JAPANESE PLAN FOR SSF UTILIZATION

Toshio Mizuno
National Space Development Agency of Japan

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
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1. JEM Program Budget Status (JFY1992)

1.1. JEM Development ¥33.7B (−262M$)*
(JEM EM, JEM multiuser experiment facility,
TR-1A, etc.)
¥24.6B (−190M$)

1.2. JEM Operations Preparation ¥4.2B (−32M$)*
(JEM Operations facility,
Crew training facility, etc)
¥3.0B (−23M$)
@1 Dollar = 129 yen

* 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.
AO. Experiment Selection, PUP/COUP/TOP

**TIME (year)**

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<th>X''-3</th>
<th>X''-2</th>
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- **X''PUP**
- **X''COUP**
- **TOP**

Reference Mission Set → Selected Mission Set (Baseline Mission)

Screened Experiments Group → Ground Research & Precursor Flight Experiment

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
### JEM Development Schedule

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### 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. \( \mu \)-G) has been operational since 1991
   - MGLAB Facility (4.5 sec. \( \mu \)-G) will be operational in 1993

5.2. GEST Development using \( \mu \)-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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<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 Kuribayashi (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 Ishil (MHI)</td>
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<td>General-purpose Furnace (ITF)</td>
<td>Melting and solidification of particle-dispersed alloy</td>
<td>(Not applicable)</td>
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<tr>
<td>Temperature-gradient Furnace (TGF)</td>
<td>Melting and solidification of high-temperature oxide superconductor</td>
<td>Ceramic material composition</td>
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<tr>
<td>High-temperature Furnace (HTF)</td>
<td>Melting and solidification of vitreous material</td>
<td>Junji Hayakawa (GIRIO)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Osamu Odawara (TIT)</td>
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</table>

TR-IA MISSION PROFILE

- **290 km**
- **Beginning of the experiment**
  - 110 km, t=80 sec
- **Rate Control**
- **Payload Sep.**
- **Burn out**
- **Parachute Dep.**
- **End of the experiment**
  - t=441 sec, Re-entry
- **Telemetry**

NASDA TNSSC

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. Telesclence Technology Application
   - Telesclence 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 G
   - 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. Thermometer circulation (TC-CL)
5. Fast flow electromagnetic unit (FRED)
6. Infrared thermometer (IR)
7. Light imaging controller (LIC)
8. Data interface unit (DIU)
9. Power distribution box (PDB)
10. Thermometer regulation (TC-HR)
11. Vertical function detection unit (VRED)
12. Access panel (*)
13. Element power switching panel (EPSP) (*)

Note (*) Provided by NASA
### JEM Early Utilization Traffic Model (as of June 1992)

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

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### JEM FM Experiment Rack Installation Model

- **Isothermal Furnace**  
  - (POIU)  
  - (PFDB)  
  - Image Processor

- **Solution Growth Facility**  
  - (POIU)  
  - (PFDB)

- **Gradient Heating Furnace**  
  - (POIU)  
  - (PFDB)

- **Levitation Furnace**  
  - Fluid Physics Experiment Facility  
  - (High Temp)  
  - Solution Growth Facility  
  - (POIU)  
  - (PFDB)

- **Physiological Signal Acquisition System**  
  - (POIU)  
  - (PFDB)

- **Protein Crystallization Facility**  
  - (POIU)  
  - (PFDB)

- **Electrophoresis Facility**  
  - (POIU)  
  - (PFDB)

- **Clean Bench**  
  - (POIU)  
  - (PFDB)

- **Cell Culture Facility**  
  - (POIU)  
  - (PFDB)

- **Refrigerator/Freezer**  
  - (POIU)  
  - (PFDB)

- **Intersatellite Communication System**  
  - (POIU)  
  - (PFDB)

- **User Storage Rack**  
  - (POIU)  
  - (PFDB)

- **User Storage Rack**  
  - (ILS-P5)
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