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

- 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)

@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)

X"-5 X"-4 X"-3 X"-2 X"-1 X"

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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**NASDA**

### 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</th>
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<tr>
<td></td>
<td>September 16, 1991</td>
<td>August-September, 1992</td>
<td>August-September, 1993</td>
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<td>Module for Experiment Observation Technologies</td>
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<td>Field observation of boundary and environment phase in crystal growth</td>
<td>Katsuo Tsukamoto (Tohoku U), Kazuhiko Kuriyashl (ISAS), Tsutomu Sawada (NIRIM)</td>
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<td>Module for Measuring Basic Physical Properties of Fluids (FTX)</td>
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<td>Marangoni convection generation and control</td>
<td>Hisao Azuma (NAL), Akira Hirata (Waseda U), Keiichi Kuwahara (IHI)</td>
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<td>Module for Experimenting Environment Maintaining Technologies (BDH)</td>
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<td>Bubble generation, growth and movement</td>
<td>Yoshiyuki Abe (Electrotechnical Lab), Masamichi Ishikawa (MRI), Shinya Ishii (MHI)</td>
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<td>General-purpose Furnace (ITF)</td>
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<td>Melting and solidification of particle-dispersed alloy</td>
<td>Yujl Muramatsu (NRIM)</td>
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### TR-IA MISSION PROFILE

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

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*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. 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

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**JEM Utilization Preparation Schedule**

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**Defined Planning**
1. Storage container
2. Storage container
3. Blank panel
4. Thermoelectric module (TE-L7)
5. Free flow electromechanical unit (FEDS)
6. Infrared telescope (IRD)
7. Light imitate controller (LIC)
8. Data interface unit (DRI)
9. Power distribution unit (PDU)
10. Thermoelectric module (TE-M7)
11. Vertical function extension unit (VFUE)
12. Access panel (*)
13. Experiment power switching panel (EPSP *)

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

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<td>LSE</td>
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<td>IF : Isothermal Furnace</td>
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<td>SGF : Solution Growth Facility</td>
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<td>PCEF : Physics and Chemistry Experiment Facility</td>
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<td>CCF : Cell Culture Facility</td>
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<td>GHF : Gradient Heating Furnace</td>
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<td>ISCS : Intersatellite Communication System</td>
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<td>TES : Teleoparation Experiment System</td>
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<td>EOT : Earth Observation TEST</td>
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<td>SAHF : Small Animal Holding Facility</td>
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<td>ZMF : Zone Melting Furnace</td>
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<td>PCF : Protein Crystallization Facility</td>
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<td>FPEF : Fluid Physics Experiment Facility</td>
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<td>LF : Levitation Furnace</td>
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<td>PSAS : Physiological Signal Acquisition System</td>
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<td>SEMS : Space Environment Measurement System</td>
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<td>SPSS : Small Payload Support System</td>
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<td>SCF : Separation Centrifuge Facility</td>
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<td>EF : Electrophoresis Facility</td>
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<td>VGF : Vapor Growth Facility</td>
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### JEM PM Experiment Rack Installation Model

- **Isothermal Furnace** (PD1U, PD2U) with Image Processor
- **Solution Growth Facility** (PD1U, PD2U) with Image Processor
- **Gradient Heating Furnace** (PD1U, PD2U)
- **Levitation Furnace** (PD1U, PD2U)
- **Physiological Signal Acquisition System** (PD1U, PD2U)
- **Electrophoresis Facility** (PD1U, PD2U)
- **Cell Culture Facility** (PD1U, PD2U)
- **Separation Centrifuge Facility** (PD1U, PD2U)
- **Refrigerator/Freezer**
- **Intersatellite Communication System**
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