JAPANESE PLAN FOR SSF UTILIZATION

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ABSTRACT

The JEM program has made significant progress. The JEM PDR was completed in July 1992; construction of JEM operation facilities has begun; and the micro-G airplane, drop shaft, and micro-G experiment rocket are all operational. The national policy for JEM utilization was also established. The Space Experiment Laboratory (SEL) opened in June '92 and will function as a user support center. Eight JEM multiuser facilities are in phase B, and scientific requirements are being defined for 17 candidate multiuser facilities. The National Joint Research Program is about to start. Precursor missions and early Space Station utilization activities are being defined.
Japanese Plan for SSF Utilization

T. Mizuno
August 4, 1992
Huntsville Alabama

Experiment Logistics Module
- Pressurized Section (ELM-PS)

Manipulator

Exposed Facility

Pressurized Module

Airlock

JEM Configuration

Experiment Logistics Module
- Exposed Section (ELM-ES)
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1. JEM Program Budget Status (JFY1992)

1.1. JEM Development

(JEM EM, JEM multiuser experiment facility, TR-1A, etc.)

¥33.7B(-262M$)*

¥24.6B(-190M$)

1.2. JEM Operations Preparation

(JEM Operations facility, Crew training facility, etc)

¥4.2B(-32M$)*

¥3.0B(-23M$)

@1Dollar=129yen

* multiyear government guarantee for appropriation

2. JEM Utilization Policy

2.1. Report by SAC SS panel was issued in April 1992.

2.2. Report addresses the following:

(1) Need of national research program for promoting JEM Utilization.

(2) Importance of developing multiuser facilities
    Identification of facility list and development policy.

(3) Cost sharing by users consistent with JEM and multiuser facility
    verification/operation phase.

(4) Identification of AO issues and experiment selection timing and
    frequency.

(5) Importance of precursor missions.
3. JEM Development Status

3.1. JEM PDR

Contractor PDR January to March 1992
System PDR June to July 1992

3.2. Technology Development Test

JEM Maintenance and Repair simulation using MSFC WETF in Nov. 1991

3.3. Engineering Model (EM) and Proto-Flight Model (PFM)

EM Contracts started in March 1991
PFM budget request is being prepared

3.4. Construction of JEM Test Facility at TKSC

Construction starts in summer 1992
### 4. JEM Operations Capability Development Status

#### 4.1. Design of JEM Operations System

- **PRR**  
  **March 1991**

- **System Review**  
  **Oct. 1993**

#### 4.2. Crew Recruiting

- MS candidate was selected in April 1992
- SS/SO will be recruited every two years

#### 4.3. Construction of JEM Operations Facility

- Weightless Environment Test Facility construction started in March 1992
- Astronaut Training Facility Construction will start in summer 1993
- Construction of SS Operations Facility (Regional Operation Center for JEM) will start in summer 1993
4.4. Development of JEM Operations Planning system
   - Strategic/Tactical planning software and database are being defined

4.5. JFD (JEM Flight Demonstration)
   - JEM Manipulator servicing capability demonstration test will be held in 1996 using STS

5. Status of Ground Research to Develop Generic Experiment Support Technology (GEST)

5.1. Drop Shaft/Drop Tube
   - JAMIC Facility (10 sec. μ-G) has been operational since 1991
   - MGLAB Facility (4.5 sec. μ-G) will be operational in 1993

5.2. GEST Development using μ-G Airplane (MU–300 Business Jet)
   - Routine 6 month/year parabolic flight since Sep. 1990

5.3. GEST Development using TR–1A Rocket
   - Successful first flight in Sep. 1991
   - Next flight in Aug. 1992
Themes and Co-Investigators of TR-IA Rocket Microgravity Experiments Program

<table>
<thead>
<tr>
<th>Experiment Module</th>
<th>TR-IA No.1 September 16, 1991</th>
<th>TR-IA No.2 August-September, 1992</th>
<th>TR-IA No.3 August-September, 1993</th>
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<tbody>
<tr>
<td>Module for Experiment Observation Technologies</td>
<td>Field observation of boundary and environment phase in crystal growth</td>
<td>Katsuo Tsukamoto (Tohoku U), Kazuhiko Kuriyayashi (ISAS), Tsutomu Sawada (NIRIM)</td>
<td>Marangoni convection generation and control</td>
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<tr>
<td>Module for Measuring Basic Physical Properties of Fluids (FTX)</td>
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<td>Hisao Azuma (NAL), Akira Hirata (Waseda U), Keiichi Kuwahara (IHI)</td>
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<tr>
<td>Module for Experimenting Environment Maintaining Technologies (BDH)</td>
<td>Bubble generation, growth and movement</td>
<td>Yoshiyuki Abe (Electrotechnical Lab), Masamichi Ishikawa (MRI), Shinya Ishii (MHI)</td>
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<tr>
<td>General-purpose Furnace (ITF)</td>
<td>Melting and solidification of particle-dispersed alloy</td>
<td>(Not applicable)</td>
<td>Ceramic material composition</td>
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<tr>
<td>Temperature-gradient Furnace (TG)</td>
<td>Yuji Muramatsu (NRIM)</td>
<td></td>
<td>Osamu Odawara (TIT)</td>
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<tr>
<td>High-temperature Furnace (HTF)</td>
<td>(Not applicable)</td>
<td>Semiconductor liquid growth</td>
<td>Effects of microgravity on the shape of solid-liquid boundary</td>
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<td>Tatsuo Nishinaga (Tokyo U)</td>
<td>Kyotachi Kinoshita (NTT)</td>
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<td></td>
<td>Melting and solidification of high-temperature oxide superconductor</td>
<td>Melting and solidification of vitreous material</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kazumasa Togano (NRIM)</td>
<td>Junji Hayakawa (GIRIO)</td>
<td>(Not applicable)</td>
</tr>
</tbody>
</table>

TR-IA MISSION PROFILE

Beginning of the experiment 110 km t = 80 sec

End of the experiment t = 441 sec

Rate Control

Payload Sep., Burn out

Telemetry

NASDA TNSC

6.1. NASDA Space Experiment Laboratory (SEL) at TKSC
- SEL plays an integral role for Japanese USCs
- SEL became operational in June 1992

6.2. Discipline USCs Concept
- Major National Institutes are expected to function as discipline-oriented User Support Center
  E.G. NAL for Fluid physics
  NIRIM for Inorganic Materials
  NRIM for Metals
  ISAS for Astronomical Observations

6.3. Telescience Technology Application
- Telescience technology will be applied to link NASDA SEL and Discipline Centers
7. Onboard Multi-User Facility (MUF) Development Status

7.1. Selection of MUF

- MUF Candidate List was completed by Pre-AO survey
  List includes three categories, a definitive one, one which needs to
  be coordinated among international partners, and one which needs
  to reflect each year's AO

- JEM EM system/MUF verification test

- JEM traffic model study identifies early stage of MUF
7.2. Technology Development Status
   - 5 MUF technology development will continue until early 1993

7.3. Requirements Update by User Advisory Group
   - 9 Advisory groups were established
   - Requirement update will be completed by summer 1992

7.4. Coordination among International Partner
   - Multilateral (MUWG)
   - Bilateral

8. Organized National Joint Research using Space Environments

8.1. Significance of the Joint Research
   - Enhance research by coordinating/complementing research among national institutes, universities, private sectors
   - Easy to accommodate experiments in SS

8.2. Joint Research Plan
   - STA authorizes the Joint Research (Core Research)
   - NASDA develops experiment technology and offers space flight chance
   - Assigned Institute for Core Research conducts the research management
     E.G. NAL, NIRIM, NRIM
   - JSUP supports general management of the Joint Research
   - The plan will be implemented in mid 1992 and will evolve step-by-step
9. Status of Precursor Mission and JEM Early Utilization of Definition

9.1. Space Experiment Status

(1) TR-1A sounding rocket
   #1 Sep. 1991, #2 Aug. 1992, #3 Summer 1993
   follow-on flights are under study

(2) IML-1
   Jan. 22, 1992, 2 NASDA Experiments

(3) FUWATT '92 (SL-J/FMPT)
   Sep. 1992, 34 Japanese Experiments

(4) SFU      Feb.-June 1994

(5) IML-2    July 1994, 12 Japanese Experiments
9.2. Definition of follow-on Precursor Mission

(1) Preliminary study of Follow-on TR-1A flight, E1 participation, Spacehab Utilization
(2) Dialogue with international partners for potential cooperation

9.3. Definition of Early Utilization of the Space Station

(1) Traffic model study of JEM early utilization
(2) Dialogue with international partners for potential cooperation
1. Storage container
2. Storage container
3. Blank panel
4. Thermoelectric radiator (TE-17)
5. Free flow electromechanical unit (FEMU)
6. Infrared telescope (IRI)
7. Light imitator controller (LIC)
8. Data interface unit (DIU)
9. Power distribution box (PDDB)
10. Thermoelectric radiator (TE-17)
11. Vertical function assessment unit (VFU)
12. Access panel (*)
13. Equipment power switching panel (EPSH)

Note: (*) Provided by NASA
<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MB12(JEM#1)</strong></td>
<td><strong>UF5</strong></td>
<td><strong>UF6</strong></td>
</tr>
<tr>
<td>Experiment Equip.</td>
<td>Clean ↑ bench</td>
<td>FPEF ↑ (norm. Temp)</td>
</tr>
<tr>
<td>IF</td>
<td>GHF ↑</td>
<td>ISCS ↑ SEMS ↑</td>
</tr>
<tr>
<td>G HF</td>
<td>ZMF ↑</td>
<td>SGF ↑ LF ↑</td>
</tr>
<tr>
<td>ZMF</td>
<td>PCF ↑</td>
<td>EPF ↑ SAHF ↑</td>
</tr>
<tr>
<td>PCF</td>
<td></td>
<td>TES ↑ SPSS ↑</td>
</tr>
<tr>
<td>LSE</td>
<td>Image processor</td>
<td>Refrigerator ↑ Freezer ↑</td>
</tr>
<tr>
<td>UP mass (Except Specimen)</td>
<td>~2.5DRE</td>
<td>~0.75DRE ~0.5DRE</td>
</tr>
<tr>
<td>IF : Isothermal Furnace</td>
<td></td>
<td>PCF : Protein Crystallization Facility</td>
</tr>
<tr>
<td>SGF : Solution Growth Facility</td>
<td></td>
<td>FPEF : Fluid Physics Experiment Facility</td>
</tr>
<tr>
<td>PCEF : Physics and Chemistry Experiment Facility</td>
<td></td>
<td>LF : Levitation Furnace</td>
</tr>
<tr>
<td>CCF : Cell Culture Facility</td>
<td></td>
<td>PSAS : Physiological Signal Acquisition System</td>
</tr>
<tr>
<td>GHF : Gradient Heating Furnace</td>
<td></td>
<td>SEMS : Space Environment Measurement System</td>
</tr>
<tr>
<td>ISCS : Intersatellite Communication System</td>
<td></td>
<td>SPSS : Small Payload Support System</td>
</tr>
<tr>
<td>TES : Teleoparation Experiment System</td>
<td></td>
<td>SCF : Separation Centrifuge Facility</td>
</tr>
<tr>
<td>EOT : Earth Observation TEST</td>
<td></td>
<td>EPF : Electrophoresis Facility</td>
</tr>
<tr>
<td>SAHF : Small Animal Holding Facility</td>
<td></td>
<td>VGF : Vapor Growth Facility</td>
</tr>
<tr>
<td>ZMF : Zone Melting Furnace</td>
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**JEM PM Experiment Rack Installation Model**

- **Isothermal Furnace (IF)**
- **Solution Growth Facility (SGF)**
- **Protein Crystallization Facility (PCEF)**
- **Cell Culture Facility (CCF)**
- **Gradient Heating Furnace (GHF)**
- **Intersatellite Communication System (ISCS)**
- **Teleoparation Experiment System (TES)**
- **Earth Observation TEST (EOT)**
- **Small Animal Holding Facility (SAHF)**
- **Zone Melting Furnace (ZMF)**
- **Levitation Furnace (LF)**
- **Physiological Signal Acquisition System (PSAS)**
- **Space Environment Measurement System (SEMS)**
- **Small Payload Support System (SPSS)**
- **Separation Centrifuge Facility (SCF)**
- **Electrophoresis Facility (EPF)**
- **Vapor Growth Facility (VGF)**
10. Other Topics

(1) Space Experiment Data Base Development Status
   - Data Base in Japanese became operational in June 1992
   - Data Base in English will be operational in mid 1993

(2) Telescience Test Bed
   - Telescience Test Bed was installed in NASDA SEL in June 1992
   - Telescience Demonstration Test for JEM MTC operation will be in Nov. 1992