device

Research into an air suction solid motor began this year with the aim of increasing the comparative thrust of a solid motor. The principle is to install an executor on the rear end of the solid motor, provide heat energy from the burning gas of a solid motor to air absorbed by the executor, and aim to increase the comparative thrust by quickening the burning of unburnt gas. This year a combustion test of the basic air suction state is being conducted to confirm this principle.

(4) Status of the study of electric propulsion devices

With regard to the ion engine, which is being considered as a candidate propulsion device for an orbital transportor, preliminary analysis is being carried out of the magnetic field (a discharge room) and trial manufacture and test of a hollow cathode is also being conducted with the aim of developing a large-scale ion engine for use on ETS-VI.

All sorts of propulsion devices will continue to be studied in the future, and the results will be reflected in the study of the future space system.

(Tsukuba Space Center Machinery and Parts Development Department)

Supersonic Transport Engine R&D

43062081 Tokyo JITA NEWS in Japanese May 89 pp 4-6

[Article by the Office of R&D, Agency of Industrial Science and Technology: "Introduction to FY89 New Themes of System of Large Industrial Science and Technology R&D: R&D on a Propulsion System for use in the Supersonic Transport" in column: "MITI Information"]

[Text] I. R&D on a Propulsion System for use in the Supersonic Transport

1. Background to and Necessity for the R&D

It is certain that going into the 21st century, there will be an expansion of supersonic air transportation that links the areas of the Pacific rim and the nations of Europe and America in a short period of time. It is expected that in the beginning of the 2000-2010 decade supersonic transports will be developed for practical use which fly between Tokyo and New York in 3 to 5 hours.

The propulsion system is an important task in the realization of a supersonic transport, and holds the key to its success or failure. There are great risks in the funding aspect and in the technology-development aspect of R&D on this propulsion system, but developing it has important national significance, such as contributing to enhancing the livelihood of the Japanese people. Therefore, the Ministry of International Trade and Industry and the Agency of Industrial Science and Technology will take up "A Propulsion System for use in a Supersonic Transport" as its 25th large project, and is scheduled to begin work on R&D in FY89, with an R&D period of 7 years (plan) and a total R&D expenditure of ¥28 billion (plan).

The R&D schedule (plan) is shown in Table 1.

Table 1. R&D Schedule (plan)

Fiscal year / Research item	1989	1990	1991	1992	1993	1994	1995
1. Ram jet R&D	Design		Trial mfg.	Testing Improvement			
2. High performance turbo jet R&D	Design		Trial mfg.	Testing Improvement			
3. Instrument control system R&D	Element research			Testing Improvement			
4. Total system R&D	Element research			Testing Improvement			
5. Prototype system R&D	Design		Trial mfg.		Testing Evaluation		

2. Outline of R&D

By highly integrating a "ram jet" (*), which is a new propulsion technology, and a "high performance turbo jet" (**), it will develop a combined cycle engine that will be capable of attaining high reliability and good fuel consumption at a wide range of speeds from low speed to the level of mach 5.

(*) "Ram jets" attempt to obtain thrust by compressing air without using turbines, utilizing the fact that air flowing at high speed rises in temperature and pressure when its speed is suddenly reduced, and blowing fuel into this air, causing it to burn and expand. It is anticipated to be a method that will be suitable for hypersonic engines.

(**) "Turbo jets" attempt to obtain thrust by compressing air by means of compressors, and blowing fuel into this air, causing it to burn and expand; it is the method used in most existing jet engines. In developing a combined cycle engine it will be necessary to further increase output and reduce size by using the newest technology.

The major R&D items are as listed below.

(1) Ram Jet R&D

The Agency of Industrial Science and Technology will conduct the following kinds of R&D for the purpose of developing a high-efficiency, high-output ram jet that will make possible stable flight at mach 3 to 5.

1. Ram Combustion R&D

Development of a flame stabilizer, a high-speed combustor and so on, which will make high-speed, stable ram combustion possible.

2. R&D of Development of High Temperatures

R&D of technology to promote mixing of fuel and air, and cause ram combustion of a large volume of fuel in a limited space.

3. Ram Jet R&D

R&D of the optimum ram jet system having a turbo jet as its core.

(2) High Performance Turbo Jet R&D

Will carry out the following kinds of R&D for the purpose of developing a small-diameter, high-efficiency, high-output turbo jet to comprise the core of the turbo ram jet.

1. R&D of a compressor, a combustor and a turbine.

Estimate, by numerical fluid analysis, of such things as distribution of load on wing surfaces and heat transfer, and R&D of a compressor, a combustor and a turbine that will operate under high temperatures and high loads based on that estimate.

2. R&D of a turbo jet

R&D of the optimum cycle in which the compressor, combustor and turbine are matched.

(3) Instrument Control System R&D

1. R&D of the electronic control system

R&D of a system that can control, simultaneously and in a proper manner, many such mechanisms as intakes, ram jets, turbo jets and nozzles.

2. R&D of the Electronic Optical Instrument System

R&D of a fast reaction-time instrument system which operates accurately under a harsh environment of pressure, temperature, electromagnetic field and so on.

(4) Total System R&D

1. R&D of the combined cycle

R&D of such things as the basic shape of the combined cycle engine, flow rates for the turbo and ram corresponding to the mach numbers, a cooling method for the engine as a whole, and application technology for new materials.

2. R&D of variable shape mechanisms

R&D of such variable shape mechanisms as intakes and nozzles for the purpose of constantly maintaining the greatest efficiency at a wide range of speeds.

3. R&D of noise reduction

R&D of such things as high-temperature sound-absorption material and technology for muffling the noise of exhaust mutual-interference.

(5) Prototype System R&D

Trial manufacture of a prototype combined cycle engine, carrying out of all sorts of performance tests, and accumulation and evaluation of necessary data.

3. Ripple Effect

(1) In the R&D on the ram jet and the high-performance turbo jet, R&D will be carried out on a high-speed stableram combustion, high temperature, high-load, and small, turbo jet engine; it is anticipated that the fruits of technology on detailed numerical analysis of hot fluids, technology on estimating heat transfer, technology on high-temperature cooling and so on, which are obtained from this R&D will contribute to such things as raising the performance, raising the output and reducing the size of gas turbines for use in power generation, ships, industry and so on.

(2) In the R&D on the instrument control system, R&D will be carried out on such things as sensors that operate accurately under a harsh environment of pressure, temperature, electromagnetic field and so on, and systems that control many variables instantly; it is anticipated that the high-reliability electronic control technology, small, high output actuator, high-precision environment-resistant sensors and so on which are obtained from this R&D will contribute to raising the performance of such things as small, high-speed computers, industrial robots, nuclear reactors and sensors that are used under such harsh environments as the depths of the sea.

(3) In the R&D on the total system, R&D will be carried out on such variable-shape mechanisms as intakes and nozzles, application technology for new materials and technology for lowering jet noise; it is anticipated that the high-temperature drive-technology, the application for new materials and so on which are obtained from this R&D will contribute to raising the performance of such things as high-temperature lubricating oil, machine parts and structural materials which apply new materials.

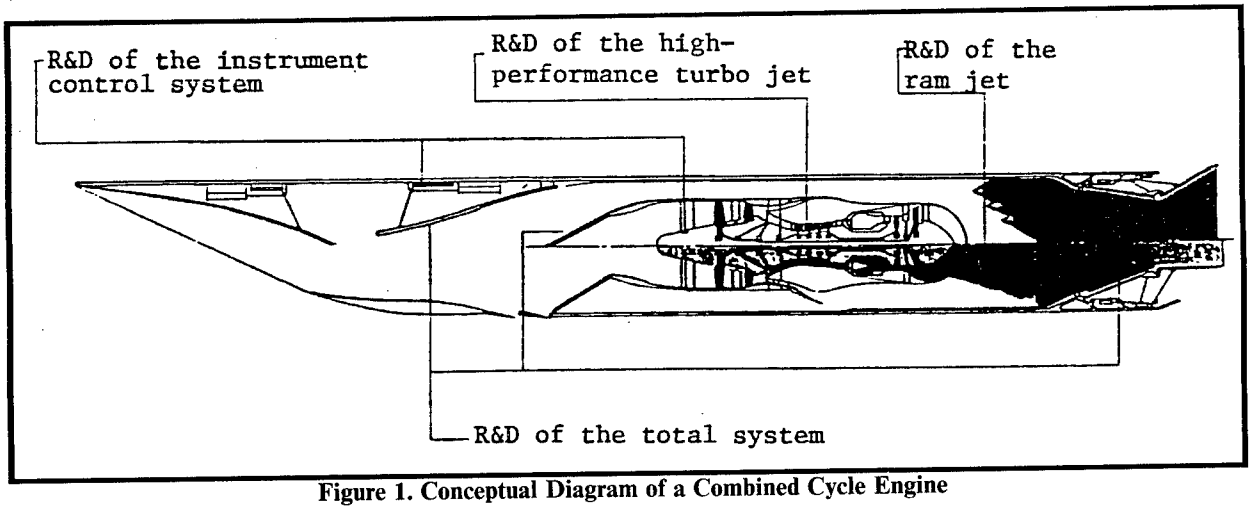


Figure 1. Conceptual Diagram of a Combined Cycle Engine

National Liaison Organization for Bioindustry To Be Formed

43073909 Tokyo JAPAN CHEMICAL WEEK in English 29 Jun 89 p 4

[Text] Bioindustry Development Center (BIDEC) will set up a national liaison office connecting major local bioindustry-related organizations by October at earliest.

By establishing the liaison office BIDEC intends to help promote the extensive development of bioindustry across Japan, create new markets, make appropriate allotment of funds to local bodies and construct facilities open to local researchers and residents. The new organization is expected to be participated in by nine organizations involved in bioindustry covering the main regions of Japan—one each in Hokkaido, Tohoku, Kanto (BIDEC), Chubu, Kinki, Chugoku, Shikoku, and Kyushu, and one organization for development of local industries.

BIDEC hopes that the new organization will serve to promote information exchange and understanding of R&D and application efforts among bioindustry-related bodies and groups of the private, academic and government sectors. It is also expected to help enhance relationships with foreign organizations involved in bioindustry.

Human Frontier Science Project

43068006 Tokyo INTERNATIONAL SCIENCE FOUNDATION in English Jun 89 pp 1-66

[Report of the International Scientific Committee: "The Human Frontier Science Program (HFSP)"]

[Text]

Contents

Introduction

The Human Frontier Science Program (HFSP) was first proposed by Japan at the Economic Summit meeting held in Venice in June 1987. The proposal was subsequently well received by the leaders of the member countries at the Toronto Summit meeting of June 1988, and the leaders voiced their expectations towards the Program in the Economic Declaration, constituting the initial step in the launching of the Program.

This report, compiled by the International Scientific Committee at the request of the Japanese government, uses as its base last year's report of the Feasibility Study Committee and comprehensively brings together the results of a series of studies, aiming further at the Program's implementation. The International Scientific Committee consists of eminent scientists and experts from the Economic Summit member countries and the Commission of the European Communities, and most were previously members of the Feasibility Study Committee.

The Human Frontier Science Program was originally proposed at the Venice Summit to pursue fundamental studies towards the elucidation of the sophisticated processes of living organisms on a global and interdisciplinary scale. Subsequently, the basic framework of the Program was investigated by the Feasibility Study Committee, composed of eminent scientists and experts from the Economic Summit member countries (including the Commission of the European Communities) between fall 1987 and spring 1988, and the report was submitted to the Japanese Government in March 1988. The results of the Feasibility Study were reported to the Toronto Summit, where further progress was expected.

Our first and second meetings were both held in Tokyo, on November 16-17, 1988 and March 8-9, 1989, respectively. The subject of these meetings was the active and enthusiastic consideration of the Program's activities, the research areas, the review system and procedure, based on the results of the Feasibility Study.

We believe that the Program under which scientists from North America, Europe and Japan would cooperate in order to build up intellectual assets common to all humanity will produce results to stimulate the accumulation of scientific knowledge and provide solutions to the problems affecting humans and their environment.

Finally, it is our fervent wish, given the expectations held of this Program by scientists and the scientific world,

that under the initiative of Japan as the proposing country, the governments concerned will combine their efforts to help launch the Program at the earliest possible time.

We believe this report to be a valuable milestone on the road toward the realization of the Program.

Tokyo, June 1989
The Human Frontier Science Program
The International Scientific Committee

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Dr. Francois Gros	Honorary Director-General, Pasteur Institute
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Prof. Yasuo Kagawa	Department of Biochemistry, Jichi Medical School
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Prof. Hideo Sakata	Faculty of Medicine, Nippon University
Dr. Takashi Sugimura	President, National Cancer Center
Prof. Akiyoshi Wada	Faculty of Science, University of Tokyo
Prof. Itaru Watanabe	Emeritus Professor, Keio University
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Dr. A. Victoria Harrison	Head of Secretariat, Medical Research Council
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Mr. David Noble	Administrative Secretary, Medical Research Council
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Prof. Coreys S. Goodman	Department of Bio-chemistry, University of California, Berkeley
Prof. Elliot Meyerowitz	Division of Biology, California Institute of Technology
Dr. Joseph Edward Rall	Deputy Director for Intramural Research, National Institutes of Health
(E.C.) Prof. Paolo Fasella (Italy)	Director-General of DG XII, Science, Research and Development, The Commission of the European Communities
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Sir John Kendrew (U.K.)	Former President, St. John's College
Prof. Ilya Prigogine (Belgium)	Universite Libre de Bruxelles
(Observer) Prof. George Metakides (E.C.)	DG XIII, ESPRIT Directorate, The Commission of the European Communities
Following scientist gave us useful advice concerning the implementation of the Program.	
Dr. John Tooze	Executive Secretary of the European Molecular Biology Organization (EMBO)

I. Significance of the Human Frontier Science Program

The Human Frontier Science Program is a project aimed at promoting, through international cooperation, basic research focused on the elucidation of the sophisticated and complex mechanisms of living organisms and making the research results available to all humankind.

It is expected that the elucidation of such biological functions, through state-of-the-art science and technology, may be a great contribution in the history of the natural sciences as an object of intellectual challenge, and may produce a number of seeds for future scientific and technological development, as well as acting as a driving force for the promotion of various kinds of research. Thus, it may help to create a new science and technology system based on complete harmony between nature and mankind—something which would bring tremendous benefits to the whole human race.

Basic research for the elucidation of biological functions will be an exploration of the common frontiers of humankind. Therefore, the HFSP, as a program which addresses issues common to all humanity, should be developed by marshaling scientific wisdom on a global scale.

To extend the scope of scientific knowledge, it is essential that outstanding scientific wisdom and differing scientific ideas be brought together and that their advocates cooperate in a variety of joint efforts.

To take advantage of the fact that an interdisciplinary approach often results in important findings, it will be our goal to involve the world's outstanding scientists from many fields. For this purpose, we need a transnational system under which scientists from many different disciplines and countries can pool their wisdom, participate in joint research, and enjoy a smooth exchange of human resources and information.

It is the intention of the Program that research results obtained through such cooperation will be made available to all countries for use in promoting the well-being of the whole of humankind through publication in scientific literature, etc.

In promoting basic research on elucidating biological functions. It is necessary to consider the ethical implications of the results of that research. It is the goal of this Program to encourage research that adds to the quality of life and the dignity of human beings, improves the environment, and increases harmony among people.

II. Basic Principles for the Implementation of the Program

The Program will aim at the goal of promoting basic research for the elucidation of biological functions through international cooperation. The following basic principles are essential to the Program activities and their implementation scheme.

1. The Program should provide unique Program activities with a distinct identity, in supporting research activities that transcend national boundaries.

(1) The Program should serve as a stimulant for the promotion of international cooperation among the scientists in the fields included.

(2) Many advances in basic research depend on originality, innovation, fresh ideas and insights. The Program must allow for the expression of individual ability and initiative.

(3) Importance is attached to the training and support of young researchers, who are expected to play an important role in originating and pursuing creative research.

(4) Interdisciplinarity should be stressed since different ways of thinking and approaches play important roles in arriving at new ideas and discoveries.

(5) Flexibility should be allowed so that improvements in the Program's operation can be made whenever deemed necessary.

2. Proposals should be reviewed on the basis of scientific merit as the primary criterion. Internationality, especially intercontinentality, and interdisciplinarity ought to be significant review points.

3. Research results must be published in internationally recognized scientific literature, etc.

4. The Program's implementation organization will not claim the intellectual property rights that will be generated through the research activities conducted under the Program. The attribution of the intellectual property rights will be determined on an equitable basis among the parties undertaking the research (and/or their institutions). [an issue to be discussed from the administrative perspectives]

5. Bioethics must be given due consideration according to the guidelines of the country where the research is conducted.

III. Implementation Scheme

1. A trans-national organization is necessary in order to properly promote and manage the HFSP as an international program through cooperation among many countries. To this end, the Organization must be established and managed on the basis of the following premises:

(1) The implementation scheme should be open internationally.

a. All activities within the HFSP should be managed from an international perspective, through cooperation among the scientists and other experts from each country that participates in the HFSP.

b. Applications should be reviewed fairly from the viewpoint of scientific merit.

c. The international exchange of related information should be facilitated.

(2) Scientists' opinions and intents should be fully reflected.

a. Scientists' opinions and intents should be reflected as much as possible in the Program's management.

b. Particularly, scientific matters should be determined by the scientists themselves.

c. It is necessary for scientists from all over the world to continue collaborating and cooperating more than ever, in order to fully support the HFSP. Therefore, the HFSP must have an international network of scientists in the research areas concerned.

(3) The implementation scheme should be highly functional and efficient.

a. The organizational structure of the scheme should be functional as well as efficient.

b. The implementation scheme should be flexible enough to allow for necessary changes.

(4) Cooperation with existing subsidy programs should be promoted.

2. Based on the basic framework described above, the outline of the Organization which needs to be established to operate the Program is presented below.

[an issue to be discussed from the administrative and legal perspectives]

(1) Board of Directors

This is a board whose members are scientists. The Board of Directors takes charge of making decisions on fundamental matters concerning program activities, including program activity planning, selection of research areas, and examination of the overall program structure, etc. from a scientific viewpoint.

(2) Review Committees

These committees are composed of leading scientists from around the world in the field with which the Program is concerned. They take charge of reviewing applications and selecting the recipients of the awards.

(3) Board of Trustees

The Board of Trustees is an organ which reflects administrative considerations, and is responsible for approving program activity plans, revising the Constitution of the Organization, and giving approval to those countries wishing to participate in the management of the Program.

(4) Secretariat

The Secretariat consists of a Secretary-General and other staff members. It is responsible for the execution of the Program, and therefore its organization must be simple, efficient, and flexible.

3. Participation in the Program

Participation in the management of the Program may be limited during the initial stage of the Program to assure a rapid and smooth start-up. However, taking into account the nature of the Program, the opportunity to participate in the management of the Program should become open as soon as possible.

[an issue to be discussed from the administrative perspectives]

IV. Research Areas

1. The following two research areas are thought to be the most suitable for the basic research subjects related to the elucidation of the biological functions, because they are of particular importance now and will be of

increasing importance in the future. Not only are they expected to be areas of rapid development, but also they promise to have significant influence on other fields of science and technology.

(1) Basic research for the elucidation of brain functions

The highly sophisticated functions of the brain, such as learning and thinking, hold special significance as research subjects. With the advancement of research in this area, many fields of science and technology would take a big leap forward.

In recent years, thanks to progress in the development of information processing and analyzing techniques in the information science and of non-invasive means of measuring biological activities, a great deal of research on the brain's functions is being conducted from the physiological, psychological and computer science perspectives. The future promises to bring further achievements produced through new approaches incorporating a combination of these and others.

(2) Basic research for the elucidation of biological functions through molecular level approaches

The mechanism of biological functions is ultimately based upon physicochemical processes and chemical reactions and their elaborate regulation at the molecular level. A considerable body of knowledge of biological functions at the molecular level has been developing recently owing to the sophistication of techniques for analysis, biological material handling and other procedures. It now seems possible to understand better the principles of biological functions.

It is expected that the understanding of these principles will be accelerated by various kinds of molecular-level research on biological functions.

In addition to basic research, researches involving work on supporting methods are also to be subsidized, because the development of supporting methods is indispensable for progress in basic research concerning the elucidation of biological functions.

2. Selection of priority research areas at the time of the implementation

It is thought to be necessary to focus on some priority research areas in these two areas at the implementation stage of the Program, in order to make the best use of limited resources and to identify highly promising research subjects most efficiently. (see Supplements)

Since basic research on the elucidation of biological functions is in the midst of dynamic development, such priority research areas should be reviewed annually by a body of scientists established in the Organization in order to reflect the latest trends.

V. Program Activities

The Program activities are research grants, fellowships and workshops, as well as related activities.

A. Research Grants

The Program will subsidize basic research carried out by "international joint research teams" in the research areas concerned, in order to accelerate scientific progress in these areas through international and interdisciplinary collaboration.

(1) Requirements for international joint research teams:

a) The principal researcher must have the nationality of one of the (*)Eligible Countries, and be affiliated with a research institution in one of the Eligible Countries. [(*) see Supplements]

b) At least one of the researchers in an international joint research team other than the principal researcher must have nationality different from that of the principal researcher and be affiliated with a research institution in a country other than that in which the principal researcher's institution exists.

c) Joint research carried out within only one country is not eligible for grants, in principle.

(2) Research grants are made available mainly to young researchers.

(3) Each research project is subsidized, in principle, for a period of up to three years.

(4) The amount of a research grant is decided on a case-by-case basis.

(5) Each research grant covers research expenses such as equipment, supplies, travel, personnel and other expenses. The indirect costs of the research institution with which the grant recipient is affiliated will be covered to a limited degree (e.g. up to 10 percent of the subsidy).

[an issue to be discussed from the administrative perspectives]

(6) Research results must be published in internationally recognized scientific literature, etc.

(7) The Organization will not claim the intellectual property rights that will be generated through the research activities conducted under the Program. The attribution of the intellectual property rights will be determined on an equitable basis among the parties undertaking the research (and/or their institutions).

[an issue to be discussed from the administrative perspectives]

(8) Bioethics should be given due consideration according to the guidelines concerned of the country where the research is conducted.

B. Fellowships

The Program provides financial assistance aimed at facilitating research activities which involve international exchange of outstanding researchers, in order to promote the development of young, internationally minded talents into future leaders in the subsidized research areas.

(1) The fellowships consist of long-term and short-term fellowships.

(2) Eligibility requirements for fellows

If the applicants have the nationality of one of the (*)Eligible Countries, they must be accepted by a research institution in a different country. If not, they must be accepted by a research institution in one of the Eligible Countries. [(*) see Supplements]

(3) Long-term fellowships

a. A long-term fellowship provides support for a period of up to two years, in principle. Contracts are for one-year terms, in principle. It is possible, however, to renew for a third year.

b. Applicants are expected to have a doctoral degree or to possess equivalent research competence, and normally to be no more than thirty-five-years old.

c. Each fellowship is limited to about U.S.$50,000/year, in principle.

d. Each fellowship covers the relocating expenses, living expenses, and research expenses (bench fees), travel expenses, language training expenses, and other expenses. (Regarding living expenses, the price level in the host country will be taken into account.)

(4) Short-term fellowships

a. Short-term fellowships provide researchers with support for up to three months.

b. Applicants are not limited to young researchers.

c. A short-term fellowship covers the fellow's travel expenses and living expenses. (Regarding the living expenses, the price level in the host country will be taken into account.)

d. Applications are accepted at any time.

(5) Research results must be published in internationally recognized scientific literature, etc.

(6) The Organization will not claim the intellectual property rights that will be generated through the research activities conducted under the Program. The attribution of the intellectual property rights will be determined on an equitable basis among the parties undertaking the research (and/or their institutions).

[an issue to be discussed from the administrative perspectives]

(7) Bioethics should be given due consideration according to the guidelines of the country where the research is conducted.

C. Workshops

The progress of science can be further accelerated through workshops at which researchers exchange up-to-date information on the focal points of their research. Such workshops also serve to promote international exchanges and cooperation among researchers. To this end, the Program will plan and subsidize international workshops in specific research areas.

(1) There are two types of workshops. One is subsidized by the Organization on an application-and-review basis, and another is planned by the Organization itself.

(2) Eligibility requirements for workshops

a. A workshop organizer must have the nationality of one of the (*)Eligible Countries, but participants do not necessarily have the nationality of one of the Eligible Countries. [(*) see Supplements]

b. Although there is no limitation concerning the nationalities of individual participants, not more than half of the participants should be from any single country. A majority of the workshop participants should be chosen from among those researchers who have submitted applications.

c. The majority of participants will be young, active researchers.

d. There is no restriction concerning the sites of workshops, in principle.

(3) The amount of a subsidy is limited to about U.S.$100,000 per workshop, in principle.

(4) The Organization may co-sponsor workshops with other organizations, if they meet the purposes and basic principles of the HFSP.

VI. Review System and Procedure

1. Basic Concepts

(1) It is necessary to examine and improve the review system and procedure periodically, in order to conduct fair and efficient review.

(2) In order to improve the reliability of the review, it is extremely important not only to improve the review procedure, but also to prudently select well-qualified reviewers.

Therefore, it is critical to maintain an international network of scientists, as well as to have at all times a good understanding of the trends and current status of the research areas concerned.

(3) The review system should ensure that review work be done smoothly and efficiently.

(4) Work related to the review (for the Secretariat and reviewers) should be spread out as much as possible throughout a year.

(5) Work related to the review should be done at a minimum cost.

2. Review Committees

There will be four Review Committees: one for grants in the research area concerning brain functions, one for grants in the research area concerning biological functions through molecular level approaches, one for fellowships and workshops in the research area concerning brain functions and one for fellowships and workshops in the research area concerning biological functions through molecular level approaches.

The members of the Review Committees must be chosen from among the most distinguished scientists in the research areas concerned, taking into consideration the members' specialities and nationalities.

3. Review Procedure

(1) The review of applications for grants and long-term fellowships will consist of two stages, that is, mail review by the mail reviewers and panel review by the Review Committees.

(2) The review of applications for short-term fellowships and workshops will each consist of a single stage, that is, for fellowships mail review by the mail reviewers and for workshops panel review by the Review Committees, respectively.

(3) A list of scientists with such information as their specialized research areas and their past review records should be kept in a form of data-base to be used when selecting mail reviewers.

4. Proposals should be reviewed on the basis of scientific merit as the primary criterion. Internationality, especially intercontinentality, and interdisciplinarity ought to be significant review points.

VII. Scale of the Program

1. Basic Concepts

(1) Taking a long-term and strategic view, it is important to start the Program as soon as possible, even though it may be small in the first phase.

(2) The participating countries are expected to give as much assistance as possible in order to achieve at an early stage the scale of the Program proposed by the Feasibility Study Committee.

(3) It is necessary to continue to review the Program's scale in the future.

2. Distribution of Funds for Each Activity

(1) It is appropriate to make decisions on the amount of funds allocated to each program activity taking into consideration the nature of the activity, the overall scale of funds available, the appropriate scale of each activity, etc.

(2) In the allocation of funds, the two areas, brain function research and molecular biology research, should be treated on equal terms, taking into consideration the number of applications (or the total amount of proposed budgets) for each research area.

(Reference) Excerpts from the report of the Feasibility Study (March 1988)

Research Grants: 30-50 per year
(Each Grant is supposed to last for three years.)

Fellowships: 100-200 per year
(Each is supposed to last for two years.)

Workshops: 10-20 per year

Concluding Remarks

The Japanese Government has officially committed the funds to run the Program during the first year of its implementation, and under such circumstances scientists have reached the consensus that the Program should be launched at the earliest possible date. In light of these recent developments, we recommend that some kind of administrative organization be formed as soon as possible, even if tentatively, to take charge of the Program's management.

Last but not the least, we would like to express our sincere hope that all governments concerned will immediately take appropriate and realistic action in an effort to actually launch the Program. At the same time we strongly encourage the Japanese Government to take further initiative as the proposer of the Program in this regard.

Supplements

[Supplements]

I. Process of Discussions on the HFSP

1. Process of discussions on the HFSP
2. Resolution of the International Scientific Committee
[Reference A] The Venice Summit Economic Declaration (excerpts)
[Reference B] The Toronto Summit Economic Declaration (excerpts)

II. Outline of the Organization

1. Outline of the Organization (Draft)
2. Image of the Secretariat (Draft)
3. Activities of the Organization (Outline)
[Reference C] Requirements for the Site for the Organization
[Reference D] Qualification for the Secretary-General for the Organization

III. Priority Research Areas

I. Process of Discussions on the HFSP

1. Process of Discussions on the HFSP

(1) Feasibility Study by Japanese scientists (from December 1986 to March 1987)

Forty-three eminent Japanese scientists discussed the general framework of the Human Frontier Science Program.

(2) London Wise Men's Conference (April 1987)

The London Wise Men's Conference assembled seventeen eminent scientists from the Economic Summit member countries, and adopted the "London Appeal" in which the Conference supported the Program, and urged the leaders of the Economic Summit member countries to give the Program their active support at the forthcoming Venice Economic Summit meeting.

(3) Venice Economic Summit (June 1987)

The Program was officially presented by Japan at the meeting, and the leaders of the Economic Summit member countries welcomed the initiative by Japan. (see Reference A)

(4) Feasibility Study Committee (from November 1987 to March 1988)

The Feasibility Study Committee was composed of thirty-four eminent scientists and experts from the Economic Summit member countries and the Commission of the European Communities. The Committee discussed program activities, research areas and an implementation scheme, compiling the report.

(5) Bonn Wise Men's Conference (April 1988)

The Bonn Wise Men's Conference assembled twenty-two eminent scientists and adopted the Declaration in which the assembled scientists commended the Japanese Government and scientific leaders for taking the initiative in proposing the HFSP, for continuing its promotion as well as for leading the conduct of the Feasibility Study.

(6) Toronto Economic Summit (June 1988)

The results of the Feasibility Study were reported at the meeting, and the leaders of the Economic Summit member countries looked forward to the Japanese Government's proposal for the implementation of the Program in the near future. (see Reference B)

2. Resolution of the International Scientific Committee

—The International Scientific Commission resolved as follows, at the second meeting held on 8, 9 March 1989.

The foreign participants in the meeting of the Scientific Committee for the Human Frontier Science Program on 8 and 9 March 1989 acknowledge with gratitude the intensive work done by Professor Okamoto and the other Japanese members of the Committee, and by their colleague in the Japanese Government, in preparation of the meeting, as well as the warmth of the hospitality with which they have been received.

The consensus of all members(*) of the Committee was that the following points should now be brought to the attention of the concerned governments:

1. The participants strongly endorse the general outlines of the scientific program as it is now proposed, and the principles discussed for its implementation;

2. In their opinion, the particular areas of research set out by the Committee in its final session constitute an appropriate set of guidelines for the execution of the program in its first year; however, given that the biological sciences are advancing very rapidly, these areas should be reformulated from year to year so that support is given to interdisciplinary fields that are of especial contemporary promise, and that would particularly benefit for an international program of the kind envisaged;

3. The participants urge that the time is now ripe for the governments of the countries involved to discuss an appropriate legal framework and an appropriate location, which together would establish the Human Frontier Science Program as an organization adapted to the implementation of the program without unnecessary delay;

4. Given the conditions under which it is hoped that initial generous financial support will be provided by the Government of Japan, given the fact that international discussions to establish new agreements inevitably take substantial time to finalize, and given that it is important to maintain the present momentum, it is also recommended that an appropriate interim mechanism of an international character be now established to execute and manage the program during the coming months and until such time as a formal mechanism is in place.

(*) (Canada)	
Prof. Max Cynader	Dr. James D. Friesen
Dr. Francis S. Rolleston	
(F.R.G.)	
Prof. Herman Bujard	Prof. Benno Hess
Prof. Ernst L. Winnacker	
(Italy)	
Dr. Michele Lener	Prof. Carlo Terzuolo
Prof. Glauco Tocchini-Valentini	
(Japan)	
Prof. Shun-ichi Amari	Prof. Setsuro Ebashi
Prof. Masao Ito	Prof. Yasuo Kagawa
Prof. Michio Okamoto	Prof. Hideo Sakata
Dr. Takashi Sugimura	Prof. Akiyoshi Wada
Prof. Itaru Watanabe	
(U.K.)	
Prof. B. B. Boycott	Dr. A. Victoria Harrison
Mr. David Noble	Dr. J. J. Skehel
(U.S.A.)	
Dr. Nina Fedorof	Dr. Joseph Edward Rall
(E.C.)	
Prof. Andre Goffeau (Belgium)	Dr. A. Gracia-Bellido (Spain)
Sir John Kendrew (U.K.)	
(Observer)	
Prof. Henri Korn (France)	Prof. George Metakides (E.C.)

[Reference A]

The Venice Summit Economic Declaration (excerpts) (June 1987)

"We welcome the initiative of the Human Frontier Science Program presented by Japan, which is aimed at promoting, through international cooperation, basic research on biological functions. We are grateful for the informal opportunities our scientists have had to take part in some of the discussions of the feasibility study undertaken by Japan. We note that this study will be continued and we would be pleased to be kept informed about its progress."

[Reference B]

The Toronto Summit Economic Declaration (excerpts) (June 1988)

"We note the successful conclusion of Japan's feasibility study on the Human Frontier Science Program and are grateful for the opportunities our scientists were given to contribute to the study. We look forward to the Japanese Government's proposal for the implementation of the program in the near future."

II. Outline of the Organization

[an issue to be discussed from the administrative perspectives]

3. Activities of the Organization (Outline)

(1) Operation and management of the Organization

(a) Preparations for meetings of each committee handling matters such as:

- Budgets, settlement of accounts, Program activity planning, progress reports, etc.
- Discussion of research areas
- Selection and appointment of members of each committee
- Overall Program review

(b) Other matters relating to Program management/administration

- Organizational structure, personnel management
- Accounting, finance, assets, etc.

(2) Project management/administration

(a) Research support projects

i. Soliciting applications for research grants, fellowships, and workshops (advertisements, announcements)

ii. Application review

- Accepting and pigeonholing of applications
- Conducting review by mail and compilation of results
- Holding meetings of the Review Committee to select the awardees

iii. Determining the size of awards and making payments

iv. Post-research review

(b) Improvement of the review system and procedure

- Preparation of a list of scientists to conduct review by mail

(c) Annual report

(d) Dissemination of research results

(e) Collection (and provision) of scientific information

(f) Others

[Reference C]

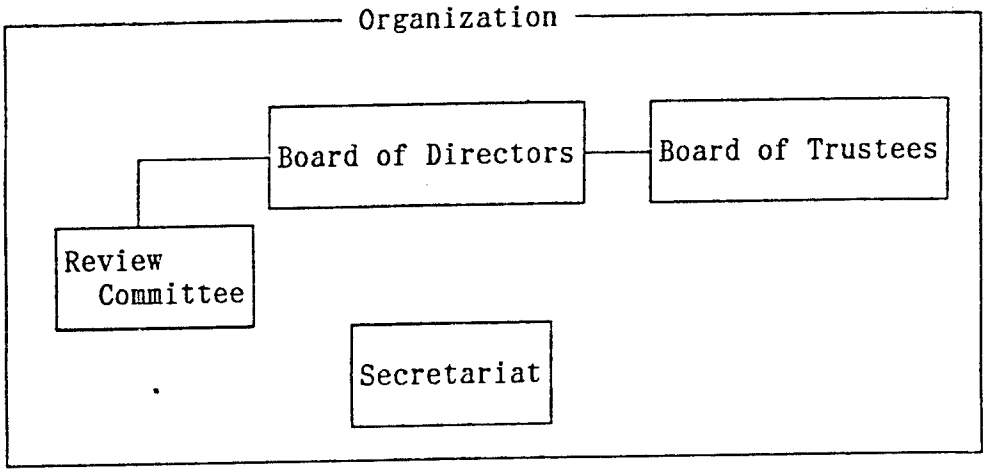
Requirements for the Site of the Organization

1. Program Management and Operation Aspects

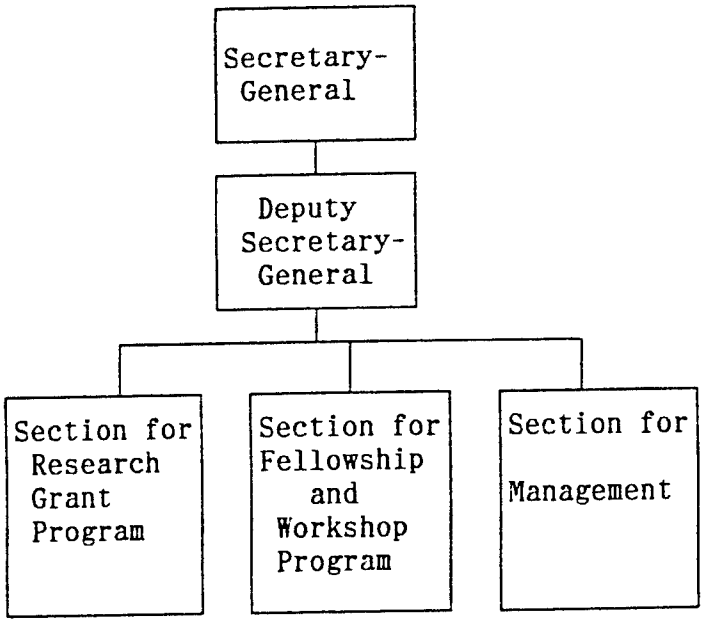
(1) Convenience in transportation and information exchange

- Easy access to/from major cities in the world (e.g., international airports, fine road systems and train services, etc.)

1. Outline of the Organization (Draft)



2. Image of the Secretariat (Draft)



- Efficient and reliable postal and telecommunication services

(2) Preferential treatment on legal and tax matters

- Tax exemption on organization's activities
- (If possible) Tax reduction for the staff of the HFSP implementation organization

(3) No restriction on recruitment

- No restrictions on working permission for foreigners
- Low labor costs

(4) Preferential treatment on facilities and public utilities

- Exemption or reduction of charges for office space, public utilities and telecommunication services

(5) No restrictions on domestic and international transfer of funds

2. Scientific Aspects

Existence of the infrastructure or foundations necessary for promoting scientific research

→ Support from Scientific Communities (such as academic associations, major research laboratories, universities, etc.) could be available.

3. Living Conditions

Language, Cost of living

4. Political Environment

(1) The Organization should safeguard its political independence and neutrality.

(2) The Organization should be free from the influence of local politics.

[Reference D]

Qualifications for the Secretary-General of the Organization

The Secretary-General is required to have:

(a) Scientific background and research career.

(b) Skills and know-how for management.

(c) Full recognition of the interaction as well as the balance between science and administration.

(d) Full understanding of the mentality of scientists.

(The way of government officials or lawyers should not be adopted.)

(e) World-wide network with top-notch scientists who are engaged in frontier research in the field of the HFSP.

III. Priority Research Areas

The priority research areas were selected from among the two areas: 1) Basic research for the elucidation of the brain functions, 2) Basic research for the elucidation of the biological functions through molecular level approaches, at the implementation stage in order to make the best use of limited resources and to identify promising research subjects most efficiently.

Since basic research on the elucidation of biological functions is in the midst of dynamic development, such priority areas should be reviewed annually in order that the latest trends be reflected. (see References E and F)

Priority Research Areas are:

A. Priority research areas for the elucidation of brain functions

A-1. Perception and Cognition
A-2. Movement and Behavior
A-3. Memory and Learning
A-4. Language and Thinking

B. Priority research areas for the elucidation of biological functions through molecular level approaches

B-1. Expression of Genetic Information
B-2. Morphogenesis
B-3. Molecular Recognition and Responses
B-4. Energy Conversion

[Reference E]

Process of Discussions Concerning Research Areas

London Wise Men's Conference (April 1987)

The Conference stated that the multinational and multidisciplinary basic research under this program which focuses on complex biological mechanisms, will contribute to both the fundamental and general development of future science and technology.

Feasibility Study Committee (November 1987 to March 1988)

The Committee stated as follows, concerning research areas.

(1) The following two research areas: basic research for the elucidation of brain functions and basic research for the elucidation of biological functions through molecular level approaches, are thought to be the most suitable of the basic research subjects related to the elucidation of biological functions.

(2) Research on supporting key technologies may be included in the Program where needed to support research in the two areas mentioned above.

(3) It may be necessary at the implementation stage to focus on some priority areas in these two areas mentioned above in order to make the best use of limited resources and to identify highly promising research subjects most efficiently.

Bonn Wise Men's Conference (April 1988)

The Conference stated that a list of more specific research areas should be made from among the research areas for the elucidation of brain functions and of biological functions through molecular level approaches, by the Scientific Committee.

International Scientific Committee (November 1988 to March 1989)

The Committee selected the priority research areas to be subsidized at the first stage of the HFSP, and made a list of examples of each priority research area, in order to make the best use of limited resources and to identify promising research subjects most efficiently.

[Reference F]

Examples of Each Priority Research Area of the HFSP

In order to facilitate smooth and efficient reviewing, the following "Examples of Each Priority Research Area" have been prepared for the convenience of reviewing. Those examples are intended to improve the review procedure in the future and do not exclude those innovative research themes which are not listed. The examples are to be reviewed every year.

A. Brain Functions

A-1. Perception and Cognition

(1) Visual Perception
(2) Non-visual Perception
(3) Multi-modal Perception
(4) Supra-modal Cognition
(5) Cognitive Psychology
(6) Models of Perception and Cognition
(7) Others

A-2. Movement and Behavior

(1) Mechanism of Motor Programming
(2) Cognitive Control of Movement
(3) Adaptive Control of Movement
(4) Innate Behavior
(5) Emotional Behavior
(6) Intellectual Behavior
(7) Functional Molecules in Behavior
(8) Others

A-3. Memory and Learning

(1) Procedural Memory and Skill Learning
(2) Cognitive Memory
(3) Cognitive Learning
(4) Development and Aging of Memory
(5) Development of Learning
(6) Synaptic Mechanism of Memory and Learning
(7) Models of Memory and Learning
(8) Others

A-4. Language and Thinking

(1) Animal Communication
(2) Neuropsychology of Language
(3) Neural Mechanism of Thinking
(4) Attention and Consciousness
(5) Language Learning
(6) Functional Localization of Language and Thinking
(7) Models of Learning and Thinking
(8) Others

B. Biological Functions Through Molecular Level Approaches

B-1. Expression of Genetic Information

(1) DNA Replication and Cell Cycle Control
(2) Transcription
(3) Translational Control
(4) Cis Elements and Motif
(5) Trans Elements
(6) Gene Rearrangement and Recombination
(7) Others

B-2. Morphogenesis

(1) Homeo-Box and Related Genes
(2) Extracellular Matrix
(3) Developmental Genes
(4) Growth Factors and Functional Hierarchies
(5) Cell Adhesion and Cell Migration
(6) Organogenesis
(7) Others

B-3. Molecular Recognition and Responses

(1) Molecular Level Research in Immunology
(2) Molecular Level Research in Neurobiology
(3) Receptor-Ligand Interaction
(4) Protein-Protein Interaction
(5) Protein-Nucleic Acid Interaction
(6) Protein or Nucleic Acid Molecular Recognition
(7) Higher-order Structures
(8) Others

B-4. Energy Conversion

(1) Membrane Electronics
(2) Phosphorylation Systems
(3) Photobiology
(4) Biological Motility
(5) Fixation of Nitrogen
(6) Others

IV. Details of the Program Activities

A. Research Grants

1. Eligibility

International joint research teams, not individual researchers, are eligible for the subsidy. Applicants must

first organize such international joint research teams that meet each of the conditions described below.

(1) The principal researcher representing a team must be from the Eligible Countries.

a. It may be possible to define, at the initial stage, the Eligible Countries as the Economic Summit member countries as well as those countries designated by the Organization, taking into account the fact that the HFSP, is an international cooperation project, which has been discussed at Economic Summit meetings.

[an issue to be discussed from the administrative perspectives]

b. "A researcher from the Eligible Countries" must have nationality of one of the Eligible Countries and be affiliated with a research institute located in one of the Eligible Countries. (The country of his/her nationality could be different from the one where his/her research institute is located.)

c. The principal researcher must represent his/her team in planning and carrying out research plans. He/she will also act as a liaison with the Organization.

(2) At least one member of an international joint research team must have nationality different from that of the principal researcher and be affiliated with a research institute located in a country other than one where the principal researcher's institute is located.

(3) An international joint research team must conduct its research in more than one country. However, it is possible for all team members to gather in one country to conduct research activities for a certain period of time.

(4) Members of the international joint research team are expected to have a doctoral degree or to possess equivalent research competence.

(5) Although there will be no age limit for members, young researchers are strongly encouraged to apply.

(6) The researchers' institutes must be equipped with fundamental research facilities and the equipment necessary for them to carry out their proposed research.

2. Research areas

Research Grants are available for the following:

A. Basic research for the elucidation of brain functions

A-1. Perception and Cognition
A-2. Movement and Behavior
A-3. Memory and Learning
A-4. Language and Thinking

B. Basic research for the elucidation of biological functions through molecular level approaches

B-1. Expression of Genetic Information
B-2. Morphogenesis
B-3. Molecular Recognition and Responses

B-4. Energy Conversion

Research involving work on supporting methods will also be eligible for subsidy.

3. Period of subsidization

In principle, each grantee will be subsidized for up to three years.

4. Expenses to be subsidized

The following expenses associated with the execution of the proposed research will be covered.

(1) Research expenses

a. Equipment

b. Materials and supplies

c. Services (consulting services and computer services including rental fees, etc.)

(2) Salaries and wages

a. Research assistants (except when they are paid by the affiliated institutes)

b. Secretaries (except when they are paid by the affiliated institutes)

(3) Communication expenses

a. Meetings (meetings of the team, fees for participation in academic conferences)

b. Travel and stay (domestic and foreign travels, stay allowances for up to four months a year)

c. Publication (publication costs of research results)

(4) Indirect costs (e.g. up to 10 percent of the subsidy)

[an issue to be discussed from the administrative perspectives]

5. Application procedure

The principal researcher of the international joint research team will be responsible for submitting all the necessary documents to the Organization by the application deadline.

On the application form, the following information should be provided for the team as a whole, according to prescribed formats.

a. Research theme

b. Name, affiliation, address, date of birth, and title of each member of the team

c. Purpose, content and background of the proposed research

d. Research schedule (entire schedule, schedule for each year)

e. Summary of proposed budget

In addition, the following information should be provided for each member on the team, according to prescribed formats. (For item j, any format may be used.)

f. Research participation pledge

g. Curriculum vitae

h. List of publications (pertinent publications within the last five years)

i. Letter of approval from the head of the affiliated research institute

j. Description of the affiliated research institute (pamphlet, brochure, etc.)

k. Proposed budget

All application materials must be written in English.

6. Period for submitting applications (Applications are accepted once a year in 1989.)

From 1989 to 1989

7. Review of applications

(1) Review procedure

Based on the results of a preliminary mail review, applications will be evaluated by the Review Committee in the Organization.

(2) Review criteria

Applications will be evaluated on the basis of the following criteria.

a. Originality, interdisciplinarity and significance of the proposed research

b. Suitability of the research program and its contents

c. Necessity for international joint research and international representation on the team

d. Team members' competence, experience, and potential

e. Suitability of the facilities and equipment at the research institutes

f. Suitability of the proposed budget

8. Important information for selected teams

(1) All correspondence subsequent to the selection should be made through the principal researcher.

(2) Method of subsidization

a. The Organization will provide subsidy according to the yearly budget.

b. Some parts of the yearly allocation may be carried forward to the next year. Any money left at the conclusion of the subsidized research should be returned to the Organization.

(3) Responsibilities of selected international research teams

a. Submission of research reports

The principal researcher must submit an annual research report to the Organization within two months after the conclusion of each year, and a final research report within two months after the completion of the research concerned.

b. Submission of accounting statements

The principal researcher must submit accounting statements to the Organization within two months after the conclusion of each year.

c. Treatment of purchased equipment (or supplies)

All equipment purchased with the subsidy belongs to the awardees, and researchers must look after and accept responsibility for the equipment, in principle. However, they may donate the equipment to non-profit organizations, after the conclusion of the research concerned, or during the research period, with the Organization's approval.

9. Treatment of research results

(1) The results of subsidized research must be disseminated soon after completion through publication in academic journals or other publications, and include acknowledgment of the Organization's support.

(2) The Organization will not claim the intellectual property rights (including industrial property right) that will be generated through the research activities conducted under the HFSP. The attribution of the rights should be decided on an equitable basis among the parties undertaking the research (and/or their institutions).

[an issue to be discussed from the administrative perspectives]

10. Bioethical consideration

Bioethics should be given due consideration according to the guidelines of the country where the research is conducted.

11. Others

(1) The Organization may request researchers to reimburse all or a part of the subsidy, if the subsidy has been used for expenses not eligible for subsidization or false accounting statements have been submitted.

(2) The Organization will assume no responsibility for any damage or injuries caused in relation to research conducted with the research grants of the HFSP.

B. Long- and Short-Term Fellowships

1. Eligibility

Applicants must meet each of the conditions described below.

(1) A researcher from the Eligible Countries who plans to go to a research institute in another country is eligible. In addition, a researcher from a country other than the Eligible Countries, who plans to go to a research institute located in one of the Eligible Countries, will also be considered under certain conditions.

a. As for the "Eligible Countries", see A-1-(1).

b. "A researcher from the Eligible Countries" is one who has nationality of one of the Eligible Countries. (Affiliation with a research institute is not an absolute requirement.)

(2) Applicants are expected to have a doctoral degree or to possess equivalent research competence.

(3) Applicants for the long-term fellowships are expected to be no more than thirty-five years of age, in principle.

(4) Applicants must have sufficient language skills to carry out their proposed research at the host research institutes.

(5) Long-term fellowships are not for those who intend to conduct their proposed research at the institute where they obtained their doctoral degrees or to work again with their research supervisor.

(6) Short-term fellowships are not for researchers whose main purpose is to attend courses, workshops, symposiums, etc.

2. Research areas

Fellowships are available for the following:

A. Basic research for the elucidation of brain functions

A-1. Perception and Cognition
A-2. Movement and Behavior
A-3. Memory and Learning
A-4. Language and Thinking

B. Basic research for the elucidation of biological functions through molecular level approaches

B-1. Expression of Genetic Information
B-2. Morphogenesis
B-3. Molecular Recognition and Responses
B-4. Energy Conversion

Research involving work on supporting methods will also be eligible for subsidy.

3. Period of subsidization

(1) Long-term fellowships

Long-term fellowships can be applied from three months to up to two years. Initially, however, a fellowship will be provided for one year, in principle, and renewal for a subsequent year will be considered on the basis of reviews. Maximum period of subsidization is three years.

(2) Short-term fellowships

Short-term fellowships run from two weeks to three months.

4. Expenses to be subsidized

(1) Long-term fellowships (up to about U.S.$50,000)

a. Cost of relocating in the host research institute: round-trip travel expenses (the shortest route, the most economical means of travel) and cost of shipping the minimum amount of personal effects.

b. Living expenses (these will vary depending on the destination)

c. Research expenses (about U.S.$10,000 per year)

d. Travel expenses or language training expenses (Applicants may request financial assistance to attend scientific conferences or to receive training for up to two months in the language of the country where the host research institute is located.)

e. Other expenses (family support allowances)

(2) Short-term fellowships

a. Travel expenses

Round-trip travel expenses to the host institute (the shortest route, the most economical means of travel)

b. Living expenses

The amount will vary depending on the destination.

c. Other expenses

5. Application procedure

Applicants must submit all the necessary documents to the Organization by the application deadline, according to prescribed formats. (For item h, any format may be used.)

a. Research theme

b. Name, affiliation, address, date of birth, title of each of the applicants, proposed duration of fellowship

c. Purpose, content and special features of the proposed research

d. Research schedule

e. Curriculum vitae

f. List of publications (pertinent publications within the last five years)

g. Acceptance from the head of the host research institute that has invited or accepted the applicant

h. Recommendations by researchers of the applicant's choice

i. Description of the host research institute (pamphlet, brochure, etc.)

All application materials must be written in English.

6. Period for submitting applications

(1) Long-term fellowships (Applications are accepted once a year in 1989)

From 1989 to 1989

(2) Short-term fellowships

No specific deadline will be set. However, applications must be received by the Organization at least three months before the applicant intends to receive his/her fellowship. If prior approval is obtained from the Organization, this condition will not apply.

7. Review of applications

(1) Review procedure

Based on the results of a mail review, a final review of applications will be done by the Review Committees in the Organization. Interviews will be conducted when deemed necessary. The renewal of the long-term fellowships will be promptly reviewed, only by the Review Committee members and not by mail reviewers.

(2) Review criteria

Applications will be reviewed on the basis of the following criteria.

a. Originality, interdisciplinarity and significance of the proposed research

b. Suitability of the research and its contents

c. The researcher's competence, experience, and potential

d. Suitability of the facilities and equipment, and competence of the host research institute and the laboratory

8. Responsibilities of fellowship recipients

(1) The recipient must engage diligently in his/her research activities at his/her host research institute according to the proposed research plan.

(2) Application for renewal

Those recipients who intend to renew their long-term fellowships must submit a renewal application (including a research report) before the conclusion of subsidization. No renewal applications will be accepted for short-term fellowships.

(3) Submission of research reports

Each recipient must submit a final research report to the Organization within two months after the completion of the research concerned. However, those who are approved for renewal may fulfill this requirement by submitting the research report.

(4) Submission of accounting statements concerning research expenses. Each recipient must submit accounting statements to the Organization within two months after the conclusion of each year.

9. Treatment of research results

(1) As soon as the concerned research is completed, the results of the research must be disseminated through publication in academic journals or other publications and include acknowledgment of the Organization's support.

(2) The Organization will not claim the intellectual property rights (including the industrial property rights) that will be generated through the research activities conducted under the HFSP. The attribution of the rights should be decided on an equitable basis among the parties undertaking the research (and/or their institutions).

[an issue to be discussed from the administrative perspectives]

10. Bioethical consideration

Bioethics should be given due consideration according to the guidelines of the country where the research is conducted.

11. Others

(1) The Organization will assume no responsibility for any damage or injury caused in relation to research conducted in connection with the fellowships of the HFSP.

(2) The Organization may request recipients to reimburse all or a part of the subsidy, if the subsidy has been used for expenses not eligible for subsidization or false accounting statements have been submitted.

C. Workshops

1. Eligibility

Proposed international workshops must meet each of the conditions described below.

(1) The workshop must provide an opportunity for the exchange of up-to-date information on focal points of the research areas concerned.

(2) A researcher from the Eligible Countries is eligible as a workshop organizer.

a. As for the "Eligible Countries", see A-1-(1).

b. "A researcher from the Eligible Countries" is one who has nationality of one of the Eligible Countries and be affiliated with a research institute located in one of the Eligible Countries. (The country of his/her nationality could be different from the one in which his/her research institute is located.)

(3) Most of the workshop participants must be active researchers who are currently engaged in research projects. They are expected to have a doctoral degree or to possess equivalent research competence.

(4) Not more than half of the participants should be from any single country.

(5) The organizers must invite applications for participation by advertising in internationally-recognized scientific literature. A majority of the workshop participants must be chosen, in principle, from among applicants.

(6) The Organization may co-sponsor workshops with other organizations, if they meet the purpose and basic principles of the HFSP.

2. Research areas

Workshops are available for the following.

A. Basic research for the elucidation of brain functions

A-1. Perception and Cognition
A-2. Movement and Behavior
A-3. Memory and Learning
A-4. Language and Thinking

B. Basic research for the elucidation of biological functions through molecular level approaches

B-1. Expression of Genetic Information
B-2. Morphogenesis
B-3. Molecular Recognition and Responses
B-4. Energy Conversion

Research involving work on supporting methods will also be eligible for subsidy.

3. Expenses to be subsidized

Only expenses directly associated with the workshop will be subsidized. Details are as follows.

a. Limits on subsidization

Up to about U.S.$100,000 will be provided. Regional factors will be considered in determining the amount of subsidy.

b. Expenses for planning and operating workshops

The subsidy will cover the cost of planning and operating workshops, including expenses for printing, communication and meetings, supplies, miscellaneous services, etc.

c. Travel expenses

Participants' round-trip travel expenses will be subsidized. (The shortest route; the most economical means of transportation)

d. Stay allowances

The amount will vary depending on the site of the workshop.

e. Other expenses

Other expenses will be subsidized with approval of the Organization.

4. Application procedure

The organizers will be responsible for submitting all the necessary documents to the Organization by the application deadline, according to prescribed formats:

a. Name, affiliation, address, date of birth, and title of the each workshop organizer

b. Workshop theme, site, and date

c. The organizers' curricula vitae and list of publications (pertinent publications within the last five years)

d. Purpose, contents and background of the proposed workshop; its relationship to other workshops

e. Workshop program (schedule, session titles, etc.)

f. List of prospective participants

g. Procedure for recruiting workshop participants; selection criteria

h. Summary of proposed budget

i. Other (whether or not the organizers have applied or plan to apply for financial assistance from other organizations; reasons for selecting the workshop site, etc.)

All application materials must be written in English.

5. Period for submitting applications (Applications are accepted once a year in 1989.)

From 1989 to 1989

6. Review of applications

(1) Review procedure

Applications will be reviewed by the Review Committee of the Organization.

(2) Review criteria

Applications will be reviewed on the basis of the following criteria.

a. Originality, interdisciplinarity, significance, and potential of the proposed workshop theme

b. Suitability of the workshop's contents and feasibility of the workshop administration plan

c. The organizers' competence and experience

d. International representation by workshop participants

e. Suitability of the proposed budget

7. Important information for participants in workshops

(1) Selection of participants

The organizers must invite applications by advertising in internationally recognized scientific literature. More specifically, the workshop must not consist only of the participants the organizers have personally invited. In principle, a majority of participants must be selected from those who have applied.

(2) Responsibilities of organizers

a. Submission of workshop report

The organizers must submit a final workshop report to the Organization within two months after the conclusion of the workshop.

b. Submission of accounting statements

The organizers must submit accounting statements to the Organization within two months after the conclusion of the workshop.

8. Others

(1) The Organization will conduct a survey to improve the Workshop Program in the future by asking workshop participants to fill out questionnaire.

(2) The Organization will assume no responsibility for any damage or injury caused in relation to workshops subsidized by the HFSP.

(3) The Organization may request organizers to reimburse all or a part of the subsidy, if the subsidy has been used for expenses not eligible for subsidization or false accounting statements have been submitted.

V. Details of the Review System and Procedure

1. The Review System

a. The Board of Directors

The Board of Directors will be the decision making organ which has in its purview the administration of the Organization activities such as the implementation of the review system, the examination of the review procedure, decision on the general framework of review criteria and the selection of priority research areas. The Board of Directors may organize a Review Committee and delegate to the Committee its duties and authorities regarding the screening of the applications and selection of awardees.

b. The Review Committee

The Review Committee, supervised by the Board of Directors, practically will decide awardees. Members of the Review Committee will be selected with a two-year term of office by the Board of Directors so as not to affect the continuity of its functions. Joint committee meetings may be held when deemed necessary.

The Review Committee will carry out such activities as the decision on awardees, establishment of detailed review criteria, the selection of mail reviewers, etc.

Members of the Review Committee must be chosen from among the most distinguished scientists in the research areas concerned, taking into consideration members' specialities, nationalities, foresightedness, sense of equilibrium, eagerness for review activities, etc.

c. The Secretariat

The Secretariat will receive applications, check submitted materials, distribute applications to mail reviewers by members of staff with scientific backgrounds, summarize the results of mail review, notify Review Committee meetings, and contact applicants, the mail reviewers and members of the Review Committee.

In order to carry out the Program activities appropriately, it will be essential to employ those staff members who are well aware of the current status and future trend of the research areas.

d. The Mail Reviewers

The Mail Reviewers will review applications purely from scientific points of view. The Organization will have to select the mail reviewers among the most distinguished scientists (several thousands of mail reviewers may be necessary in the future), and update the list on a regular basis.

2. Details of the Review Procedure

(1) The review of applications for grants and long-term fellowships will consist of two stages, that is, mail review by the mail reviewers and panel review by the Review Committee.

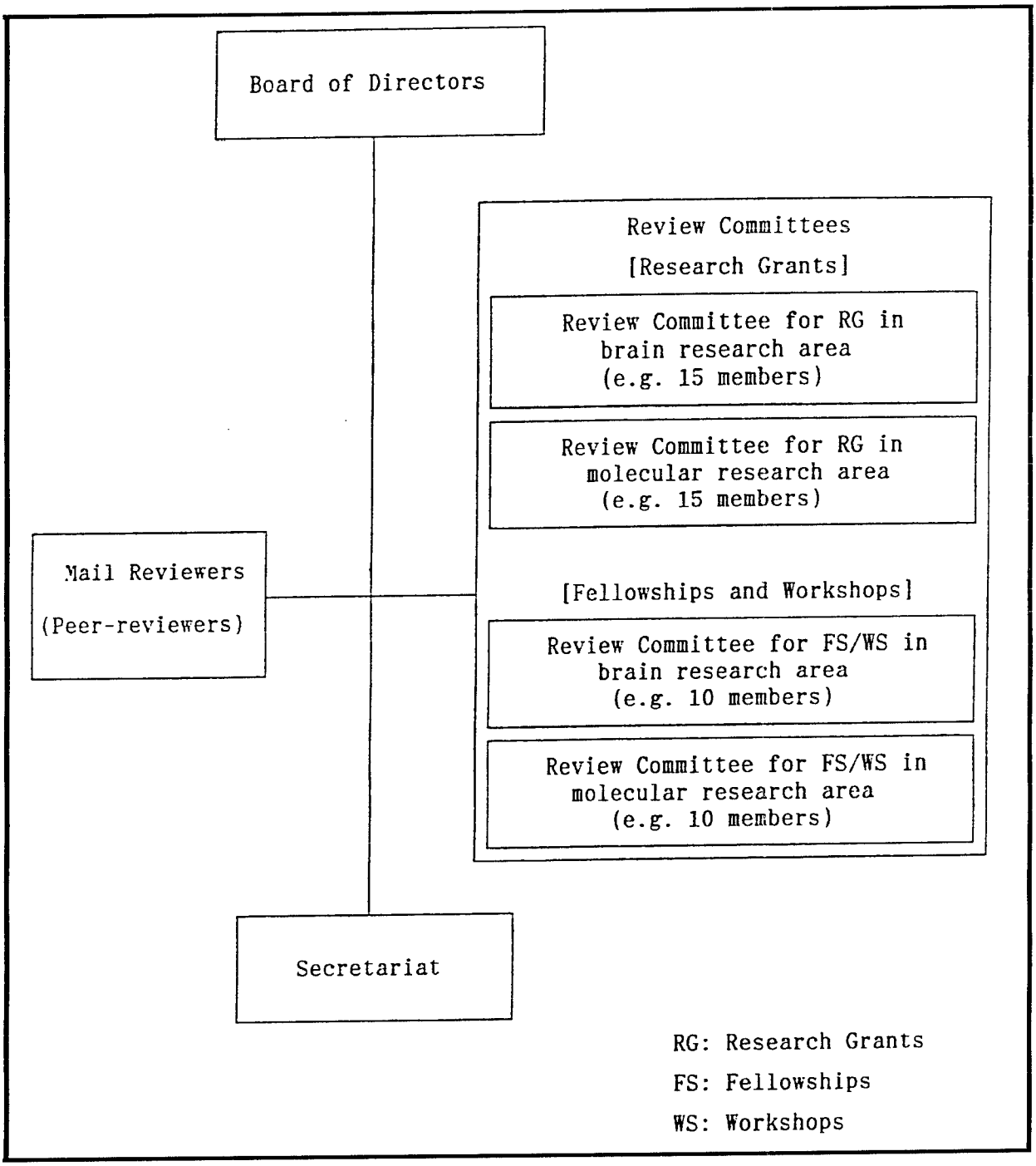
(2) The review of applications for short-term fellowships and workshops will consist of a single stage, that is, mail review by the mail reviewers and panel review by the Review Committee, respectively.

(3) The reviewers are required to review the applications purely from scientific points of view in a sincere and fair manner.

(4) The list of mail reviewers will not be made public.

(5) The review process will be confidential, no explanation, therefore, will be offered and no correspondence can be entered into on decisions taken.

(6) A list of scientists with such information as their specialized research areas and their past review records should be kept in a form of data-base, to be used when selecting mail reviewers.


Board of Directors
Review Committees
[Research Grants]
Review Committee for RG in brain research area (e.g. 15 members)
Review Committee for RG in molecular research area (e.g. 15 members)
Mail Reviewers
(Peer-reviewers)
[Fellowships and Workshops]
Review Committee for FS/WS in brain research area (e.g. 10 members)
Review Committee for FS/WS in molecular research area (e.g. 10 members)
Secretariat
RG: Research Grants
FS: Fellowships
WS: Workshops

(7) Others

a. In the case of mail review, after applications have been pigeonholed by the Secretariat (classification of applications into specific research areas, checking of submitted materials, etc.), mail reviewers will be chosen for each application using the list of scientists above.

b. No honorarium will be paid to the mail reviewers and members on the Review Committee, but travel expenses and daily allowances will be provided for those attending meetings of the Review Committee.

A. The Research Grants

[Outline]

A review will consist of two stages, that is, mail review by mail reviewers and panel review by the Review Committee within the Organization.

[Procedure]

Application from scientists—the Secretariat (checking eligibility and selecting mail reviewers)—mail review (first stage of review by mail reviewers—the Secretariat (ordering)—panel review (second stage of review and deciding awardees by the Review Committee)—the Secretariat (checking budget and giving notice to the Board of Directors)—provision of subsidy.

[Mail Review]

Five to seven mail reviewers will be chosen for each application, and copies of the complete application will be sent to the mail reviewers. (Utmost efforts should be made to select as appropriate mail reviewers as possible, because the result of the mail review will largely depend on the selection. It should be arranged for each mail reviewer to evaluate more than one application (two or three) so that he/she can make comparison among them.)

In order to avoid the dispersion of mail review ratings among reviewers, a five-point rating scale is adequate for overall evaluation rather than a finer rating scale. In addition, applications will be evaluated in a five-point scale for each item of the criteria and also by written comments.

The Secretariat will select an appropriate number (less than about three times as much as the budget limitation) of applications with higher ratings in the overall evaluation in the first stage of review and submit them to the Review Committees for the second stage.

[Panel Review]

The Review Committees will review from a general point of view the applications submitted by the Secretariat, referring to the overall ratings, ratings for each item, and comments by mail reviewers. Giving full respect to the mail review, the Review Committee will decide the priority order for awards.

Each application will be read by more than one member of the Review Committee. One member of the Review Committee is expected to be able to review only about ten applications. However, all applications should be accessible to each member of the Review Committees. The Review Committee may adjust the budgets of each of the applications to be reasonable from a scientific point of view.

The Secretariat will subsidize the applicants within the funds available, according to the order decided by the Review Committee.

[Review Criteria]

a. Originality, interdisciplinarity and significance of the research.

b. Suitability of the research planning and its contents.

c. Necessity for the joint international research and the international representation of the research team.

d. Ability, experience and potential of the researchers.

e. Suitability of the facilities of the research institutes.

f. Propriety of the proposed budget.

B. The Fellowships

<Long-term fellowships>

[Outline]

A review will consist of two stages, that is, mail review by mail reviewers and panel review by the Review Committee within the Organization.

[Procedure]

Application from scientists—the Secretariat (checking eligibility and selecting mail reviewers)—mail review (first stage of review by mail reviewers)—the Secretariat (ordering)—panel review (second stage of review and deciding awardees by the Review Committee)—the Secretariat (checking budget and giving notice to the Board of Directors)—provision of subsidy.

[Mail Review]

Three reviewers will be chosen for each application. Copies of the complete applications will be sent to the reviewers. (Utmost efforts should be made to select as appropriate mail reviewers as possible, because the result of the mail review will largely depend on their selection. It should be arranged for each mail reviewer to evaluate five applications (three to seven) so that he/she can make comparison among them.)

Applications will be evaluated on a five-point rating scale for each item of the criteria and also by written comments.

The Secretariat will calculate the total point for each application by adding up the score for each evaluation

item (with a specified weight that will be approved by the Board of Directors) and submit them to the Review Committees. The Secretariat will select an appropriate number (less than about three times as much as the budget limitation) of applications with higher ratings in the overall evaluation in the first stage of review and submit them to the Review Committee for the second stage.

[Panel Review]

Giving full respect to mail review, the Review Committees will decide the priority order for awards.

Each application will be read by more than one member of the Review Committee. However, all applications should be accessible to each member of the Review Committees.

The Secretariat will subsidize the applicants within the funds available, according to the order decided by the Review Committee.

[Review Criteria]

a. Competence and potential of the researcher

b. Originality, significance and interdisciplinarity of the research

c. Suitability of the research planning and its contents

d. Suitability of equipment, facilities, and competence of the host research institutes and the laboratories

<Short-term fellowships>

[Outline]

Since awardees of short-term fellowships should be decided promptly, applications will be evaluated only by mail review, without panel review.

[Procedure]

Application from scientists—the Secretariat (checking eligibility and selecting mail reviewers)—mail review (reviewing)—the Secretariat (ordering)—the Secretariat (deciding awardees, checking budget and giving notice to the Board of Directors)—provision of subsidy.

Three reviewers will be chosen for each application. Applications will be evaluated on a five-point rating scale for each item of the criteria. (Utmost efforts should be made to select as appropriate mail reviewers as possible, because the result of the mail review will largely depend on their selection.)

The Secretariat will calculate the total point for each application by adding up the score for each evaluation item (with specified weight that will be approved by the Board of Directors).

Those applicants whose total points exceed the upper standard point will be given awards immediately. For the applicants whose total points are between the lower and the upper standard points, awards may be provided every three months within the funds available after compiling and rank-ordering the applications according to the total points.

[Review Criteria]

a. Competence and potential of the researcher

b. Originality, significance and interdisciplinarity of the research

c. Suitability of the research planning and its contents

d. Suitability of equipment, facilities, and competence of the host research institutes and the laboratories

C. The Workshops

[Outline]

The Review Committee will review applications for workshops according to the following review criteria. The planning of workshops will be also done by the Review Committee and/or the Board of Directors.

[Procedure]

—Workshops on an application-and-review basis

Application—the Secretariat (checking eligibility)—the Review Committee (deciding awardees)—the Secretariat (checking budget and giving notice to the Board of Directors)—provision of subsidy.

—Workshops planned by the Review Committee

Planning by the Review Committee—the Review Committee (decision on themes, organizers, etc.)—the Secretariat (arranging budget, giving notice to the Board of Directors)—provision of subsidy.

[Review Criteria]

a. Importance, interdisciplinarity, innovativeness and potential of the workshop theme

b. Suitability of the contents and the plan of the workshop

c. Competence and experience of the organizers

d. International representation among workshop participants

e. Propriety of the proposed budget

D. Timetable of the Review

VI. Unfinished Business for the Implementation of the Program (Outline)

The following is a list of items of business which need to be taken care of to smoothly put the Organization in operation (including those to be decided by the Organization).

Yearly Schedule of Application Review

		Grant Program	Long-term fellowship/ Workshop Program
Apr.	Determination of budget, research activity plan	Begin receiving	Application deadline
May	Approval of financial statements		
			Mail Review (1 month)
June		3 months	
July		Application deadline	Meeting of the Review Committee
Aug.			Provision of subsidy
Sep.		Mail Review (1.5 months)	
Oct.			
Nov.			Application deadline
		Meeting of the Review Committee	
Dec.		Provision of subsidy	Mail Review (1 month)
Jan.			
Feb.			
			Meeting of the Review Committee
Mar.			Provision of subsidy

* Applications for short-term fellowships will be received anytime. Awardees will be selected every three months.
* Public relations for application will be carried out when deemed necessary.

1. Establishment of the Organization (after the site has been determined)

(1) Procedure to establish the Organization

- Negotiation with the host country about provision of various privileges and services
- Preparation of the constitution

(2) Opening an office, etc.

(3) Others

2. Organization and systems

Establishment of the internal organization and systems

3. Selection and appointment of committee members, etc.

(1) Selection and appointment of members of the Board of Directors, Review Committee members, members of the Board of Trustees, Secretary-General, Secretariat staff, etc.

(2) Compensation/remuneration for committee members and staff

4. Items concerning Program management

(1) Preparation of various internal regulations

(2) Deciding on the details of each Program activity

(3) Preparation of document such as application forms and guide books

5. Items concerning application review

(1) Preparation of a list of scientists to conduct mail review

(2) Preparation of a handbook for application review

Alpha Project for Supercomputer Software Development Expands

43068007 Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese
No 34, 6 Sep 89 p 10

[Unattributed article: "Japan's Alpha Project Expands: Aid of More Members Enlisted"]

[Summary] Estimates are that Japan's national Alpha Project to develop supercomputer software for general-purpose three-dimensional fluid-analysis systems will enlist the aid of 200-300 members this year. This project was jointly initiated last year by 13 computer and other firms since its subject matter is a critical area in the intense competition over recent years among Europe, the United States and Japan to develop high-speed supercomputer applications. Since Japan does not currently possess this software and cannot easily import it from the United States, Professor Akiyama of Tokyo University organized a research council in November 1987 to address the problem. In the 4 years from March 1988 to March 1992, the council has budgeted 1 billion yen to develop the "Superflow" general-purpose 3-D fluid-analysis system. In its first year, the Alpha Project has completed the basic design and detailed specifications. The second-year target is development of a prototype; this will be followed by test-program development in the third year and interconnection of the various modules in the fourth year.

Fujitsu Views Latest ASIC Design Technology

43065566a Tokyo SEMICON NEWS in Japanese Apr 89 pp 29-34

[Article by Shigenori Baba of the Technological Support Department, MOS Division, Fujitsu Ltd]

[Text] 1. Introduction

The word ASIC has become a general word in the electronics industry in the last years. ASIC users are found in all kinds of industries. The general definition of ASIC is shown as in Figure 1 [not reproduced]. Technologies cover devices of ECL, TTL, BiCMOS, CMOS, etc. Especially it is estimated that the rate of use will increase for BiCMOS arrays in the future.

In this article, CMOS gate arrays and standard cells, which are the mainstream of the present ASIC, will be fully described.

The today's prosperity of ASIC devices results from the fact that the diversification in users' needs and an environment which satisfies these needs have been prepared and developed in hardware and software by venders. It should be noted, however, that the kinds of products, technologies, and circuit types of the ASIC are certainly widely diversified. There is no single ASIC that can satisfy all the demands of users at present. The development environment of supporting facilities does not yet come up to the level of the hardware; this gap then becomes a gap between users and IC venders. It is especially conspicuous in large-scale ASICs accompanied by the high-density integration of the ASIC. The working loads for logic design of users, preparation of test data, various verifications, and so on in the developing states are tremendous.

Based on this background, the latest trends in ASIC design technologies, the developing environment, and problem areas of design will be described below.

2. ASIC Devices

Progress in ASIC is remarkable. As shown in Figure 4 [not reproduced], however, features are different based on design methods. Gate arrays and standard cells, which are the mainstream of ASIC devices complement one another's drawbacks with advantages and are progressing toward overcoming the drawbacks.

The gate array does not have fixed regions. The SOG-(Sea of Gate) type gate array, in which basic cells are laid on the surface of the entire chip, has been commercialized. RAMs and ROMs can be freely mounted in arbitrary bit/word constitution. Thus, high-grade functions are being implemented. In the standard cells, layout is automated, and shortening of the developing period is intended.

2.1 Gate Array

(1) SOG

At first, the gate array was started as a channel type in which a basic cell region and a wiring area were separated. It has been developed into a composite type in which RAMs, ROMs, and so on are mounted as fixed hard macros. It has further progressed into the SOG.

In the SOG, a system-on-chip configuration of gate arrays, has become possible for the first time. A mixed presence of memories is inevitable in a system with several tens of thousands of gates. One-chip configuration of the large-scale system has become possible by the SOG, on which memories can be freely mounted.

The SOG has the secondary effect, of improvement in integration density of the gate in IC designing. The wiring density of an IC is highest at the center of the chip and becomes coarser toward the periphery. The larger the circuit scale, the larger the imbalance in density. In the conventional channel type, the wiring region is fixed, making it difficult to solve this problem. In the SOG, a necessary wiring region can be freely provided (not totally free), therefore, high density can be accomplished.

Since the SOG has various advantages as described above, it is considered that it will become the mainstream of future gate arrays.

(2) Gate Array With Shorter Delivery Time

The highest feature of the gate array is QTAT (Quick Turn-Around Time). An ordinary TAT (from the completion of simulation to shipment of ES) is about 10-14 days. Last year, gate arrays of supershort delivery dates—the shortest being 2 days—were announced by two domestic firms.

The 2-day deliveries were accomplished by customizing the device with only one metal-layer wiring instead of the conventional customizing method of using two metal-layer wiring. Because of redundancy in the lower metal wiring layer, however, the chip size is increased by about 50 percent in comparison with the conventional gate array. This method is not suitable for mass production.

Therefore, in Fujitsu Ltd, the mass production of QCLTM (Quickly Customized Logic: gate length is 1.2μm) of the devices of supershort delivery is conducted by utilizing a cell library and the gate arrays in UHB series (gate length: 1.5μm) having interchangeability in AC characteristics. In comparison with the UHB, the load per gate of QCL increases by the increased amount in chip size. This is offset by increasing the performance of the gate, and the interchangeability of the AC characteristics is maintained.

2.2 Standard Cells

(1) Poly-Cell Method

This is the layout method by which the height of the cell is made constant and the direction of the width is made variable in correspondence with the scale of a circuit.

For example, when the gate array cell is used intact, the CAD technology developed with the gate array can be used almost intact, thus the layout can be automated. The layout work is finished in about 1 week, and the area is about 80-90 percent of the gate array.

In this method, the standard cell, on which already developed gate arrays, memories, analog circuits and so on are mounted in a mixed state, can be readily designed. This method is effective when the ASIC is developed in a short period by utilizing past design resources. Regarding a user's selection, acquiring of samples in a short period is emphasized (depending upon the degree of integration sought).

(2) Building Block Method

In this method, a cell is formed so that the shape becomes smaller to correspond with the circuit scale, individual cells and blocks are assembled, and the layout is performed (Figure 8 [not reproduced]). Since a cell in which freedom in cell design is high and optimized is used, the chip size becomes smaller. On the other hand, automation is delayed, since the cell shapes are all different. Recently, however, automation has become possible, and a layout is finished in 3-6 weeks.

The greatest advantages of this method are high integration density and high speed. The gate integration density is about 1.5-2 times that of the gate array.

3. ASIC Developing Tools

In the development of the ASIC, a series of data processing, such as logic registration, design-rule check, and logic simulation, are indispensable as work to be done by users. What kinds of products and methods should be adopted is the first point in realizing the ASIC. Performances and prices are, of course, considered within the range of selections based on the functions to be realized.

At the same time, it is every important to consider sufficiently how to develop the ASIC and whether or not the development environment is prepared.

(1) Trend of CAD Tools

As an ASIC developing tool, at first an EWS (Engineering Work Station) which uses general-purpose microprocessors as engines and has an excellent graphic function appeared and served a role in today's prosperity of the ASIC. But the EWS has the following drawbacks: it is expensive; redesign is required because of simulation errors since the simulation model is slightly different from the IC vender's model; and the compiled cells cannot be supported in a timely manner.

Therefore, there is a recent example of CAD software being provided and loaded into a personal computer by the IC vender itself. Simulation-executing time, accuracy, circuit scales, and so on have reached a stage which is not inferior to a general purpose EWS.

(2) Cells/Modules and Compilers

Various methods have been adopted in CAD technologies with the progress of the ASIC. Above all, a cell compiler will become the essential technology for the future large-capacity ASIC. With the cell compiler, the designed logic simulation library and mask pattern are automatically formed only by setting the parameters of the functions for every cell (module) which has specified functions. This is the indispensable technology in design efficiency.

Now cells for arrays of RAMs, ROMs, and PLAs and cells for data paths, such as multipliers and ALUs, are put into actual use. The future task is the automation of the preparation of test data of the complied cells.

4. Problem Areas in Design

(1) Noise

Achievements in the CMOS logic circuit are remarkable. The delay time/gate is approaching that of a bipolar ultrahigh-speed logic element. Generation of noises in a printed board, on which the high-speed CMOS ASICs are mounted, and erroneous operations due to noise are becoming problems. Noise is mainly caused by high-speed switching of ICs and relation between floating capacitance and inductance in the printed board. Various methods are being considered for the classification of noises. In Table 1 [not reproduced], five general classifications are given, and the causes of the noises and countermeasures are shown. For achievement of low speed in the countermeasure, there is the following example. The through rate of an output buffer, whose output driving current is large (therefore a source of large noises), is controlled (achievement of low speed) when the speed in the IC is the same, and noise is suppressed.

(2) Power Consumption

There is no direct current flow in a CMOS circuit, but there is a transient current due to a load capacitance. Because of the trend toward high speed and high integration density of the ASIC, power consumption due to the transient current is not a negligible state. The power consumption Pd is expressed as C.V2.f. When an IC having 40,000 gates is operated at 20 MHz, Pd = 0.4 x 10-12 (F) x 5 2 (V) x 20 x 106 (Hz) x 40,000 x 0.2 = 1.6 (W) is obtained (where the average load of the gate is assumed as 0.4 pF and the gate-on rate is assumed as 20 percent). Mounting on a plastic package is therefore difficult.

(3) Fault-Detecting Rate/Test Data

It is general in the ASIC that the test pattern in simulation is also used as a test pattern in shipment of ICs. The preparation work of the high-quality test pattern (fault-detecting rate is high) by users is a heavy burden with the increase in circuit scale. The fault-detecting rate and the preparation of the test data will be described in detail in the next chapter; therefore it will not be especially described in this article, but this is one of the important problems in ASIC development.

(4) Package

As the trend of packages, implementation of multiple-pin types, miniaturization, and small pitches progress, demands on DIPs (Duan In-Line Package) and surface-mounting type packages (SDM) in which high-density mounting is possible, are increasing. With the achievement of the compact configuration and the thin types for the packages, problems in mounting and reliability are emerging.

5. Epilogue

As described above, the progress of the ASICs and advance in technological development in correspondence with the various needs of users are remarkable although they are not sufficient. It is thought that the growth will continue in the future.

Accompanied by this trend, competition between IC venders is fierce. In the future, consolidated technological power and supporting power such as design, tests, and packages including software will be requested.

Fujitsu Perspective on Advanced ASIC

43065566b Tokyo SEMICON NEWS in Japanese Apr 89 pp 35-39

[Article by Minoru Yamamoto of the ASIC Design Department, MOS Division, Fujitsu Ltd]

[Text] 1. Introduction

Test patterns used in simulation at the time of design are used as the data of an LSI tester, and are thus used to conduct. Therefore, the test technology of the ASIC comes back to mainly a circuit-designing and test-pattern forming method. These methods are not limited to the ASIC but can be commonly used in standard IC design. What is definitely different is as follows: The ASIC is usually designed by a system design specialist and the design is completed in quite a short period. The standard IC, however, is designed by an IC-circuit designer in a semiconductor firm and the circuits and the test data are designed after due consideration. Users are, of course, interested in the circuit design for realizing the system and the preparation of the test data for verifying the operation of the system. But the preparation of the test data is cumbersome and a considerable burden for testers.

Since the shipping test of ICs is conducted to remove defective products, test patterns adequate to find defects, are required. As an index for showing good performance of the test pattern, a fault-detecting rate is used. It is desirable that a 90 percent or higher fault-detecting rate be achieved. Especially in the present system-on-chip age, a poor ASIC directly means a poor system; therefore, user interest in fault detection is increasing remarkably.

With the achievement of high-integration density in ASIC, a tremendous length of time has been required in preparation of the test pattern. In some cases, more developing time than that required for logic design may be consumed in designing the test pattern.

As the ASIC testing technology in the above-described background, a technology by which a test pattern with a high fault-detecting rate can be formed quickly and simply, is what is expected by the user.

2. Flow of ASIC Design

The design flow of the ASIC based on the preparation of the test pattern is shown in Figure 1 [not reproduced]. In the ASIC design, it is usual for the operation in simulation to be confirmed and feedbacks be repeated several times.

1) Logic-Circuit Design

In circuit design, a system is usually disassembled into modules, with a circuit designed for each module; a test pattern is formed for the circuit, the test pattern is confirmed by circuit simulation, and the circuit is determined. In a ASIC designed, a minimum test pattern tends to be used at this time, while in the design of standard ICs, quite a few test patterns are used, and the operation of the system is verified in many cases. The decision depends on whether or not a breadboard is used, the length of the design time, and whether delivery date has priority or not.

2) Addition of IC Test Patterns

The circuit for every module is combined. The test pattern for the entire IC chip is added. Necessary timing and operation tests are confirmed by simulation. At this time, whether the circuits are activated or not is confirmed with the test patterns (transient-count check). If the result is insufficient, patterns can be added. The above-described work is usually conducted with a personal computer or a work station. When the design is completed, the data are released to the semiconductor venders.

3) Preparation of Final Test Pattern

The vender conducts confirming simulation based on the released data. The layout of a chip is carried out and the simulation (validation) is conducted again. The circuit operation based on actual wiring capacity is verified. If necessary, changes in circuit, changes in test patterns and addition of test patterns are carried out at this time. Thereafter, fault simulation, which will be described later, is conducted. When the fault-detecting rate is unsatisfactory, test patterns are added. Thus the final test patterns are completed at last. After trial manufacture of ES, the final test is carried out by using the tester.

As described above, in the ASIC design, changes and additions of test patterns are repeated quite frequently. Since fault simulation usually requires considerable computer time, the simulation is conducted in parallel with the trial manufacture of the ES.

3. Fault Simulation

Fault simulation is a software function for checking whether logic faults that can occur in the ASIC can be detected with the given test patterns or not. As a model of a fault, a single stuck-at-fault, where the input or output of a logic element is fixed to a "1" or a "zero," is assumed. As the result of the fault simulation, a fault-detecting rate, i.e., (detect fault number) ... (total assumed fault rate), is computed.

Based on experiments, it is thought that a fault-detecting rate of 95 percent is required; 90 percent must be secured at the very least. In general, when test patterns of the minimum limit for a system are used, 30-60 percent is obtained. When the patterns are designed with considerable attention to the detecting rate, about 60-95 percent is achieved. These values vary with the scale and constitution of the circuit.

4. Design for Easy Tests

To improve the fault-detecting rate, it is not good just to increase the test patterns greatly; it is also necessary to design the circuits suitable for the tests in advance to improve the fault-detecting rate efficiently.

For this purpose, it is important that inputs to the logic gates in the IC be readily controlled through outer terminals and the outputs be observable through the outer terminals. In Figure 2(a) [not reproduced], an example of a multiple-stage counter is shown. Clocks of 2 (m+n) are required to move an X output. When the clocks are divided into m+n bits as shown in Figure 2(b) [not reproduced], the number of clocks can be greatly decreased and the controllability is improved. When input/output terminals for testing are provided at cutoff points as shown in Figure 2(c) [not reproduced], both controllability and observability can be strikingly improved. The same concept can be applied to complicated circuit modules other than flip-flops.

5. Testing Method of Large-Scale Macro-Circuits

When already designed circuits and various functional circuits (multipliers, analog circuits, ASSPs, CPUs, various peripheral ICs, etc.) are used as macro-circuits accompanied by the achievement of large-scale ASICs, all the input/output terminals of the macro-circuits are made to be controlled from the outer terminals. Thus, the test patterns of the macro-circuits can be directly utilized. Figure 3 [not reproduced] shows an example of this case, which is the application of the device in Figure 2(c). In Figure 4 [not reproduced], an example on which an analog circuit is mounted in a mixed mode, is shown.

6. Design of Scanning

The testing methods described above depend on manual operation. With the realization of the large-scale ASIC, tremendous time and man-hours are required in designing high-quality patterns. In some cases, the designing is impossible in actual application.

The designer is expected to create only the minimum pattern for system tests, and later automatic test-pattern generation by a computer can be utilized. The logic circuits can be classified into combined circuits and sequence circuits. For the combined circuits, automatic test-pattern-generating algorithms have been developed and put into actual use. Meanwhile, handling of the sequence circuits is difficult in general. As a result, circuits are converted into the combined circuits by utilizing a scan-path method, and then the test patterns are formed. This is an ordinary method.

Figure 5 [not reproduced] shows an example. All flip-flops are operated as shift registers, which are connected in series in a test mode. At first, data are serially transferred (scan in) to the flip-flops through a scan-data input port. The outputs (Q) of the flip flops are handled as input signals to the combining circuits. The combining circuits are operated together with other general input signals. Of the output signals, those which are inputted into the flip-flops as the data are all received. The data, which are set in this way, are taken out (scan out) as the serial data again through a scan-data output port. In this method, input and output can be carried out through the input/output terminals of the flip-flops from the external terminals.

In this method, it is necessary to replace all the flip-flops with devices having input-switching circuits called scan flip-flops and scan clocking circuits. Therefore the number of gates is increased in comparison with ordinary flip-flops. One drawback is that the extra wiring for serial scanning are required at the time of circuit designing. In an IC having the scan design, almost 100 percent test pattern can be readily obtained by automatic test-pattern generation (ATG), a great advantage.

Of the drawbacks described above, a reduction in gate-number increase and elongation of delay time can be suppressed to some extent. In the scan design itself, automatic conversion by a computer is put into actual use based on non-scan design. In this way, it is thought that the scan-path method will be proliferated.

7. Epilogue

The progress of the ASIC is remarkable. An SOG having 100,000 gates and a gate array in 10,000-gate scale whose ES can be fabricated within 5 days, have been already commercialized. In the future, high integration density, high speed, and short delivery date will be further accelerated. Along with this trend, design and test technologies will be based on even more abstract principles. For example, compilers and generators in software will be utilized in full scale, and the circuits which control them will be formed by logic synthesis. The test patterns of the ASIC will be prepared where these technologies are combined into the software.

Progress in JPDR Dismantling Outlined

43063525a Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 9 Feb 89 p 5

[Text] JAERI (Japan Atomic Energy Research Institute) will promote research on the re-use of metal wastes to be generated from dismantling of reactors, so as to complete it before 1992. Accordingly, during 1990 JAERI will complete a "testing system for melting and ingot production of radioactive metals" collecting data on radioactive nuclides during melting and solidification of active metal wastes, and will conduct tests using actual metal wastes from the JPDR [Japan Power Demonstration Reactor].

It is thought that large amounts of wastes (approximately 500,000 tons) are generated from dismantling nuclear power facilities and nuclear power stations housing light water reactors of 1.1 million kW class. Thus, the re-use of dismantling wastes has become one issue.

Also, according to the long-term plan revised in June 1987, "the way for re-use of wastes whose radioactivity level is very low will be opened under specified conditions." As a result, an R&D policy for this purpose was worked out.

JAERI reacted to this policy, and has been proceeding with research using a "testing system for melting and ingot production of active metals," in order to re-use metal wastes produced during dismantling.

The said testing system is a small furnace in which metal wastes are melted, and some nuclides, such as cesium, are discharged by raising temperature to a high degree and caught by the filter, while the remaining metals are converted into ingot. This furnace will allow data on the behavior of radioactive nuclides during the melting and solidification of such metals to be gathered.

JAERI has completed the conceptional design of such a system, and is now fabricating the first-phase portion (melting furnace), and will complete it in 1989. In 1990, JAERI will start the fabrication of the second-phase portion (ingot production equipment, off-gas treater, and measuring equipment), and install this equipment at the site.

Meanwhile, cold and hot tests are to be conducted. Around 1991, melting and ingot production tests will be conducted on components, etc. around the actual piping, valves and pressure vessels in JPDR, as "Tests on Articles Dismantled in the JPDR."

For information, a series of tests will be completed in 1992.

In this connection, before 1992 JAERI also intends to summarize the results of "The Overall Survey on a Re-Use System for Wastes From Reactor Dismantling" showing overall studies from the generation of wastes from dismantling of reactors to the completion of reproduced articles, from the aspects of safety, economy, and technology.

Electrolytic Decontamination System

43063525c Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 16 Feb 89 p 7

[Text] Genshiryoku Daiko (head office: Tokyo; president; Sadaichiro Suzuki) will deliver an electrolytic decontamination (DE) system used for JAERI's JPDR [Japan Power Demonstration Reactor].

In the electrolytic decontamination system, the principle of electrolysis used for plating is applied. If, in dilute sulfuric acid, contaminated items such as pipes and valves are connected to the stainless steel plate to pass the direct current, then the associated contaminated surfaces are electrolyzed and the contaminants are precipitated on the stainless steel plate on the negative side.

The system is effective for nuclides such as cobalt, manganese, tritium, and cesium which has adhered to pipes, valves, and tanks, etc. having mateirals such as SUS, SS [stainless-clad steel] and molybdenum.

The advantages to be gained from the introduction of such a system, are said to be as follows: 1) Volume reduction of contaminated metal wastes; 2) Shortening of decontamination time; 3) Reduction of working exposure to radiation; 4) Re-usability of useful metals.

Genshiryoku Daiko's system will be applied to a nuclear power station for the first time in Japan.

In December 1987, dismantling tests were started at the JPDR. Various tests on decontamination and cutting have been conducted so far. Also, fundamental and proving tests on the electrolytic conditions and solution in the electrolytic decontamination system have been completed.

The system to be delivered to JAERI includes an electrolytic decontamination tank, cleaning tank, and neutralization system. The DC output of the system is 4,000A-30V, thus its configuration is full-scale.

Genshiryoku Daiko wants to deliver its system to nuclear power stations and radioactive waste disposal facilities which will be newly opened, with the recent contract award as a lever.

Nuclear Safety Cooperation With Soviets

43063036c Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 9 Mar 89 p 2

[Text] The Japan Nuclear Industry Council (JNIC) is to expand cooperation with the Soviet Atomic Energy Utilization National Committee (GKAE) in the field of safety improvement of nuclear power generation.

This was agreed at the sixth meeting of representatives of the two parties in January this year, and it was reported to the Japanese-Soviet Atomic Energy Cooperation Coordination Committee.

According to the memorandum signed at the meeting, "earthquake resistance, fire prevention, diagnosis, remote-control technology, man/machine interface, and probability theory risk evaluation" were taken up as subjects of special interest on which information is to be exchanged in the future, and it says "the comparison of the safety analysis of nuclear power plants, the comparison of the safety regulations of the two countries, and the safety of nuclear power plants and public consciousness will probably become important matters of cooperation in the future."

There is also a possibility that the safety exchange programs between the JNIC and GKAE would be conducted within the framework of the present cooperation programs with the United States, West Germany, and France, and with the participation of these countries.

Concrete proposals will be made between the two parties by May this year, and a representatives meeting to discuss a new agreement on the field of safety is expected to be held in the Soviet Union late this year if things go well.

In addition, the meeting also agreed to pursue the possibility of Japanese-Soviet joint research in the field of FBR in the future.

It was also agreed to hold Japanese-Soviet seminars in 1989-1990.

According to the program, seminars to be held in the future are as follows.

"Main Parameters of the FBR [Fast Breeder Reactor] Considering Profitability, Reliability, and Safety and Optimization of Heat Diagram" (in first quarter of 1990, in Japan).

"Improvement of Fuel Cycle Particulars of the FBR" (third quarter of 1990, USSR).

"Calculation and Experiments on the Physical Problems in FBR Design" (second quarter of 1989, USSR).

"Justification of the Design of Safety of HTGR [High Temperature Gas-Cooled Reactor] Type Nuclear Power Plants, Strength Analysis of the Components of HTGR Equipment" (1989, Japan).

"Nuclear Reactor Loop Test of HTGR Fuel Elements and Components and After-Irradiation Research and Technology of High-Temperature Experiments" (1990, USSR).

"Design Experience of VVER Reactor, Antiseismic Strength of Equipment/Piping" (third quarter of 1989, Japan).

"Analysis of VVER Fuel-Melting Accidents" (1990, USSR).

"Base Load Including Output-Adjusting High-Combustion Operation Problems/and Methods of Experiment and Research of VVER Fuel Element During Transition Period, Technology, Results and Safe Operation (Reliability) Regulation, MOX [mixed oxide) Fuel-Processing Problem" (fourth quarter of 1989, USSR; fourth quarter of 1990, Japan).

"Transport and Storage of Used Fuel, and Other Fuel Cycle Fields" (third-fourth quarters of 1989, Japan; third-fourth quarters of 1990, USSR).

"Operational Experience of Nuclear Ships, Prospects, the Development of Reactors for Ships" (1989, USSR; 1990, Japan).

The JNIC is also holding seminars with the Soviet Department of Nuclear Power Generation, and as a part of them, it is expected to hold a seminar whose theme is measures in case of emergency and matters related to earthquake resistance.

Cooperation With France on Neutron Beam Injection Device

43063036d Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 9 Mar 89 p 1

[Text] The Japan Atomic Energy Research Institute is planned to conclude a research cooperation agreement on "the energy collection system of the neutron beam injection device" with the Atomic Energy Agency of France (CEA) within this fiscal year if things go well.

This cooperation is a part of "The Japan-EC Nuclear Fusion Cooperation Agreement" concluded on 20 February 1989.

Neutron beam injection (NBI) is a method of injecting neutron beams of high energy into plasma and heating the plasma with the energy. Neutron particles are used because they will not reach the plasma obstructed by the confinement magnetic field if they are in an ionic state. The neutron beam proceeds in a straight line even if there is a magnetic field, and neutron particles are re-ionized by the collision with plasma particles, which will give energy to the plasma particles confined in the magnetic field.

The Neutron Beam Injection (NBI) heading device works as follows: Ions are extracted from plasma which was formed using a filament in the plasma forming chamber, and then accelerated by ion accelerating electrodes to produce ion beams. Next, the ion beam is transformed into a neutron beam by neutralization cell. The neutron beam is then injected into the plasma to be heated.

However, the conversion efficiency in the neutralization stage is about ⅓ and the energy (2/3) used for the

acceleration cannot be used for heating the plasma, which is absorbed into the beam damper.

This time research and cooperation is to test the collection of the energy that is thrown away at present. It aims at the realization of about 90 percent energy utilization efficiency. To be concrete, JAERI will make an ion source plasma forming section, and conduct tests by combining the test equipment of Kadarash [phonetic] Research Institute.

JAERI has already completed an ion source plasma forming section, which will be transported to France and experiments will be started as soon as the signing is completed. The period for this cooperation is three years, and the final evaluation is planned to be conducted in fiscal 1991.

Copper Vapor Laser Developed for Uranium Enrichment

43063049a Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 4 May 89 p 2

[Text] On 29 April Kansai Electric Power announced that in cooperation with the Laser Technology Research Laboratory and Toyo Denki Seizo, it had developed a highly reliable, long-life copper vapor (CV) laser which uses semiconductor elements in its power source.

Copper vapor lasers will be essential to next generation uranium enrichment methods and in recent years research into improving their performance has expanded enthusiastically both here and abroad. In order to use CV lasers in uranium enrichment, an important research topic has been the development of power source equipment with the capability of generating pulses in the 100 watt class for one 10 millionth of a second and repeating them 5,000 times per second. Specifically, because the elements performing laser oscillation require superhigh speed switching (one 10 millionth of a second), high voltage (15,000 volts), and high current (1,000 amperes), unique discharge elements (thyratrons) meeting these conditions have been utilized in CVLs. However, thyratrons are not only expensive, but also have short lives of about several hundred hours and in order for CVLs to reach the practical use stage, the development of longer-lived, reliable elements has been anticipated.

The principal result here has been the fulfillment of these requirements by the introduction of semiconductor elements such as long-life thyristors. These elements are called "high power semiconductor element static induction (SI) type thyristors" and were developed in 1975 by Professor Nishizawa of Tohoku University. They are capable of high speed switching at high voltages with large currents and specifically show extremely strong characteristics with rapidly rising large currents.

With this laser device they succeeded in increasing pulse control speeds and in pulse compression (for laser oscillation, compression is necessary to the degree required by the pulse width) by not only arranging these SI thyristors in multi-stages so that they could withstand high voltages, but also by utilizing magnetic switches with strong, cobalt-type, amorphous magnets.

Plutonium Use Strategy Group Established

43063049b Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 11 May 89 p 1

[Text] On 9 May the Japan Atomic Energy Commission established the Expert Subcommittee on Nuclear Fuel Recycling (Subcommittee chariman, H. Murata, Chairman of the Board of the Japan Atomic Energy Promotion Foundation) in order to consider concrete policies to promote the use of plutonium in Japan. Their first meeting will be at the end of this month and they will proceed with the consideration of subjects such as 1) the use of plutonium in light water reactors, 2) ways of advancing the establishment of systems for the production of mixed oxide (MOX) fuels, 3) ways of advancing the transport of returned plutonium, and 4) ways of advancing the utilization of reprocessed uranium. They expect their initial focus to be on the transport of returned plutonium which will begin to be returned from Great Britain and France in 1992.

The purpose of the Expert Subcommittee on Nuclear Fuel Recycling established here will be, on the basis of long-term calculations, to investigate and consider overall concrete nuclear fuel recycling policies regarding the normalization of reprocessing to be performed under contract overseas, the development of a plan for a private-sector reprocessing plant at Rokkashomura in Aomori Prefecture, and the rate of progress in developing new types of reactors.

As a preliminary step, in January of this year the Science and Technology Agency studied the matter by establishing the "Round Table Discussion on Plutonium Use" (Round Table Leader, H. Murata). The Round Table plans to consolidate its point of view on the 11th of this month. Upon receiving these results, the subcommittee will advance their studies further.

In specific terms, their principal subjects for consideration will be 1) ways of advancing plutonium use in light water reactors as one form of demand for domestic plutonium use, 2) ways of advancing the etsablishment of systems for the production of mixed oxide (MOX) fuel, 3) ways of advancing the utilization of reprocessed uranium, etc.

Of these, in regard to the transfer of returned plutonium, they have considered policies in outline form for accomplishing the ocean transport, but in this case, under the terms of U.S.-Japanese agreements, escort ships will be necessary and because this is a matter for next fiscal year's budget, the reaching of a decision on this question is anticipated at an early stage.

In this sense it is expected that as the subcommittee initially studies a manual for the transport of returned

plutonium, it will also investigate things such as the amount to be transported in light of domestic demand for plutonium.

Testing Slated for New BWR Fuel Assemblies

43063049f Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 25 May 89 p 2

[Text] This fiscal year, the Nuclear Power Engineering Test Center will begin "thermohydraulic testing of new-type BWR fuel assemblies." These experiments will confirm the integrity of the thermohydraulic design of this new fuel which aims for higher burnup rates. The project will require 5 years in which they will conduct limited output tests which will use a tube nest void test facility to verify the thermal integrity of the fuel and hydraulic vibration tests which will verify integrity by confirming thermal and vibrational margins for the fuel assemblies.

In order to avoid reductions in thermal margins which follow increases in uranium enrichment rates and reductions in reactor shutdown margins in these new-type BWR fuel assemblies which aim for high burnup rates, they plan to utilize either a new type of spacer in which heat removal results will be increased by changing existing lattice types to cylindrical (round cell) types, or a large diameter waterload which will increase burnup efficiencies by increasing the water to uranium ratio and enlarging the domain in which the water does not boil. Compared to existing improvements such as increasing the number of fuel rods, this will radically change basic elements and so through the utilization of new structural spacers or large diameter waterload, they will confirm that none of the fuel rods become difficult to cool and suffer thermal damage (burnout) and that the fuel rods do not vibrate easily, giving rise to fretting abrasion (the fuel rod cladding tubes wear down by rubbing against the spacers) and damaging the fuel.

Furthermore, in order to reduce fuel cycle costs, advanced boiling water reactors (ABWR) are being designed with increased ranges of core flow regulation and it will be necessary to confirm the fact that integrity can be maintained in light of hydraulic vibration from fuel rods, etc. during flow adjustment operations.

During limited output testing, they will use full-size simulation fuel assemblies with the new fuel, duplicate normal and emergency nuclear reactor conditions, and measure the limited outputs. By comparing measured data with design values, they will verify the reliability of the thermohydraulic design process.

During hydraulic vibration testing, they will confirm the mechanical integrity of the fuel rods, water load, etc. by measuring hydraulic vibration data with two-stage flow, under high temperature, high pressure conditions the same as those within a nuclear reactor.

Plans call for basic design which will decide the concepts behind the content of the tests to begin this fall, construction of the test facility to begin next fiscal year, and testing to commence in 1992.

Nuclear Fuel Planning System Developed

43063049i Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 1 Jun 89 p 5

[Text] Kansai Electric Power which is continuing to develop several types of expert systems (ES) for nuclear power generating plants, is planning soon to test operate a "System for Drafting Plans for Nuclear Fuel Related Operations" at its Fukui Atomic Energy Office.

Since 1985 Kansai Electric has been working regularly on research introducing AI to the atomic energy field.

There are many experts throughout the world who have given practical assistance at nuclear power plants maintaining first class safety standards and high operational efficiencies and the main purpose of these systems has been to successfully transfer their valuable experiences gained over long years to succeeding generations as these future generations take over. Furthermore, in light of nuclear accidents such as Three Mile Island, it is all the more important to systematically arrange and make effective use of the experiences and knowledge of experts in areas such as operation and maintenance under conditions which emphasize man-machine interface problems, human factor problems, etc.

For this reason it has become essential to push ahead with the research and development of artificial intelligence (AI) and ES techniques specifically. With this point of view, Kansai Electric has normalized AI research in the atomic energy field and up to the present time has worked in 17 subject areas.

From the standpoint of the efficient operation of entire nuclear plants, it is important to perform smoothly the transport of fuel to nuclear plants, its loading, and the series of operations from the removal of spent fuel to its reception in storage pits. In the transport of fuel, ongoing operational circumstances change with the method of transport such as land or sea and with choices involved with seasonal timing. In regard to the removal of spent fuel as well, a series of delicate operations is necessary for the treatment of burnable poison, etc.

For these reasons, appropriate operational management and the drafting of plans for delicate operations by experts with many years of experience and know-how in these operations is considered necessary for this work.

The system which will be test operated soon will assist in the drafting of appropriate operational plans by gathering this type of know-how and knowledge together. The system prototype will be completed by questioning on-site experts and in the future they plan to supplement

and revise the knowledge gathered through test operation on actual work and ultimately to complete an ES with which even beginners can draft operational plans along side veterans.

In addition, for use in the training and education of operations personnel, they are continuing to develop a "Knowledge Acquisition Assistance System" which assists in the rapid understanding of plant conditions. It is a system which checks important data from information regarding changes in conditions in essential equipment (for example, flow rates, pressure, and temperature) and systematically comes to learn about phenomena which are predicted on the basis of their special characteristics.

At the present time the formation of a knowledge base is continuing.

Furthermore, development is proceeding steadily on: an "Accident/Damage Analysis Evaluation Assistance System" which in the event of trouble quickly indicates the location of the problem and important items for inspection, a "Guidance System for Operations During Accidents and Emergencies" which assists operations personnel by displaying appropriate management procedures in case unusual phenomena are seen, and a "System for Assisting in the Planning of System Isolation Operations" which assists in the drafting of plans for the isolation of systems such as complicated pumps and plumbing during inspection work.

In the future, Kansai Electric says that it has plans to build a company-wide information network (new computerization) incorporating these various ES.

BWR Fuel Assembly Void Test Equipment Completed

43063051a Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 11 May 89 p 5

[Text] The Nuclear Engineering Test Center recently completed the manufacture of pipe grouping void test equipment for BWR fuel assemblies and has began its installation. Plans call for installation and test operation to be completed this fiscal year and experimentation to start next fiscal year.

In light water reactors cooling water conditions are closely interrelated with the operation of the reactor and from the standpoint of assuring safety it is very important to accurately understand cooling water behavior. Having been boiled by the high heat generated by the fuel elements, cooling water flows under two-phase gas/liquid conditions consisting of voids (steam bubbles) and water and it is important to understand this behavior accurately, specifically the direction of flow and the percentage of voids (void rate) within the two-phase flow. On the basis of high temperatures and high pressures the same as those in actual reactors, the pipe grouping void test determines void behavior with a pipe grouping system which simulates fuel assemblies.

Having received approval from the Ministry of International Trade and Industry, the Nuclear Engineering Test Center began planning the test in 1987 and has proceeded with the design and manufacture of the test equipment. Plans call for the equipment to be installed at the Isoko Engineering Test Center, for test operation to be performed to adjust and performance-check the various devices, and for a perfected system to be set up for the performance of regular testing.

In these tests, for the first time in the world, measurement will be performed using X-ray CT. This technique has been developed with recent advances in X-ray measurement. It will precisely measure void distribution conditions in fuel assembly cross-sections by turning 360 degrees around the test object. Changes in void rate in the direction of the fuel assembly axis will also be measured using an X-ray densimeter. They say that accuracy will be remarkably improved over that of present-day measurement using gamma rays.

Plans call for the determination of void behavior for both normal operation and emergency cases. This fiscal year five types of test objects will be produced with varied outputs, etc. and both of these cases will be measured in detail. Evaluation and collation of data is tentatively scheduled for 1991.(tab)

Laser Use in Nuclear Engineering

43063069a Tokyo GENSHIRYOKU SANGYO SHIMBUN in Japanese 15 Jun 89 p 1

[Text] On 10 June the Laser Enrichment Technical Research Association (Chairman of the Board, M. Toyoda, Vice-President of Tokyo Electric Power) which has set a goal of proving the practicality of uranium enrichment technology using atomic lasers, began construction of the Tokai Enrichment Test Facility within the Japan Atomic Energy Research Institute (JAERI) in Tokaimura in Ibaraki Prefecture. Installation of equipment will be completed during this fiscal year and experiments using a test device (enrichment capacity: one ton SWU per year) will begin next fiscal year.

Construction was formally begun when a building permit was received from Ibaraki Prefecture on 9 June. Usage approval had been received from the Science and Technology Agency on 26 April.

The Association has planned for the test device facility to be located on JAERI's grounds on the north side of the Japan Atomic Power Company's Tokai Generating Plant in Tokaimura. The site will be leased from JAERI.

The Research Association is a corporation for research which received siting approval from the Science and Technology Agency and the Ministry of International Trade and Industry (MITI). It is composed of 21 members from the Japan Atomic Power Company, Japan Nuclear Fuel Industries, the Central Research Institute of Electric Power Industry, and the nine electric power companies including Tokyo Electric Power.

Initial plans call for an investment of approximately ¥ 20 billion including government subsidies over the four year period from 1987 through 1990 with the goal of demonstrating the technical feasibility of atomic laser enrichment techniques and the possibility of bringing them into actual use. However, from results up to now from elementary devices and system testing, the Federation of Electric Power Companies base understands that experiments using the test device will last not only through 1990, but an additional year as well and in the future it appears that it will become necessary to consult with MITI and to adjust the schedule for evaluations comparing this method with the laser molecular method which the Japan Atomic Energy Commission has scheduled for around 1990.

In the two years since 1987, the Research Association has designed the test device in parallel with the research and development of elementary equipment such as laser devices and separation equipment.

In the future they plan to improve the equipment developed up to now, install a test device in the Tokai enrichment Test Facility, and perform experiments by FY90.

Construction costs for the Tokai Test Facility will total approximately ¥ 6 billion including buildings and equipment. Using steel frame construction they will build accessory structures including an office building and a test building (two story) with an overall floor area of approximately 3600 square meters.

In February of this year, the Association also concluded an "Atomic Energy Safety Agreement" with Tokaimura and Ibaraki Prefecture where they plan to install the test device.

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