NASA TECHNICAL MEMORANDUM

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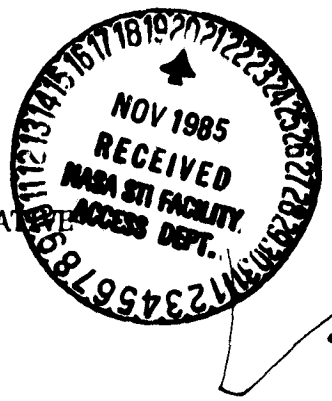

REPORT ON THE FINDINGS OF THE JAPANESE INVESTIGATIVE TEAM ON U.S. SPACE STATION DESIGN (KEIDANREN)

Translation of "Homi uchu kichi keika chosatan hokokusho, Ucho (Space) No. 23, 1985, Space Development Promotion Council (Keidanren), Tokyo, Japan, pp. 1-113

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16. Abstract

The objectives, itinerary and results of the Japanese Investigative Team on U.S. Space Station Design (Keidanren), consisting of members of the Space Development Promotion Council and representatives of Japanese industries involved in Japan's space station development effort are presented. This team visited NASA facilities in February, 1985. The objectives of the study team are shown to be to gather information on preliminary design efforts toward space station planning in Japan and the promotion of Japanese space related industries, as well as the evaluation of the present status of space environment exploitation in the U.S. This report is intended to be a basic reference for government agencies and industry in addressing the course of action to be taken in the future development of Japan's space station participation.

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THE KEIDANREN: (Federation of Economic Organizations)

The Keidanren is a federated body of individual industrial groups and a whole bodied economic group consisting of membership of practically all of the major enterprises of our country. The objectives of the Keidanren are as follows: (1) to seek the interaction among all fields in the economic community; (2) to gather the opinions of the economic community on the various issues concerning the domestic and international economy and to endeavor to have those opinions bear fruit; and (3), thereby to foster a vigorous economic development and to seek to enhance the welfare of the people. For this purpose, the Keidanren has established some 30 regular committees, work groups (panels) and special committees to carry on its activities.

The Uchu Kaihatsu Suishin Kaigi: (Space Development Promotion Council)

The Keidanren in June, 1961 established the Special Committee on the Peaceful Use of Space and commenced space development related activities. However, in March, 1968, as our national space development program progressed, that special committee was gradually dissolved and the Space Development Promotion Council was established and continues to the present time. This Council, based on the consensus view of the economic community, obtained the cooperation of all fields of endeavor in order to plan for a total effort for investigative research, exchange of information and the coordination and consolidation of opinions on the subject of space development and its exploitation. The Council further sought to gain cooperation in the National Space Development and Utilization Plan by promoting the research and development and application of space science and technology, thereby pursing the objective of advancing the national economy and welfare of the people.

Key personnel of the Space Development Promotion Council

Chairman:	Hiroharu Kobayashi
Vice Chairmen:	Haru Moriya, Suoji Sanami
Regular Committee:	Katsushige Mita, So-ichiro Suenaga, Toshi Ishihara, Akisada Kogama, Teruji Ogawa, Tadahiro Sekimoto, Dai-suke Kobayashi, Sadakazu Shindo, Koichi Yahashi, Jun Kobayashi, Yosaku Inaba, Jinhachiro Hanamura, Gen-ichi Masuda, Takuji Matsuzawa, Sadateru Yamada, Yamaguchi, Hanshi Msrikawa
Auditors:	Hasegawa, Nami-o Hashimoto

On issuing the report on the visit to the U. S. by the Space Station Plan Study Team

Today, as space application develops steadily in such fields as communications, broadcasting and Earth surveying, the exploitation of the "space enrivonment" which is characterized by such properties as zero gravity (weightlessness), high vacuum, etc. is on the verge of becoming a major issue. The Space Station Plan proposed by U. S. President Reagan in January of last year, wherein he invited Japan, Europe and Canada to participate, has generated great expectations as an impetus for the dramatic expansion in the areas of space environment exploitation. All the invited nations, including Japan, have indicated they will initiate efforts in the preliminary design work in April of this year, on the premise that they will participate in the plan.

The Promotion Council had previously recognized the importance of the Space Station Plan and cooperated in the government's exploratory efforts; and through the convening of various symposia, have conducted initial introductory activities. In the process, we have achieved a full fledged investigative structure through such progress as establishing interaction among the several civil space station exploitation research enterprise

groups; and the establishment of the "Space Station Plan Participation Promotion Special Group" with the capability to collect all types of data to maintain liaison with other related agencies in the community.

This document has been compiled on the basis of the "Report on the Visit to the U. S. by the Space Station Plan Study Team covering the visit to NASA, USA, in mid-February, representing one facet of the activities of the aforementioned special group. The report contains information not only obtained by the Study Team from NASA, but also the related information obtained to date from sources within Japan. It will be fortunate if this data can serve as reference for all members in their future efforts to address space station issues.

Last, but not least, I wish to express my gratitude for the great support from all the members of the Space Development Corporation.

Hanshi Morikawa,
Committee Member
Space Development Promotion
Council

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INTRODUCTION

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Chief, Space Station Plan Study Group Visiting the U. S.

Chief, Special Section on Space Station Plan Participation Promotion of the Space Development Promotion Council

President, Nippon Denki Kabushiki Kaisha (Japan Electric Co., Inc.)

Tadahiro Sekimoto

I wish to extend my warm gratitude for the great support provided by the Science and Technology Agency and other related administrative organizations and the Space Development Corporation on the occasion of the Space Development Promotion Council's sending of the Space Station Plan Study Team to the U. S.

Also, in the midst of busy schedules, the active participation of the Space Development Committee member Saito, the Space Development Council Director, Yorimizu, as advisors; and Science and Technology Agency Space Station Plan Promotion Office's Deputy Chief, Namiya, Space Development Council Principal Development Staff, Kato, and the Space Development Council's Los Angeles Office Chief, Hara, as attendants, made great achievements possible. I again extend my deep gratitude for their efforts.

The objective of this study team was to gather the most comprehensive and detailed information possible for input into the preliminary design efforts toward space station planning in our country, and on the present state of space environment exploitation in the U. S., and on the nurturing of space related industries, through information discussions with key officials of NASA, or by observing (touring) NASA facilities.

*Numbers in margin indicate pagination of foreign text.

During the study tour, we were greeted with a thoroughly prepared program and given detailed explanations, facility tours and discussion meetings at NASA's Johnson Space Center (Houston), Kennedy Space Center (Florida) and Headquarters (Washington, D. C.).

In particular, NASA Administrator, Beggs; Associate Administrator, Office of Space Station, Culbertson; Director, International Affairs Division, Pederson, et al., directed the associated organization chiefs to receive us, and they participated in friendly discussions.

I thank them from the bottom of my heart, and feel that a thoroughly significant dialog was established between the U. S. and Japan.

What impressed me most on this study tour was, as the old saying goes, "one look is better than a hundred words", that is, the direct exchange of opinions is most valuable. I was convinced upon listening to NASA's thorough approach to its space station plan that there is no doubt whatsoever that the plan will be realized. /2

Also, from the tour of facilities, I could not help but note the difference between our two countries, both in the level of capabilities and in experience.

In taking part in space station planning, the method by which our country takes on the planning, how to proceed, and what to exploit are vitally important. It is best to make a proposal to the government only after we acknowledge and then understand this difference in level of capability as a realistic issue.

The details of the observations made during the tour of NASA facilities and the context of meetings with the NASA key officials are included in the individual reports in this document.

This particular study team was made up of those individuals in industrial circles who, in a practical sense, are aiming for "a piece of the action" in Japan's space development program. That these individuals, though for only a brief period, were able to eat and room together in gaining this experience, I believe, will inevitably bring about results bearing on the promotion of a space station planning program which necessarily will require the total mobilized strength of our country. It also offered a rare opportunity for all members to know one another intimately. I earnestly hope that the results of this study will benefit greatly Japan's future space station plan.

Finally, while we were in Washington, D. C., we were treated with great kindness by Ambassador Okawara and Councillor Ishida of our Embassy in the U. S. and Chief Yamada and the Senior Representative Ishida of the Washington office of the Space Development Corporation. I again express my deepest gratitude.

1. PURPOSE/OBJECTIVES /3

The practical utilization of space is progressing steadily in the areas of communications, broadcasting and Earth observation/survey. The major areas being considered for the future are in space environment exploitation through experimentation in such areas as the manufacture of high cost products such as new materials and pharmaceuticals. It is expected that our participation in the Space Station Plan proposed by President Reagan will not only provide for the enhancement of our nation's space development technology, but will extend by great strides the field of space environment exploitation.

The study team's objectives were: to gather information to be input into the preliminary design of our nation's station plan; to gain a grasp of the present status of space environment exploitation, and the development of space associated industry in the U.S.

and to provide a reference baseline for addressing the course of action to be taken in the future development and exploitation.

2. MAKE-UP OF THE STUDY TEAM

(honorifics/titles omitted; not in order)

Team Chief:	Chief, Special Section for the Promotion of Participation in the Space Station Plan; President, Nihon Denki KK	Tadahiro Sekimoto
Advisor:	Member, Space Development Committee	Naribumi Saito
Advisor:	Director, Space Development Corporation	Yoshio Yorimizu
Team Member:	Executive Director, Ishikawajima-Harima Heavy Industries (Jyukogyo) KK	Sadao Takahashi
Team Member:	Executive Director, Itochu Trading Company (Shoji) KK	Taketo Orihata
Team Member:	Executive Director, Kawasaki Heavy Industries (Jyukogyo) KK	Masahiko Iwata
Team Member:	Executive Director, Sumitomo Trading (Shoji) KK	Tomikazu Akiyama
Team Member:	Director, Toshiba KK	Tomo-e Okuda
Team Member:	Executive Director, Nissan Motors (Jidosha) KK	Kazuo Shibata
Team Member:	Director, Nissho-Iwai KK	Takehiko Tsuchiya
Team Member:	Managing Director, Hitachi Manufacturing (Seisakujo) KK	Susumu Isa
Team Member:	Executive Director, Marubeni Marubeni KK	Masa-e Nagasawa
Team Member:	Director, Mitsui Bussan KK	Kazutami Ishiguri
Team Member:	Executive Director, Mitsubishi Trading (Shoji) KK	Yoshio Sasaki

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Team Member:	Executive Director, Mutsubishi Trading (Shoji) KK	Yoshio Taniguchi
Team Member:	Managing Director, Mitsubishi Electric (Denki) KK	Tsunero Shio
Team Member:	Chief, Development Section, Keidanren	Hanshi Morikawa
Attendant:	Assistant Chief, Office for the Promotion of Space Station Plan, Research Coordination Bureau (Kenkyu Chosei Kyoku), Science and Technology Agency	Mamiya
Attendant:	Principal Development Member, Space Experimentation Group, Space Development Corporation	Takehiko Kato
Attendant:	Chief, Los Angeles Office, Space Development Corporation (joined on-site)	Sen-ichi Hara
Attendant:	Manager (Shihai-nin) Nippon Electric (Denki) KK	Ryuji Kuroda
Attendant:	Member, Development Section, Keidanren	Katsunori Nemoto

Total, 22 members

(TN: KK = Kabushiki Kaisha, Incorporated)

3. SCHEDULE

DATE	POINT OF DEPARTURE	DESTINATION	LODGING	REMARKS
1985 Feb. 18 (Mon.)	Tokyo (Narita) via San Francisco Houston		 Houston	depart arrive depart arrive
Feb. 19 (Tues.)	Houston via Atlanta Orlando	NASA Johnson Space Center	 Orlando	depart arrive depart arrive
Feb. 20 (Wed.)	Orlando Washington, D. C.	NASA Kennedy Space Center	 Washington	depart arrive
Feb. 21 (Thurs.)		NASA Headquarters	Washington	
	Joint Space Development Corporation/Study Team Reception following when the team disbands			

4. PERSONS CONFERRED WITH AND THE TEAM'S AGENDA AT THE PLACES VISITED

4.1 NASA Johnson Space Center (February 19)

(1) Persons conferred with

- Dr. Carolyn L. Huntoon — Associate Director
- Mr. Joseph P. Loftus — Assistant to the Director (Plans)
- Capt. Robert L. Crippen — Astronaut
- Mr. Jack Wait — Protocol Officer

(2) Study team's agenda

(briefing)

10:00 - 10:10 Brief of Johnson Space Center

10:10 - 10:50 present status of Space Station Plan

(tour)

10:50 - 12:00- Mission Control Center (MCC)

- Mock-up and training facility

4.2 NASA Kennedy Space Center (February 20)

(1) Persons conferred with

- Mr. Richard G. Smith	Director
- Mr. Robert Gray	Manager, Space Station and Advanced Project Office
- Mr. S. Beddingfield	Deputy Director, Shuttle Projects Management
- Mr. J. Twigg	Hight Systems Management Office

(2) Study team's agenda

(briefings)

9:00 - 9:15	Greetings
9:15 - 9:30	Brief of Kennedy Space Center
9:30 - 9:50	Shuttle launch preparation procedure
9:50 - 10:10	Cargo preparation procedure
10:10 - 11:00	Space Station launch procedure
11:00 - 11:15	Brief of tour course
(11:15 - 12:00	Lunch)
(tour)	
12:00 - 15:30	Operations and Checkout Building (Spacelab)
	Orbiter Processing Facility
	Solid Rocket Booster Processing Facility
	Mobile Launcher
	Crawler Transporter
	Vertical Assembly Building (VAB)
	Launch Pad; LC-39A, LC-39B
	Shuttle Landing Facility

Visitors Information Center
(Escorts: Mr. Jim Johnson, Mr. Tom Davis, Mr. Glenn Parker)

4.3 Nasa Headquarters (February 21)

(1) Persons conferred with

- Mr. James M. Beggs	Administrator
- Mr. Philip E. Culbertson	Associate Administrator, Office of Space Station
- Mr. Chester M. Lee	Director, Customer Service Division, Office of Space Flight
- Mr. L. J. Evans, Jr.	Deputy Assistant Administrator, Office of Commercial Programs
- Mr. Kenneth S. Pedersen	Director, International Affairs Division, Office of External Relations

(2) Study team's agenda

(briefings)

13:00 - 13:10	Greetings	(Mr. Pedersen)
13:10 - 14:00	Present Status of Space Station Plan	(Mr. Culbertson)
14:00 - 14:30	Present Status of the Shuttle Program	(Mr. Lee)
14:30 - 15:00	NASA Space Commercialization Policy	(Mr. Evans)
15:00 - 15:30	NASA Programs	(Mr. Beggs)

The matters either heard or studied at the NASA facilities mentioned above, plus some subject areas studied prior to the visit, have been incorporated in Sections 5, 6 and 7 of this report in order that this report may be used meaningfully in the future.

5. SUMMARY OF NASA /8

5.1 Establishment and U. S. Aeronautics and Space Law

Sputnik, the first artificial satellite in the history of mankind, was launched by the Soviet Union on October 4, 1957. The Soviet Union next launched Laika, the dog, as they implemented a space program leading to the development of space exploration and manned space flight.

On the other hand, the situation in the United States at the time was one of disunity with the army, navy and air force pursuing their own programs.

To break this problem, the United States on October 1, 1958 established the National Aeronautics and Space Agency (NASA), a non-military agency, in order to consolidate all aeronautics and space activities into a single program. (NASA has thus been in existence for 26 years and 5 months as of the end of January, 1985).

NASA's Space Development Program is planned and implemented on the basis of the U. S. Aeronautics and Space Law. The objectives of NASA's policy and planning are specified in the Aeronautics and Space Law. The essentials of the law are indicated below.

The framework of the declaration on the policy and planning and the objectives of the U. S. Aeronautics and Space Law was derived from Section 102 (a) through (c) of United States Congressional Report No. PL 85-568, as indicated below (July 29, 1958).

• Section 102(a): The United States Congress declares that it will be the United States policy that the U. S. space program will be limited to peaceful purposes for the benefit of all mankind.

• Section 102(b): The United States Congress declares that it will be necessary to formulate appropriate laws related to aeronautics and space activities in order to insure the welfare and safety of the people of the United States. The Congress further declares that these activities will be conducted under the

management and responsibility of a civilian agency (meaning NASA) in a single combined aeronautics and space program implemented according to the United States national budget. However, space activities unique to, or relating in the main, to the development of weapon systems, military operations or the defense of the /9
United States (including research and development necessary to formulate realistic laws pertaining to the national defense) will be directed under the responsibility of the Department of Defense (DOD). Further, the nature of the responsibility and the policies to be issued by that agency in reference to space activities will be determined by the President, consistent with the provisions of Section 201(c).

• Section 102(c). The United States Aeronautics and Space Program will be conducted for the purpose of contributing realistically to at least one of the several objectives listed below.

(1) Expanding mankind's knowledge of the various phenomena taking place in the Earth's atmosphere and in space.

(2) Improving the utility, performance, speed, safety and effectiveness of aeronautic and space vehicles.

(3) Developing and operating space transport vehicles capable of carrying measuring devices, equipment, food and biological specimens (living things) into space.

(4) Establishing long term research programs on the potential benefits and the various problems thereof, derived from the opportunities and utilization of aeronautics and space activities conducted for peaceful and scientific purposes.

(5) Maintaining the United States' role as the leader in the scientific and technological fields related to aeronautics and space, and the application areas in peaceful activities within and external to the Earth's atmosphere.

(6) Sending information having military value or of significant discoveries to those agencies having to do directly with national defense. Also for those agencies to send information having a value for, or of significant discoveries, to non-military agencies (such as NASA) which have been established to direct and coordinate non-military aeronautics and space activities.

(7) For the United States to cooperate with other nations (bilaterally or multilaterally) in conducting activities in accordance with this law, and in peaceful exploitation of the results derived therefrom. /10

(8) Planning for the most efficient use of the scientific and engineering resources of the United States, for all organizations in the United States to cooperate closely in order to avoid unnecessary duplication of personnel, facilities and equipment.

NOTE: NASA was activated on January 1, 1958, in accordance with this law (act), thus, NACA (National Advisory Committee for Aeronautics) which had been in active exitence since it was established on May 3, 1915, was dissolved and became NASA.

5.2 Major activities

NASA has been engaged in numerous space activities but among the most important are the series of manned space flights which bore fruit through the implementation of the Mercury Program (1958-1963), the Gemini Program (1961-1966) and the Apollo Program (1961-1973) which were based on President Kennedy's declaration before Congress on May 25, 1961 of a national space plan to "send man to the moon within 10 years (the decade)".

Following this were the Skylab Program (1964-1974), the Apollo-Soyuz Project (1970-1975) and into the Space Shuttle Program (1972-1982) whereby the reusable manned spacecraft, the "Space Shuttle", was developed.

Since the initial Shuttle flight in April, 1981, and through November of last year, a total of 14 mission flights have been made.

In January of last year, President Reagan announced three essential matters as listed below in his New Year's general message:

(1) Within the next 10 years, to build and put into low Earth orbit a permanent, manned space station.

(2) Attaching great importance to international cooperation in the various activities in space, to invite allied nations to participate in the construction of the space station.

(3) To encourage space commercialization activities and to eliminate obstacles that impact the United States government's efforts to commercialize space.

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NASA is vigorously pursuing the preliminary phase of the Space Station Phase B (system specification and preliminary design) operations (projected for April of this year) with the participation of Japan, ESA and Canada, in consonance with NASA's schedule.

5.3 Organization, budget and manpower trends

(1) Organization: NASA's organization, current as of September, 1984, is as shown in Figure 5.1 and key persons are also indicated along the blocks (Figure 5.2 is the Japanese language rendition of NASA's organization).

(2) Budgetary and manpower trends: The U. S. space budget trends are shown in Figure 5.3 while NASA's budgetary and manpower trends are shown in Figure 5.4. During the calendar years 1976 and 1977, with the change in the start of the U. S. fiscal year (changed from July to October), the transitional one-quarter period (transient quarter) has been broken out separately.

On the manpower trends, NASA's manpower has stayed fairly constant, with personnel strength fluctuations dictated by budgetary cuts being made through adjustments in the number of contractor personnel.

5.4 NASA facilities and places visited /16

NASA facilities are shown in Table 5.1; the locations of facilities are shown in Figure 6.4. The facilities visited on this tour included those shown in Figure 5.4 by the enclosure [ ]. Maps of headquarters and the two centers are shown in Figures 5.5 through 5.7.

5.5 Space Shuttle /27

Among NASA's present programs, the largest in the scale of its operations and related activities is that supporting the Space Shuttle. The thrust of the Space Shuttle operation is directed, as indicated in Figure 5.8, at optimizing two diametrically opposing requirements--that of maximizing the success rate and minimizing the turn around time (refurbishing time) and that of minimizing costs.

As far as the Space Station Plan is concerned, the Shuttle itself and the Shuttle as logistics methodology are most important. By present plans, in the initial phase of Space Station operation (IOC), seven flights of the Shuttle will be used to transport and assemble the Station. Figure 5.9 shows the operational schedule of the Shuttle Station, starting at post-landing, through flight readiness, loading of the logistics module and the launching. The "shift" referred to here is eight hours of work. Therefore, if the work is performed on the basis of so many shifts a day, it is possible to relaunch within less than 20 days.

The flight chronology from the initial flight of the Space Shuttle (STS-1) is shown in Table 5.2.

TABLE 5.1 NASA Headquarters and Fields/Centers: Mission, Locations, Acreage

	Mission (functions and responsibilities)	Location (address) (acreage)	NASA regular employees (end of 1984)
NASA Headquarters (HQs)	• NASA program planning, coordination and control. Program/project definition, management, procedures, performance criteria determination, progress evaluation, program status review and analysis • The following offices have the responsibility for the programs: Space Science Application (OSSA) • Aeronautics and Space Technology (OAST) • Space Flight (OSF) • Space Tracking/Data Systems (OSTDS) • Management (OM) • Space Station (OSS) • Commercial Programs (OCP)	National Aeronautics and Space Administration Washington, D. C. 20546 (Note: No street address is to be used) (locations scattered) (-)	1423 (people)
Jet Propulsion Lab (JPL)	• JPL is a California Institute of Technology (CIT) research facility, performing NASA deep space exploratory projects (development operations and tracking) under contract to NASA. • Operates control center for deep space (unmanned) scientific missions, and deep space network (DSN). Advance research on solid and liquid engines; advance research on G&C systems; energy technology areas	Jet Propulsion Laboratory 4800 Oak Grove Drive Pasadena CA 91103 (177 acres) (same address for NASA JPL Resident Office)	JPL has about 4000 Caltech employees
Goddard Space Flight Center (GSFC)	• Space sciences (unmanned) research; meteorology and communications satellite R&D; management of STDN and NASCOM. • Project Office for the Delta launch vehicle • Responsible for Space Station Plan level C WP-3	Goddard Space Flight Center National Aeronautics and Space Administration Greenbelt, MD 20771 (554 plus 600 acres)	3599 people
Goddard Institute for Space Studies (GISS)	• Research under the operational direction of GSFC (New York City)	Goddard Institute For Space Studies National Aeronautics and Space Administration 2880 Broadway, New York, NY 10025	

Wallops Flight Facility (WFF)	Under the operational direction of GSFC, launches scientific observation launch vehicles (such as the Scout); develops the processing technology of acquired experimental data; and training of foreign researchers	Wallops Flight Facility Goddard Space Flight Center NASA Wallops Island, VA 23337 (6561 acres)	
Langley Research Center (LaRC)	• Straddles Langley Air Force Base with the western area (949 acres) and eastern area (23 acres, Air Force); plus simulated drop area (3286 acres); and a 110 acre intraspace radiation effectiveness research laboratory at Newport News, Va. Aeronautics and space structures and materials; re-entry aerodynamics of space-craft; research on future aerodynamic vehicles (in particular, environmental effects, performance, safety and economy).	Langley Research Center National Aeronautics and Space Administration Hampton, VA 23665 (772+110+3286=4168 acres) ↑ └749+23	2835 people
Lewis Research Center (LeRC)	• Power generation sources, aircraft engines, rocket engines, electrical propulsion systems, engine noise suppression, data bank for aeronautical and space safety. • Project Office for Atlas-Centaur rocket. • Responsible for Space Station Plan Level C WP-2	Lewis Research Center National Aeronautics and Space Administration 21000 Brookpark Road Cleveland, OH 44135 366 acres	2591 people
Ames Research Center (ARC)	• Space environment physics, simulation facilities, high speed aerodynamics, stability of aeronautic and space configurations, structures, G&C research, life sciences research, various wind tunnels (transonic, supersonic) • Wind tunnel testing of shuttle heat shield tile system, space waves and research	Ames Research Center National Aeronautics and Space Administration Moffett Field, CA 94035 421 acres	2021 people
Dryden Flight Research Facility (DFRF)	• Under the operational direction of ARC, conducts flight tests of aeronautical vehicles, supersonic test craft and space vehicle systems. • Landing tests of the shuttle orbiter ("Enterprise"), shuttle orbiter landing site (test flight) and an alternate emergency landing site in post-operational periods.	Dryden Flight Research Facility National Aeronautics and Space Administration P. O. Box 273 Edwards, CA 93523 219 acres	

Johnson Space Center (JSC)	• Lead center for design, development and manufacture of manned spacecraft (Apollo, ASTP, Skylab and Shuttle) • Control center for manned missions; operational control center for Shuttle payload. • Astronaut selection and training center, space medicine, life sciences (animals). • Responsible for Space Shuttle Plan Level B lead center and level C WP-2.	Lyndon B. Johnson Space Center National Aeronautics and Space Administration Houston, TX 77058 established September, 1961 1621 acres	2021 people
White Sands Test Facility (WSTF)	Under the operational direction of JSC: • Ground test of hazardous materials and auxiliary engines for Apollo and Shuttle. Launch site for small rockets (SPAR) (including recovery). (SPAR launches completed in 1981).	JSC White Sands Test Facility National Aeronautics and Space Administration P. O. Drawer MM Las Cruces, NM 88001 54080+1409 acres)	
Kennedy Space Center (KSC)	• Hub for launch of manned (Shuttle) and unmanned (Delta, Atlas-Centaur rockets, landing site for Shuttle (STS-7, STS-10. The Delta and Atlas-Centaur launch point located in the lower southern area of Cape Canaveral Air Force Station.	John F. Kennedy Space Center National Aeronautics and Space Administration Kennedy Space Center, FL 32899 (140,393 acres)	2082 people including KST-STS
KSC-STS resident Office (KSC-STA R.O.)	Under the operational direction of KSC: • Launches the Delta and Atlas E/F (located within Vandenberg Air Force Base) (previously also launched the Scout vehicles). • Landing site for the scheduled Shuttle launch of October, 1985.	KSC STS Resident Office (Vandenberg AFB) National Aeronautics and Space Administration P. O. Box 425 Lompoc, CA 93438 (-)	2082 people including KSC
Marshall Space Flight Center (MSFC)	• Research and development of space transporter (Saturn, Shuttle) • Research of space technology and space science technology (such as materials experimentation) • Responsible for Space Station Plan Level C WP-1	George C. Marshall Space Flight Center National Aeronautics Space Administrations Marshall Space Flight Center AL 35812 (1830 acres)	
Michaud Assembly Facility (MAF)	Under the operational direction of MSFC: • System engineering, design, fabrication and assembly of Saturn rocket engine, Shuttle engine.	Michoud Assembly Facility National Aeronautics and Space Administration P. O. Box 29300 New Orleans, LA 70189 (891 acres)	

Slidell Computer Facility (Center) (SCC)	Under the operational control of MSFC: • Consolidates NASA's computer system needs (scientific data, data processing; static combustion data processing, etc .)	Slidell Computer Complex Marshall Space Flight Center NASA 1010 Gause Blvd., Slidell, LA 70458 (14 acres) (from August 1, 1982	3250 people
National Space Technologies Laboratories (NSTL)	• Static combustion test of large rocket engines (Saturn, Shuttle), environmental research, Earth resources research	National Space Technology Laboratories National Aeronautics and Space Administration NSTL Station, MS 39529 138,808 acres)	107 people
			TOTAL: 21,117 people OTHER THAN REGULARS: 883 TOTAL: 22,000 people
		about 4000 people as Caltech employees at JPL	

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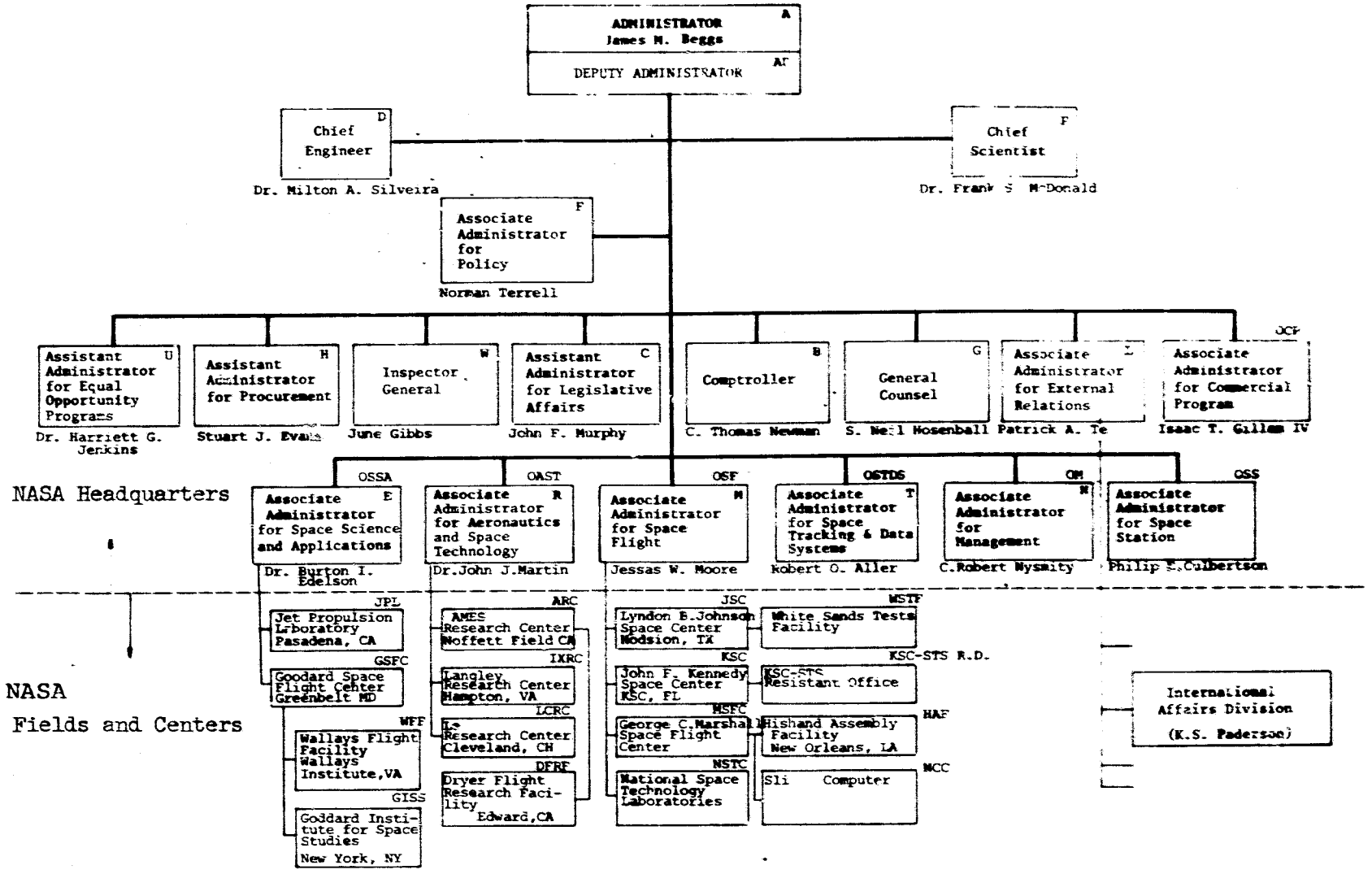
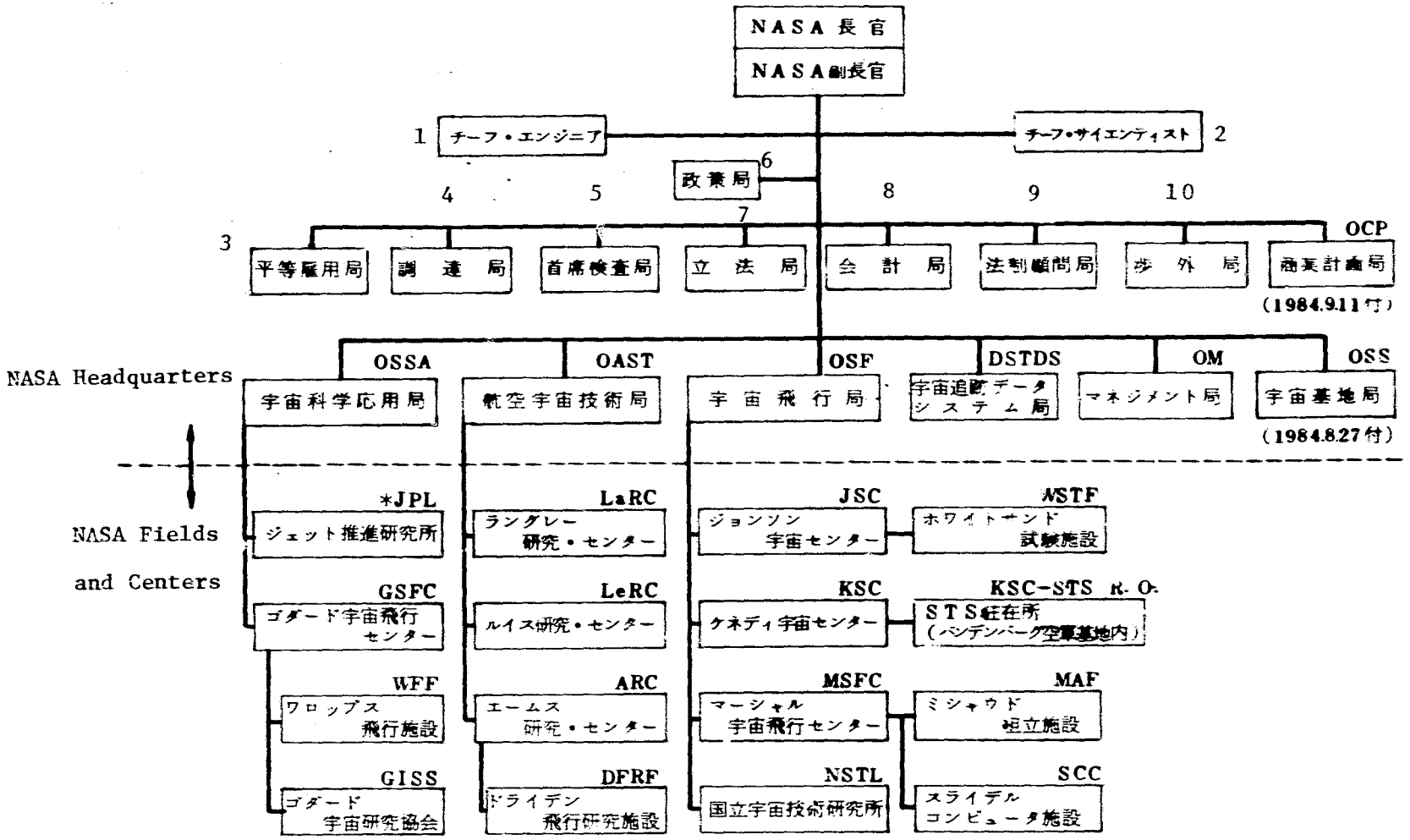


Figure 5.2. NASA Organization
(as of September 1984)



＊カリフォルニア工科大学より
委託運営される。

* Operated under contract with
California Institute of Technology

1 - Chief Engineer; 2 - Chief Scientist; 3 - Office for Equal Opportunity Employment; 5 - Office of Inspector General; 6 - Office for Policy; 7 - Office of Legislative Affairs; 8 - Office of Comptroller; 9 - Office of General Counsel; 10 - Office of Public (External) Relations

Figure 5.2. NASA Organization (as of September 1984)

Figure 5.3. U.S. Space Budget Trends

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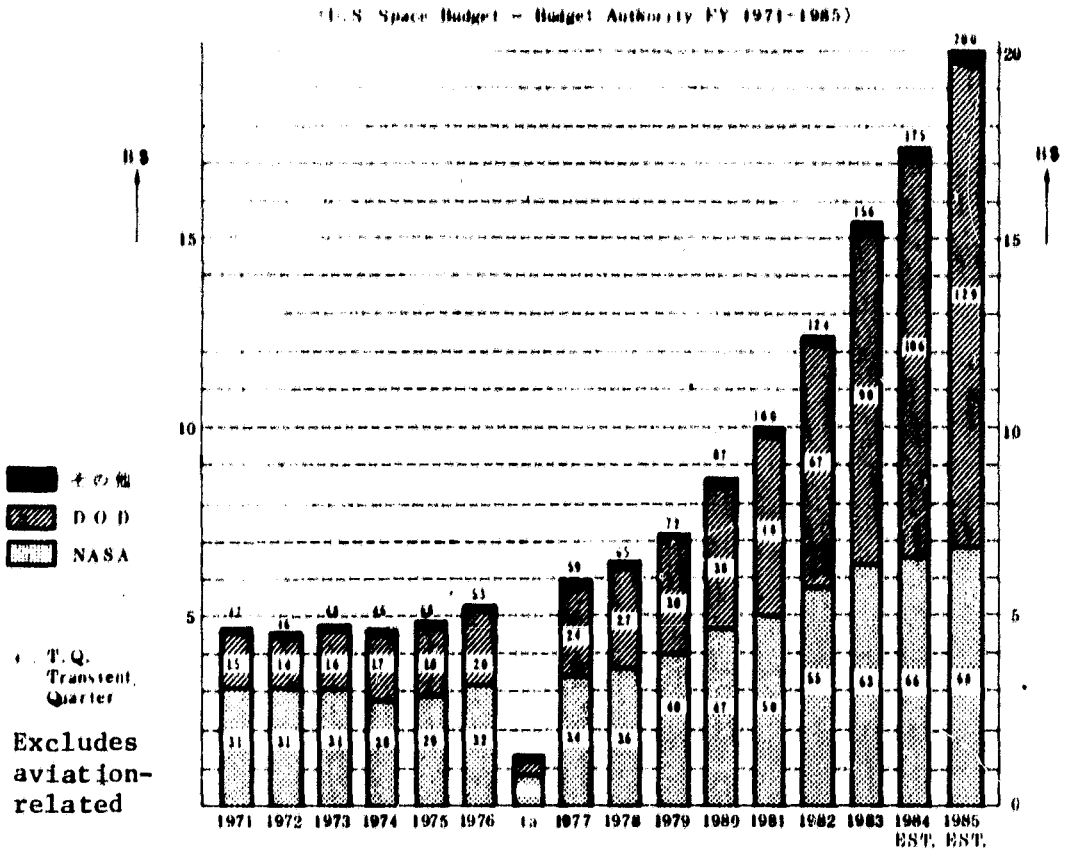

a. T.Q. Transient Quarter

b. Excludes aviation-related

Space Activities of the U.S. Government

HISTORICAL BUDGET SUMMARY – BUDGET AUTHORITY

(in millions of dollars)

Fiscal Year	NASA Total	NASA Space[a]	Defense	Energy	Commerce	Interior	Agriculture	NSF	Total Space
1960	330.9	960.9	489.5	36.3	...	...	...	...	786.7
1960	523.6	961.5	560.0	40.3	...	...	...	0.1	1,063.8
1961	964.0	926.0	813.0	67.7	...	...	...	.6	1,808.2
1962	1,824.9	1,796.8	1,298.2	167.8	30.7	...	...	1.5	3,296.8
1963	3,673.0	3626.0	1,500.0	215.9	43.2	...	...	1.5	5,436.5
1964	5,000.7	5,016.3	1,599.3	210.0	2.0	...	...	3.0	6,871.4
1965	5,249.7	5,137.6	1,573.9	220.6	12.2	...	...	3.2	6,955.5
1966	5,070.9	5,066.5	1,680.8	186.8	26.5	...	...	3.2	6,969.8
1967	4,965.6	4,830.2	1,663.6	183.6	29.3	...	...	2.8	6,709.5
1968	4,387.3	4,430.8	1,921.8	165.1	28.1	0.2	0.5	3.2	6,528.9
1969	3,990.9	3,822.8	2,013.6	110.6	30.6	.8	.7	1.9	5,975.6
1970	3,749.0	3,597.0	1,870.4	107.0	0.0	1.1	.8	2.0	5,560.5
1971	3,311.2	3,101.3	1,512.5	94.0	27.0	1.0	.8	2.0	4,760.9
1972	3,306.6	3,071.0	1,407.0	55.2	91.3	3.0	1.6	2.0	4,576.7
1973	3,408.2	3,093.2	1,623.0	34.2	39.7	10.3	1.9	2.6	4,826.9
1974	3,038.0	2,750.5	1,766.0	41.7	60.2	9.0	3.1	1.8	4,640.3
1975	3,229.1	2,915.3	1,892.1	29.6	64.1	8.2	2.2	2.0	4,914.2
1976	3,550.3	3,225.4	1,803.3	33.3	71.5	10.4	3.6	2.4	5,319.9
Transitional Quarter	931.0	869.2	460.4	6.6	22.2	2.6	.9	.6	1,360.3
1977	3,817.8	3,440.2	2,411.9	21.7	98.8	9.3	6.3	2.4	5,982.8
1978	4,060.1	3,622.9	2,758.3	36.4	100.8	9.7	7.7	2.4	6,518.2
1979	4,505.5	4,030.4	3,025.6	38.6	90.4	9.9	8.2	2.4	7,243.3
1980	5,240.2	4,609.4	3,866.6	38.6	92.6	11.7	13.7	2.4	8,668.8
1981	5,518.4	4,992.4	4,837.7	40.3	87.0	12.3	15.5	2.4	9,977.8
1982	6,143.9[b]	5,527.6	6,678.7	40.6	100.5	12.1	15.2	2.0	12,440.7
1983	6,875.2[c]	6,337.9	9,018.9	30.9	177.8	4.6	20.4	0.0[d]	15,586.5
1984 est.	7,217.5	6,590.4	10,590.3	36.1	236.0	6.7	23.0	0.0[d]	17,677.3
1985 est.	7,691.4	6,804.3	12,912.7	33.5	256.6	6.2	16.0	0.0[d]	20,025.3

[a] Excludes amounts for air transportation (subfunction 402).
[b] Includes $33.5 million unobligated funds that lapsed.
[c] Includes $37.6 million for reappropriation of prior year funds.
[d] NSF funding of balloon research transferred to NASA.

SOURCE: Office of Management and Budget.

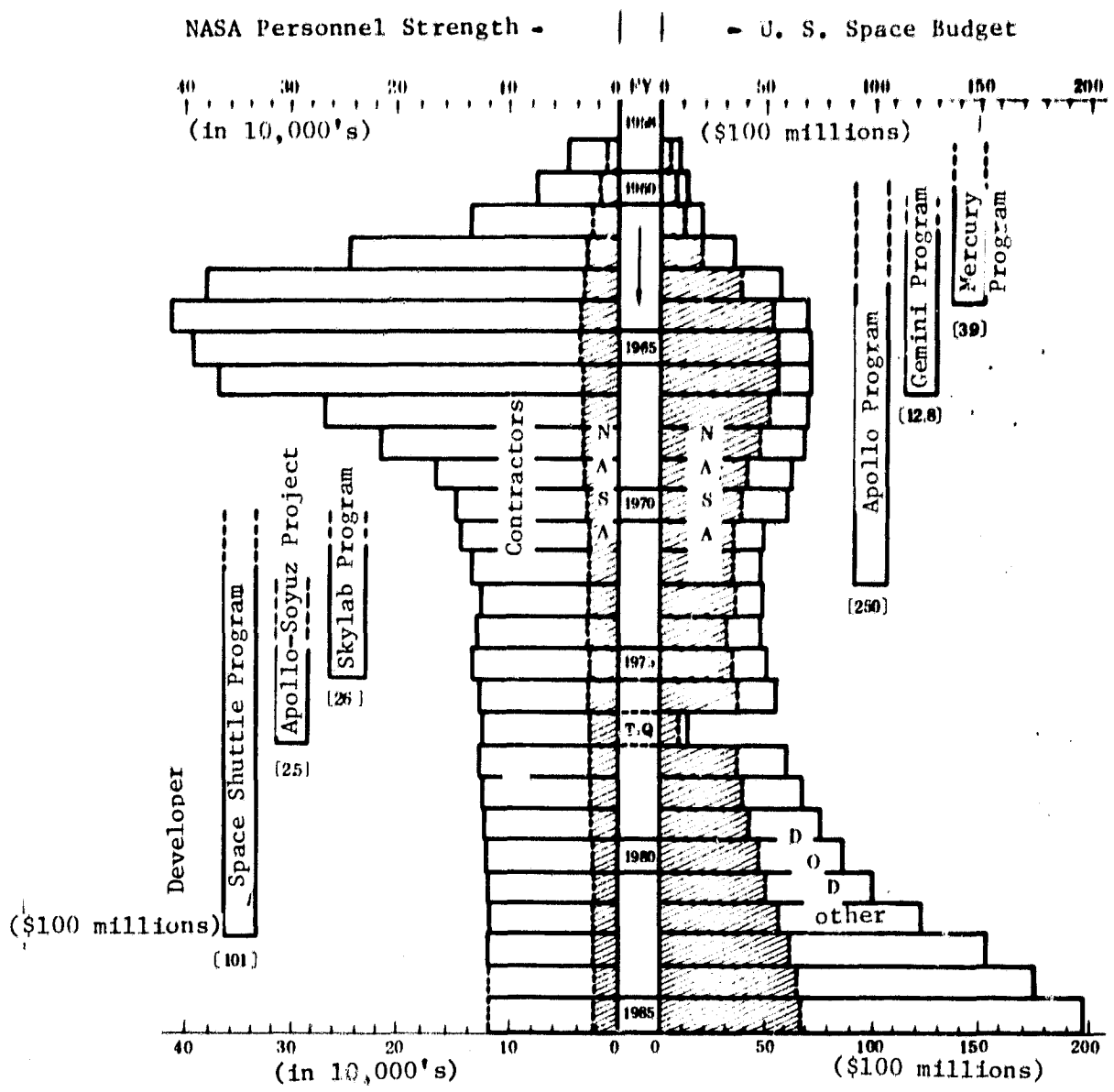

Figure 5.4. NASA Budget and Manpower Trends

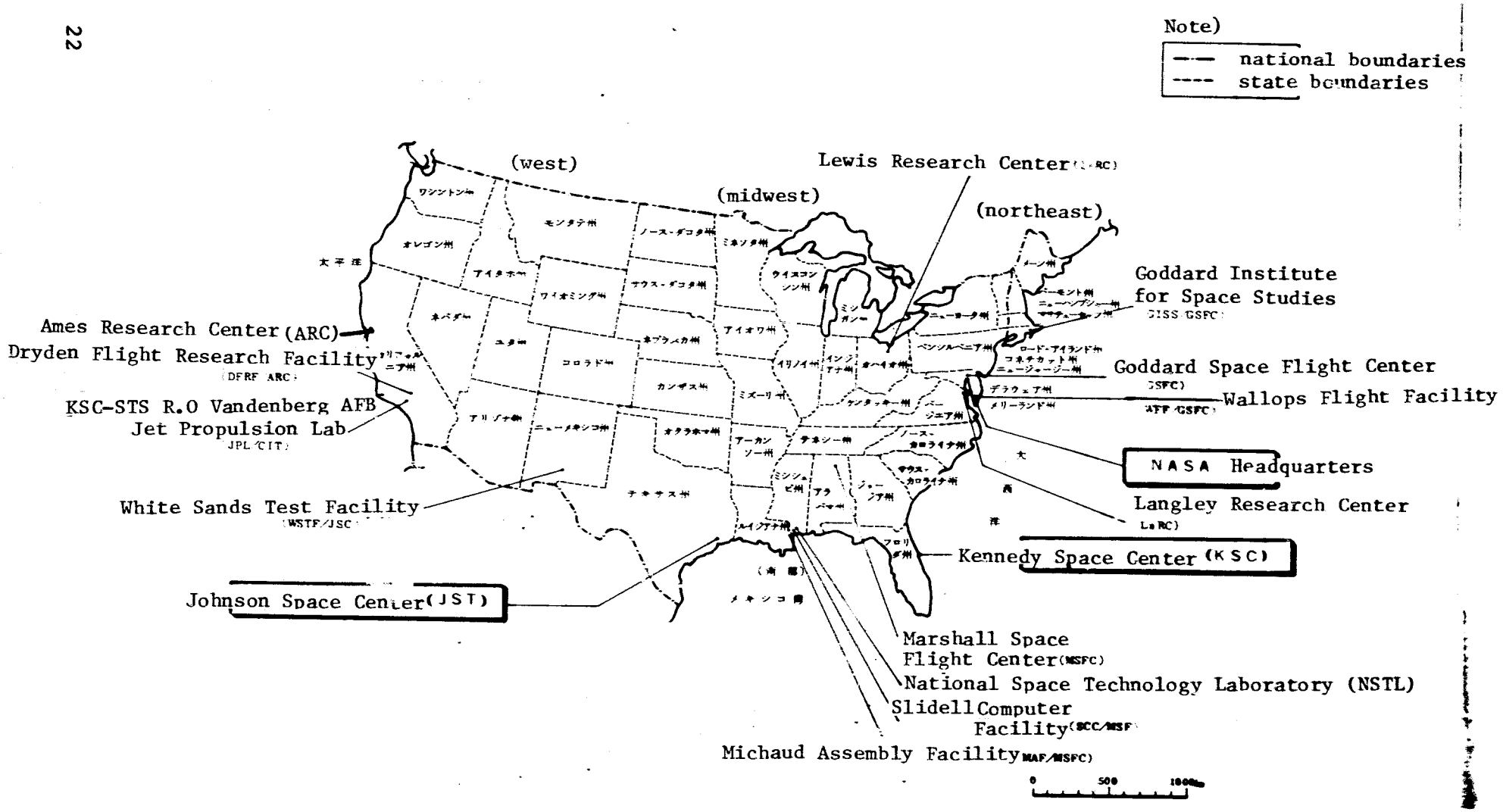

Figure 5.4. Location of NASA Facilities/Installations as of October 1982. (Headquarters, Field Facilities and Centers)

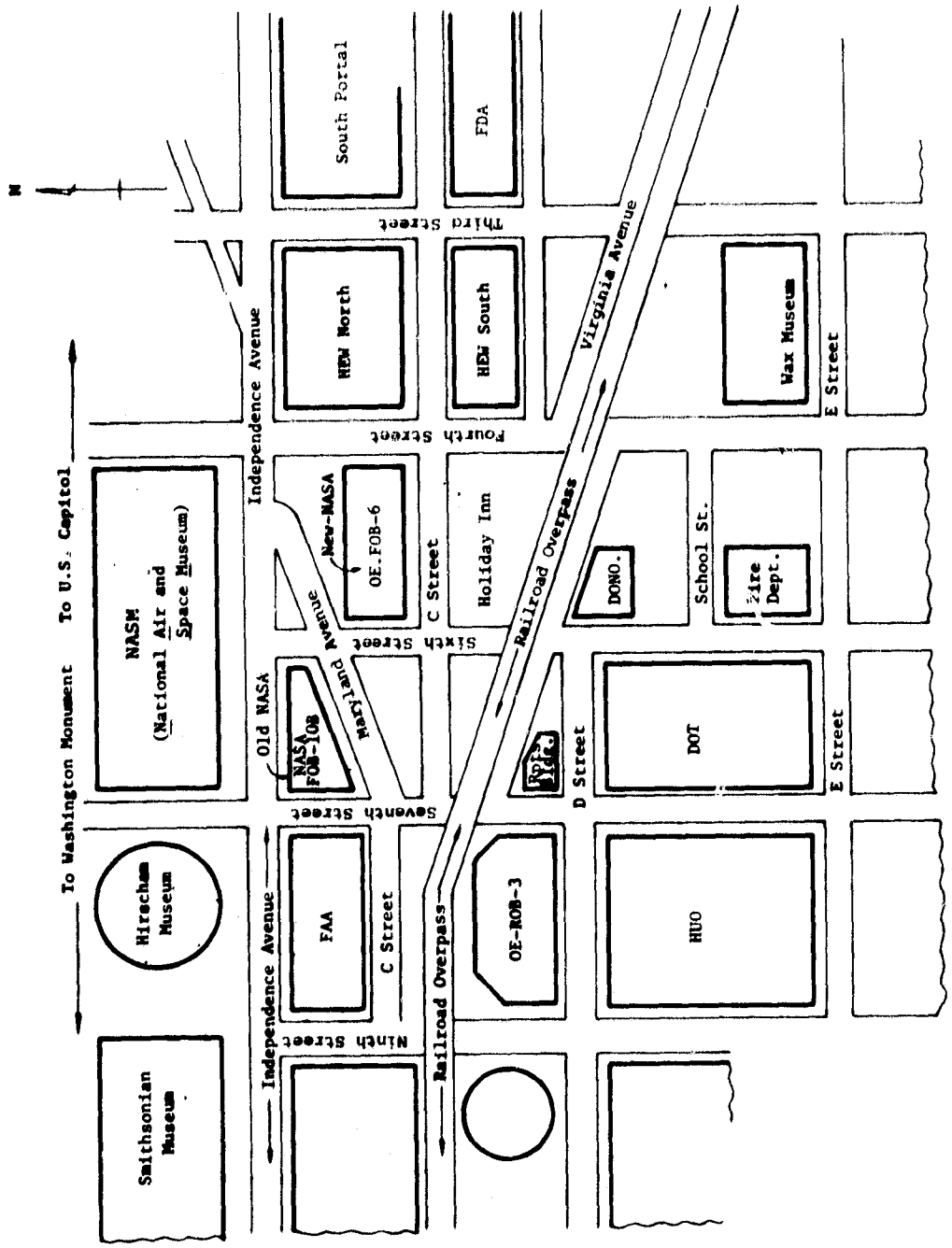

Figure 5.5 NASA Headquarters (Washington, D. C.)

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(GROUND PROCESSING PHILOSOPHY)

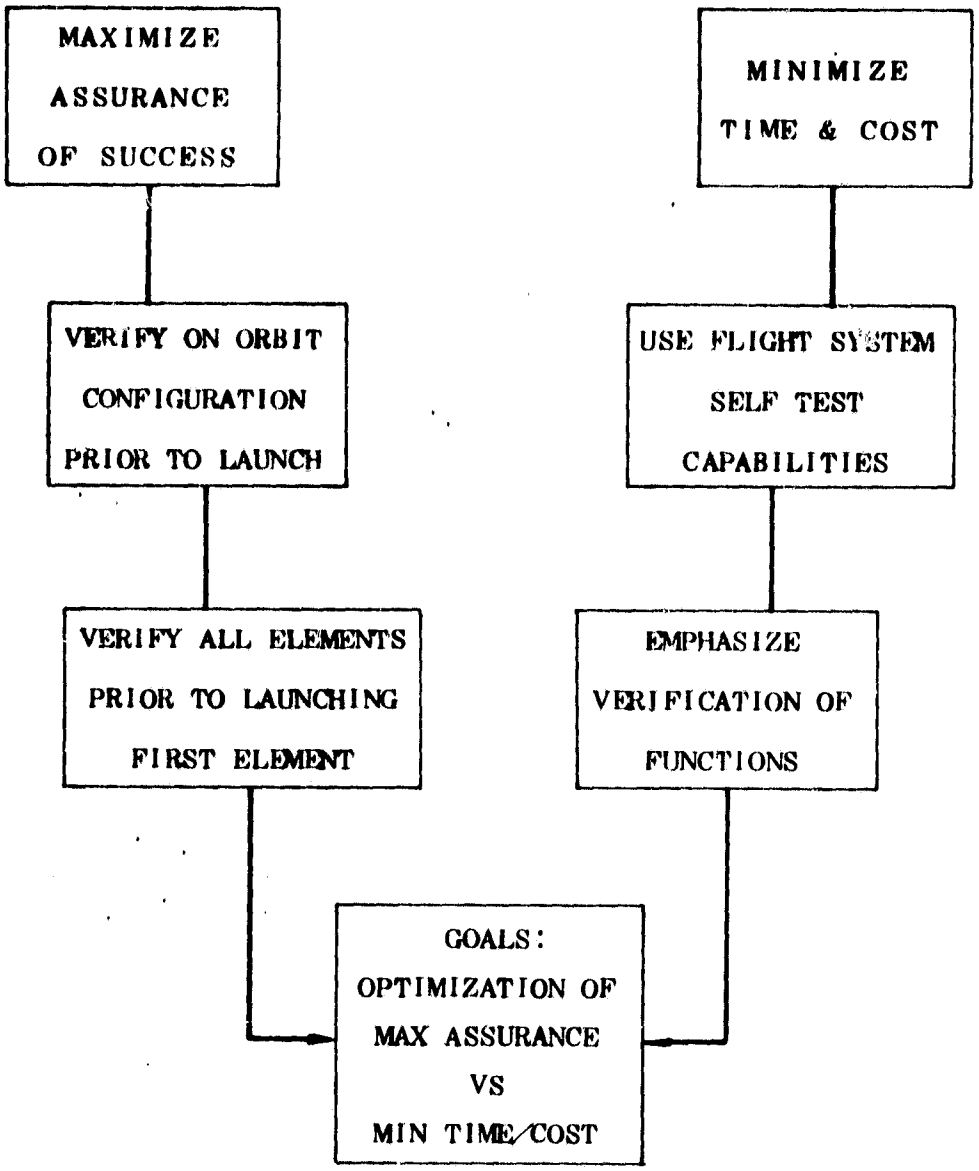

Figure 5.8. Thrust of space shuttle ground support operations.

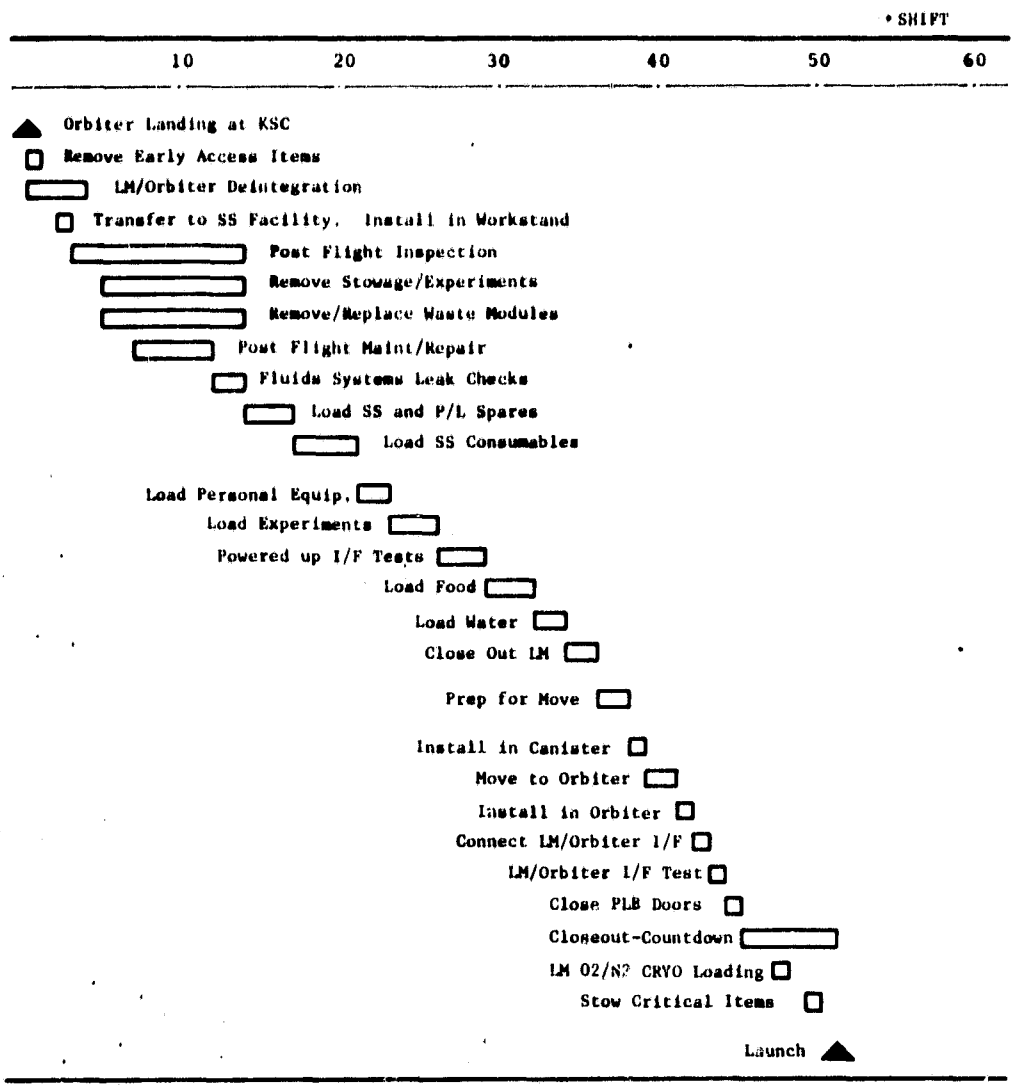

Figure 5.9. Operational schedule for relaunching the logistics module.

			STS-1	STS-2	STS-3	STS-4	STS-5
flight period (local time)			1981.4.12~14	'81.11.12~14	'82.3.22~3.30	'82.6.27~7.4	'82.11.11
flight time			2days,6hrs,21 mins, 57secs	2days,6hrs,24 mins,4secs	8days,6mins, 9secs	7days,1hr,10 mins,9secs	5days,2hr mins,29se
circular orbit altitude/ orbital inclination			278km/40.3°	254km/38°	241km/38°	326km/28.5°	296km/
crew number			2	2	2	2	4
crew members	names	commander	John Young	Joseph Engle	Jack Lousma	Thomas Mattingly	Vance Bra
		pilot	Robert Crippen	Richard Truly	Charles Full-erton	Henry Hartsfield	Robert Ov
		MS					
		MS					
		MS					
		PS					
		PS					
orbiter designation			Columbia (OV-102)				
wt. breakdown (kg)	(1) lift-off gross wt. kg		2020052	2030287	2031653	2033434	2036
	(2) ET (at lift-off) kg		756440	756440	756440	756440	756
	(3) SRB's kg		1179340	1179340	1179340	1179340	1179
	(4) orbiter (empty wt.) kg		73480	73480	73480	73480	73
	(5) total cargo wt. kg		4913	8771	9658	12000***	14
	cargo payload		DFI ACIP (kg)	OSTA-1 : 2425 DFI IECM** : 6370 device	OSS-1 : 2264 Palette: 851 ACIP : 126 GAS : 324 DFI : 3015 other	DOD : 3630 payload (CIRRIS) other	SBS/PA : Anik/P :
				RMS : 408	RMS : 408		otl
	orbital landing wt. kg		89014	92534	94122	95029	9
REMARKS							

	STS-3	STS-4	STS-5	STS-6	STS-7
4	'82.3.22~3.30	'82.6.27~7.4	'82.11.11~16	'83.4.4~9	'83.6.18~24
hrs,24 ecs	8days,6mins, 9secs	7days,1hr,10 mins,9secs	5days,2hrs,15 mins,29secs	5days,24mins, 31secs	6days,2hrs,25 mins,41secs
°	241km/38°	326km/28.5°	296km/28.5°	298km/28.5°	296km/28.5°
	2	2	4	4	5
Engle	Jack Lousma	Thomas Mattingly	Vance Brand	Paul Weitz	Robert Crippen
Truly	Charles Full-erton	Henry Hartsfield	Robert Overmeyer	Karol Bobko Joseph Allen William Lenoir	Frederick Hauck John Fabian Sally Ride (woman) Norman Thagard
				Challenger (OVO-099)	
7 0 0 80 71 2425 5370 e 408	2031.653 756,440 1,179,340 73,480 9,658 OSS-1 : 2,264 Palette: 851 ACIP : 126 GAS : 324 DFI : 3,015 other RMS : 408	2033,434 756,440 1,179,340 73,480 12,000**** DOD : 3,630 payload (CIRRIS) other	2036,010 756,440 1,179,340 73,480 14,974 SBS/PAM : 3,271 Anik/PAM : 3,316 other	2036,889 756,440** 1,179,340** 73,480 20,658 TDRS/IUS/ cradle : 19,550 DFI : 798 GAS×3 : 552 other	2034,666 756,440** 1,179,340** 73,480 14,553 Palapa/PAM/ cradle,522 Anik/PAM/ cradle,443 OSTA-2 : 1,448 SPAS-01 : 2,278 GAS×7 : 1,335 RMS :
	94,122	95,029	92,581	89,177	92,069
				****projected value	

2 FOLDOUT FRAME

SERIAL MISSION No.	10			11	12
	STS-8	STS-9(SL-1)	41-B	41-C	41-D
flight period (local time	'83830~95	1983 1128~128	'8423~211	'8446~413	'84830~95
flight time	6days,1hr,9 mins,32secs	10:07:47	7 days 23 h 19 m	6 days, 23 h 38 m	6 days, 57
circular orbit altitude/ orbital inclination	278km/28.5°	250km/57°	305.3km/28.5°	462.5km/28.5°	296km/28.5°
crew number	5	6	5	5	6
crew members / names / commander	Richard Truly	John Young	Vance D.Brand	Robert Crippen	Henry Hart
pilot	Daniel Brand-enstein	Brewster Shaw	Robert Gibson	Francis Scobee	Richard Co
MS	Dale Gardner	Owen Garriott	Bruce McCand-less	Terry Hart	Judith Resn
MS	Guian Bluford	Robert Parker	Robert Steward	James VanHoften	Steven Haw
MS	William Thor-tensen	Byron Leichten-berg	Ronald McNair	George Nelson	Richard Mu
PS		Ulf Werbold			Charles Wa
orbiter designation	Challenger (OV 099)				Discovery(O
wt. breakdown (kg) (1) lift-off gross wt.kg	2038027	2042604	2043140	2045364	2045633
(2) ET (at lift-off) kg	756440**	756440**	756440	756440	756440
(3) SRB's kg	1179340**	1179340**	1179340	1179340	1179340
(4) orbiter (empty wt)kg	73480	73480	73480	73480	73480
(5) total cargo wt. kg	10255	15265		15000	21628
cargo payload	INSAT/PAM : 3377	SL : 12780	Palapa-B2 : 3435	LDEF : 9670	SBS-4 : 334
	PAM cradle : 1102	Structure : 8145	Weston-VT : 3325	SHM Loading (FSS) : 4043	Telstar : 339
	PFTA : 3856	Pressurized : 3386	SPAS-01A : 1448	HHU/FSS : 527	OAST-1 : 154
	DFI : 1570	Module	IRT : 90.7	Cinema-360 : 273	Lasest-2 : 695
	GAS×12 : 2230	Palette		IHAX : 102	(Syncom IV)
	CFES : 353	Other		SSIP : 23	IHAX : 13
	other	Other Experimental		Support	CFES : 288
	RMS : 408	Devices		System	
orbital landing wt. kg	92657	100000	91385	89095	95563
REMARKS:					Initial Flight of Discovery

MS = mission specialist; PS = payload specialist

FOLDOUT FRAME

11	12	13	14	15
41-C	41-D	41-G	51-A	51-C
'8446~413	'8430~95	'8405~	'8418~16	'8524~27
days, 23 h m	6 days, 57 m	8 days 5 h 21 m	7 days, 23 h 21 m	-
462km/285°	296km/285°	315km/570°	296km/285°	-/-
5	6	7	5	5
bert Crippen	Henry Hartsfield	Robert Crippen	Frederick Hauk	Thomas Mattingly
ancis Scobee	Richard Coats	Jon McBride	David Walker	Loren Shriver
erry Hart	Judith Resnick	Kathryn Sullivan	Anna Fisher	Ellison Onizuka
ames VanHoften	Steven Hawley	Sally Ride	Dale Gardner	James Buchli
eorge Nelson	Richard Mullane	David Leestma	Joseph Allen	Gary Payton
	Charles Walker	Marc Garneau (Canada)		
		Paul Scully-Power		
	Discovery(OV-103)		Discovery(OV-103)	
2,045,364 756,440 1,179,340 73,480 15,000 LDEF : 9,670 SHM : Loading (FaS) : 4,043 HHU/FSS: 527 Cinema-360 : 273 IHAX : 102 SSIP : 23 Support System	2,045,633 756,440 1,179,340 73,480 21,628 SBS-4 : 3,349 Telstar : 3,395 OAST-1 : 1,544 Lasest-2 : 6,950 (Syncom IV) IHAX : 131 CFES 2884	2,040,296 756,440 1,179,340 73,480 8,203 ERBS : 2,307 OSTA : 1,929 LFC&ORS : 1,078 GAS(9個) : 1,619 IHAX : 154 Other	2,049,710 756,440 1,179,340 73,480 17,375 SYNCOM IV-1 (Leasat 1) ANIK D-2 (Telesat H) DHOS RME	- - - - - - DOD Mission
89,095	95,563			
	Initial Flight of Discovery	PS First Canadian	Palapa, Westor Mission Recovery	DOD Mission (2 stage) IUS employed

2 FOLDOUT FRAME

At the start of the study team's visit, it was scheduled for /27
the study team to witness the projected launch of the Space Shuttle flight 51-E on February 20, but we were notified just before our departure for the U. S. that the orbiter, "Challenger", was delayed because of tire work.

However, the NASA side prepared a detailed schedule for the KSC visit, enabling us to tour shuttle launch facilities which would not have been accessible in a straight countdown launching; therefore, in one sense, we were able to enjoy a particular valuable experience.

6. SUMMARY OF NASA SPACE STATION PLAN /32

6.1 President Reagan's Plan Announcement

U. S. President Reagan in his State of the Union Message of January 25, 1984, made the following announcement relating to the promotion of the manned space station plan.

"...Our second objective is to build upon the American pioneering spirit and open up the next frontier. A vigorous economy will vitalize the progressive spirit and initiative to create new industries and provide a competitive spirit to the older industries.

"Nothing can be greater for our next frontier, Space. In order to enhance the quality of life on Earth, there is no other than "Space" to emphasize effectively our technological leadership and capabilities.

"The Space Age has a history of only a quarter of a century. We have already advanced civilization by achieving progress in science and technology. By transcending the boundaries of knowledge, and setting foot deeply into unknown territory, our opportunities and work will become ever multi-faceted.

"Our progress in space--a great step forward for all mankind--demonstrates American teamwork and superiority. The great spirit among government, industry and academia have been consolidated and the following can be said with utmost pride. We are first. We are best. And the reason why we are that way is because we are free.

"America has been great when she had to be great. We have again attained greatness. We can pursue our dreams to the distant stars by living in and working in Space for the sake of peaceful, economic and scientific programs.

"Tonight, I am directing NASA to develop a permanent, manned space station within ten years (the decade). The Space Station will bring about an epochal jump in the research of science, communications and of materials and pharmaceuticals that can only be processed in space. /33

"We hope that our allies will help us by participating in this challenge, and share in the benefits to be gained. NASA will request other nations to participate. We will thereby strengthen the peace, enhance prosperity and expand freedom, jointly with all those having common goals.

"Just as the oceans opened up a new world for sailboats and yachts, and American commercial shipping, Space, today, offers a great potential to commerce. The market for space transport will probably exceed the capabilities with which we are attempting development. Enterprises trying to transport payloads into space will require the opening of the way for launch services from civilian bases. The Department of Transportation will attempt to support the implementation of the launch service enterprises which have survived on obsolete rockets. We will shortly ease the legal constraints and obtain the support of NASA to make a reality of the many administrative actions needed to encourage investment into space endeavors by the civil sector."

6.2 Invitation to various countries to participate

(1) Following the above announcement during his general message, President Reagan sent letters to the heads of state of Japan, Germany, France, England, Italy and Canada, appealing for their cooperative participation.

For our country, a personal letter was delivered to Prime Minister Nakasone in which President Reagan indicated he would send James M. Beggs, NASA Administrator, as his personal representative.

Also, a letter was sent from the NASA Administrator to Iwado, Chief (at the time) of the Science and Technology Agency. The letter stated among other things that the president was appealing to friendly and allied nations for their participation in the Space Station plan in order to reassure the desire of the United States to work with other nations in the peaceful exploration and utilization of space.

(2) Following this, Administrator Beggs, after visiting ESA, the European countries (included in the president's appeal) visited /34
Japan from March 11 to 13. He paid respects to Prime Minister Nakasone and Foreign Minister Abe, then exchanged ideas with Iwado, Chief of the Science and Technology Agency, the Space Development Committee, the Keidanren's Space Development Promotion Council, making an appeal for Japan's participation in the Space Station plan.

(3) Combining the information obtained as of this point in time from the explanations by Administrator Beggs, the announcements of NASA and the discussions among the Japanese participants in the meetings with NASA, the thinking of NASA on the subject of international cooperation is as follows:

1 International participation

The level of participation varies from utilization of space station facilities to cooperation in its development.

NASA's intentions are to build a space station of a minimum scale (8 to 8.4 billion dollar annual base) with or without international participation; and hoping for other countries to supplement this effort with their capabilities. As far as the format of international participation is concerned, it is a "white paper". It is NASA's wish to discuss the desires of the various nations. It is intended to phase into preliminary design from the 1985 U. S. fiscal year, and with the Space Station's overall structure firming up, unless the nations express their intentions to participate and define the essence of those intentions, the provisions for accepting and incorporating those intentions become increasingly limited.

Further, although the scale of participation is up to the judgement of the participating nations, Administrator Beggs, on the occasion of his press conference in Japan, stated that it was NASA's desire that the participation by Europe be at 20 to 25% of $8 billion (1.6 to 2 billion); by Japan at 10 to 15% (0.8 to 1.2 billion dollars) (about ¥200 to 300 billion) and Canada at several 100's of millions.

2 Civil program

The U. S. Space Station Plan (Program) is a civil program which is totally funded by NASA budget without any allocation of national safety assurance funds.

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The Department of Defense, at an early stage of the Space Station Program proposal, worked jointly with NASA in the review of the requirements upon space, both near term and long term, but they concluded that they had no requirement whatsoever for a manned space station.

However, as in the case of the Shuttle, the Space Station is to be used by the user, and if ever a national safety assurance user appears on the scene, domestic and international users alike can utilize this facility by paying for expenses.

Further, in case the defense establishment of the United States or its allies show an interest, they are envisioned to develop a space station separate from this station. In such a case, NASA is expected to make available any of the technologies it has independently developed. Thus, it is in effect being utilized in this aspect by the DOD.

On the development of technologies other than NASA's, the developer's desires will be respected.

3 Submission of technologies and devices

In the international cooperation of the Space Station Program there should be no problem in the U. S. enterprises making available technologies, devices and parts to Japan's development work, but it will depend on the context, according to NASA.

4 Reversion of results

On the reversion of results derived from experiments performed aboard the Space Station, NASA's position is that it will be in favor of the user as long as he has paid for expenses. As for the essentials of the tests performed, NASA principally requests an a priori safety test.

6.3 Agreement at the summit /36

Subsequently, at the London Summit which took place from June 7 to 9, the following agreements were made with respect to the Space Station Plan:

"We believe that the manned space station is a plan that will provide a stimulus to technical development that will lead to a stronger economy and upgrading of the quality of life. The idea that a Space Station of this type should be launched within the framework of the plans of the respective nations, and internationally, is being studied by several nations among us. In this regard, we will examine carefully the kind and considerate invitation extended by the President of the United States to the Summit members, to participate in the development of the U. S. manned space station. We look forward to a report at the next Summit by the United States on the status of the respective nations' participation in the plan."

6.4 Summary of U. S. Space Station

Following are the stated capabilities and structure of the U. S. Space Station:

(1) Capabilities and structures of the Space Station

i) Capabilities of the Space Station

- Multipurpose facility built in Earth orbit, utilizing the Space Shuttle
- Has the potential for growth as the scale and technology progresses
- By performing repairs in orbit, it has the unique feature of having the potential for indefinite operation, specifically, functions such as:

(1) in-orbit test lab (for research in a wide variety of scientific experiments, materials experimentation and life science experiments)
(2) Fabrication facilities (fabrication of high purity crystals and new materials for semiconductors)
(3) Service (support) facilities (securing and repair of satellites)

(4) Long term observation facilities (platforms) (observationof the Earth and planets)
(5) Relay point for space transport (for navigation into high orbits, the moon and the planets) /37
(6) Assembly facilities (assembly of large structures such as antennas)
(7) Storage base in space (facilities for securing preparatory items, consummables, satellites, etc.)

ii) Structure of the Space Station

- Permanent manned station assembled in a low (altitude about 500 km) circular Earth orbit
- Initially manned by a crew of 6-8, to be increased gradually; 3-6 months rotation
- Structure (configuration) elements (concept as of the present time (February 1985))
  - Habitable module (2 each)
  - Storage module (1)
  - Laboratory module (2)
  - Free flyer (polar and 28.5° orbits)(2)
  - orbital work vehicle (orbital maneuver vehicle)(1)
- Requir 1 expenditures: 8 billion dollars up to first quarter, U. S. fiscal year 1990 (about 2 trillion ¥en)

(2) Baseline (reference) configuration

NASA has selected the following three configurations as candidates for the Space Station which satisfy the capabilities and structure indicated in (1) above:

a) flat surface (planar) configuration (Figure 6.1)
b) Delta configuration (Figure 6.2)
c) electrically powered (power) tower configuration (Figure 6.3).

As a result of analysis of the three configurations, the "reference" configuration to be used as a baseline for Phase B efforts to start in April, 1985, was determined to be the "power tower" configuration. This configuration was determined to be the most suitable to serve as the reference configuration from factors /41 such as: The difficult viewability from observation devices placed on the "delta" configuration; the "power tower's" ready accommodability to supplementary modules although there are many common features between the "planar" and "power tower" configurations. The configuration(s) was(were) reviewed quite broadly in the first half of Phase B; in the latter half, the scope will converge, and the preliminary design will be performed within this framework.

(3) Growth potential of the Space Station

As one feature of the Space Station design philosophy, from the standpoint of concept design, there is included the concept that this system will evolve into a facility having ever increasing capability as time goes on. The industries cooperating with NASA will not be very large at the start of operational application (implementation) in the early period(s) of the 1990's, and will design a space station that can attain the target capabilities within its original scope. After that, it is planned to expand the space station to the extent that the end objective can be defined or as available can support the program. The outstanding feature of the space station that can accommodate growth is that NASA believes it absolutely essential to design growth potential into it although the design itself will be difficult. Figure 6.4 illustrates the initial phase Space Station and Figure 6.5 illustrates an example of a conceptual drawing of a growth model.

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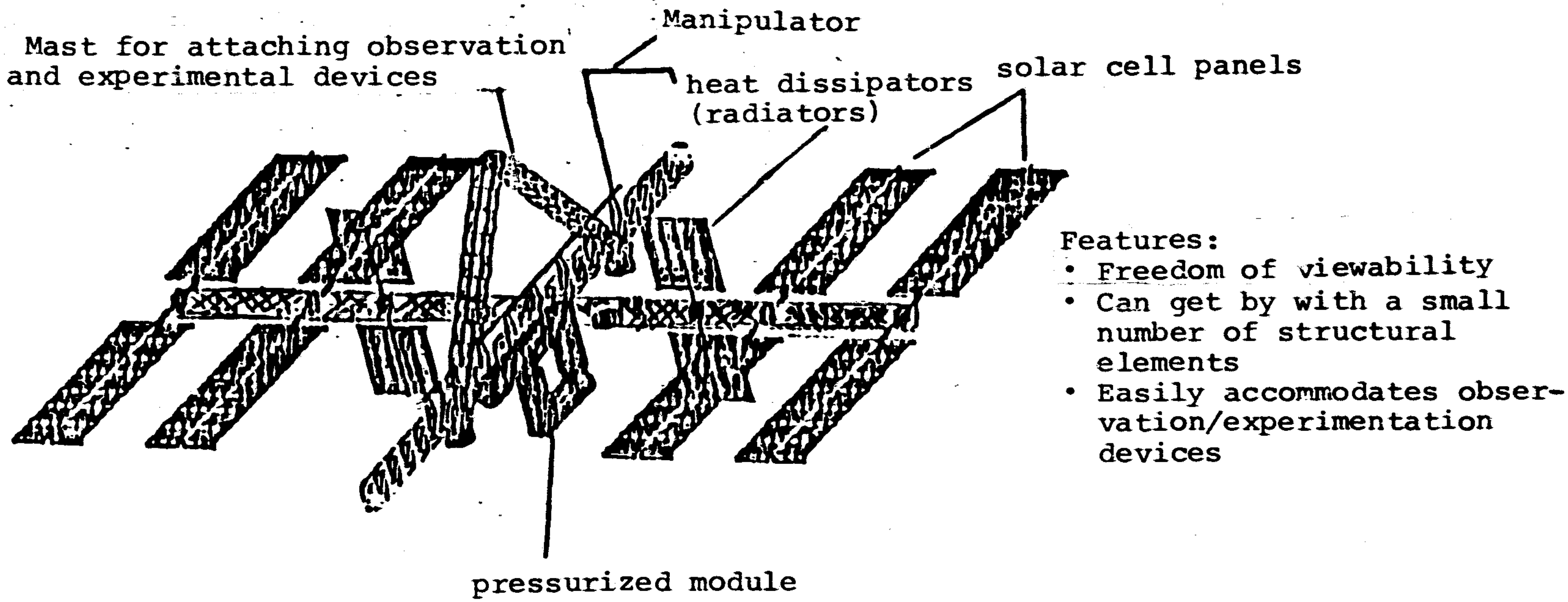

Figure 6.1 Planar (flat surface model) configuration

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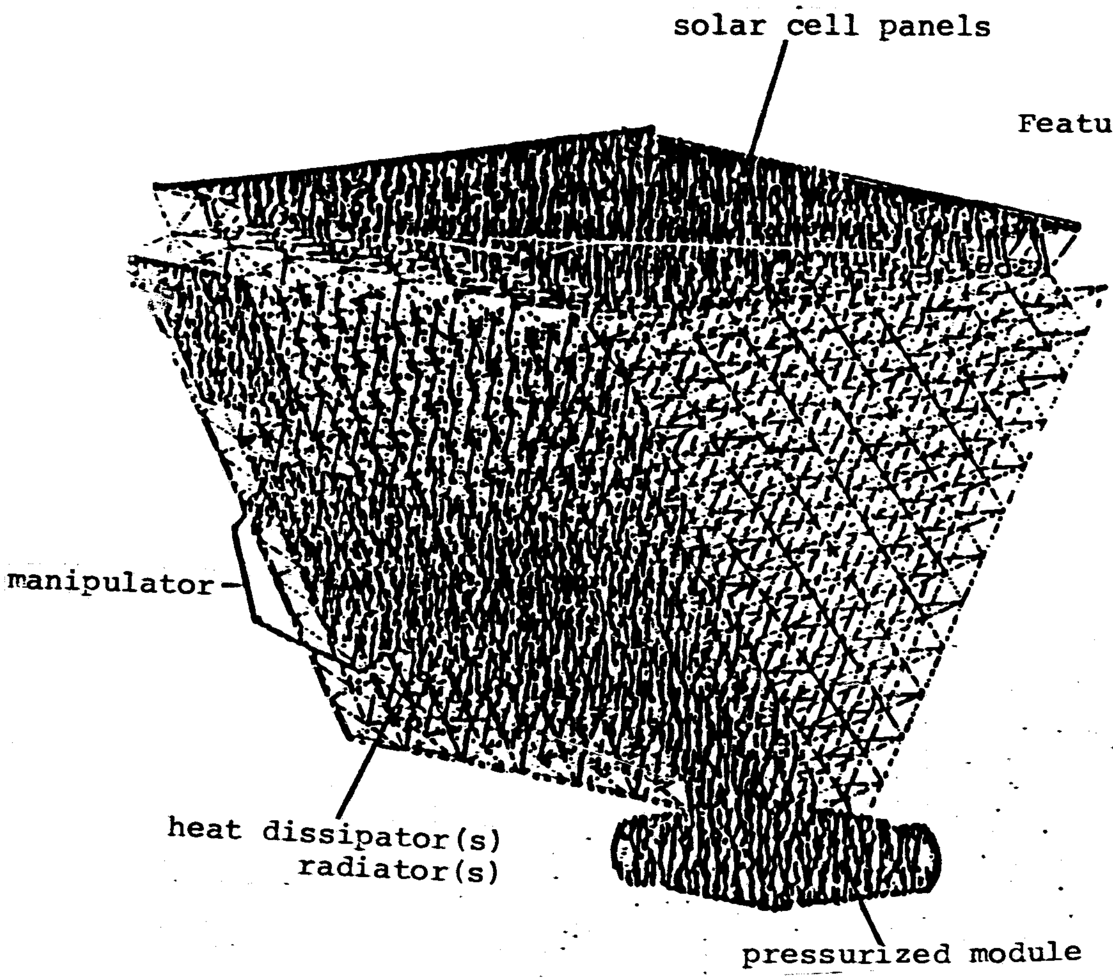
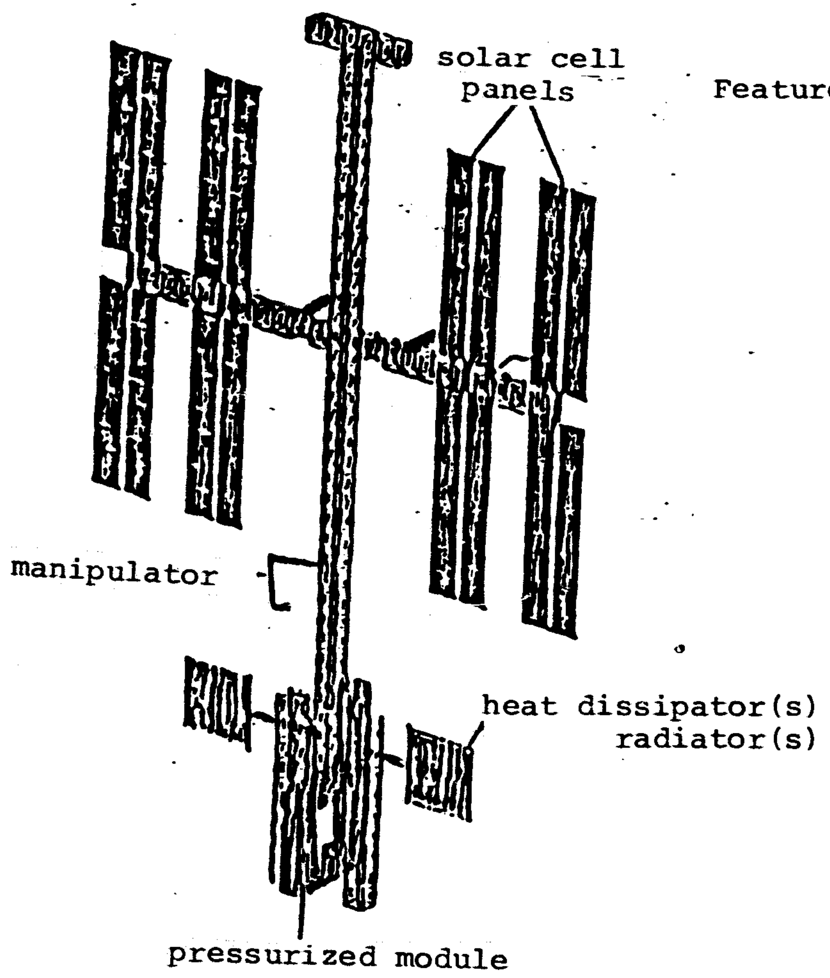


Features:
- High structural integrity
- Easy to attitude Control
- Wide area available for attaching observation devices

Figure 6.2 Delta (Deruta model) configuration



Features:
- wide viewability
- easily accessed
- inertially stable configuration

Figure 6.3 Power Tower (electrically powered model) configuration

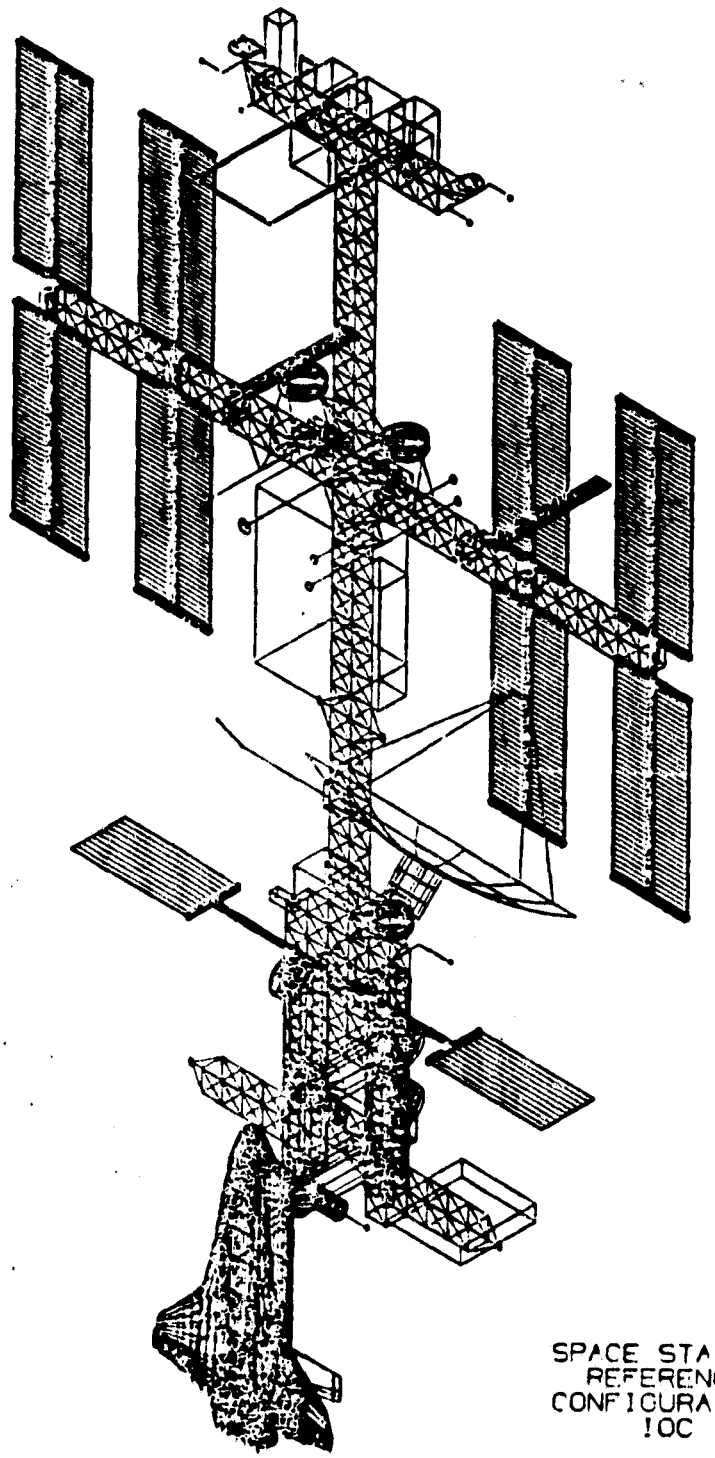


Figure 6.4 Space Station initial configuration

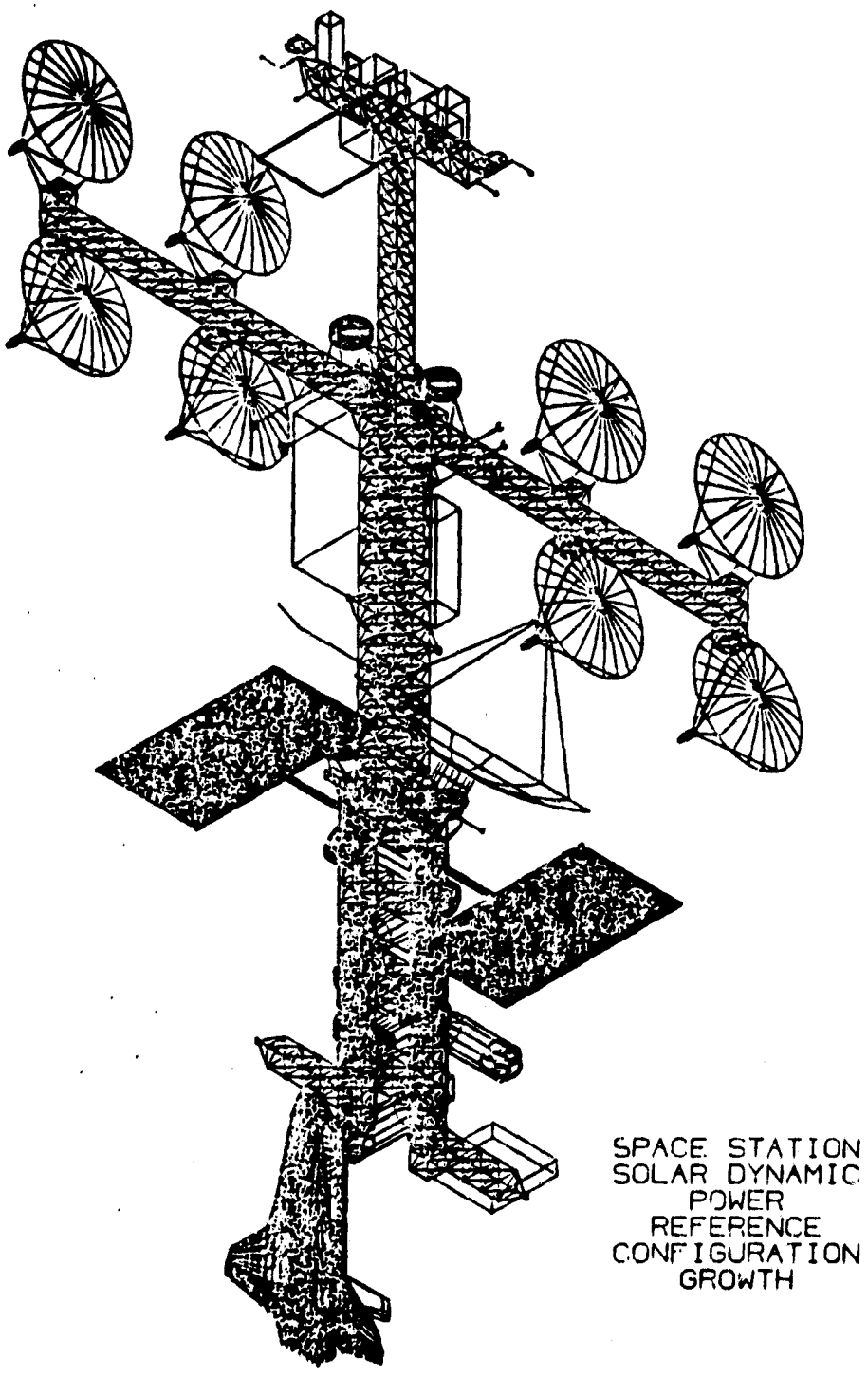


Figure 6.5 Example of Space Station growth configuration

6.5 Development schedule /44

The schedule shown in Figure 6.6 was released in June of last year as representing the Space Station development schedule with a target Initial Operational Capability (IOC) for the Space Station of 1992. Following this, there were frequent rumors that the IOC may slip to 1993 or 1994 because the Fiscal Year 1986 Reagan Budget Request reduced the allocation for the Space Station to a figure lower than that requested by NASA. However, NASA has not officially changed the 1992 launch date, according to the briefings provided our study team. But the schedule for the preliminary design (phase B) has been changed as shown in Figure 6.7 because of the budget, as explained in a following section of this report, and the need to be compatible with the interface proposed from foreign countries. The major milestones are as follows:

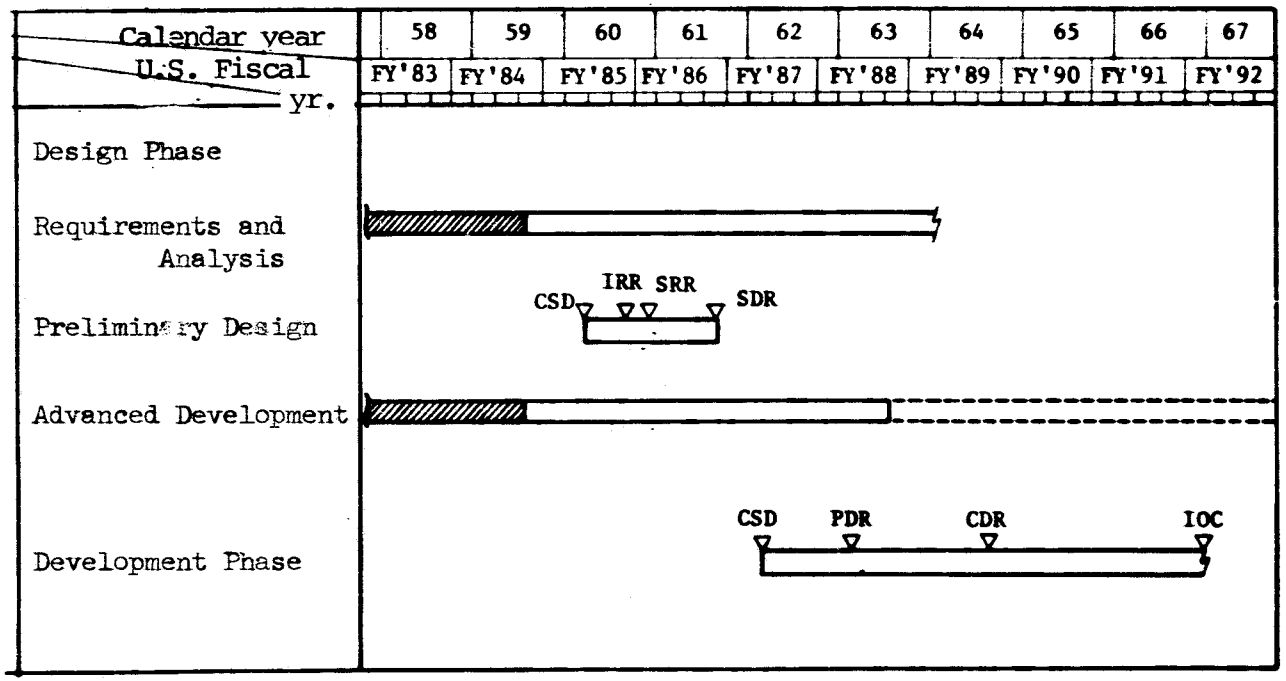
CSD (contract start date): April 1, 1985
IRR (Interface Requirement Review): April 1, 1986*
SRR (System Requirement Review): April 3, 1986*
ISR (Interim System Review): April 7, 1986*
SDR (System Design Review): April 1, 1987**

* 2 months slippage from previous plan
** 3 months slippage from previous plan

Note: Administrator Beggs stated at the press conference following submittal of the Fiscal Year 1986 Budget Request that "NASA has not to date officially mentioned an IOC of 1992. At the beginning of last year, Reagan made the commitment that construction would be completed within 10 years--and that is NASA's official objective. The FY 1986 Budget requested for the Space Station was $50 million less than NASA's share, but that amount should be well within the target years (1993 to 1994). Therefore, even though the Space Station plan may slip a little, there will be No Major Slip, No Major Change".

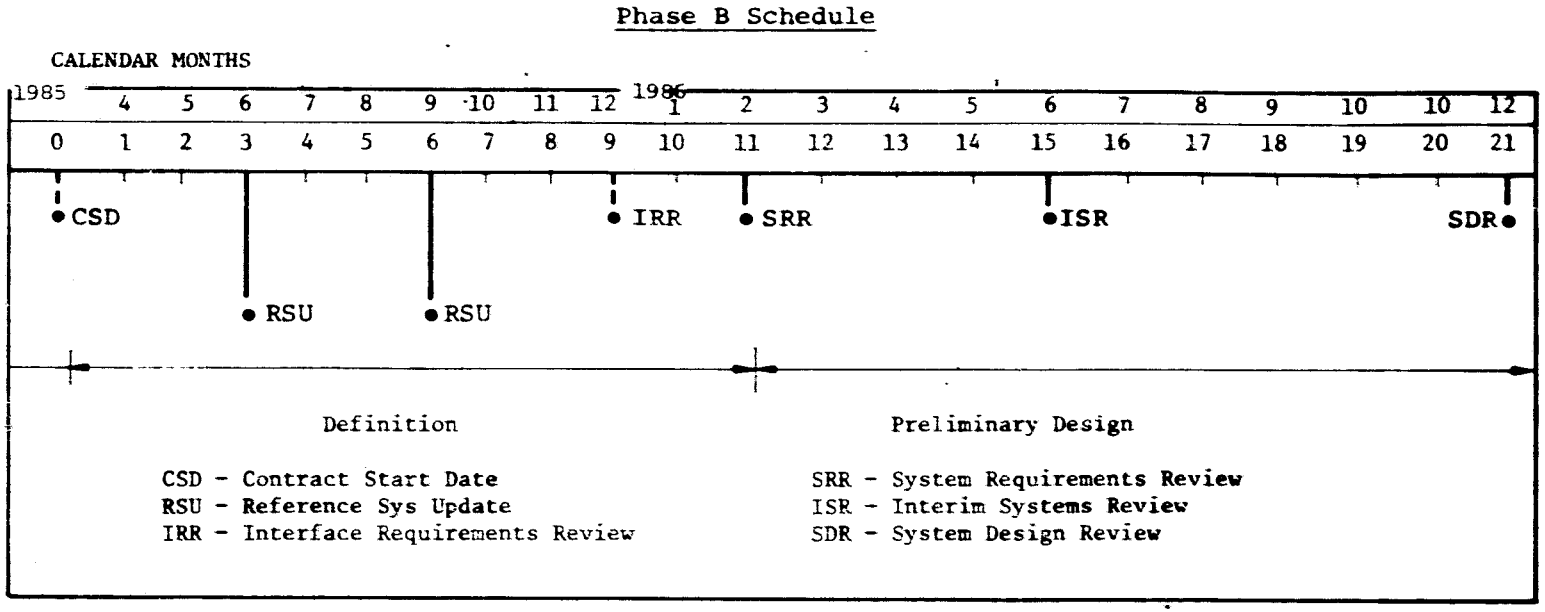
Figure 6.6 Schedule Relating to the Space Station Plan

As of June, 1984



CSD - Contract Start Date
CDR - Critical Design Review
IOC - Initial Operational Capability
IRR - Interface Requirements Review
PDR - Preliminary Design Review
SDR - System Design Review
SRR - System Requirements Review

Figure 6.7 NASA Phase B Development Milestones



- o Target Contract Start Date April 1, 1985
  - o Start from System Requirements & Reference Configuration
  - o Proceed to Baseline by Mid-Term
  - o Preliminary Design of Baseline During Last 10 Months
- o Sequenced to Produce Preliminary Design

(Source: Data obtained February 10, 1985)

6.6 NASA Space Station Budget /48

The Budget Message for Fiscal Year 1986 was released on February 4. According to the message, the approved budget (proposed) outlays for 1986 (October 1985 through September 1986) for NASA totalled approximately 7.9 billion dollars; excluding the aviation-related, the space portion totalled 7.3 billion dollars (about 1.7 trillion yen) which is greater by 383 million dollars. Within the space budget, the Manned Space Station related budget (proposed) has been computed at 230 million dollars (about 53 billion yen) which is an increase of 80 million dollars over last year. Further, preliminary design will start in April of this year and will continue for 21 months (normally 18 months).

The items and amounts of the budget relating to the Space Station Bureau of NASA Headquarters are shown in Table 6.2. With regard to the 1985 portion of this table, the items and amounts have changed from last year's request, but this was due to adjustments made as a result of adjustments in some of the detail.

Further, the NASA budget request for Fiscal Year 1986 for Space Station related items, including the above-mentioned Space Station Bureau is computed as follows:

budget item	FY 1986 Request
(1) Space Station	$230 million
(2) OMV	$ 25 million
(3) Space Science Applications	(though unclear, some amount available)
(4) Space commercialization	$ 30 million
(5) Space R&T (including OTV)	$168 million (not all earmarked for Space Station)

Note: The assigned NASA program bureaus were:
(1) and (2), OSS; (3), OSS-A; (4), OCP; (5), OAST

TABLE 6.2 Budget trend for NASA Space Station Bureau (Office of Space Station) in million dollars

	FY1984	FY1985	FY1986 (requested)
UTILIZATION	4.1	9.0	15.0
ADVANCED DEVELOPMENT	6.9	52.3	82.0
PROGRAM MANAGEMENT/ INTEGRATION	5.4	33.7	52.0
OPERATIONAL READINESS	–	3.0	7.0
SYSTEM DEFINITION	5.5	52.0	74.0
TOTAL	21.9*	150.0	230.0

* Funded as part of the Office of Space Flight ($130 million), Office of Aeronautics and Space Technology ($60 million), Office of Space Science and Applications ($20 million), and Office of Space Tracking and Data Systems ($09 million).

Source: Data obtained February 21, 1985

6.7 Promotion structure of the U. S. Space Station Plan and Phase B Assignments

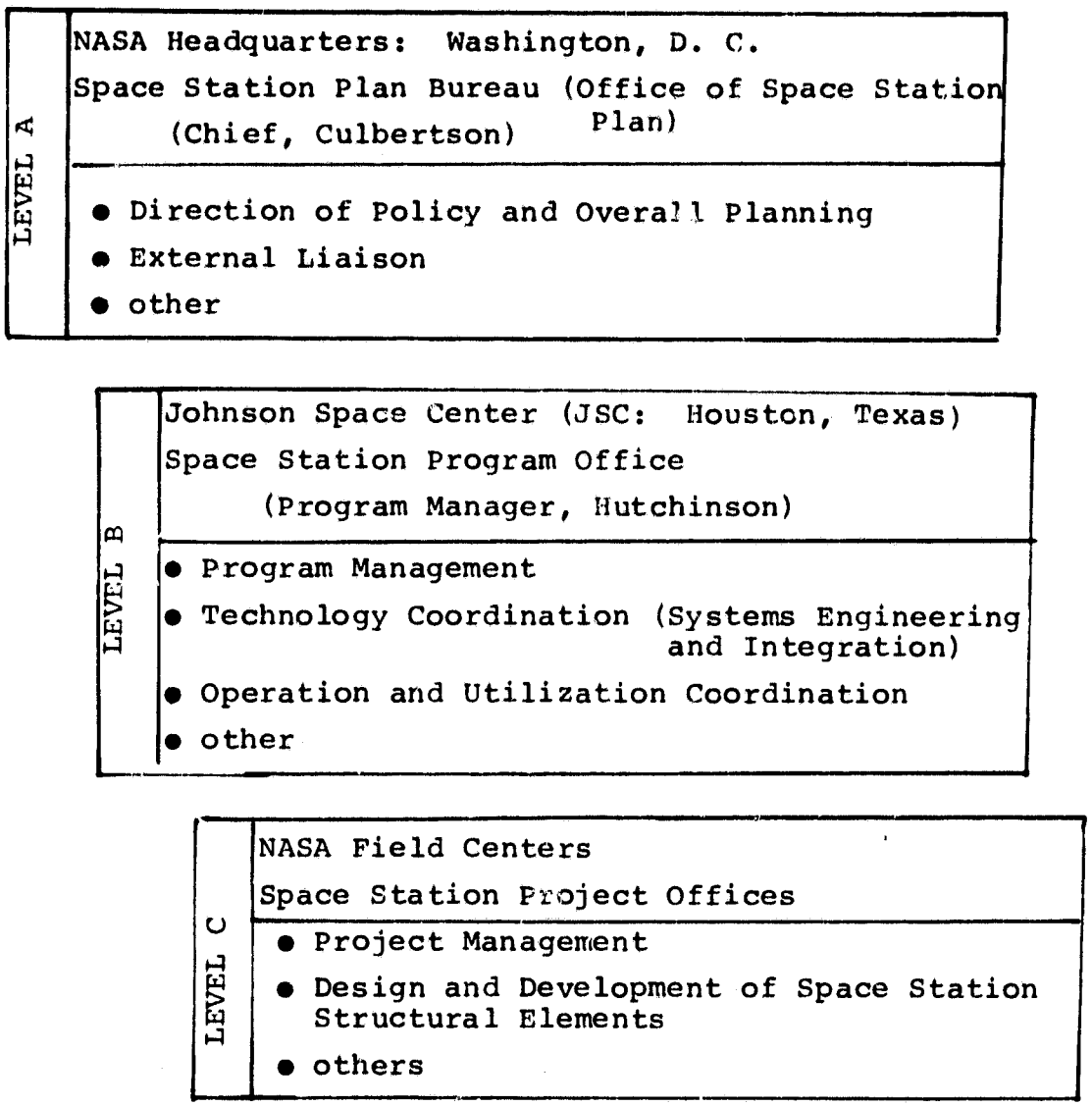
(1) Space Station Task Force (Chief, John Hodge) established at NASA Headquarters in May, 1982.

(2) In April of this year, following President Reagan's official announcement promoting the plan, a Space Station Plan Bureau (Interim Space Station Program Office: Chief, Associate Administrator Culbertson; Deputy, John Hodge) was established as a transitional organization. This office is formulating the promotion structure (presently raised in status to an official office).

In taking on the development of the Space Station, NASA believes that management is the key to its success. And, whereas in the development of the Shuttle, the integrator job was contracted out, for the case of the Space Station, both the systems engineering and integration will be done in-house (within NASA Headquarters) as in the Apollo Program.

For effective internal management of NASA, the organization /49
will be structured on three levels--A, B and C, with functions and responsibilities as indicated in Figure 6.8.

FIGURE 6.8. Management of NASA's Space Station Plan Development



Level A assumes the responsibility for directing policy and overall planning; level B conducts the actual technical operations of development; level C, at the present, is broken down into four work units (referred to as Work Package(s)) which are assigned to NASA's four field centers.

(3) In April of the same year, Johnson Space Center was selected as the lead center to perform the primary role at the operational level (Level B) in the promotion of the plan.

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(4) In June of the same year, the Space Station Tasks (Work Package) were allocated to the four NASA Centers as follows:

(1) Marshall Space Flight Center (WP-1)
- Space Station Pressurized Module ("Common" module)
- Environmental Control/Propulsion Systems
- Orbital Maintenance Vehicle (OMV) for Space Station
- Mechanisms/Devices to convert the Common Module into a Test Lab Module or Logistics Module

(2) Johnson Space Center (WP-2)
- Attachment and assembly of major Space Station structural components and systems
- All mechanisms necessary for the on-orbit assembly of the Space Station including the Space Station-Space Shuttle interfaces and the Manipulator
- Attitude control, heat control, communications and data management systems
- Devices and equipment needed to adapt the Common Module to a Crew Habitat Module

(3) Lewis Research Center (WP-3)
- Electrical power system

(4) Goddard Space Flight Center (WP-4)
- Free Flyer
- Facilities for attaching the devices and payload to the external structure of the Pressurized Module
- Definition of the Pressurized Test Module

Figure 6.9 Work Package and the Contractor Candidates

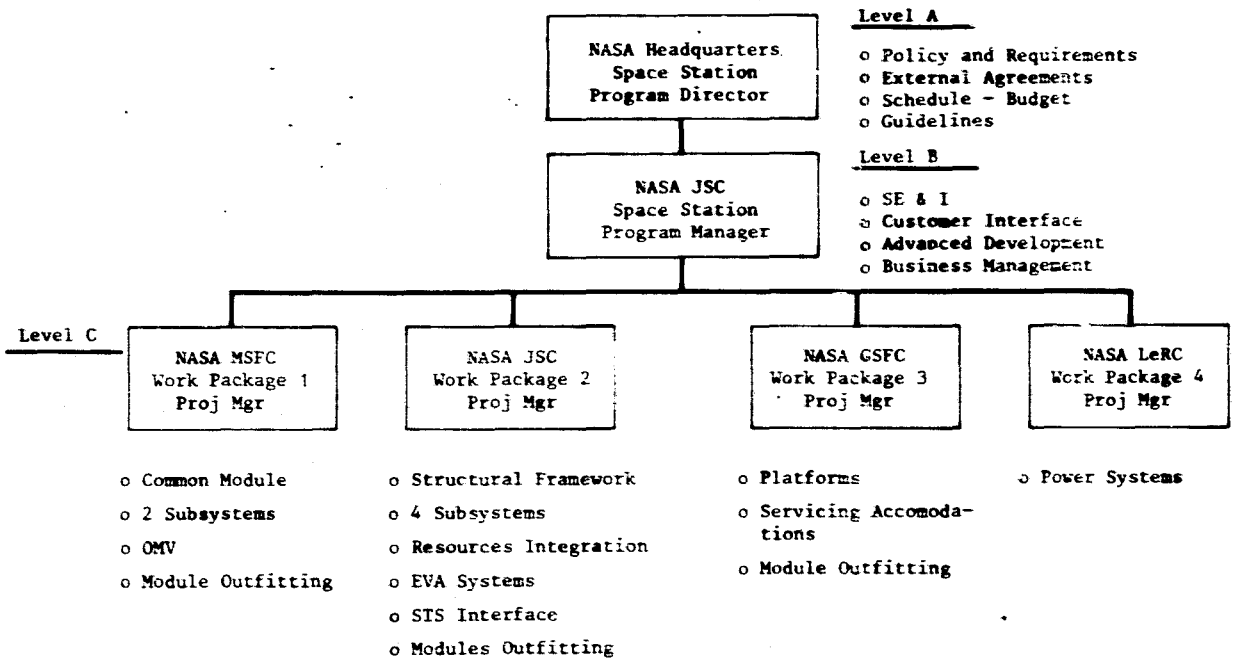


Figure 6.9 shows the Work Package assignment to each center and the forecasted contractors for the assigned work package. In Phase B, two teams will be assigned to each Work Package from among the current 11 teams. It is projected to select a total of eight teams.

Figures 6.10(a) through (l) illustrate the assignments made to the respective centers as of the present time. NASA has released the names of Space Station Phase B contractors as follows:

Work package 1 (MSFC):
Boeing/Martin Marietta: $24 million
Work package 3 (GSFC): RCA/GE: $10 million
Work package 4 (Le RC): Rocketdyne/TRW: $6 million
Work package 2 (JSC: presently being negotiated $27 million)

(5) Space Station Advisory (interrogation) Committee:

(1) In scientific areas: Space Station Scientific Advisory Committee (SESAC Task Force on Scientific Uses of Space Station: Committee Chair, Peter Banks, Stanford University professor, about 25 committee members) established in 1982.

NASA asked this committee to request other countries to send observers. In the committee's initial meeting on April 25-26, 1982, an observer from Japan participated. NASA states it was hopeful of conducting formal liaison with other countries so that foreign participants could join as regular members.

(2) In industrial areas, too, NASA plans to establish similar committees.

NOTE: SESAC: Space and Earth Sciences Advisory Committee, an Interrogation (Advisory) Agency to the Chief, Space Sciences Application Office, NASA

(6) Other. The following are also active: the Space Sciences Branch (SSB) and the Space Applications Branch (SAB) of the (U.S.) National Academy of Sciences (NAS); the American Aeronautics and Space Academy (American Institute of Aeronautics and Astronautics)(AIAA); the American Astronautics Academy (AAS); International Astronautics Federation (IAF). /65

6.8 International cooperation

The trend of opinions on international participation with respect to the present status of the U. S. Space Station is as follows (first International Space Station Workshop, June 21-22, 1984).

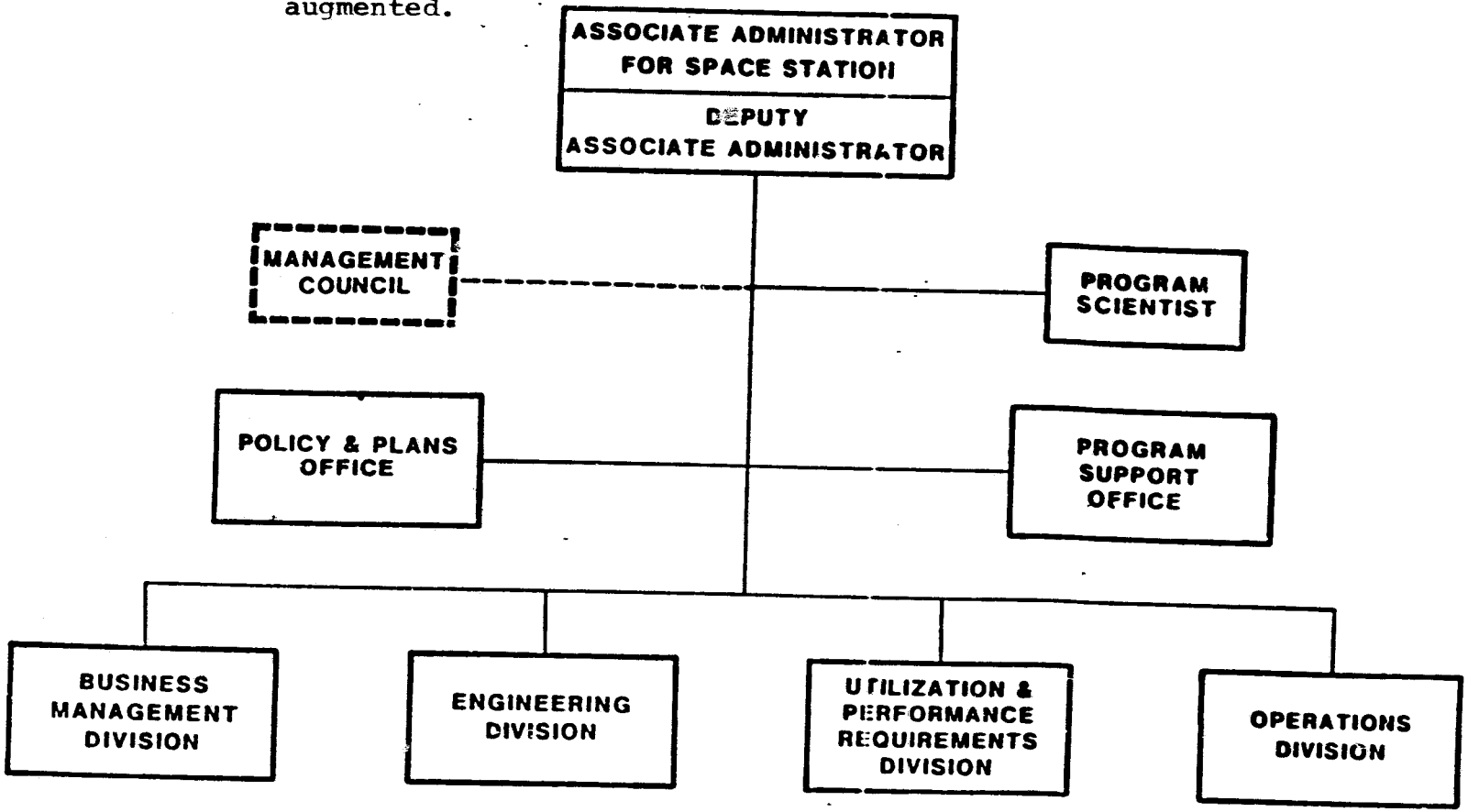
(1) The status of NASA activities

The overall concept of the Space Station Plan is as has been previously described, that is: the manned Space Station is always in a state of accommodating habitation by humans, which does not necessarily mean that a human must occupy the station at all times; it is a system that is adequately automated; it is conceived to provide for two Free Flyers which are man-tended; it is to be easily utilized by the users; and it will constantly integrate new technologies/techniques. These are the ideas that are emphasized.

(a) Eleven U. S. industrial contractor teams have submitted proposals for the four work units comprising preliminary design. These proposals are presently being evaluated, and it is expected that results will be submitted to Administrator Beggs by mid-March 1985. As a matter of principle, two contractor teams will eventually be selected for each of the work units. Because of the larger number of contractors, it will behoove NASA to maintain a tight management.

Figure 6.10 (a) NASA Headquarters Space Station Bureau (Office of Space Station)
(Level A)

As of February 1985 about 110 people; currently being further augmented.



Note: Figures 6.10(a) through (l) are derived from NASA Publication, "Space Station Management Plan and Procurement Strategy" (dated December 14, 1984).

Figure 6.10 (b) Organization of NASA Johnson Space Center (JSC)

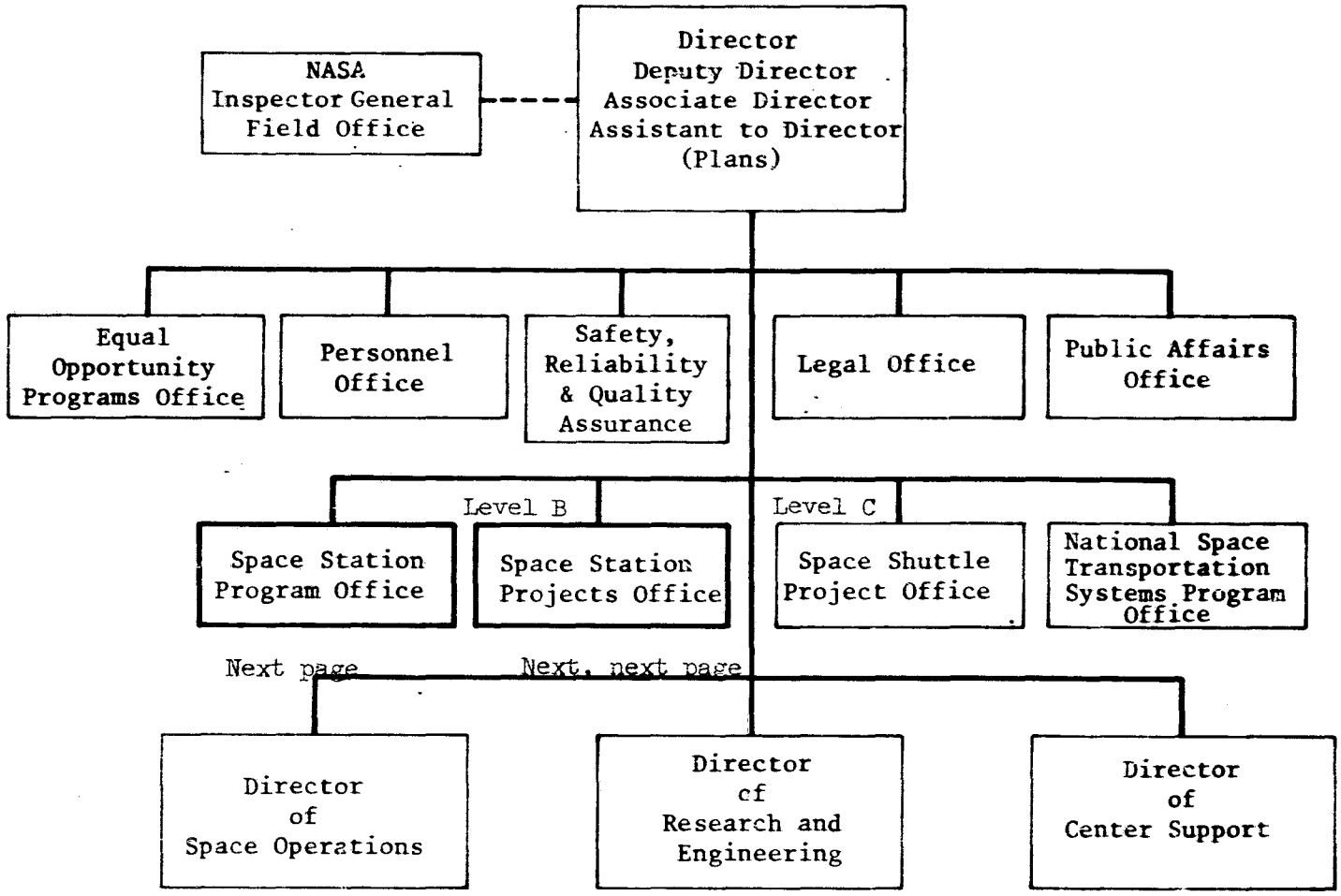


Figure 6.10 (c) JSC Space Station Program Office (SSPO) (Level B)

(As of February 1985
About 250 people;
currently being further
augmented)

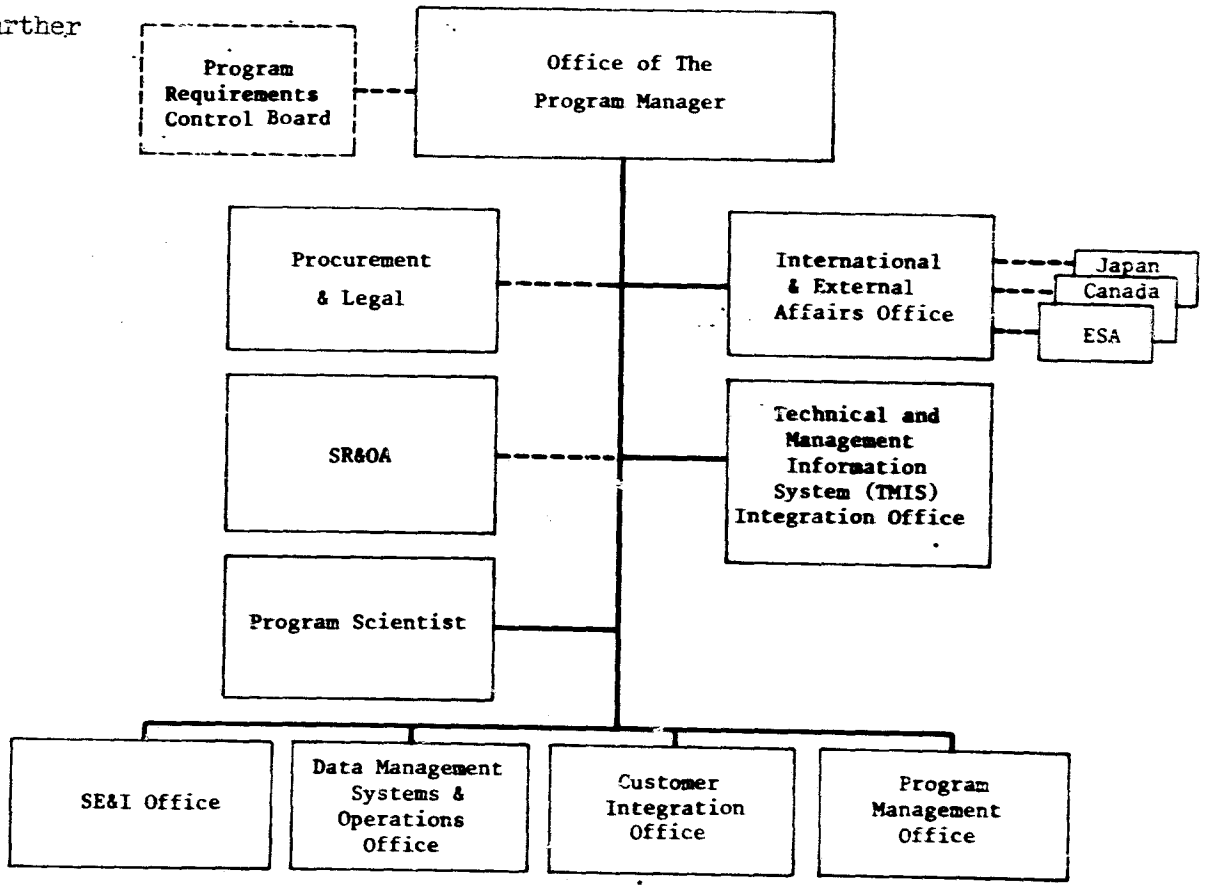
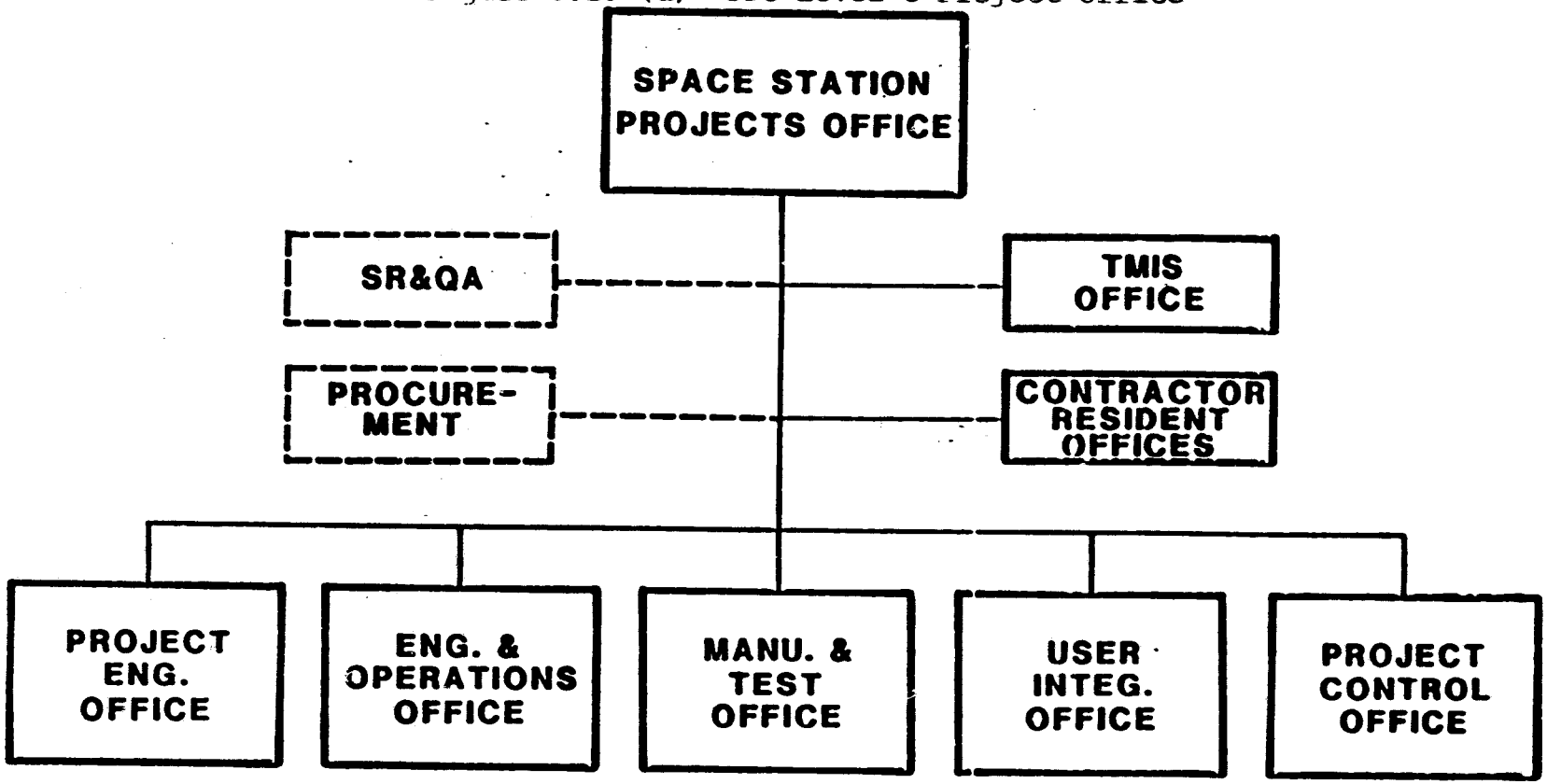


Figure 6.10 (d) JSC Level C Project Office



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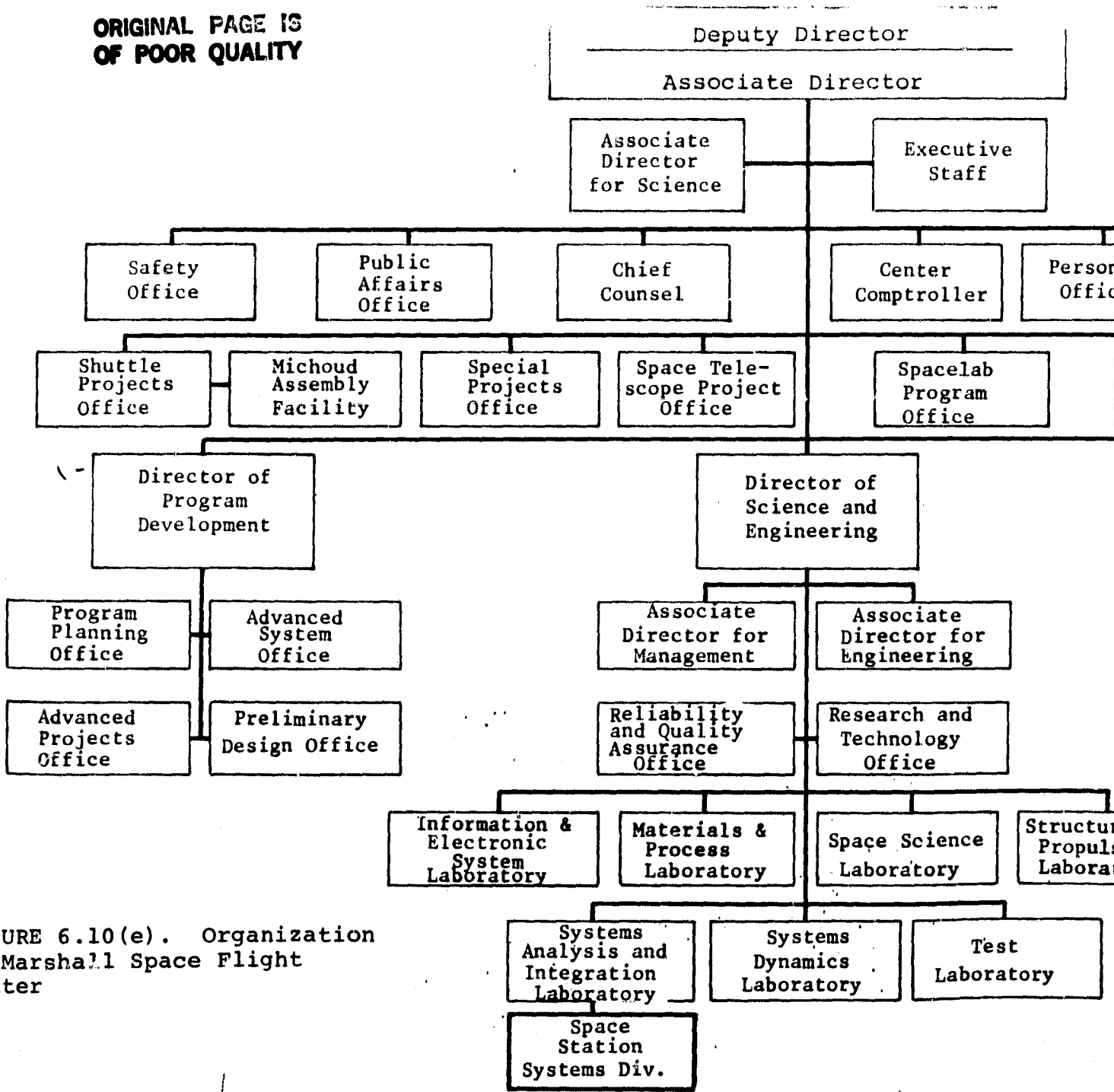

FIGURE 6.10(e). Organization of Marshall Space Flight Center

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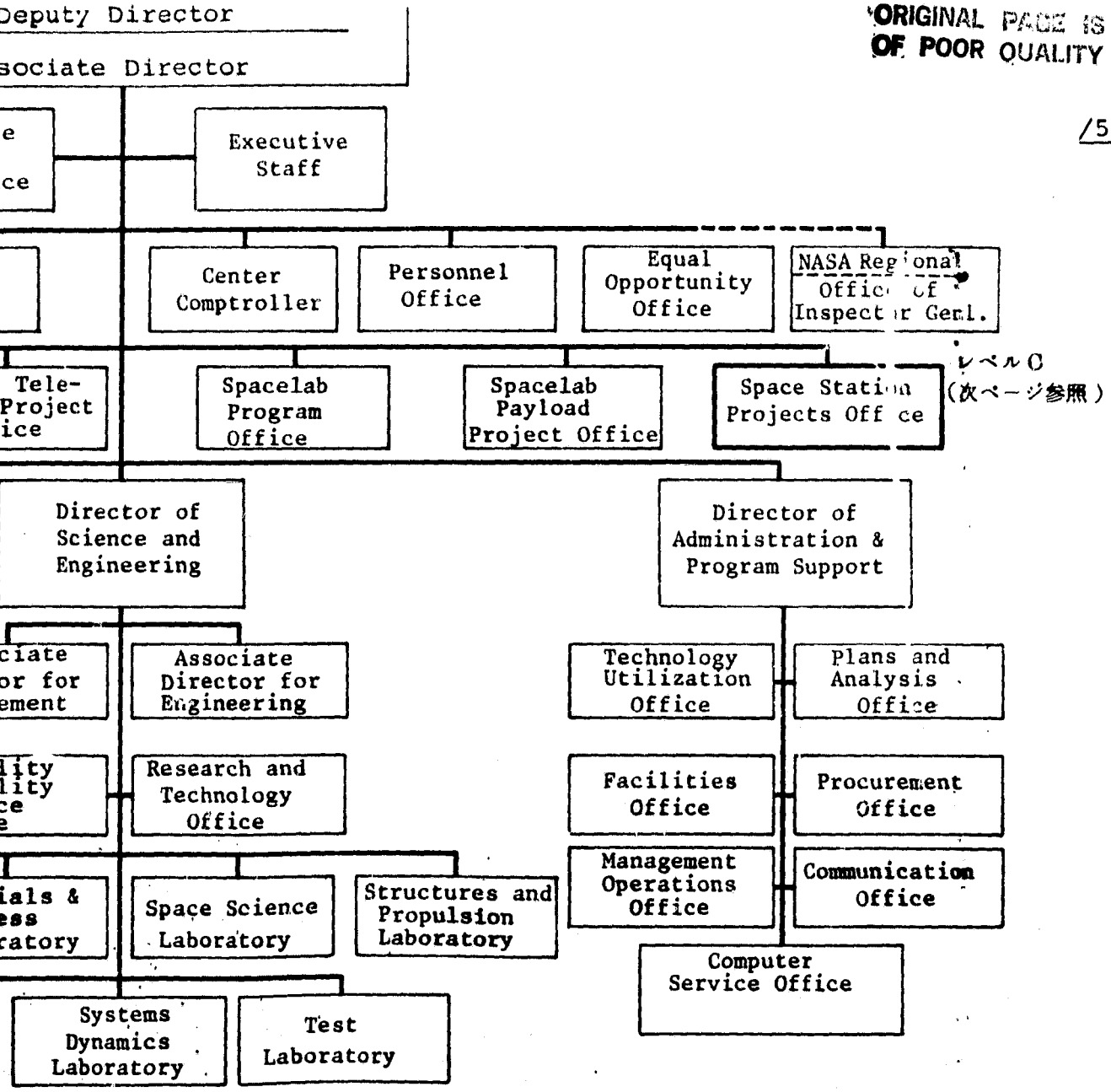

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Figure 6.10 (f) MSFC Level C Project Office

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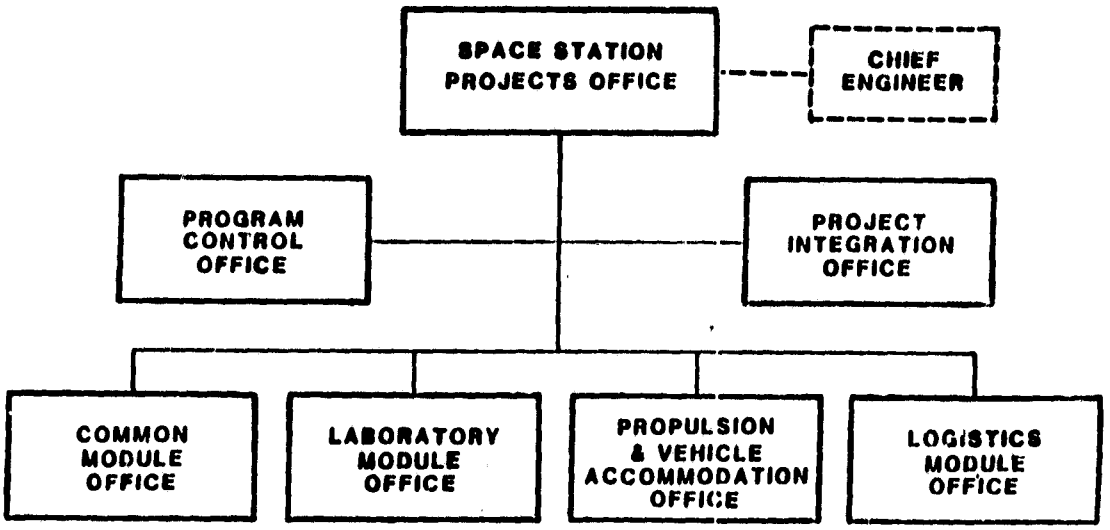

Figure 6.10 (g) Organization of NASA Lewis Research Center (LeRC)

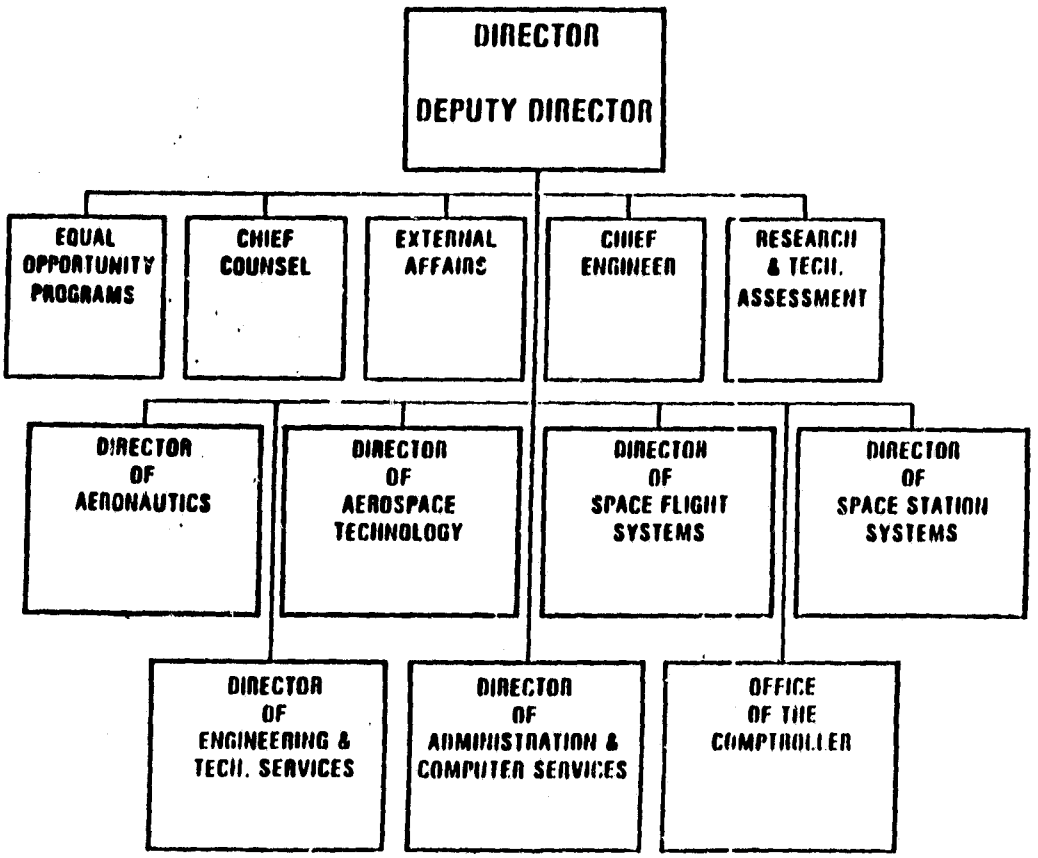

Figure 6.10 (h) LeRC Level C Project Office(s)

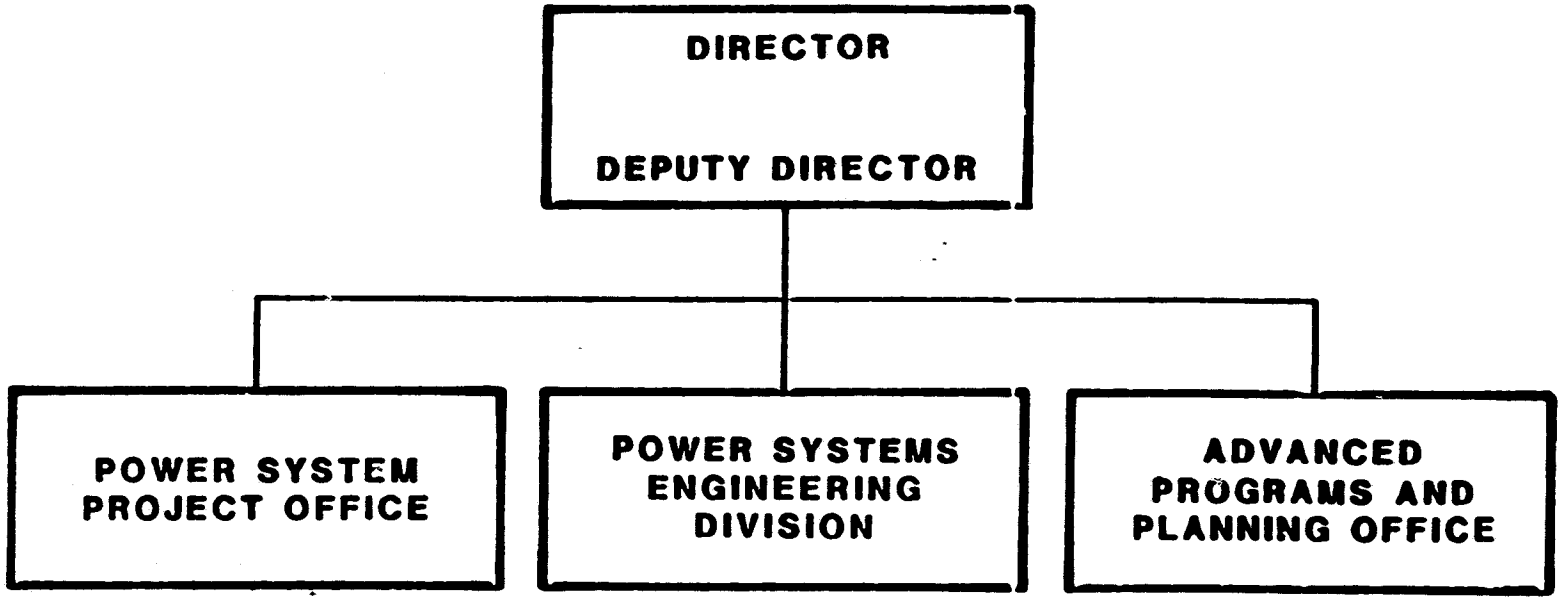

Figure 6.10 (i) Organization of NASA Goddard Space Flight Center (GSFC)

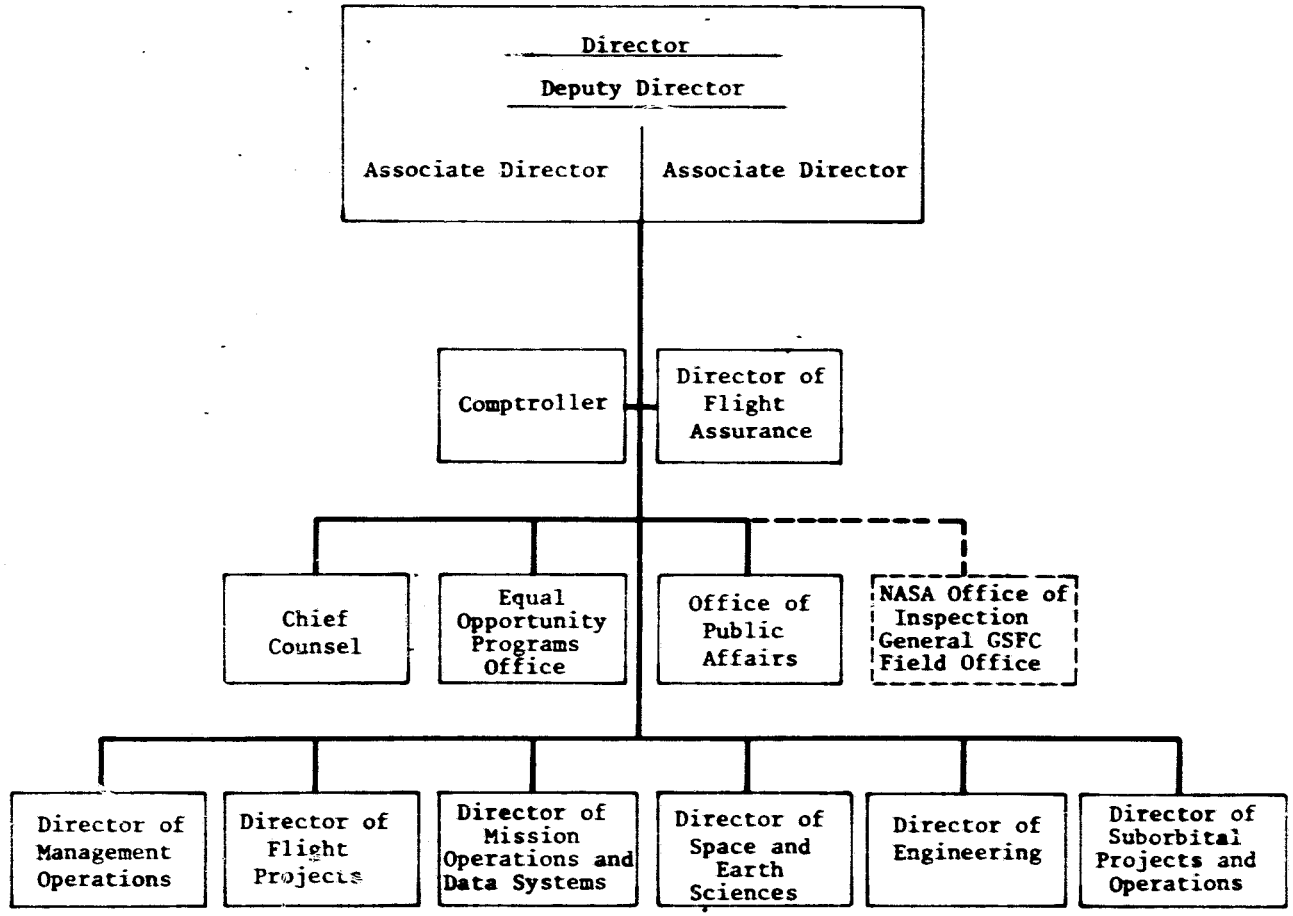

Figure 6.10 (j) GSFC Level C Project Office(s)

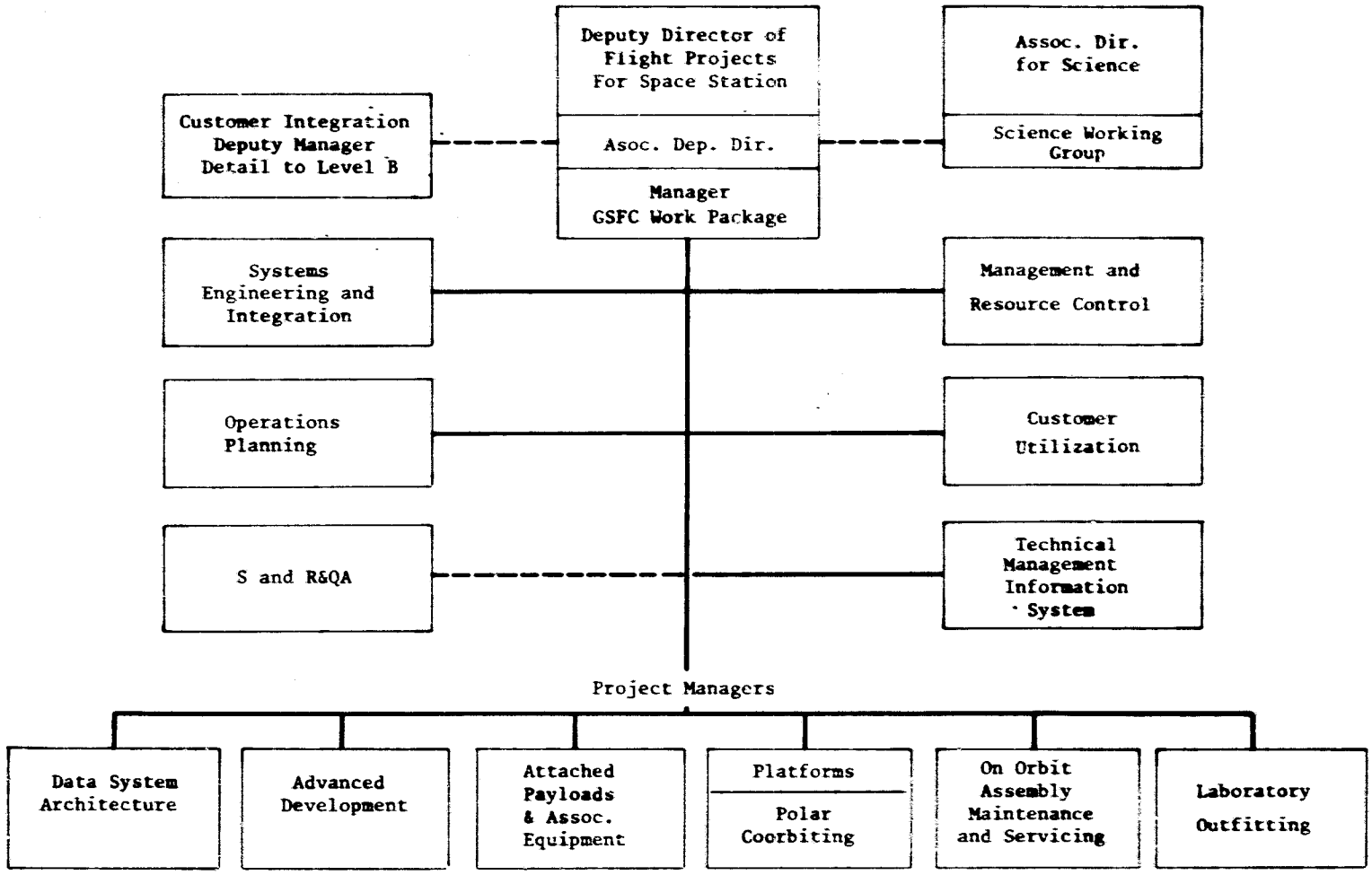

Figure 6.10 (k) Organization of NASA Kennedy Space Center (KSC)

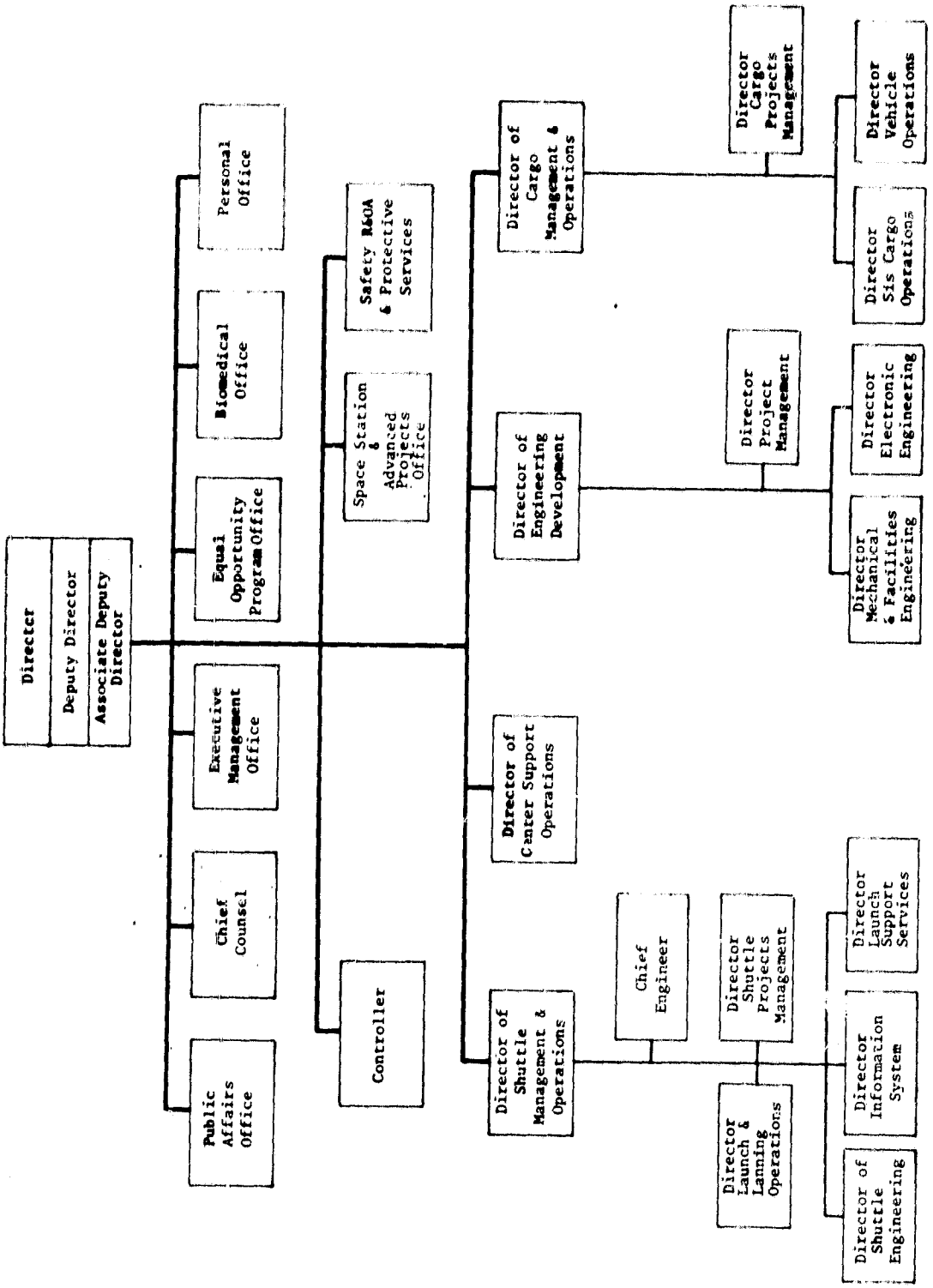

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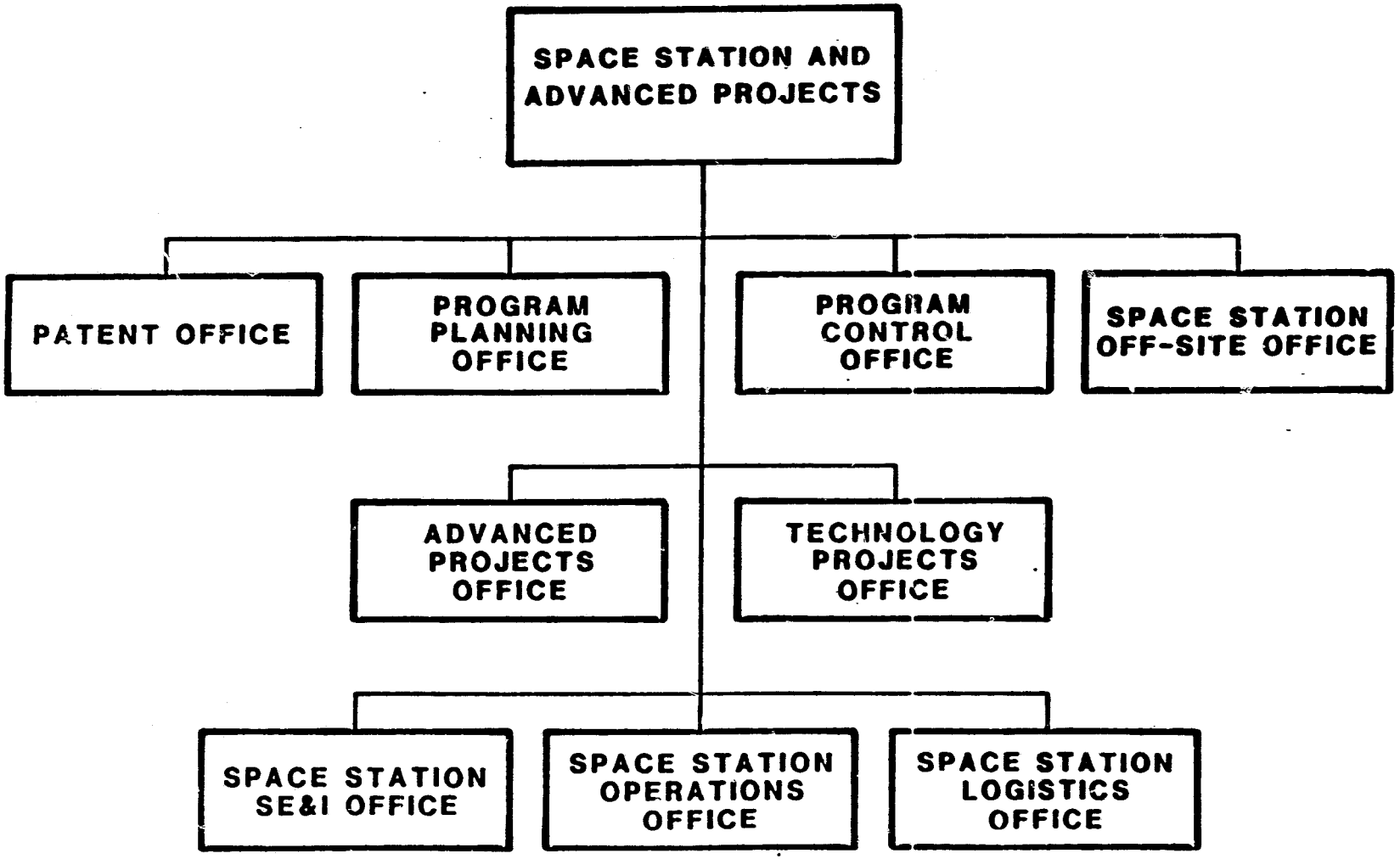
Figure 6.10 (1) KSC Level C Project Office(s)



Research is in progress on the automation of the Space Station and results thereof will be reflected in the preliminary design efforts.

(b) With regard to Mission Requirements, to date three Mission Requirements workshops have been conducted and a total of 324 issues have been identified, including 237 for the U. S., and 87 for the foreign countries (27 for Europe, 22 for Canada and 38 for Japan). Figure 6.3 shows the mission issue breakdown in numbers by purpose.

FIGURE 6.3 Mission requirements by purpose /68

Type of Entry*	Number of Missions U.S.	Canada	Europe	Japan
o Science, Applications Operational	108	7	22	17
o Technology	70	11	5	21
o Commercial	59	4	-	-
TOTAL	237	22	27	38

Effort in next several months will be to select from these candidate missions the best set from which to derive space station accomodations.

* A "Entry" ranges from a complete manned module to an individual instrument/experiment.

Reference: Material obtained February 21 985

It is thought that if all these mission requirements are consolidated, the capability offered by the initial Space Station configuration would be exceeded, therefore, it becomes necessary for judgements to be made realisitically as the program progresses.

(c) Advanced technical development will be conducted in parallel with the preliminary design work, and will provide alternatives/options to the technologies to be applied to the Space Station.

Especially in regard to (electrical) power, solar batteries (cells) will be used, but it has not been determined whether or not solar thermal electricity will be used. Since this decision will affect the choice between the main electrical circuits to be used in the Space Station between direct current or alternating current, the participating countries, too, are hoping that this issue will be given careful consideration.

(d) With regard to the operation of the Space Station, the preliminary design contractors have been tasked to address operational aspects, starting with operational costs. It is also contemplated to have data exchanges at the International Working Groups. NASA is hopeful that the operational requirements will firm up by the U. S. FY 1986 1st quarter (October through December, 1985) and the operational plan by the U. S. FY 1987 2nd quarter (January through March 1987).

(2) Framework of international cooperation

(a) Guidelines for international cooperation

Chief of the Space Station Plan Bureau Culbertson explained the guidelines (Table 7.1) for international cooperation at the 1st Workshop. He pointed out that these guidelines were important for understanding the basic approach to performing preliminary design work from here on.

TABLE 7.1 Guidelines for International Cooperation (NASA, June 21-22, 1984) /68

1. International cooperation must be mutually beneficial to the U. S. and the participating nations.
2. The participating nations must have a requirement for long range use of the Space Station.
3. The participating agencies must be government agencies.
4. The participating nations will bear full technological (technical) and financial responsibilities necessary for promoting their respective individual development projects.
5. Agreements of international cooperation must be made for specific projects or functions for which obligations and responsibilities have been clearly defined.
6. Agreements must provide for flexibility sufficient to accommodate changes in development planning and design.
7. Management and technical interfaces among the various elements of the Space Station must be maintained on clearly defined bases within the maximum scope realistically possible.
8. The prime responsibilities for management, integration and implementation (operation) lie with the United States; but the participating nations that invest large amounts of funds into the Space Station project will assume roles in management and operations consistent with the amount of investments made.
9. Space Station components or capabilities furnished by participating nations will be considered to be proprietary to those nations, and the responsibilities for technical and operational management to belong to those participating nations.
10. Safety and reliability factors will be formulated on the basis of commonly agreed upon technical criteria, and applied uniformly among the Space Station Plan participants.
11. This cooperation plan will be implemented to avoid inappropriate technology transfers among participating nations;

however, there will be assured data exchange among the participants based on effective interface

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(b) International coordination in the preliminary phase

(1) Plan Coordination Committee

This committee will be formed at the headquarters level of the participating nations' agencies (between two nations). The committee will function as the agency to perform overall coordination for making the major decisions pertaining to international cooperation. It will convene once every two to three months.

(2) Review meetings for schedule control

This is review at program manager level (between two nations) that coordinates the basic structure and the interface between the adjoining components and the main body in order to define the principal design constraints (interface requirement inspection, system requirement inspection, etc.).

(3) Review meetings for multi-national planning

As an extension to the current workshop, a meeting to review the plan in totality is convened once every two to three months. Working groups may also be convened as required.

(3) Techical coordination concerning all participating nations

NASA has drawn up technical guidelines of concern to all participating nations, but these are not formally bound guidelines, and can be modified depending on proposals made by the participating nations. Highlights are as follows:

(1) The participating nations may be furnished electrical power, heat and communications by the United States.

(2) The data processing system to be employed by the Space Station's main component will be composed of standard network plus interface devices. The communications network within the participating nations' module (local network) will be the responsibility of the module supplier.

(3) The participating nation's module system will:

a) be compatible with the U. S. Space Station's main component subsystems and interfaces,
b) will have similar designators (nomenclature) and operational (piloting/procedural) systems in order to minimize crew member training and any confusion in times of emergency, /70
c) will comply with mutually agreeable design criteria.

(4) The docking procedure will be controlled by the Space Station crew members. The requirement for direct access to the individual nation's module by means of the Shuttle will be evaluated (appraised) during the preliminary design phase.

(5) Air space that accommodates the installation of hardware for purpose of Shuttle rendezvous will be evaluated during the preliminary design phase when such is indicated prior to that phase. The discard of waste matter from the spaceship will require individual approval (for each case).

(4) Activity of foreign nations

ESA (European Space Agency)

The ESA convened a top level (staff committee (commission)) at Rome on January 30-31, 1985. Agreements were made as follows:

(1) To acknowledge the balanced, long range European Space Plan as proposed by the ESA's Chief of Administration, spanning a 10-year period (1985 through 1995) which has as its objective a consolidated autonomous capability.

(2) To welcome and accept the solicitation of the President of the United States to participate in the Space Station Plan, under the condition that the commitment to the cooperative (joint) venture will fulfill our desire to maintain and strengthen a true partnership in the field of Space.

(3) To kick off the Columbus Plan (NOTE: Testing (Experimental Lab) module and Polar Orbit Free Flyer(s)) as an essential part of the United States Space Station Plan. (The projected cost for development and the initial three year operation and exploitation through 1995 is about 2.6 billion AU (about 560 billion yen)).

(4) To kick off development of the next generation rocket (launch vehicle) (the Ariana 5) cryogenic propulsion engine (HM-60) (projected development cost: 2.6 billion AU) (about 56 billion yen).

(5) To maintain an interest by taking note of France's determination to implement the manned spaceship, Hermes, and of /71
France's proposal to conduct a detailed study with ESA partners who express an interest in this plan.

(6) To strengthen and expand Space Science plans (programs).

(7) To continue in the programs on Earth surveying, space communications, microgravity and space technology fields.

(8) To welcome proposals on follow-on elements that would provide for independent capabilities of Europe in the areas of automation and manned orbital operations.

All the top-level (key staff) members understood the necessity to increase the funding for the ESA in the 1985-1990 period due to the above decisions. (It is projected that the annual budget which was about 970 MAU (210 billion yen) for 1985 gradually increases to about 1,650 MAU (360 billion yen) in 1990).

Canada

It is projected that the decision to participate in Space Station Phase B will be made in mid-March.

United Kingdom

The British Industrial Information Minister declared on January 29, 1985 that the UK will, in the near future, establish the "United Kingdom Space Center", participate vigorously in the ESA's Columbus Plan, and will assume costs of about 7 million pounds (about 2.5 billion yen) which amounts to 15% of the approximately 50 million pounds (for two years) that had been preliminarily targeted for the Columbus Plan.

The United Kingdom has further announced that they will continue the concept study of the future single stage shuttle, HOTOL (horizontal take-off and landing).

France /72

Will continue detailed research on the Hermes.

7. THE UNITED STATES SPACE COMMERCIALIZATION ACTIVITY /73

7.1 Government (White House) actions

President Reagan announced the United States National Space Policy on July 4, 1982. In that announcement, he stated that the "role of the United States Government (in commercial space)

is to plan for the creation of a favorable climate for expanding the investment into civilian space programs". Following this, the House of Representatives Committee on Science and Technology made a report to the effect that "a policy should be established to encourage the commercialization of space technology to the maximum degree possible" (April 15, 1983); and the Senate Commerce, Science and Transportation Committee(s) too issued a report to the effect that "this committee supports fully the exploratory efforts to seek marketing opportunities and private investments into Space areas (May 16, 1983)".

Following this, President Reagan on August 15, 1984 announced the United States National Space Strategy, the essence of which was as follows:

(1) To obtain favorable tax legislation with respect to space commercialization (Economic Initiatives); to seek legislation that will deny impediments to space commercialization (Legislative Initiatives); for the government to conduct research and development useful to space commercialization (R&D Initiatives), and for the government to assure consistent services and policy (Policy Initiatives).

(2) (1) Encourage the use of Expendable Rockets (launch vehicles) (ELV). To relax government regulations to the extent possible to enhance the competitive position of the ELV. For the Department of Transportation to assume responsibility for the ELV commercialization program.

(2) Promote Civil Space Activity. Enable the civil sector to participate in space related enterprises without the federal government's direct support. Implementation to be based on (1) above.

(3) Establish the United States Space Committee (National Commission on Space). This commission was established in accordance with NASA Authority Act of 1985.

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The role of the Commission is to compose a report on the purpose, opportunities and policy on non-military space utilization areas in the next 20 years, and to submit the report to the President. The Science and Technology Policy Bureau (Office of STP) will review the report within 60 days and forward it to the President via higher echelon department liaison groups (SIG).

The major milestones of the United States Space Commercialization activities are outlined in Table 7-1 and a summary of the National Initiatives discussed in (1) above is given in Table 7-2.

TABLE 7-1 Major milestones in the progress of space commercialization in the United States /75

1958	Oct 1	NASA established.
1962		United States (National) Communication Satellite Act promulgated.
1963		COMSAT Company established.
1972		Open Sky Policy declared.
1973		Transfer of Landsat operations from NASA to NOAA decided by President Carter.
1982	Jul 4	New Space Policy proclaimed by President Reagan.
1983	Jan 31	Landsat operations formally transferred from NASA to NOAA.
	May	Civilianization of ELV operations urged by President Reagan.
	Aug	Space Commercialization Task Force (SCTF) established at NASA Headquarters
	Nov	Law denying the civilianization of meteorological satellites signed by President Reagan.
	Nov	Executive agency for ELV launching determined to be the Department of Transportation.

1984 Jan 3 RFP for civilian management of the Landsat issued by the Department of Commerce.

25 State of the Union Message by President Reagan.

Feb 24 Presidential Directive assigning the Department of Transportation as the Executive Agency for commercialization of ELV issued by President Reagan.

Mar 10 RFP on civilianization of the Landsat closed (seven contractors respond; EOSAT prevails).

May 25 Ariane Space Company accused of dumping by Transbase Carriers, Inc. (TCI).

Jun 5 Commercial space launching bill passed by the House of Representatives.

29 Space Enterprise Tax Law submitted to the House of Representatives.

Jul 10 TCI suit received and investigation initiated by United States Trade Representative (USTR).

17 Ground Remote Sensing Satellite System Civilianization Act of 1984 signed by President Reagan.

17 United States (National) Space Strategy announced by President Reagan.

20 Space Commercial Utilization policy announced by President Reagan.

1984 Aug Commercial Space Launching Act submitted to Senate.

15 United States (National) Space Policy announced by President Reagan.

27 Space Station Bureau (office of Space Station) established at NASA Headquarters.

Sep Civilian Landsat Company--EOSAT--selected.

Sep Space Development Act submitted to Senate.

11 Office of Commercial Plans (Programs) established at NASA Headquarters.

Oct 30 Commercial Space Launch Act signed by President Reagan.

Nov 20 Space Commercial Utilization policy announced by NASA.

1985 Jan	9-11	Center for Space Policy (CSP) convened in Washington
Feb	4	FY 1986 Budget request by (NASA) President Reagan.
	6	State of the Union Message by President Reagan ("the second American Revolution will take place in space").
	end	National Security Assurance Directive based on DOD/NASA agreement (DOD will utilize one-third of NASA's Space Shuttle over the next 10 years), signed by President Reagan.
until Mar	8	New NOAA Proposal submitted by EOSTA.
Feb	25	CFR on ELV Launching Licensing Policy submitted by DOT (limited to mission review and flight safety review).
	25	Directive on Second Generation Shuttle, HLLV (Saturn V class) signed by President Reagan.
Feb		Civilian management of Delta by TCI given third extension (until April 1, 1985).
Mar		Decision on new NASA Shuttle Utilization Pricing Plan (for FY 1989 through 1991) still pending. (another 1/2 year delay?)
Mar?		NASA's Shuttle Marketing Support contractors reduced from two to one? ((1) Booz, Allen & Hamilton, Inc. (2) Sears World Trade Systems).
Mar		RFP for Space Utilization Promotion Center(s) (3 to 6) issued. (Forecast decision in September: 500 thousand to one million dollars per company, maximum five years).

TABLE 7-2. Summary of National Initiatives /76

(ECONOMIC INITIATIVES)

(a) To amend the tax exemption clauses in the present tax laws with respect to the 25% increase in test laboratory costs. To push for a tax system on R&D programs in Space which are the same as that for similar programs on the ground.

(b) To amend the tax code in such a manner as to have the 10% reduction apply appropriately to the tax investment and the law pertaining to the recouping of accelerated investment capital --for those enterprises established for Space development purposes with U. S. capital investment and operating within the United States.

(c) To make it possible for long-range contracts on Space development which lead to industry products having a potential need by the government even when the cost-effectiveness is high.

(d) For the Department of the Treasury to formulate a draft tax plan that will permit an industrial contractor to be given an income relief on the R&D funds needed in the development of a prototype for a government program even when that prototype leads later to commercial exploitation.

(e) To carry out a tax revision for the purpose of preventing a project product which is manufactured in Space from being treated as an import item when and if that product is retrieved on the ground.

(LEGISLATIVE INITIATIVES)

(a) To allocate frequency bands to the civil sector at appropriate times.

(b) To revise provisions of the Munitions Control Act and the ITAR to the Civil Space Launch Law.

(c) To provide for supplementary protection on proprietary data.

(d) To guarantee fair international competition.

(R&D INITIATIVES)

(a) To seek as many enterpreneurs as possible through R&D programs in the realm of Space, and to endeavor to attract the attention of the non-Space associated business world to the

opportunities afforded by Space ventures.

(POLICY INITIATIVES)

(a) To establish an implement a totally consistent and credible commercial Space policy.

(b) To draw up suggested plans for the civilianization of special categories of government Space activities.

(c) To get involved in negotiations at the national level in reference to Space commercialization issues.

* NASA, receiving national level initiatives, will implement the plans outlined below:

(1) To encourage civil participation by standardizing the procedures for cooperation between NASA and the private sector.

(2) To engage in promotion actions to provide for marketing opportunities in Space areas.

(3) To promote the utilization of the Shuttle (such as rationalizing the utilization costs).

(4) To provide for regulatory measures toward Space commercialization.

(5) To conduct coordination with other government agencies.

7.2 NASA's policy on the commercial use of space /77

(1) The status of investigation

In accordance with the directive of Administrator Beggs, the Space Commercialization Task Force (SCTF) was established on June 6, 1983. L. J. Evans, Jr. (presently Deputy Administrator of the Office of Commercialization Plans (Programs) was assigned as the principal staff of the SCTF and reported to Deputy Administrative Aid (presently Administrator of the Office of Space Station) P. E. Culbertson (January, 1984).

The SCTF consists of members from NASA, industry, academia and NASA contractors; investigation was conducted in four working groups. The SCTF was opened for access by other government agencies and industry; and maintained a close interface with Congress. Especially in the interface with industry, it was able to work on close terms with the White House Industry Advisory Group (on Space Commercialization) and the SCTF Advisory Council. The SCTF accomplished the following:

(1) proposal on NASA Commercial Space Policy (NCSP)
(2) NCSP Implementation Plan
(3) general dissemination of information; plan for expansion of cooperative activities between NASA and the civil (private) sector
(4) advice on budget initiatives
(5) advice on commercial initiatives that exceed NASA's prerogatives

(2) Brief summary of NASA's policy on the commercial use of space

The brief outline of "NASA Commercial Use of Space Policy" which was formulated by the SCTF and released on November 20,

1984, is as follows:* /78

1. This policy has as its purpose to encourage the investment and participation by private enterprise in the commercialization program that is derived from utilizing Space. The term, commercialization program, is meant to include the following elements in order of importance:

- The development of new commercial high level technology enterprises (hi-tech commercial ventures),
- new commercial application of existing space technologies,
- commercial enterprises generated by transferring existing space programs to private industry.

2. For the purpose of promoting this (these) program(s), specific implementation plans have been defined with respect to the above policy in five areas: (A) R&D programs and facilities (B) space transportation system application (promotion of) (C) regulations and procedures (D) organization and (E) cooperation with the private sector.

(A) R&D implementation plans

1) In drawing up its Research Plan Proposal, NASA to assign priority to that research that promotes commercial use of Space.

2) To encourage research plans (programs) in the civil (non-government) sector through subsidies.

3) As private enterprise incurs investment risks in

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*For details on NASA's Policy on the Commercial Use of Space and Implementation Plan, please refer to the Space Development Promotion Council Bulletin (Report) (Uchyu Kaihatsu Sui-shin Kaigi-ho) Number 22.

manufacturing products, for NASA to buy up those products as deemed necessary; thereby, covering the investment risks incurred by private industry.

4) For NASA to expedite its evaluation procedure so that JEA may award the contract within six months after receiving a written proposal.

5) When the private sector makes plans for the development of new type Space-related devices and services, even though these plans may not be considered necessary for NASA's development program, for NASA to provide funds for the development of the facilities necessary for private enterprises.

6) For NASA to support in particular those advanced research programs engaged in by the industrial community/universities/ /79
goverment believed to have fall-out potential for commercial industries. These implementation plans have targeted March, 1985 for implementation. There may be situations calling for revision of NASA's charter in which case the implementation could be delayed until September.

(B) Facility/transportation system aspects

1) To lower the cost of Shuttle use in those Space utilization ventures with a commercial base in the R&D phase.

2) To reduce by about six months the integration phase for those Shuttles carrying commercial payloads.

3) To define and standardize the interfaces in order to simplify the loading and integration procedures into the Shuttle cargo bay and mid-deck of the commercial payload.

4) To make it possible for private enterprise to use NASA's ground test facilities and equipment at low cost.

5) To guarantee the use of the Shuttle for commercial payloads already worked into the schedule except for those cases considered to be necessary for national security.

6) To make it possible for the following three uses of the commercial payload:

a) The mid-deck and associated facilities in the case of non-military Shuttle missions. However, if the application for use of the commercial payload is not received within 20 weeks in advance of launch, for it then to be used for other programs.
b) To open up (release) the cargo bay to the civil sector once every six months.
c) To open up in entirety or in part, the pressurized module to the civil sector after 1986 or 1987.

(C) Regulation and procedure aspects /80

1) NASA to proceed on the premise that it will neither manage nor control Space utilization that has a commercial base. It will support government agencies in the evaluation of definitions and applicable procedures of all regulations deemed necessary for the commercial use of Space.

2) To encourage the civilian (non-governmental) use of NASA-held technology (including those for which NASA has patents).

3) Other than those cases where it is necessary in the conduct of their assigned duties for NASA to respect the proprietary rights of civil enterprises and not to demand the submission of acquired data.

4) For NASA not to provide such special privileges as low-cost or free use of the Shuttle for those commercial based high-tech ventures that are yet in the R&D phase--that is, such ventures that are being pursued under a joint enterprise agreement (JEA) with NASA.

5) For NASA not to develop the same technologies that are being developed by United States pri e enterprises under the Joint Enterprise Agreement (JEA).

(D) Organizational aspects

1) To support the establishment of an Industry Advisory Group to permit consultations to be furnished with respect to NASA's research on commercial utilization.

2) T establish special offices at NASA Headquarters and at the respective field centers for the purpose of encouraging civil Space use. The office is designated the Office of Commercial Programs (see Figure 7-1) and is composed of three sections as follows:

Technology Application Section - To maintain and strengthen the duties of making available to civil enterprises in the United States those technologies developed by NASA by means such as joint enterprises or by information transfer.

Commercial development Section - To conduct negotiation and coordination on dual or multi-faceted agreements with or among aerospace enterprises or non-aerospace enterprises seeking access to NASA technologies and facilities.

Further, to pursue the development of the commercial market in advanced technologies having the potential to expand further the Space Shuttle and Space Station capabilities in the future.

Planning, policy and evaluation section - To conduct /81
planning of the necessary long-range Strategic Plan for formulating NASA policies for the purpose of expanding the investment of the civil sector into non-military Space and associated activities.

(E) Aspects of joint civilian efforts

1) For NASA to provide advice on the procedures necessary for advancing continuous dialog and working efforts among industry and enterprises in the private sector, believed to be necessary in establishing an Act on the Commercial Use of the Space Environment.

2) To depend on the counsel of financial and insurance circles in cases where the interrelations between NASA and industry and academia are to be strengthened and where it involves decisions dealing with Space commercialization activities.

3) For NASA to reappraise the methodology for making available scientific and technical data to the private sector.

4) For NASA to investigate the employment of specialty companies that can perform in an intermediary role for the government in its dealings with the private sector in order to encourage the participation of the private sector in the commercial use of Space.

NASA has gotten more diligent about the development of Space users in the private sector and on the one hand, has sought points of contact with the private sector via MOU, JEA and TEA; and tasked Booz Allen and Hamilton and Cooper and Grumman Aerospace during the period from the end of 1983 to early spring 1984 to examine the development methodology for the private users with special focus on the Space Station. The intermediary role referred to in 4) above followed from the acknowledgement of the necessity of that role, as a result of the investigation task above; and with the formal announcement of this policy, the intermediary selection /82

process will commence on a concrete (realistic) basis. This /82
intermediary role is believed to be indispensable for strengthening the heretofore lukewarm link between NASA and the non-aerospace related industries.

Incidentally, the following tables are offered for reference: Table 7-3 on the rules for participating in NASA's Microgravity Experimental Research; Table 7-4 which shows the present state of commercial activities enjoining NASA and United States industries. Also, Table 7-5 provides a breakdown of Space activities, and Table 7-6 shows the commercialization trends as forecasted by the CSP Company.

Figure 7-1 NASA Headquarters Commercial Planning Bureau

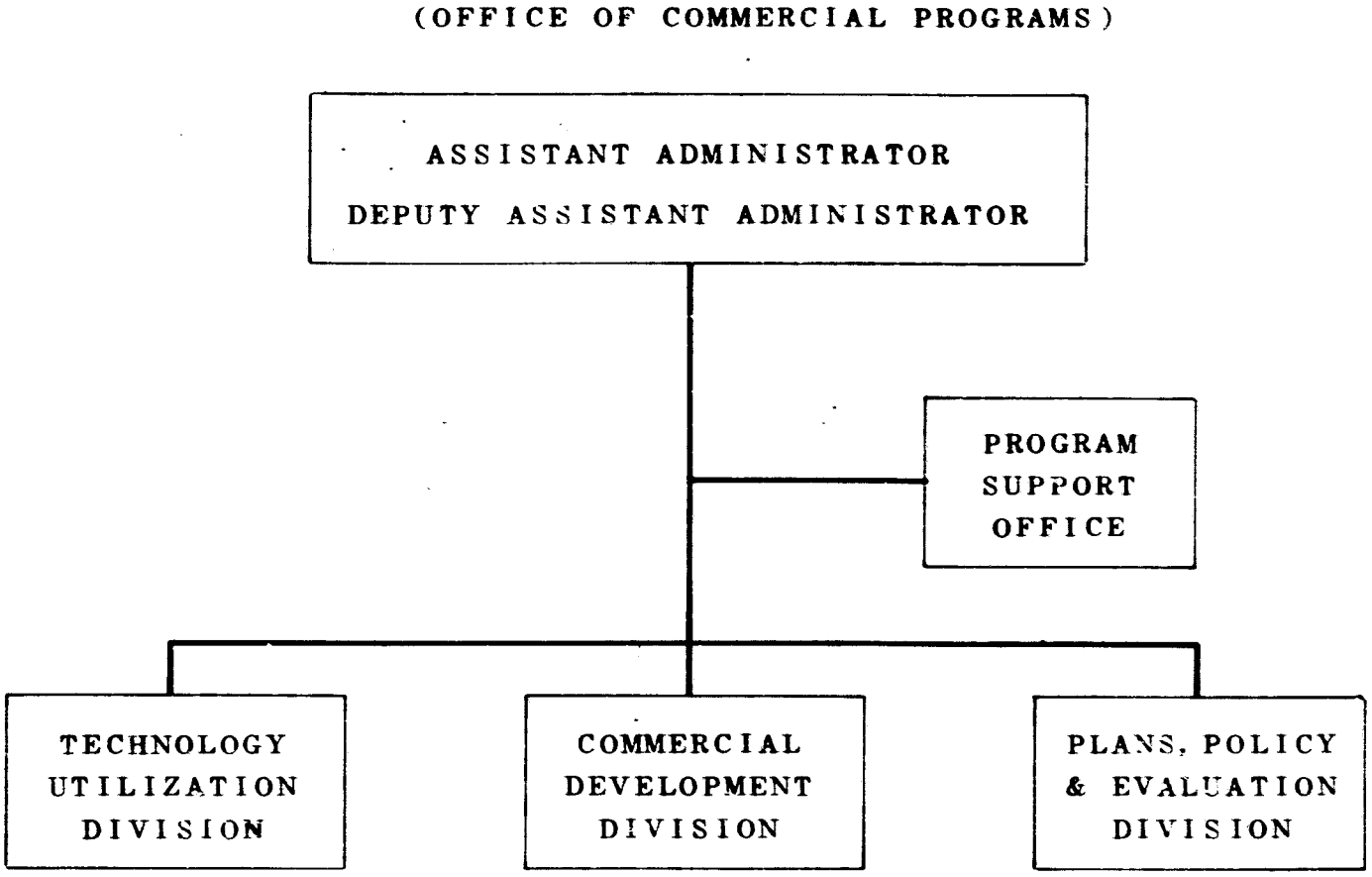

TABLE 7-3. How to apply for participation in NASA's Microgravity Testing/ Research Program

(NASA EP-212)

1. For use by United States Government agencies, Universities and Public Institutions:
   - DEAR COLLEAGUE LETTERS (A.).) based (induced) applications.
   - Foreign government agencies may apply (however, they must bear their own capital)
   - All resulting data must be released to the public.

2. For use by United States Contractors (enterprises):
   (1) MOU————Enterprise F.S. Phase; Joint (Mutual) technology discussions
   (2) TEA————Pre-flight testing
   NASA to provide ground facilities (drop towers, aircraft, research laboratories); capital borne privately.
   (3) JEA————Shuttle flights with special themes.
   No mutual exchange of capital (capital assumed individually).
   Acquired data normally become enterprise proprietary.
   NASA will also use those facilities.
   (4) Contracts——Enterprised based (includes GAS payload)
   (5) Contractor scientists researchers—Studies at the NASA centers on subjects of mutual interest
   (I.G.I.) Expenses of scientists/researchers on duty at NASA to be borne by individual contractors.

Table 7-4 Joint Commercialization Programs NASA and United States Industry

MDAC	cell separation by cataphoresis (continuous flow electrophoresis)	JEA (1980/1 Jan	completed 4 times on STS
MGRA	G_2As production	JEA (1983/3 Mar	1985–1986 in flight
FAIRCHILD INDUSTRIES	lease of unmanned platforms	JEA (1983/8 Aug	1987 starts in
SPACECO	environment monitor of Shuttle cargo bay	JEA (1984/1 Jan	1985 starts in
ORBITAL SCIENCES	transfer orbit (TOS) insertion section	JEA (1983/4 Apr	1986 start in
JOHN & DEER	graphite form research	TEA (extended)	transferred to JEA
DUPONT	catalyst material research	TEA (1981/6 Jun	research completed
INCO	electroplating	TEA (1981/8 Aug	research in progress
HONEYWELL	crystallization of Hg,Cd,Te	TEA (1983/2 Feb	research in progress
A. D. LITTLE	long term preservation of blood	MOU (1983/2 Feb	consortium being formed
C2 SPACELINES	contracted services for Shuttle (cargo) loading	MOU (1984/1 Jan	–
3M	research on organics; diaphragm research	MOU (1984/1 Jan	TEA being drafted
SPACE INDUSTRIES	lease of I.S. facility	MOU (1984/2 Feb	May be transferred to JEA
GDC	Civil Atlas-Centaur launch vehicle	contract (.)	being negotiated
TCI	civil Delta launch vehicle	con- (1984/5 May tract	submitted to Congress
GRUM MN AERESPACE	semiconductor materials	MOU (1985/2 Feb	transferred to JEA
ROCKWELL INT'L Co.	fluid experimental devices (FEA)	MOU (1985/2 Feb	Used by NASA also
HUGHES CONN. INC	fluid dynamics experiments	– ( )	1985 (51–D)

* Several MOU, 8 JEA and 6 TEA as of Feb. 1, 1985; project more than a dozen agreements in FY 1985

TABLE 7-5. Breakdown of United States Space Commercialization Activities

Space Commercialization	Transportation systems	Government assumes ELV	Responses to RFP received; NASA awards contract (Delta to TCI; A las-Centaur to GD)
		Independent development by the private sector	under development (example: SSI's Conestoga)
		Shuttle upper stage	operational in part (PAM); other under development (TOS)
		Shuttle acquisition and operation	depends on what NASA decides to do about Orbiter No. 5
	Satellite systems	communications/broadcast	operational (communications); under development (broadcast)
		government assumes remote sensing system	Metsat--not considered feasible for commercialization
			Landsat--RFP issued Jan. 3, 1984. Close date March 19. Single EOSAT firm selected in Sept. 1984. (currently under negotiation with NOAA)
		private sector to develop independently	Space America (remote Center AEROS)
		Satellite pre-launch preparation	Astrotec Space Operation completed. Orders received for 6 satellites in 1985
	use of Shuttle, Space Station, etc.	commercial programs on the use of Space Station; commercial programs on use of Space Shuttle and Free Flying platforms — material processing, Life sciences, other	MDA/J&J materials processing being tested on the Shuttle; others being investigated and/or under preparation

TABLE 7-6. Forecast of Space Commercialization (according to CSP Company, U. S., March, 1985) /87

Δ Forecasted areas with great potential
- Manufacture of pharmaceuticals (protein crystals)
- Inorganic crystals
- Organic crystals
- Glass
- Special metals/alloys
- Other

Δ Forecasted gross revenues (until the year 2000)
44.5 to 53.0 billion dollars (1.1 to 1.3 trillion yen)

	Forecasted Areas and Gross Revenues (until 2000)		Total (M$)
processing, manufacture of materials	production of pharmaceuticals	~20,000	≲25,000
	inorganic crystals	~ 3,100	
	organic crystals	~ 800	
	glass	~ 500	
	special metals/alloy	~ 500	
	other	~ 100	
satellite communications	fixed services	10,000~12,000	15,000~20,500
	D B S	4,700~ 7,500	
	mobile services	~ 1,000	
remote sensing	• sale of unprocessed data		≲2,000
on-orbit services	• satellite on-orbit service	260~ 1,300	~800~2,400
	• lease of platforms	550~ 1,100	
Space Transport Industry (rockets)	• civil launch vehicles/ upper stages		~800~1,000
ground support	• satellite pre-launch processing • space insurance		~925~1,700
total			44.5-53.0 billion dollars

8. IMPRESSIONS OF ADVISORS AND TEAM MEMBERS /88

Space Development Council
Member: Naribumi Saitō

In my position I have had frequent opportunities to visit NASA Space Centers, but based on those experiences, I feel I can readily appreciate the thoroughness of the concerns with which NASA officials prepared for the visit by this particular study team. The presentations and the facility tours in small groups for which specially prepared materials were presented by Administrator Smith at Kennedy Space Center and the assigned specialists (experts) were especially exhaustive offerings. We have heard that tours of the Orbiter Repair Facility (OPF) are not normally permitted, but the guided tour which allowed us to view the tile replenishment procedure wherein we were able literally to crawl into the under part of the Orbiter left quite an impression with us.

At the NASA Headquarters meeting, we were given detailed briefings or presentations which provided answers to questions we had submitted in advance, including subjects such as on the Space Station Plan, the Space Shuttle transportation system and Space communications programs. This was followed by greetings from Administrator Beggs, thus completing a most rewarding day's program. The Conference Room in which this meeting took place was introduced as the specific place where all the important NASA decisions were made, for example, on the Apollo program, Space Shuttle program and the Space Station plan. In my own case, when I participated as Japan's delegate to the regular interface meeting (SSLG) between NASA and the Space Development Council, I was overwhelmed with a feeling of excitement by the fact that we exchanged some "hot" arguments on international cooperation with respect to the Space Station concept--in this very room.

This warm hospitality shown by NASA toward our study team is believed to have been due to the great expectations held by NASA toward our study team which were fostered by such factors first, of course, as confidence in our country as a partner, derived from the steady progress demonstrated in our country's Space Development Plan, and the Japanese government's quick response to the issue of participation in the Space Station Plan; and also NASA's appreciation of the contribution to be made by our country's industrial community (which has as its hub the Keidanren). Especially in the United States at the present time /89 when Space commercialization proposed by President Reagan is the major topic, it appears there is something special about the attention being directed toward our country's industrial community.

At the end of the meeting with Administrator Beggs, I made a straight-forward statement as follows: "I am truly thrilled to have been able to meet in this very Conference Room this time as a Special Advisor to the Keidanren Study Team, and as Japan's chief delegate to the SSLG two and a half years ago. By this I mean that I firmly believe that we were able to demonstrate to you that we are exerting our best effort toward participation in the Space Station Plan in a consolidated effort between the Japanese government and the unified industrial circles of Japan, as represented by the Keidanren".

This was certainly not diplomatic rhetoric, but represented my sincere personal feelings, and also the purpose of why I so gladly allowed myself to join the study team. After the meeting ended, many team members also expressed their joy at what I said, and I felt very good about it.

It was on the occasion following the meeting with NASA when I went with Team Chief Sekimoto, Chief of Keidanren Development Section, Morikawa, Advisor Yorimizu and others to visit Ambassador Okawara, that the Ambassador expressed delight that Japan and NASA were enjoying a good relationship through joint

international efforts in the midst of times when he was being plagued with the headaches concerning Japan-U. S. trade frictions. I felt keenly that our nation's participation in the Space Station plan (program) not only had great significance toward our nation's Space development efforts, but had an enormous role in achieving Japan-U. S. friendship.

At the study team's adjournment ceremony following the final day's social evening, I expressed my deepest appreciation for the fact that Team Chief Sekimoto and all the members of the study team who literally comprise the front line leadership of Japan's industrial world, had for one full week immersed themselves totally in the study and evaluation of the Space Station plan (program). I believe that the team membership collectively shoulder more than 95% of our nation's Space development industry. It is not an exaggeration to state that the members of our study team will literally provide all the support to our nation's Space development efforts. It is my fervent hope that you will continue to provide your support and cooperation.

Space Development Corporation /90
Yoshio Yorimizu, Director

I was able to participate in the role of an "advisor" to the Keidanren's Space Station Plan Study Team's visit to the United States, and thereby to visit NASA Johnson Space Center, Kennedy Space Center and Headquarters over about a week's period from February 18.

Special preparations were made for the study team and the places visited; and we were treated with the greatest hospitality. In particular, at the Johnson Space Center, we received a briefing by Astronaut Crippen; at the Kennedy Space Center, we toured the OPF and witnessed repair operations in progress on the Discovery; and at NASA Headquarters, we were greeted personally by Administrator Beggs. All in all, we were overwhelmed by NASA's

kind considerations.

Further, the tours of Johnson Space Center Mission Control Center and the Shuttle Mockup-Training camp, the Space Shuttle launch complex and the VAB at KSC, and the IMAX made for a great harvest of knowledge and understanding for me as I had been limited in my exposure to these matters only to photographs and films.

Our nation is to participate in the Space Station plan in the Testing (laboratory) Module, but Japan is without technical experience in the realm of manned Space problems. It is necessary, therefore, for us to exchange information on a close basis with, of course, the United States and with the ESA, too. We must skillfully acquire all the data possible on the FMPT to be conducted in 1988 to keep this program effort moving.

In any case, I believe this visit to the United States enabled those of us who are to take the reins in the implementation of the Space Station plan which holds great promises for creating new technologies and new products, to firm up our future thinking and to reaffirm our resolve to take on this program effort.

Finally, I extend my sincerest thanks to all the persons who were involved in the planning of the dispatching of this study team and to those who provided all the kindnesses; and offer this memo of my impressions simply as they came to mind.

Ishikawajima-Harima Heavy Industries /91
Executive Director, Sadao Takahashi

Ever since United States President Reagaon formally announced the promotion of the Space Station Plan in January of last year, we have joined in numerous activities as the

interest in the Plan quickly rose in our country, including the visit by NASA Administrator Beggs. However, as a result of this study team's visit, I was thoroughly astounded at the enormous scale of the United States Space development program which I found to be quite beyond anything I had ever imagined. In particular with regard to the Space Shuttle program planning and achievements, I experienced unabated interest and was awestruck at each and every briefing and viewing with my own eyes the mammoth hardware which symbolize the very epitome of the latest science and technology. I again was made to believe in the old saying, "one hundred words cannot match one look".

Up to now, each time that we heard the report that another launch of the Space Shuttle had been delayed or postponed, we exclaimed arrogantly, "What are they doing?...this would never happen in Japan". But when I actually set my eyes on the Shuttle, I was overtaken by a mental frame where I could not help but feel a great sympathy--that it was not unreasonable for these delays and postponements to take place. This was all probably the manifestation of my feelings of intimidation and utter surrender resulting from the great gap that existed between my imagination and reality. As NASA leaders have stressed, the fact that we have never witnessed a single major accident is no doubt due to a continuously tightly knit plan and implementation. I was made to reflect again on America's pioneering spirit and the greatness of its strength.

According to the briefings, the Space Station plan is proceeding smoothly. Europe and Canada, too, are displaying a positive posture. Japan also should be concluding a full fledged MOU; it is believed Japan must unit nationwide or it will not be able to kick off the program. It is most vital to formulate plans at an early stage, and to phase into implementation even a moment sooner. I believe the realization of a Space Station is to be the responsible duty of an advanced nation for assuring mankind's well being.

I believe the key to success does not lie in the pushing of only a single enterprise but in the mutual understanding of the true meaning of the effort as a national joint program. And at the same time, I expect that the many superior Japanese technologies will be utilized in this program; and I believe it essential that we continue our diligent efforts for that purpose.

/92

Finally, I wish to state that this trip was a brief one, but the study team members had many opportunities for intimate conversations, and I anticipate this will play an important part in the many future joint efforts.

Ito Chu Shoji (Trading) KK
Masato Orihata, Executive Director

When President Reagan in his State of the Union Message at the beginning of last year stated, "the NASA Administrator is directed to develop a manned Space Station with ten years", a new challenge was launched, filled with the dreams of mankind. Following that announcement, at a stage where the policy was decided upon for our nation, too, to participate in this Space Station Plan in response to the President's proposal, we were able to take advantage of the opportunity to visit the United States as a Study Team. I believe that the fact that all the NASA agencies that took us in were so extremely hospitable to the Study Team is an indication that the United States has high expectations of the Japanese government and industry.

To state simply my impressions from the visit to the Johnson and Kennedy Space Centers and to NASA Headquarters, it is that the spectacular Space Station concept has with a mammoth funding investment, backed up super high technology, has crossed the threshold into vitalization. I can feel in my flesh the time to come 10 years hence when groups of technicians and scientists commence their scientific research and experimentation in Space, working in shifts.

On the other hand, the difficulties involved in the gigantic system design and the required fine precision for all parts exceed all imagination and this can be inferred from the fact that the launches of the Shuttle have been delayed or postponed so many times. I believe this is indicative of three things.

First is that it will probably be inevitable that the Space Station development will have to proceed without a clear definition as to whether or not the Space Station plan will evolve into something that will provide a commercial base. Can we expect something that will match the gigantic investment that provides for two and three level safety? I cannot help but feel that without government direction there will be a limit to how much a burden the private sector will be able to shoulder.

/93

Second is the issue of the advantageous position held by the United States manufacturers by virtue of their head start in the business. For Japanese industry Space is still an unknown territory, and we would expire should we take on research and development in the dark. In the face of selection of United States manufacturers who are aligning to the NASA program, I believe it desirable that we work on developing joint technical working or exchange relationships.

Third is that there are offered many areas where Japan's manufacturers can make significant contributions by virtue of their superior quality control over hardware systems. What absolutely must not be lacking in the construction of such a precision system is hardware quality. I believe it to be inevitable that Japan will assume increasingly greater roles in the construction, of course, of the Japanese module and of the other nations' modules, too.

Finally, I give my deepest thanks for all the kindnesses extended by the Chief of the Study Team and by all the individuals of the different agencies. I also wish to add that the opportunity to join in the team over a four-day period, thus becoming intimately acquainted with the team members, was another rewarding experience for me.

Kawasaki Heavy Industries, KK
Tadahiko, Iwata, Executive Director

Among the primary objectives of this study team were to meet and get acquainted with the various individuals who comprise the top responsible officials at NASA in the Space Station and to tour the facilities at Johnson and Kennedy Space Centers, but it was quite an intense schedule where we attempted to digest the context of these objectives within each day, including travel time.

However, in spite of this tight schedule, we were able to achieve a great insight into matters of great depth. This was due in part to the two sessions of lectures given by the people at the Science and Technology Agency and the Space Development Corporation prior to our departure, and to the fact that NASA officials presented us with friendly yet frank briefings and discussions, based on material prepared especially for our visit. I hereby express my deepest gratitude for their kind efforts.

/94

At a point aside from impressions concerning the study itself, I would like to comment on a particularly deep impression I experienced on the second day of the tour, that is at Kennedy Space Center.

This is the base where the work related to space launchings as "America's Spaceport", about which Mr. Gray provided briefings and a conducted tour. He gave us a detailed explanation on how

the preparations were progressing toward the launch of the Space Station. I believe this preparation planning is proceeding from the abundant experience gained to date, and derived a great personal interest from this exposure. It is possible that this feeling could be traced to the fact that there was a similarity to the convergence toward a goal as we aircraft people made our preparations toward the flight of aircraft. What was particularly impressive was the point that a prime goal for Ground Processing Philosophy is Optimization of Maximum Assurance vs. Minimum Time/Cost. This was because I believed it to mean that this effort was about to transition into the utilization phase.

Following this, we viewed on a super sized screen, a documentary film on the first launching of the Space Shuttle. I felt that the film was not only magnificent as a work of art, but the spectacle of the structure undoubtedly conveyed great emotion among the populace.

The fact that one of the two astronauts shown in the film being given a great welcome happened to be the very same Mr. Crippen with whom we had shaken hands just the day before while we were visiting Houston, could have intensified our impressions further.

Sumitomo Shoji KK
Tomikazu Akiyama, Executive Director

Our visit to the United States on this occasion lasted for only the very short period of three days; but in that time, I became strongly convinced that the long range plan whereby a permanent station was to be built in Space and for humans to reside there normally was no longer a figment of science fiction, but has already started moving out into reality. /95

I had heard that not all pepple supported with complete confidence in the ultimate success at the time of commencing programs such as the Apollo which contributed mightily to the national prestige by landing man on the moon, and the Skylab and Space Shuttle programs which followed; nevertheless the United States achieved these programs in spectacular fashion. The Space Station plan appears to enjoy the strong support of the public, and I have a strong feeling that the Space Station will achieve success. The frontier spirit continues to be in vigorous shape in the United States. I had up to now frankly regarded Space as something in the realm of another world, but acquired during the course of our visit to the United States a feeling that reality in Space is quite near at hand. I highly recommend to any person to be associated with this project in the future, whether he be government or privately affiliated, to visit the United States in particular NASA to get a first-hand personal look. I would urge all member companies of the Space Station Utilization Discussion Society (Supesu suteshon Riyo Kondankai) which is being sponsored by my company as an administrative office, to make opportunities to visit NASA at the earliest time possible. (I would even consider our company taking a key role to organize a mission for touring NASA sites). I am convinced that a hundred words do not match one view, and that a visit to the United States would greatly help to get an insight into the enthusiasm and seriousness with which the United States is taking on this project while also providing direction to our efforts to investigating the steps by which our nation should proceed in the future on this project.

Although there is the aspect that the objective of the Space Station plan is really to impress the United States domestic and foreign worlds with the notion of a strong America as President Reagan has so repeatedly stressed and to revitalize a sense of unity which has tended to erosion because of the multi-ethnic make up of the people; however, I felt vividly the strong

will of the United States to continue in the forefront of the world in the fields of advanced technology. Europe, which is said to be getting behind in advanced technology areas, is taking advantage of the opportunity to participate in the Space Station plan with the ESA (European Space Agency) as its core, and has determined at staff level conferences of the ESA participants to increase significantly their Space development budgets in the future. As we observe the activities of these several countries, we feel keenly the necessity to immerse ourselves seriously into national enterprise a Space development effort which is regarded as a treasure trove of new technology to secure Japan's future international competitive position toward the long range goals Japan is seeking as a high tech nation and as a pacer in advanced technology trade.

I further believe that to take on the Space Station program under the provisions of joint efforts among Japan, the United States, Europe and Canada would be to play a significant role in the strengthening of the ties among the free world nations, thus to be completely in line with the benefits derived for Japan. /96

Finally, I express my gratitude to Team Chief Sekimoto who organized the visit to the United States by the Study Team and to all those people from the Keidanren Administration Office and the Science and Technology Agency as well as NASDA for their efforts.

Toshiba KK
Tomoe Okuda, Director

Joining the Study Team and visiting JSC, KSC and NASA Headquarters at a timely phase when the Space Station plan was proceeding into its Phase B Preliminary Design phase, together with a most appropriate consideration by NASA officials combined to achieve useful results. Also very meaningful was the fact

that I was able to establish contact with the associated team members and to exchange ideas with them as an affiliate of an enterprise that will be participating in the future in the Space Station plan under the guidance of the Science and Technology Agency and the Space Development Corporation.

I felt I had had a grasp of many points on the context of the Space Station plan because of the many studies conducted in our home country, but receiving the briefings directly from the NASA staff, I acquired the feeling of a high evaluation placed on the political and technical roles which symbolize the leadership and United States prestige in Space arising from the significance of the Station plan, in particular the participation of the free world nations.

The visit to KSC provided me with the first opportunity to be impressed with the posture of NASA wherein they were exerting great efforts to obtain a consensus of the public with respect to the Space program which has drawn the interest of so much of the nation.

With respect to the development of commercial use of the Space Station plan which is to be capable of securing and maintaining on-orbit services and to operate over long periods of time, I felt as I listened to the briefings that I acquired the feeling that there was the possibility to develop into areas which are unknown at the present time.

It goes without saying that this plan is dependent to a great degree on the legacy of the Shuttle capabilities, but I was left with the feeling as I listened to the briefings on the speed with which the Shuttle could accomplish its turn around from landing to the next launch, and on the Shuttle tile repair operations, that things were simpler than I had previously imagined. However, I was totally awestruck by the enormity of the development efforts to date. /97

In any case, I feel the same sentiments as expressed by the Team Chief on the occasion of adjournment of the Study Team, that is, that there was great significance to this Study Group which was formed under NASA to enhance cooperative efforts among industry, and to pursue this program in accordance with a national policy.

Nissan Motors KK (Nissan Jidosha)
Kazuo Shibata, Executive Director

I had the opportunity to visit two Space Centers and NASA Headquarters in the United States as a member of the Keidanren Space Station Plan Study Team's visit to the United States. By touring the facilities associated with Space development at the places visited and by listening to briefings presented by many presenters including many key officials, on the present status and future outlook of the United States Space Station plan, I feel I can appreciate the greatness of this program which was personally proposed by the United States President. From the vantage point of the Plan's international joint cooperation, I was able to gain useful knowledge and an insight from the indication that Japan's cooperative approach was being enthusiastically welcomed, and the hospitality toward the Study Team was beyond our expectations.

Some of my impressions of visited sites are listed below:

Johnson Space Center: Following a general briefing in the Conference Room, we toured the Mission Control Room, the Shuttle Mock-up Center, etc. It was said that this Mission Control Room was provided with the highest performance capabilities, and controls all aspects of Space flight related to manned missions. The training facilities were complete; it was pointed out that for the success of manned space flight, not only must the hardware be superior, but that it is necessary for astronaut training to be thorough.

Kennedy Space Center: Following a general briefing at /98
headquarters, we toured the launch firing facilities (Orbiter service building, Vehicle assembly building, Shuttle firing (launch) stand, etc.). It was most enviable for me to behold all the different facilities arranged at ample safe distances from one another on such a large scale that comprise the launch base of expansive real estate. Just coincidentally while we were touring the Orbiter service building, the Orbiter's damaged heat shielding tiles were undergoing manual repair. It appears that this type of work becomes involved in the Shuttle project which is the epitome of science.

NASA Headquarters: We were given detailed briefings on the Space Station plan by Administrator Beggs and Director Pedersen of the International Affairs Division. They emphasized the fact that now was the time to commence the Space Station plan as the Space Shuttle was operating effectively, and the fact that this plan was taking into consideration international joint cooperation and commercial utilization. The United States budget allocated to this Plan is gradually being received. It appears probable also that United States industry is conscientiously joining in this Plan, international cooperation is being developed and the Plan is moving forward deliberately.

Finally, it is my opinion that the United States which had heretofore been soliciting the participative cooperation of several countries in the Space Station plan, is evaluating Japan's position as a dynamic posture of unified cooperation between the government and the private sector toward the United States Space Station Plan, as a result of contact with our study team.

I feel that in order to participate in an international program such as the Space Shuttle Plan, it will be absolutely

necessary for us to plan for the promotion of the Plan by assuming a long range view, a proper budget and an even more determined combined government-private effort.

Nissho-Iwai KK
Takehiko Tsuchiya, Director

Following announcement by President Reagan on the implementation of the Space Station Plan in his State of the Union Message on January 25th of last year, and upon receipt by Canada, the United Kingdom, France, West Germany, Italy and our country of the solicitation for cooperative participation in that Plan, /99 we initiated action in our country to participate in it as a full fledged international program. That is to say, our country, too, acknowledged the great impact that the Space Station Plan could have on future Space development and Space activity; the many industry groups established their individual Space utilization study workshops, and the Keidanren, too, in November of last year organized the "Space Station Plan Participation Promotion Special Committee" made up of trading concerns, Space development makers, banks, user firms, etc., with President Tadahiro Sekimoto of Nihon Denki (Japan Electric) as Committee Chairman. The committee is currently involved not only in liaison with the related ministries and government bureaus, but providing a forum for the exchange of opinion among the committee membership, and for the time being, the gathering of information.

In the brief visit by the Keidanren's United States Space Station Plan Study Team which consisted of six business firms (trading companies) and eight Space related companies as its core, we visited NASA's Johnson Space Center, Kennedy Space Center and NASA Headquarters in Washington, D. C., which provide the thrust for the United Space Station Plan; and received detailed briefings from Administrator Beggs, Director Culbertson

of the Office of Space Station, Director Evans of the Office of Commercial Planning, and others on topics such as the significance of the Space Station Plan, the Space Station Plan's operational progress status and future schedules, plans and policy concerning the nurturing of Space industries including the commercial utilization programs. With all of this, I believe our initial objectives of the visit were sufficiently accomplished.

As Team Chief Sekimoto stated at the Study Team's kick-off ceremony and again at the adjournment ceremony, should not we members of the Space Station Study Team to the United States, as responsible individuals in our respective enterprises, cooperate with one another and join forces in promoting the Space Station Plan in our country and act as the prime mover to assure its success?

Hitachi Manufacturing
Susumu Isa, Managing Director

IMPACT: One hundred words do not match one view. We were brought to bear witness as if a show of strength to the foundation of the United States Space development located through the Space "belt" of the U. S. South. The static JSC and the dynamic KSC are linked in a complete organic interlock, and a finely twined fabric of a schedule proceeds from a lateral expanse of Levels A, B and C and the Definition Phase into the Development Phase. /100

We were powerfully made aware of the massive significance of the Shuttle. Shuttle technology will probably follow a variety of course changes toward the target--Space Station. We were to witness in a trip of only four days the confidence and determination well within the Team Chief and all the members of the "government, academia, manufacturer, trader" combine.

A'LA CARTE

(1) It is massive. Perhaps because it is primarily a quiet brain center, JSC appears to be rather involved in high level control technology, training and more recently, functioning as a Space Station Planning Center, very little there aroused my enthusiasm, but leaping over to and setting foot into KSC, this feeling completely changed as a body crunching impact was experienced from the presentations, one to the next in succession. These were all specific and real. At the Shuttle Orbiter service building, the Discovery was undergoing overhaul in the manner of a bomber plane prior to its flight into combat. In another building, remote measurements were being taken on the pre-loading phase of the payload in its final testing in a simulated configuration within the Orbiter. We further entered the largest building within the complex, the VAB (the Shuttle assembly area). The height is said to be 160 meters, and the floor space equal to three times the Korakuen Ballpark. A 200-ton class crane runs along the ceiling. This crane suspends the Orbiter in a vertical position and transports it laterally in one movement to the rocket attachment area. On hearing the latter, any doubt about its being an "egg of Columbus" was completely dispelled, causing me again to gaze up at the 160 meter ceiling. The second thing of massive scale is the crawler transporter which transports the completely assembled Shuttle in a vertical position from the VAB to the launch stand. The transporter is said to be capable of bearing loads in excess of 2000 tons,

turning its path 360 degrees in a single swing, and transporting the Shuttle in a vertical position while moving along steep inclines. The third thing of massive scale is the launch pad. It is 39 LC (launch complex) located on the north end of the Banana River. 39B is currently undergoing refurbishment and we were able to view it close at hand. It would be a gross error to think of it as a simple rocket launcher. As the designation "complex" implies, it gives the impression of a greatly expanded scale of a super precision machine. The mere beauty of the structure was enough to take one's breath away. Complex 39A appeared forlorn in the distance as it was standing in a /101 waiting status devoid of the Challenger which we were scheduled to view, because of its painful sore point, the peeling heat shield tiles.

(2) Shuttle trip: "Shuttle One Trip" can be regarded as a one-scene play, but as several trips build up, a major drama unfolds. I hear that 30 to 50 days are required for "one trip" from launch, the mission, recovery, ground servicing (for turn around). Since Columbia was launched on April 12, 1981, as STS-1, "one trips" have gradually increased and five such trips were made in 1984. At the present, the two spacecraft, Discovery and Challenger, are being used primarily; in the near future, the Rockwell Company-led Atlantis will be completed and with the modification of the Columbia, it is planned for 19 trips in 1988 using four configurations. "One trip" costs 42 million dollars (11 billion yen), the trend is inflationary, and it is predicted that the cost will reach 70 million dollars by 1988. This may be a relatively small amount compared with NASA's total budget, but the proportion within the Space Station budget is quite large. Considerable and painstaking attention is being directed to cutting costs by such efforts as booster rocket recovery and the elimination of paint jobs on the fuel tanks, but it is my opinion that authority to enforce "allocation method" cost distribution must be acquired, moreso than to

concentrate on the acquisition of a budget dependent upon the "Cumulative Expense Computation Method". Additionally, a simple Shuttle will probably be developed as the first generation Space Station progresses into the second generation Station.

(3) The dominance of defense in the United States Space Budget. 65% of the United States Space Budget of 20 billion dollars (5.2 trillion yen) is associated with defense. It is the complete reversal of 10 years ago with the defense budget increasing year by year. In the five-year period from 1981, the growth rate for defense has been an annual 27% compared with the NASA rate of 8%. The percentage breakdown of the value of contracts awarded by NASA to its 15 principal contractors shows that Rockwell stands way and ahead alone at top with a share of 23.5% (1984) with the other major manufacturers having extremely low shares of 2 to 7%. The Defense Department programs are probably keeping the other contractors heavily occupied.

(4) Not to become isolated from the public. What bothered me as I wrote the comments thus far is the changing relationship /102 with the public. The briefing at JSC by STS-1 pilot, Robert Crippen, who is blessed with the uniquely American cheerfulness, was friendly, forceful and certainly informal (without pretension). The true PR spirit shown at NASA Headquarters in the address by Administrator Beggs and other NASA officials was certainly magnificent; and the popular (appealing to the public) programs for all age groups, from children to the elderly, put on at the Kennedy Information Center certainly left me with the feeling that this was the way it should be. The remoteness of Space development from the public as associated with defense is probably a difficult problem in the United States also.

(5) Tile replenishment and the Orbiter. That the sore point haunting the Orbiter which might be likened to the authority figure of the most advanced technology happens to be the

peeling off of its tiles is a totally strange problem. It is a problem of localized (random) peeling. It is indeed strange that though the damages sustained differed according to location, NASA technology has yet to succeed in solving the problem over 15 Shuttle flights. For replacing the mere single tile that we saw on the belly of Discovery, an infrared lamp for the purpose of drying the adhesive, and the tile which were supported by a wooden post, were affixed by a binder to the top of the stand.

It was as if the program was bewitched by a fox. It appears to be more a point of the humanness of man that can be looked at benignly.

(6) International Space Station. At the NASA Headquarters Conference Room where Administrator Beggs personnally spoke of the numerous historic decisions having been made, he excited us time and again with statements such as, "Within the framework of joint effort, the United States, Europe, Canada and Japan will have equal access". "Information exchange, including political meetings, will become a reality by April". "According to the United States public opinion survey, the Space Station industry ranks among the top four as the industry of the future with the greatest appeal". "Capital will not only come from the government budget but a large amount will come from the private sector". And so forth. Administrator Beggs concluded with the forthright declaration, "NASA will build with confidence, based on an achievement base of 26 years, the Space Station which had been in a concept phase since NASA's creation 26 years ago".

(7) "Iacocca Trip". This trip was one in which my "reading book" changed from "Excellent Companies" to "Iacocca". The book was being read in complete absorption by a Japanese and an American seated across the aisle from each other within the same airplane passenger cabin, in the Japanese and original text versions.

The wonders of virtual simultaneous publication of the translated and original language editions (November 1984)! The transfer of science and technology is rapid, but it appears /103 the publishing world has taken a step lead. I, too, acquired a pair of the books at the Los Angeles International Airport for $19.95 plus $1.30 tax for a total of $21.25. What I found in reading the books was that the original English language text was in very simple expressions, and that the development of ideas was very much as would be presented by a Japanese whereby one could project what was forthcoming in the following pages. I would hope that the Space Station technical documents would be like this.

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Lastly, I thank the Team Chief and all others for their warm guidance and kind considerations. Thank you with all my heart.

Marubeni KK
Masa-e Nagasawa, Executive Director

Though it was a somewhat tight schedule within a brief period, we were able to enjoy a fruitful trip from the time of the Study Team's assembly at Narita on the afternoon of February 18, through one day each at Houston and Orlando, and until adjournment at Washington, D. C. on February 21. I wish to express again my gratitude for the efforts and considerations of Team Chief Sekimoto and the members and aides who joined the visit.

On the occasion of the tour of facilities at the NASA Johnson Space Center on February 19, Captain Crippen, the astronaut who participated in a number of flights on the Shuttle since the first flight in April, 1981, explained the internals of the vehicle--Crippen, rather small-framed for an American, with a rather severe mien, talked very casually, and his

occasionally smiling expression was particularly disarming. By concidence, on the following day, as we completed our tour at the Kennedy Space Center, we were further impressed upon viewing the film, "Hail Columbia", at the Visitor's Center, as it showed the emotional scene where Crippen was toasted with a grand welcome parade upon his return from the Shuttle flight and safe landing on Earth. This further added to our memories of meeting personally with him.

On the 21st at NASA Headquarters in Washington, we met in /104
friendly meetings with Director Pederson of the Office of International Affairs Director Culbertson of the Office of Space Station and, finally, NASA Administrator Beggs. Following this, a grand reception cosponsored by NASDA and the Study Team, which certainly was an evening to be remembered in that it continued well beyond the scheduled time because of the lively conversations among the great number of attendees from within and outside our circle. Also memorable were the words spoken by Team Chief Sekimoto at the adjournment ceremony that took place during the reception. As the Team Chief emphasized again, it is hoped that this trip did not simply terminate at this point, but that the valuable experience gained and friendships made will be kept alive and bear fruit in the future.

Mitsui Bussan KK
Kazutami Ishiguri, Director

We are grateful that although this Study Team existed for only a brief few days, we were able to make the tour and exchange ideas and opinions very efficiently and with great results because of the thorough preparations made by persons from all the involved agencies, prior to our departure.

After all, a "hundred words cannot match one view". What left the greatest imprint on my mind was my sincere feeling from the reality of the conferences with, and the briefings,

by the United States officials; the beholding with our own eyes, the actual Space Shuttle vehicle; feeling directly, the seriousness with which the United States is proceeding toward non-military Space application objectives upon which the United States Government, in particular President Reagan, has staked the country's prestige; and the great expectations placed on the development of Space technologies through the international political medium of a joint agreement among the free world nations.

Of course, it is clear that the intentions of the United States Government which has taken on Space development over a period of almost 20 years, were to attain concrete results from the development of pertinent materials and technologies. As a result, people the world over have received the benefits and we have seen our life style upgraded through the use of communications, broadcast and meteorological satellites which provide a major contribution to the advancement of the world economy.

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However, the Space Station Plan provides a challenge for mankind into new technologies similar to the creation of a new substance. Although it is said that there are currently more than 200 technology items being considered for comparative research, it is thought that it would be difficult to realize near term pay-offs. In fact, the goal of participation in the Station plan should be considered as a high level challenge for the unity and technology advancement among the free nations.

From the vantage point of this high level objective and the proposal of international politics, the United States is acting in the form of government initiatives. I believe our country is in a similar status. (Especially in association with the might of the role to be accomplished by the Reagan regime with respect to this plan, there prevails the opinion from some quarters of Plan supporters that the program should be pushed forth as vigorously as possible while Reagan is in power;

I sensed the weight exerted by the United States Government with respect to this point).

In comparing the difference between the climate in Japan and the United States with respect to the Plan, in contrast to the U. S. proceeding on a thrust mode with the government at its core, Japan gives the impression of a thrust mode based on a combined government-private sector effort, although admittedly Japan is still in the initial stage of development. The combined thrust mode may appear to be the ideal mode but unless there is strong government leadership, one cannot deny being fearful that the Plan's thrust will be meandering in the future. In my opinion, we must ask that the government act aggressively but the private sector, too, must assure the positive support of the industrial circles and of the public in promoting the Plan.

Finally, I totally agree with the statement by Team Chief Sekimoto on the occasion of the adjournment ceremony in Washington that the mission of our nation has just begun and what is important is how it will evolve from here on. I hope to exert my best efforts to contribute my miniscule part toward the long range promotion of the Plan.

Mitsubishi Heavy Industries
Yoshio Sasaki, Executive Director

This visit to the United States was a somewhat busy trip, but I am deeply grateful for the opportunity to live together with Chief Sekimoto and the staff of all the companies, and to receive the guidance of Professor Saito, Director Yorimizu and the representatives from the related government agencies, and the thoroughly prepared itinerary by NASA, thereby succeeding in enjoying a study trip which was extremely fruitful.

I will here try to jot down two or three of my impressions /106

as they come to mind.

I (1) The United States is in the process of making a reality of the "dream among dreams", that is, to have man reside in and conduct research, experiments and processing of materials in Space. I have been greatly impressed by America's greatness im promoting a project of such enormity under a democratic (not a dictatorship) form of government.

(2) Having thoroughly considered and taken into account, on a priority basis, the factors of safety, reliability and maintainability, program planning is already beginning to take form in such aspects as materials, structures and assembly plans; the manned environment; the testing and research plans; electrical power support system; the logistics service plans, etc.; and progressed to the point where NASA states resolutely that "there has been no substantial change". The pacing of this program is truly astounding.

It is said that NASA in the course of accumulating its wealth of experience in manned Space flight through manned satellite flights, lunar landings and the Shuttle program, has invested 1000 technicians and will invest a total of 5000 such persons in the peak period (1989-90)(and the contractors, too, will proceed with their own plans to align their efforts consistently with these numbers).

(3) The fact that the European group, too, has designed a Spacelab and is building hardware is quite an advancement; and it appears they are trying hard to catch up with the United States.

II. Japan will participate in the Plan starting in Phase B. But how will we proceed to join with the U. S. and Europe who are running way ahead of us? Have we sufficient technical personnel? Will a budget be allocated? Will it be enough?

What about testing and program and facilities? What about system planning? What is our overall system management structure--including current level manpower resources, education, facilities, money, timing, etc.?

III. Proposal: The operating level management at the Science and Technology Agency, at NASDA and at the contractors should organize and dispatch the next Study Team at a suitable time for the purpose of exhaustively viewing, listening to, and discussing the NASA methodologies, status of progress, etc. It will be necessary to evaluate thoroughly the above in order to formulate a methodology suitable for Japan (system, approach, etc.). Depending on the subject, we would like to be guided as /107 to the when's and why's of soft and hard (software and hardware), and then for us to determine the need for technology transfer into our country. Since Japan's module is to be attached at a later phase of the program, it will behoove us to clearly establish an attitude of doing our investigating and verifying thoroughly to avoid any situation where we end up with "failure due to missing the schedule" for those factors that have little impact for being late.

IV. Monologue: Although military application has never entered the discussions, will the time ever come when a restriction is placed on the Station which we joined with the U. S. to build? In view of all the shouting about Star Wars and depending on how a hostile nation might act? Will the time come when the budget burden starts to spiral ever upward? It will be necessary to make these points crystal clear in an MOU.

Again, would it not be necessary to nurture the capability to build and operate a manned Station on our own, for some eventuality?

Mitsubishi Shoji (Trading) KK
Yoshio Taniguchi, Executive Director

The opportunity accorded me, as a member of the Keidanren Space Station Plan Study Team, to tour the United States' two Space Centers, Johnson and Kennedy, and to visit NASA Headquarters and hear the briefings by Administrator Beggs and the respective experts on the Space Station Program (SSP) were extremely meaningful and informative for our understanding of the SSP in the future. I believe it was an excellent opportunity for the entire team, headed by Team Chief Sekimoto, Advisors Saito and Yorimizu, and including the key staff of the major companies holding the reins of Japan's industrial world, to consolidate their thinking as experts in their respective fields, as to how Japan must proceed in order to participate in the SSP.

Since I am one who works for a trading company (and not a manufacturer), I am not qualified to comment on the technical aspects, but when I viewed NASA facilities close at hand, I was greatly impressed by the depth of the United States Space Development program which is backed up by many years of accumulated technology and experience, and I sensed keenly the firm confidence and pride with which the United States progresses toward the successful construction of a manned Space Station. I recognized again the deep significance and heavy responsibility involved in Japan's participative cooperation in the magnificent Space Station construction task. I believe it necessary for Japan to be possessed of considerable determination and an adequate system structure in order to take on the promotion of the Space Station program. Also, what interested me in particular were the themes, "how does one seek out commercial use(s) of the Space Station?" and "how does one go about developing those uses?" Along these lines, the words of Administrator Beggs and the Deputy Director, L. J. Evans, Jr., of the Office of Commercial Plans were of particular interest. I believe that the SSP is a plan of colossal scale involving a variety of

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problems such as on the technologies and the funds aspects, but to develop this as a 21st Century program, there must emerge many, many specific plans on the utilization aspects over and above the technology and funding, or we cannot hope for any great progress.

According to the Presentations Papers used at NASA Headquarters, the premise of "commercial use" has been made eminently clear and thereby, that its control will be transferred to a private base. Among the items included in the market sector toward which we will want to focus our attention is "material processing" and five major items headed by "electronic materials", that is, we would focus on how to commercialize these items. My firm has initiated research and development on the processing of "biological materials" in Space, in cooperation with an American company, and are in the process of modifying and deepening our awareness that this effort will contribute in some way to promoting the commercial use of the Space Station in the future. We are anticipating that the funds needed in the application of the SSP will be unimaginably greater than that required for similar tasks on the ground, but we expect that the results will justify the expenditure of such funds, and will contribute heavily toward the advancement of social economy. I believe the problem will be how "top management" will contend with the "risk taking" as we step into implementation of this program. /109

I will consider it most fortunate from the above concerns if I can find the opportunity for further exchange of ideas with all of you whom I was privileged to join in the trip.

Finally, I thank warmly all those persons responsible for conducting the trip without hitch.

Mitsubishi Denki (Electric) KK
Tsunero Shio, Managing Director

First, I wish to thank from the bottom of my heart all those persons involved in providing me the opportunity to escape the realm of imagination and into viewing with my own eyes a panoramic layout of the Space Development Program in the United States. I again physically experienced the meaning of the old cliche, "one hundred words cannot match one view". If I were to include all the detailed specifics, I would have too much to say, therefore, I will confine my comments to those on two major subjects.

(1) We must think very carefully as to what the context is to be of our nation's joint efforts in the Space Station plan.

The scale, specificity and promotional structure of NASA's plan certainly drew one's attention. To state it simply, the practical implementation of Space Station construction and management will probably be conducted under a plan that is totally integrated under the principal leadership of NASA. In particular, the mammoth system that provides for the construction and operation and maintenance of the Station from the legacy of the Shuttle allows room for no one but NASA to handle. Far from being a one-to-one relationship between Japan and the United States, it is more like a single travel trunk being allowed as cargo in a small back corner space of a giant truck. In all probability, Japan will experience great difficulty in making an effective contribution to the basic structure of the Space Station.

Then the problem focuses on what the internals of the travel trunk are to be--and if those internals are of a unique brand, only then can we claim that our cooperative efforts have resulted in a positive contribution. There is not in the

least the notion that a spirit "for the sake of the national prestige, etc., etc." must be shouted forth, but we certainly cannot afford to take the chance being chastised for spouting words without substance. The crux of Japan's serious plans for that purpose will be a critical issue in the future. /110

(2) The efforts needed to obtain the consensus of the public with respect to space development.

It may be an obvious matter if one should so point it out, and it may be claimed that there is no limit to how much one must do in such a vast program as NASA's Space Development Program, yet I believe it totally commanding of one's respect as one observes the fact that the activities at each of the NASA Centers is made as open to the public as possible; that PR materials are prepared in lavish quantities; and that great efforts are expended for the purpose of attaining the understanding and support of the general public.

It is this very background that allows such a large scale project to be smoothly kicked off with only a single message from the President. Even if the levels of budget can in no way be compared, I cannot deny the feeling that we have yet a long way to go in our country in exerting efforts to obtain the broad understanding and support of the public for a national policy on Space development even though there is much noise-making in the public relations battles among all areas of the government and private sectors and among the industrial enterprises (contractors). It will first be necessary to continue the efforts to build an orderly cooperative framework as a premise for mutually understanding the true objective among all the associated segments, and then to assure all the segments are convinced of the need.

Keidanren (Incorporated)
Hanshi Morikawa,
Director of Development

My first impression on this trip to the United States was the extraordinary determination with which NASA is proceeding toward the construction of the Space Station. This is also manifested in the requirement stated for preliminary design in the United States Government Fiscal Year 1985 budget in the amount of 53 billion yen (Japan's 1985 budget plan is for 1.4 billion yen).

It may be obvious from the great difference in comparison with our country, but it may be said that from consideration of the investment of national capital that there is an order of magnitude difference between Japan and the United States in the early phase.

What impressed me next was that under the premise that it would be difficult to accomplish a large project like this without the support of the public, NASA is conscientious in its PR efforts toward the general public, for example, at Space Centers such as Johnson and Kennedy, the care with which the elderly and children and other visitors were attended to, and the patience with which questions were answered no matter how trivial caught my attention. /111

The next thing that impressed me was the depth of America's Space Development resources, including technical and capital investments, and that even more than that depth, what is being realized are the plans required for aggressively drawing out the resources of the private sector.

An outstanding example of this technique is in the realm of taxation whereby favorable conditions are being provided for. The United States has traditionally in comparison with our

country, provided for favorable conditions on taxation of R&D investments by industry. A classical example is the provision for exempting 10% of investment from taxation. I would think this type of policy would be necessary in Japan where technology is weaker than in the United States, but it is the latter that is ahead of the times.

Now, international cooperation is the world of "give and take". The Space Station is no different. Unless Japan possesses a superior, independent technological base and a national will to bear considerable investment burden, we cannot hope for a truly effective international cooperation. It becomes highly desirable to redouble our efforts and to establish effective facilities through a unified government-public body in order to close even a bit the gap existing between Japan and the United States and to develop our own independent technology base.

At any rate, I thank from the bottom of my heart the very thorough considerations shown toward our Study Team by NASA through their facility tours and meetings with their key officials.

Finally, I thank warmly the great support provided our team by the concerned administrative agencies, headed by the Science and Technology Agency and the Space Development Corporation.

9. List of acquired references

9.1 Johnson Space Center

*(1) Space Station Program Overview for Keidanren Study Team on Space Station /112

(2) NASA Facts (The Shuttle Era)

(3) NASA Facts (Earth Resources)

(4) NASA Facts (Space Benefits)

(5) NASA Facts (Manned Space Flight The First Decade)

(6) NASA Facts (Skylab, 1973-1974)

(7) NASA Facts (Lyndon B. Johnson Space Center)

9.2 Kennedy Space Center

*(1) Japanese Keidanren Study Team visit to KSC

(2) America's Spaceport

9.3 NASA Headquarters

*(1) Space Station Presentation to Keidanren

*(2) 25 Years Experience in Space

*(3) Encouraging the Commercial Use of Space

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*(1) Material used in briefing by Director Culbertson of the Office of Space Station

*(2) Material used in briefing by Director Lee of the Office of Space Flight's Customer Service Department

*(3) Material used in briefing by Deputy Director Evans of the Office of Commercial Plans (Programs)

(4) Statement by Philip E. Culbertson
Subcommittee on Space Science and Applications /113
Committee on Science and Technology House of
Representatives

(5) Remarks prepared for The Wilbur and Orville Wright Memorial Lecture, Royal Aeronautical Society, London, England (December 13, 1984)
by Administrator James M. Beggs

(6) Space Station: The Next logical Step by James M. Beggs

(7) Space Station
The Next Logical Step

(NOTE)

*Denotes material prepared specifically for the Study Team