2004 Research Solicitation
for
Research Themes of Utilization of International Space Station in the Fields of Life Science and Space Medicine

- Guide -

Jan. 2004
Japan Aerospace Exploration Agency

Contents

1. Outline of Research Solicitation

1.1 Introduction

JAXA (Japan Aerospace Exploration Agency) solicits International Space Life Sciences and Space Medicine Research proposals for space flight experiments that would be conducted during the following time frame:

Space Life Sciences Beginning mid 2004 and ending late 2006.
Space Medicine: First flight opportunity beginning 2007

This Research Solicitation is for space experiments. Proposed themes need to have a hypothesis to be verified by space experiments, based on previous ground or space experiments, and also need to have clear methods to verify the hypothesis. Ground preparation experiments, which are not related directly to space experiments, should not be included in the solicitation.

Applications shall propose a space experiment in accordance with the conditions described in this Guide and "Flight Experiment Information Package 2004 ” FEIP". The FEIP can be downloaded from the following Web site. Please read the FEIP, though it repeats some parts of this "Guide" and the "Guidelines on Preparing Application Documents".

JAXA Homepage:	**http://www.jaxa.jp/index_j/html**
	http://www.sfo.jaxa.jp
	http://isas.jaxa.jp/j/index.shtml
JSF Homepage:	**http://www4.jsforum.or.jp**

Any correspondence related to the solicitation will be addressed to JSF (Japan Space Forum).

e-mail: life@jsforum.or.jp

1.2 Limitation of the species for space experiment

In general, resources such as crew time, electrical power, and refrigeration/freezing will be extremely limited during this period. Thus, it is expected that implementation will be limited to experiments that require minimal crew training, simple and limited experiment procedural steps, minimal energy, and minimal thermal-conditioned storage of samples.

2.0 Flight Research Capabilities

2.1 Research Involving Human Subjects

This solicitation requests proposals for flight research that will lead to the development of effective countermeasures or operational techniques for problems associated with preparation or pre-adaptation/pre-habilitation of humans for spaceflight, and/or for their re-adaptation/rehabilitation after return to Earth (beginning 3-5 days after landing). *Research proposals for long-duration ISS research should be not require data collection during the first two weeks of flight, or during the first 72 hours after return to Earth.* Critical questions from the Critical Path Roadmap which deal specifically with the issues of human pre-adaptation/pre-habilitation and/or re-adaptation/rehabilitation after return to Earth are enumerated below for proposers. Critical questions are in the areas of: 1) bone loss, 2) cardiovascular alterations, 3) food and nutrition, 4) human behavior and performance, 5) immunology, infection and

hematology, 6) muscle alterations and atrophy, 7) neurovestibular (sensorimotor) adaptation and 8) clinical capabilities. The critical questions are presented in more detail in Section I of the NRA Solicitation. Proposals may address critical questions in any of the physiological disciplines described in the CPR, so long as they can be convincingly ascribed to the pre-habilitation/rehabilitation thrust areas.

The first flight opportunity for human life sciences investigations solicited through this research announcement will be no earlier than 2007 due to the required processes and procedures for implementing these types of experiments. The amount of time it takes to complete a study is based on the required number of subjects and crewmember participation. Investigations selected under this solicitation will be flown while there are three crewmembers on board ISS, and it should be assumed that two Increment crews will be flown every year for a total of 6 potential subjects a year. In order to account for variations in subject participation and suitability, it should be assumed that two subjects per Increment will participate, for a total of four subjects per year. Therefore, if an investigation requires a minimum of 6 crewmember subjects, it will take a minimum of three ISS Increments (1.5 years) to complete the inflight data collections. Investigations requiring short duration crewmembers as subjects should assume flight data could be collected on 6 subjects per year.
Due to the limited resources (e.g., crew time, on-orbit experimental supplies, temperature-controlled sample storage) available for the conduct of ISS research, NASA is pursuing the intentional formation of teams of investigators whose experiments will leverage resources by addressing different facets of the same critical question. NASA anticipates that such intentional teaming arrangements will result in better utilization of available resources to resolve specific critical questions. NASA highly encourages individual investigators submitting applications in response to this NRA to consider identifying such collaborations between individual proposals as part of the development of their individual proposals and to identify this pre-coordination in their submissions.

2.1 Research Involving Non Human Subjects

The available samples are limited to *Arabidopsis thaliana*, *Brassica rapa*, *Caenorhabditis elegans*, *Saccharomysces cerevisiaee*.

Because there was no restriction until now, there were proposals using various species, and various corresponding equipment for were needed. Consequently, it will be required several or more years to experiment implementation from selection.

In order to avoid this problem, participating organizations agreed to adopt the space experiment configuration which aimed at the early implementation for less than three years. Consequently, the proposals are limited to this configuration to use the above specimens. The details of experiment configuration are shown in 2.3.

2. Application Guidelines

2.1 Qualifications for application

Proposers must satisfy the following requirements.

(1) The proposers' nationality and location (within or outside Japan) of the organization to which proposers belong do not matter.

(2) However, JAXA will not bear the cost related to research carried out by organizations

outside Japan.

(3) Be capable of properly implementing the proposed research.

(4) Be able to enter into a research agreement with Japan Space Forum, with which JAXA has a contract for business consignment.

2.2 Subjects of Research Solicitation

(1) Proposals for space experiments in the life science field using *the model specimens* described 1.2.
(2) Experiment on the International Space Station.
(3) Promoted research fields of Japan are based on the following scenarios, which have been established separately by the Space Environment Utilization Research Committee of JAXA. Contents of a proposal must not differ greatly from the direction of these research scenarios. Please be sure to refer to these research scenarios on JAXA's homepage at the following addresses.
"Research scenario in the field of space medicine"
URL http://iss.sfo.jaxa.jp/utiliz/jp_senario_med.html
"Research scenario in the field of life science (bioscience/biotechnology)"
URL http://iss.sfo.jaxa.jp/utiliz/jp_senario_life.html

2.3 Outline of space experiment
2.3.1 Mission Scenarios (in general):
Experiment operations, vehicle constraints, and operational activities vary during different phases of a mission and are dependant on the physical location of the payload hardware and/or biological samples. The following phases address capabilities and limitations during those periods.

Late Access/Ascent:
Payload hardware and biological specimens are loaded into the Shuttle Middeck or into the Multi-Purpose Logistics Module (MPLM) in the Shuttle payload bay prior to launch. Loading of the MPLM typically occurs one to two months prior to launch with limited access approximately 4 days prior to launch. Access to the middeck can be as late as 17 hours prior to launch on a limited basis.

Passive thermal carriers, ambient temperature, and soft stowage are also available for transport of biological specimen. Opportunities for launch of live plants to the ISS will be available but less frequent than those for dry seeds. Proposals must address the experiment requirement to launch live plants versus seeds.

During the ascent phase, limited crew procedures may be performed on the experiment/hardware prior to Shuttle/ISS docking (launch + three days). Proposals must provide explicit justification for crew-mediated operations during this flight phase. Items that are stowed in the MPLM will not be accessible during this period.

Docked Operations:
During docking operations (docking operations are defined as launch + 3 days through launch + 10 days), experiment hardware/stowage will be transported from the middeck and MPLM to the ISS. During this phase, it is highly unlikely that the flight crew will be available for performing

experiment operations.

ISS Operations:
The duration of the proposed experiments on ISS may range from days to weeks. Given the constraints and priority of ISS assembly requirements, it is advantageous if the proposed experiments are flexible regarding initiation, termination, and operational performance. Plant growth can be accommodated at various gravity levels during ISS operations using EMCS.

If biological samples are collected during the experiment and/or at its end, the proposal must address how the samples will be stored. There is capability for chemical fixation. The availability of refrigerator or freezer storage of the fixed or unfixed samples is limited. Proposals which utilize sample storage at ambient temperature are preferable for this solicitation.

Descent/Early Access:
Limited opportunities are available for return of live plants. During the descent phase, crew operations on plants (i.e. harvesting, fixation) are highly limited. Limited freezer volume will also be available. The proposal must address the need for return of live plants, the descent crew operations required and the justification for requiring fixation/freezing resources.

Early access (within 3 hours) to the hardware/samples following landing is available for items stowed in the middeck. Items that are stowed in the MPLM will be accessed within 2-3 days following landing.

Limited Resources:
As described in the mission scenarios, several shuttle and station resources are severely limited. It is the goal of this solicitation to maximize the overall science return by managing these limited resources with the best cadre of proposed experiments. It is anticipated that most experiments will require some limited resources, and some experiments may require several. Utilization of these resources will be assessed during the selection process and may affect the ability of the proposal to be successfully implemented. The following items must be addressed on Form F including anticipated need and rationale:

- **Ascent/return of live tissue**
- **Crew operations during all mission scenarios listed in 4.0**
- **Ascent, on-orbit, and descent cold stowage/ambient stowage/fixation requirements, including the quantities of tissues to be preserved**

2.3.2 Mission scenario for each specimens

1）Outline of the experiment using *Saccharomysces cerevisiaee*

Protocol: A total of 84 (10 ml) OptiCells will be inoculated with YPD medium and yeast pre-flight (yeast-OptiCells). The yeast-OptiCells will be stored at +4 °C during transport to ISS.

Once on ISS, the yeast-OptiCells will be stored in an ISS refrigerator (+4 °C) until completion of all SSBRP hardware installation, checkout, and validation activities are completed. Within 2-3 weeks of the docking of the return Orbiter, the yeast-OptiCells will be transferred to the SSBRP Incubators for incubation. At the end of the incubation period, the yeast will be returned to +4 °C, in the Incubator, for the remainder of the on-orbit duration and then returned to Earth in +4 °C storage. A ground control experiment, which mirrors the flight experiment, will be conducted.

The Passive Dosimeter System (PDS) will be used to provide data on space radiation exposure during the on-orbit duration of the experiment. The PDS is designed to measure and record the biologically active space radiation dose at experimenter-defined locations. The PDS consists of a two component assembly and a Reader. The assembly contains one Pille Thermoluminescent Detector (TLD) system and three stacks of Plastic Nuclear Track Detector (PNTD) system inserted into a PDS holder. The PNTD component of the PDS will be used to measure dosage during the ascent and descent flights. The scenario for use of the PDS is as follows. A PDS holder containing the PNTDs will be placed into the transport container, which is carrying the *C. elegans*-OptiCells, for ascent. Once on ISS, a TLD will be inserted into the holder and then the PDS assembly will be co-localized at all times with the *C. elegans*–OptiCells. At the end of the mission, the PNTD will be returned in the same transport container that will hold the *C. elegans*-OptiCells, and the Pille memory cards will be stowed in the Middeck. The team at the Hungarian Space Agency will analyze the data from the Pille memory cards and then the data will be delivered to the PNTD processing team. The PNTD processing team will analyze the PNTD stacks and then combine this data with the TLD data to determine the corrected total dose, dose equivalent, and average quality factor. The PDS report will be provided to the Principal Investigator.

Participation: The successful respondent, PI, will participate in 1) identifying specific yeast strains, including deletion mutant series, and incubation thermal requirements, 2) ground testing studies, and 3) defining specimen processing and collaborative efforts. The consideration for each of these items must fit within the constraints of the MYCOS protocol. Depending the processing requirements, the ILSRA Principal Investigator may be involved in pre-and post-flight sample processing operations at the launch site processing facility and prime and secondary landing facilities. Also, the PI may be involved in ground communication activities.

Outline of the experiment is summarized in Table. 1)-1 and 2.

Table. 1)-1 Protocol Framework Summary for *Saccharomysces cerevisiae*

Organism	***S. cerevisiae***
Incubator	**2 SSBRP Incubators**
Duration On-Orbit	**30 to 110 days**
Experiment Duration	**Incubation period[1]**
Ascent Thermal Requirement	**+4 °C live specimen storage**
ISS Thermal Requirement **- Pre-incubation** **- Incubation period** **- Post-incubation**	 **+4 °C live specimen storage (approx. 14 to 80 days)** **+20 °C to +30 °C** **+4 °C (approximately 14 to 21 days)**
Descent Thermal Req.	**+4 °C live specimens**
Culturing Chamber	**OptiCell**
Medium	**YPD***
Radiation Monitoring	**Passive Dosimeter System**

[1]Duration dependent on strains selected and ground studies
[2]Medium used is dependent on strains selected

Table. 1)-2 Summary of Hardware Available to Support Research on *S. cerevisiae*

	Shuttle-	**ISS-**	**Agency**	**Website**

	Based	Based		
Fluids Processing Apparatus (FPA)	**X**	**X**	**BioServe Space Technologies**	**http://www.colorado.edu/engineering/BioServe/spaceflight.html**
Group Activation Pack (GAP)	**X**	**X**	**BioServe Space Technologies**	**http://www.colorado.edu/engineering/BioServe/spaceflight.html**
ADvanced SEParations Processing (ASDEP) Vented Fluid Processing Cassette		**X**	**Space Hardware Optimization Technology**	**http://www.shot.com/Products.htm**
SSBRP Incubator		**X**	**NASA**	**http://spaceprojects.arc.nasa.gov/Space_Projects/SSBRP/index.html**

2) Outline of the experiment using *Caenorhabditis elegans*

Protocol: This protocol includes 1) 4 separate incubation periods, 2) video recording sessions, 3) 3 subculture sessions, 4) on-orbit preservation of specimen aliquots by freezing (-80 °C) or immersion in Trizol, and 5) return of live specimens. A total of 18 (10 ml) OptiCells will be inoculated, pre-flight, with *C. elegans* in axenic medium (Lu, N. C; Goetsch K. M. Nematologica 39(3): 303-311; *C. elegans*-OptiCells). The *C. elegans*-OptiCells will be stored at +20 °C during delivery to ISS.

Once on ISS, the *C. elegans*-OptiCells will transferred to the SSBRP Incubator (+20 °C) and four of the 18 *C. elegans*-OptiCells will placed into the Incubator video system holders. Periodically during each incubation period, the *C. elegans* in each video system holder will be video recorded. The video data will be downlinked at the earliest opportunity. At the end of each incubation period, all of the *C. elegans*-OptiCells will be subcultured and then aliquots will be sampled for freezing at –80 °C and for nucleic acid and protein preservation in Trizol. The Trizol-treated samples will be stored at –20 °C or colder temperature. For the descent phase of the experiment, the *C. elegans* from the fourth incubation period will not be processed on-orbit, and the specimens will be returned alive. The –80 °C samples will be returned in a gaseous nitrogen dewar (GN2 dewar), and the Trizol-treated samples will be returned at +4 °C or lower temperature. A ground control experiment, which mirror the flight experiment, will be conducted.

The Passive Dosimeter System (PDS) will be used to provide data on space radiation exposure during the on-orbit duration of the experiment. The PDS is designed to measure and record the biologically active space radiation dose at experimenter-defined locations. The PDS consists of a two component assembly and a Reader. The assembly contains one Pille Thermoluminescent Detector (TLD) system and three stacks of Plastic Nuclear Track Detector (PNTD) system inserted into a PDS holder. The PNTD component of the PDS will be used to measure dosage during the ascent and descent flights. The scenario for use of the PDS is as follows. A PDS holder containing the PNTDs will be placed into the transport container, which is carrying the *C. elegans*-OptiCells, for ascent. Once on ISS, a TLD will be inserted into the holder and then the PDS assembly will be co-localized at all times with the *C. elegans*–OptiCells. At the end of the mission, the PNTD will be returned in the same transport container that will hold the *C. elegans*-OptiCells, and the Pille memory cards will be stowed in the Middeck. The team at the Hungarian Space Agency will analyze the data from the Pille memory cards and then the data will be delivered to the PNTD processing team. The PNTD processing team will analyze the PNTD stacks and then combine this data with the TLD data to determine the corrected total dose,

dose equivalent, and average quality factor. The PDS report will be provided to the Principal Investigator.

Participation: The successful respondent principal investigator will participate in 1) identifying specific *C. elegans* strain, including deletion mutant series, and incubation thermal requirements, 2) ground testing studies, and 3) defining specimen processing and collaborative efforts. The consideration for each of these items must fit within the constraints of the protocol. Depending upon the processing requirements, the principal investigator may be involved in pre-and post-flight sample processing operations at the launch site processing facility and prime and secondary landing facilities. Also, the principal investigator may be involved in ground communication activities.

Table. 2)- 1 Protocol Framework Summary for *Saccharomysces cerevisiae*

Organism	***C. elegans***
Habitat	**1-2 SSBRP Incubators**
On-Orbit Duration	**30 to 110 days**
Ascent Thermal Requirement	**+ 20°C Incubation**
ISS Thermal Requirement	**+ 20 °C incubation** **+ 4 °C media storage** **≤-20 °C Trizol sample storage** **-80 °C sample storage**
ISS Flight H/W	**Glovebox**
Descent Thermal Req.	**+ 20 °C live specimens** **≤+4 °C sample storage** **≤-80 °C sample storage**
Culturing Chamber	**OptiCell**
Medium	**Axenic Liquid Medium*** **C. elegans Maintenance Medium**
Incubation Period Duration	**17 to 28 days**
Subculture	**3 sessions**
Sampling	**Concurrent with subculture sessions**
Specimen Video Sessions	**7 to 14 day intervals** **(4 C. elegans-OptiCells)**
Radiation Monitoring	**Passive Dosimeter System**

***LU,N.C., and Goetsch, K.M. 1993, Nematologica 39 (3):303-311**

Table 2)-2 Summary of Hardware Available to Support Research on *C. elegans*

	Shuttle-Based	ISS-Based	Agency	Website
ADvanced SEParations Processing (ASDEP) modified Vented Fluid Processing Cassette	**X**	**X**	**SHOT**	**http://lsda.ksc.nasa.gov/Hardware/GetSpecificHardware.pl?hdw=bric**
Space Station Biological Research Project (SSBRP) Incubator		**X**	**NASA**	**http://spaceprojects.arc.nasa.gov/Space_Projects/SSBRP/index.html**

3) Outline of the Experiment using Plants

Protocol: The experiment can be initiated from either seeds or live plants. Flight opportunities for seeds will occur at a greater frequency than those with live plants. Plant growth in a

controlled environment can be accommodated at microgravity and variable artificial gravity conditions (while on ISS). Candidate proposals must include explicit justification for the need to launch live plants, return live plants, and/or utilize on-orbit centrifugation.
Two hardware platforms are available, the European Modular Cultivation System (EMCS) and the Advanced Biological Research System (ABRS). Either hardware is compatible with experiments starting from seeds and both will support experiment durations up to 130 days. (ABRS) is capable of launching live plants, which can remain in ABRS hardware or transported to EMCS on orbit. The crew can access plant chambers on orbit in both pieces of hardware. Additionally, on-orbit chemical fixation and freezer hardware will be available for harvested tissue. Specifics of the hardware capability are provided below in the matrix. Requirements for use of available hardware/resources will need to be addressed in supplemental Form F.

Table 3)-1: Plant Growth Chamber Capabilities

	ABRS	EMCS
Growing area	2 chambers @284 cm^2	8 chambers @ 36 cm^2
Max plant height	19.0 cm	16.0 cm
Illumination	max 300 $\mu mol/m^2/s$	max 300 $\mu mol/m^2/s$
Photoperiod	User adjustable	User adjustable
Temperature	10-35 °C controlled	18-40 °C controlled
Water/nutrient addition	Automated	Automated
Atmospheric separation	2 chambers, using cabin air with filtration and ethylene removal	8 chambers, using bottled gases mixed to provide user-required atmospheric composition
Atmospheric CO_2 control	0.03%-ambient controlled	0.03-0.05% & 1-5% controlled
Atmospheric ethylene removal	25 ppb max	Below 10 ppb
Atmospheric relative humidity	60-80%, individually controlled for each growth chamber	50-85%, individually controlled for each growth chamber
Downlink	Data and video	Data and video
Imaging	Visible light	Visible and IR light
Gravity level	10^{-3} g	10^{-3} g – 2.0 g

Table 3)-2 Summary of Available Hardware to Support Research on Plants

	Shuttle-Based	ISS-Based	Agency	Website
European Modular Cultivation System (EMCS)		X	ESA	http://www.estec.esa.nl/spaceflight/emcs/emcs.htm
		X		
Advanced Biological Research System (ABRS)	X	X	NASA	http://lsda.ksc.nasa.gov/Hardware/GetSpecificHardware.pl?hdw=abrs

2.3.3 Special requirement against given protocol.
Requirement for another hardware is impossible as a principle. Also, requirement for another on board experiment sample processing is impossible.
Please consult with the personnel in charge of JAXA or JSF before application.

2.4 Steps to acquire budget

As mentioned in Section 1.2, this solicitation is for themes using Arabidopsis and nematode. Thus, budget will be restricted only to consumables that are related to analysis of returned samples.
Details of steps to acquire budget are described in the following Section (1). The budget for implementing a selected candidate theme will be coordinated between the organization to which the proposer belongs and JAXA, and steps to acquire budget, including requests for appropriation, will be made in FY2005. As a result of adjustments, the time and amount of budget acquired may not necessarily meet the requested budget.

1) The compatibility test of experiment conditions
Cost for checking that experiment procedure and sample containers satisfy the requirements of the proposed experiments (purchase expense, such as a reagent and a sample).
2) Cost concerning the experiment analysis after a flight (such as a reagent for analysis of an returned samples).
3) Expenses for joint research

① In the event that co-investigators belong to the organization outside Japan are included as the part of the members in a proposal that will be submitted to JAXA. JAXA will not bear any expenses relating to implementation of a research proposal at an organization outside Japan or any travel expenses necessary for coordinating its experiments (from a foreign country to Japan). A space agency or an equivalent organization of the country where the co-investigator's original organization is located shall be responsible for arranging the budget for the co-investigator.

- **Describe the research budget required by the co-investigators in International Application Forms F and G and also in Supporting Budgetary Information, and submit these documents to JAXA. Also explain the details to the co-investigator and ask them to inform the space agency or equivalent organization of the country where their original organization is located of the research budget plan.**
- **Describe the domestic research budget for implementing a joint research in JP-Form-4, including overseas travel expenses (from Japan to a foreign country) for proposers in Japan to coordinate with the co-investigators living outside Japan.**
- **In addition to the above JP-Form-4, submit JP-Form-1 and-2, reflecting the allocated part of the entire research proposal conducted by the co-investigator living outside Japan so that budget details can be corroborated. Also submit the Research Allocation Agreement using JP-Form-3 (E).**

② In the event that a researcher living in Japan participates in the application as a co-investigator under a principal investigator living abroad

Fill in JP-Form-4 regarding the budget plan, including expenses relating to implementing the allocated part of the entire research and also including overseas travel expenses necessary for coordinating experiments with the co-investigator living outside Japan, together with the name of the principal investigator, and then submit it to the Secretariat. Also fill in JP-Form-1, -2, and-5 regarding the allocated part of the entire research proposal and submit them to the Secretariat.

[Notes regarding ① and ②]

Though some parts of Sections 5.12 and 5.13 of FEIP (Forms F and G, and Supporting Budgetary Information) differ from this Guide, please follow the above explanations in ① and

②.

③ In the event that both a principal investigator and co-investigators are living in Japan.

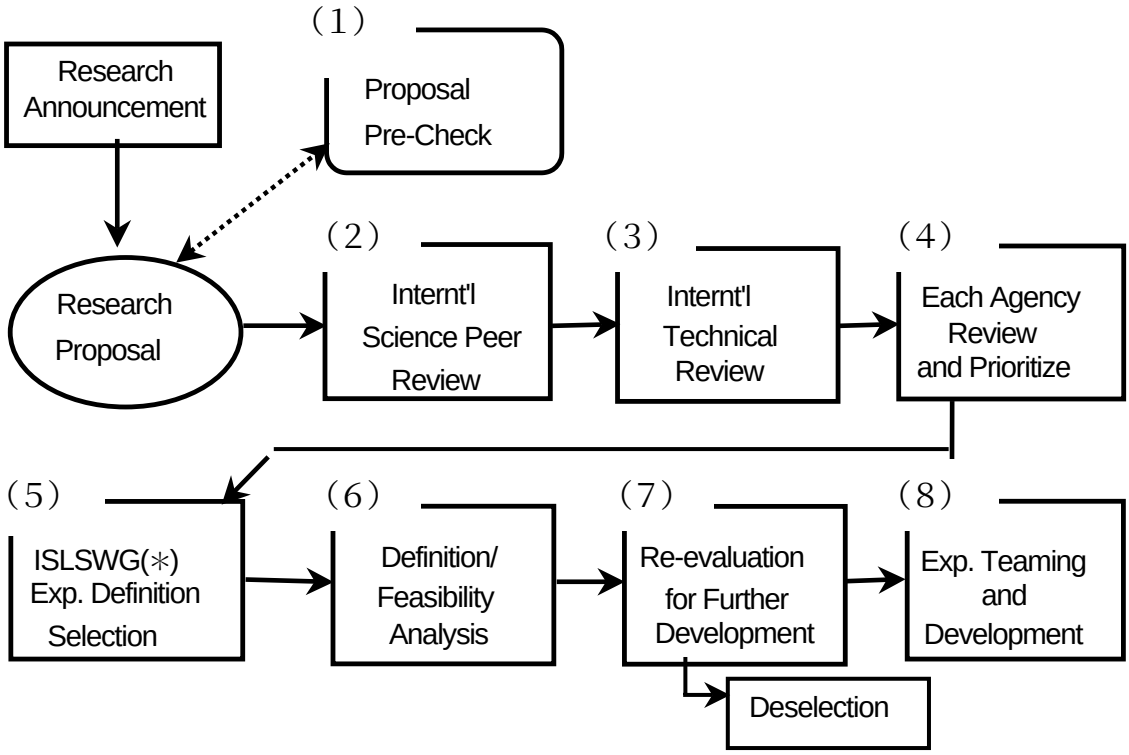
It is not necessary to submit both Forms F and G, and Supporting Budgetary Information regarding the research budget. Prepare documents in accordance with the instructions in Table 1 and submit them to the Secretariat.

(For further details, contact JAXA or JSF.)

3. Selection of Submitted Proposals

Submitted proposals will be evaluated and selected as follows:

Process from Solicitation to Selection



(*) ISLSWG (International Space Life Sciences Working Group)
This is the international meeting relating to space experiments in the fields of Life Science and Space Medicine. In the event of this research solicitation, the selection of candidate themes for space experiments will be conducted at this meeting.
The content of evaluation on each step is as shown below (They are shown in order of the number in parentheses of the figure).

(1) Pre-Check of proposals by the Secretariat
The Secretariat will pre-check the proposals regarding the structure of entire content of them.

(2) Science peer review
1) Method of review

Scientific evaluations will be done by the International Science Review Panel composed of panelists recommended by each participating agency. Not less than two reviewers will be assigned to a proposal and they will pre review the proposals. After that, the proposals will be examined and evaluated at the International Science Panel Meeting based on the results of pre review.

2) The point of review (in accordance with Section 4.0 of FEIP)

Submitted research themes will be reviewed by International Science Review Panel based on the following criteria, and will be assigned a score from 0 to 100 to be ranked. Taking into account the results of the score ranking, the possibility whether the content of experiments will be able to do during the period conducting space experiments (between mid 2004 and the second half of 2006), and the number of the themes, the selection of themes passing the science review will be made.

The points of Science Peer Review (The criteria of examination)

Significance	**Does this study address an important problem? If the aims of the application are achieved, how will scientific knowledge or technology be advanced? What will be the effect of these studies on the concepts, methods, or products that drive this field?**
Approach	**Are the conceptual framework, design, methods, and analyses adequately developed, well integrated, and appropriate to the aims of the project? Is the proposed approach likely to yield the desired results? Does the applicant acknowledge potential problem areas and consider alternative tactics?**
Innovation	**Does the project employ novel concepts, approaches, or methods? Are the aims original and innovative? Does the project challenge existing paradigms or develop new methodologies or technologies?**
Investigator	**Is the investigator appropriately trained and well suited to carry out this work? Is the work proposed appropriate to the experience level of the principal investigator and any co-investigators? Is the evidence of the investigator's productivity satisfactory?**
Environment	**Does the scientific environment in which the work will be performed contribute to the probability of success? Do the proposed experiments take advantage of unique features of the scientific environment or employ useful collaborative arrangements? Is there evidence of institutional support?**

(3) Technical review

1) Method of review

The International Technical Review Panel composed of panelists from each participating agency will review the only research themes that pass the science review panel.

In this solicitation, space experiment configuration will be fixed, therefore it will be evaluated whether different experiment procedures are included or not and whether the technique of the analysis using the recovered samples meets the objectives or not.

Each impact on conducting the flight experiment will be an object to be subtracted from a score of 100. The themes will be assigned a score by the method of subtraction from 100. A big impact will lead to a big subtraction. Based on the score, the themes will be classified into risk assessment level indicated uncertainty about conducting the space experiments (Low Risk, Medium Risk and High Risk). Generally, if the theme is decided as High Risk, it will not be selected as a candidate theme of flight experiment.

2) The point of review

Technical evaluations will be carried out regarding mostly international application FormC

described in Chapter 9. of this guide based on the following criteria.

The points of Technical Review (The criteria of examination)

Functional Requirements	**・Will the planned flight and ground hardware meet the requirements of the experiment?** **・What experiment-unique hardware will be required, and can it be developed in time for projected flight opportunities?**
Operational Feasibility	**・Is there any requirement different from fixed procedure?** **・Is there superfluous number of requirements?**
Environmental Health and Safety	**・Are there elements of the proposed ground or flight activities that pose concerns for the health and safety of personnel and/or the environment?**

(4)Evaluation and prioritization based on the policy of space utilization environment in Japan

1)Method of review

The research themes, which pass the international science review and technical review, shall be reviewed and prioritized by the Space Environment Utilization Research Committee of JAXA (Each participating agency shall also review and prioritize research themes based on each policy of space utilization environment.).

2)The point of review

・Contents of a proposal must not differ greatly from the direction of the research scenarios, which have been established by JAXA (Please be sure to refer to these research scenarios on JAXAQ's homepage as shown in Section 2.2 of this guide).

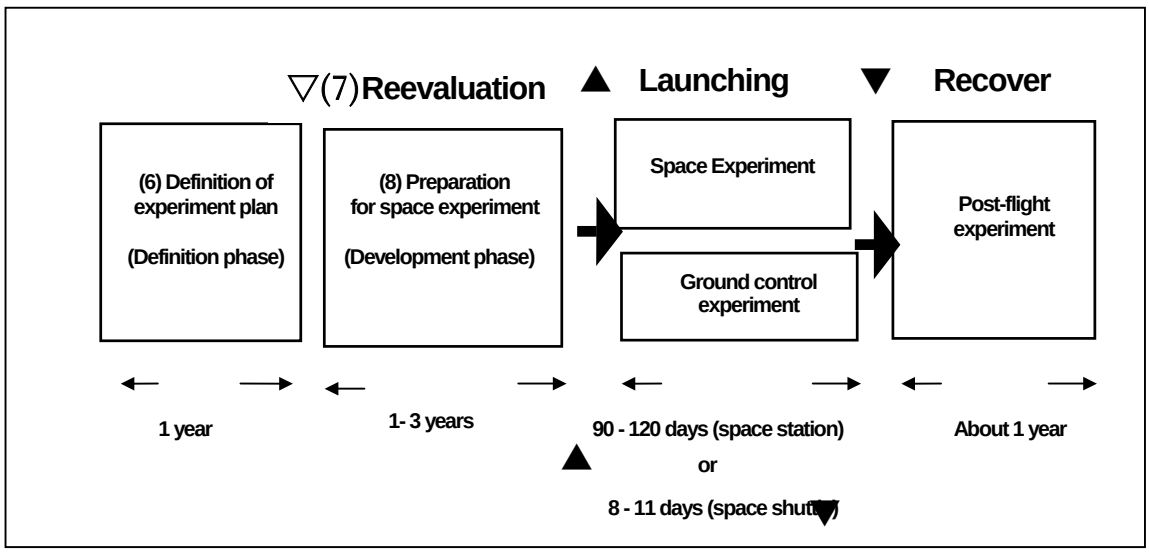
・Matching to a policy of flight hardware utilization.

・Whether the cost for preparation and conducting of the space experiments should be put out for, or not.

(5)Selection of candidate themes

The themes passing from (1) to (4) will be collected from each agency, and the final selection of candidate themes will be made at ISLSWG, taking into account the available resources.

The following is the flow of work after a proposal has been selected as a candidate theme for a space experiment (For further details, contact JAXA or JSF):



(6)Definition of experiment plan (Definition phase)

About a candidate theme, it will be checked whether the analysis using the sample obtained

from a fixed experiment procedure are possible, and an experiment plan document will be prepared.
Moreover, it is asked for preparing a reply for an indication matter from a science evaluation panel and a technical evaluation panel within the limit of during this work.
When there will be team organization, cooperation with another member may be included.

(7) Reevaluation: evaluation and examination as to whether the definite preparation of flight experiments will be able to be got started, or not.
Based on the results of work in (6), the themes will be evaluated and examined whether the definite preparations for flight will be able to be got started, or not, by JAXA and each Agency preparing flight hardware. If the experiment requirement document cannot be completed, the theme may be perhaps deselected (This terms of decision is explained in Section 4.5 of FEIP).
(8) Preparation for flight experiment (Development phase)
The themes passing (7), as candidates of flight experiment themes, will be got started the work to research about verification test between the hardware and the specimen, mission operation (establishment of experiment operation procedure during space experiment, verification for safety, etc.).

4. Required Documents for Application

We will not use submitted documents for any purpose other than our review. The contents of proposals will be kept strictly confidential.

4.1 Introduction

It is necessary to submit both the International Application Forms and the Domestic Application Forms.

[Note] Be sure to read the "Guidelines on Preparing Application Documents".
The Guidelines explain in detail the following:
- **Notes on preparing application documents (writing procedures and techniques)**
- **Notes on describing proposal contents (how to describe proposal contents accurately)**

4.2 How to obtain related application documents

The related application documents can be obtained by either of the following methods.

(1) They can be downloaded from the following Web site via the Internet:

URL http://www4.jsforum.or.jp

(2) By postal mail
Address requests to:
Secretariat of International Life Science Research Solicitation
C/o Space Utilization Research Department
Japan Space Forum

Hamamatsu-cho Central Building 8F
1-29-6, Hamamatsu-cho, Minato-ku, Tokyo 105-0013
Tel: +81-3-3459-1653 Fax: +81-3-5470-8426 E-mail: life@jsforum.or.jp

4.3 The Number of documents to be submitted

(1) International Application Forms (Form A through H, and others)

※ Submit 25 copies of each of 1) through 15) in Table 1 shown next Page.
Disregard the number of copies "25" stated at the confirmation item at the end of Form H, and supply three copies only.

※ Some application documents are not designated in the form but be sure to submit such documents.

※ For details, refer to Section 5.0 of FEIP.

(2) Domestic Application Forms (JP-Form 1 through 3)

※ Submit 3 copies of each.
JP-Forms are to be used for the domestic review. JP-Forms should be used and submitted only by researchers belonging to Japanese domestic organizations and should be written in Japanese in principle (only the name of the proposer can be written in the Roman alphabet).

4.4 Documents to be prepared (1)

(1)Letter of Intent

Any person wishing to apply for this solicitation must submit a Letter of Intent as shown in Chapter 9 of this Guide.

1)The Letter of Intent must be written in English, but certain items should be written in Japanese.

2)Proposers are requested to state the names of two preferred researchers by whom the proposals could be scientifically reviewed at the International Science Panel and also the names of non-preferred researchers, if any. However, note that your request will not necessarily be met.

3)The Letter of Intent should be submitted by E-mail. Postal mail and facsimile transmission are also acceptable.

4.4 Documents to be prepared (2)

Table 1 shows all the documents to be prepared after submission of the Letter of Intent. Confirm the necessary documents to be prepared according to the proposal contents.

Table. 1: List of documents to be prepared

Documents to be prepared / Research system (PI: Principal investigator) (CI: Co-investigator)		You are ＰＩ		You are ＣＩ	
		ＣＩ		ＰＩ	
		Domestic researcher only	Including overseas researchers	Domestic researcher	Overseas researchers
1) —	Cover Page: Solicited Proposal Application	○	○	×	×
2) —	Proposal Abstract	○	○	×	×
3) —	Proposal Title Page	○	○	×	×
4) —	Project Description	○	○	×	×
5) —	Management Approach	○	○	×	×
6) Form B	Personnel/Biographical Sketches	○	○	○→ PI	○→ PI
7) —	Facilities and Equipments	○	○	×	×
8) —	Special Matters (see section 4.4)	○	○	×	×
9) Form C	Summary Budget Form	×	×	×	×
10) Form D	Detailed Budget, 12 Months	×	×	×	×
11) —	Supporting Budgetary Information]	×	×	×	×
12) Form E	Other Support	×	×	×	×
13) —	Letters of Collaboration/Support	×	×	×	×
14) —	Appendcies	○	○	×	×
15) Form F	Space Flight Experiment Requirements Sumamry	○	○	×	×
	3.5"FD for International Application	○	○	×	×
JP-Form-1	General matters 【Note 4】	○	○	×	○
JP-Form-2	Research plan 【Note 4】	○	○	×	○
JP-Form-3	Research Allocation Agreement 【Note４】	○	○	×	×
—	3.5"FD for Domestic Application Forms; JP-Form 1to 5	○	○	×	×
	Postcard to notify receipt of application documents	○	○	×	×

4.4 Documents to be prepared

Data related to ethics examination

(1) In the event that the experiment subjects are to be human beings, human tissue, or the first cultured cells of human beings

It is essential that they should be judged and approved by the applicable committee of the organization to which the proposer belongs and then an assurance in English should be submitted. The format of this assurance will be sent separately. This assurance should be attached as "Special Matters" of the documents to be submitted.

(2) In the event that the experiment subjects are to be vertebrate animals (including embryos, fertilized eggs and first cultured cells)

1) If there is an appropriate committee of the organization to which the proposer belongs

They should be judged and approved by that committee and then an assurance in English should be submitted. The format of this assurance will be sent separately. This assurance should be attached as "Special Matters" of the documents to be submitted.

2) If there is not an appropriate committee of the organization to which the proposer belongs, or

as long as the experiment subjects are to be animals that are not within the scope for judgment at the applicable committee, the matter shall be judged by the Animal Care Committee of JAXA.
It is assumed that small fish are not included within the scope for judgment at the applicable committees of some organizations, but note that small fish should be included within the scope for judgment regarding space experiments.
If you are not sure, contact JAXA or JSF.
Clearly express your request for judgment by the Animal Care Committee of JAXA in the application format when submitting the Letter of Intent. The Secretariat will send all concerned parties the format for judgment, after confirming the contents of requests.

All concerned parties shall prepare the documents for judgment and submit them to the Secretariat by Feb. 25, 2004, separately from the application documents.

4.5 Address for submission of documents

(1)Do not submit the documents directly to NASA.
(2)Please send the necessary documents to the following Secretariat by ordinary registered mail.
(3)After receipt of the documents, a notification of acceptance will be returned from the Secretariat.
(4)If you do not receive notification of acceptance within two weeks, please contact the following Secretariat.

Note that if application documents are not in order, we may not be able to accept them. Also note that even if a research organization compiles and submits the application documents to us, we will send the notification of acceptance directly to the proposer.

[Address for submission of documents]

Secretariat of International Life Science Research Solicitation
c/o Space Utilization Research Department
Japan Space Forum

Hamamatsu-cho Central Building 8F
1-29-6, Hamamatsu-cho, Minato-ku, Tokyo 105-0013
TEL: +81-3-3459-1653
FAX: +81-3-5470-8426
E-mail: life@jsforum.or.jp

5. Supporting Programs for Formulating Application Documents

5.1 Preliminary check

If requested, JAXA plans to conduct a prior check of proposals regarding the scientific description and the flight experiment technique.

(1) Prior check of scientific description

- **JAXA will conduct a prior check of the scientific description of proposals and give advice on**

improvement prior to the closing date of the International Research Solicitation.

- **So far, five out of six selected candidate themes had availed themselves of this prior check. It seems therefore that the prior check was very beneficial for successful selection.**

(2) Prior check of flight feasibility

- **JAXA plans that the persons in charge who have experience in supporting for space experiments will conduct a prior check of the flight feasibility of experiments proposed and give advice on improvement prior to closing date of the international Research Solicitation.**
- **There are some characteristic restriction items in space experiments. So, it is essential to avoid and overcome these items for improvement of flight feasibility.**

Accordingly, JAXA recommends those who intend to submit proposals to definitely request this prior check. The related expenses will be borne by JAXA. Details of application for the prior check will be informed after submission of the Letter of Intent.

5.3 Guidelines on preparing application documents

This is the 4th International Research Solicitation for JAXA. There were some so strict evaluation comments in selection result of proposals submitted from Japan, so far. Each evaluation will be the object for subtraction, after then these will be put together in a total evaluation. This result will be used to judge whether acceptance or not acceptance.
Based on these results, the former "Guidelines on preparing application documents" was substantially revised to prepare for this International Research Solicitation. JAXA recommends that those who intend to submit proposals should refer to this guideline to prepare the application documents.

6. Schedule for Research Solicitation

The schedule from release of this research solicitation and before the start of space experiments is as shown in the following Table 2.

Table 2. : Schedule for research solicitation

Subjects	Period	Related action items and documents submitted, etc.	
		Prior check	
		In case of requesting	In case of not request
Release research solicitation	Feb. 18, 2004	—	
Closing date for Letter of Intent	Mar. 18,2004	Letter of Intent	
Due date for application documents for proposer requesting prior check	Apr. 5, 2004	A set of application documents (Domestic and International Application)	—
Implementation of Prior check	Early of Apr., 2004	—	
Notification of the results of prior check	Mid Apr. 2004	Return the comments on proposals to the Proposers	—
Due date for application documents (in Japan)	Apr. 23, 2001	A set of revised application documents (Domestic and International Application)	A set of application documents (Domestic and International Application)

Science Review	**Early of June, 2004**	—
Technical Review	**Apr., 2004**	—
Prioritization by JAXA	**July, 2004**	—
Selection of candidate themes by ISLSWG	**Sept. , 2004**	—
Notification of the results of selection	**Sept. , 2002**	**Notification of the results of candidate themes selected**

***Note: It is essential that the human ethics examination should be done and approved by the applicable committee of the organization to which the proposer belongs.**

7. Procedures after Acceptance

For the selected as candidate themes for space experiments, a contract with Japan Space Forum, with which JAXA has business consignment, will be concluded in accordance with the following procedure.

(1)Outline of work after selection
1) Making answer to critique : within about 1 year after selection of candidate themes
The themes will be received critiques regarding subject and problem of contents proposed, from reviewers during the process of selection. It is essential to make the answers to these.

2) Establishment of experiment plans (work of definition phase): within about 1 year after selection of candidate themes
Based of proposal, hardware required to conduct the experiment and the procedure of experiment operation will be carefully examined, the experiment plan will be established.

3) Reevaluation: about 1 year after selection of candidate themes
The results of the work contents, described in 1) and 2), will be examined. The themes will be re-reviewed whether the preparation for space experiment will be able to get stared or not.

4) Preparation for starting of space experiment (work of development phase): 1 to 4years before the implementation of space experiment
Based on the experiment plans established on the work, described in 4), the themes will be prepared for starting of space experiments.

5) Implementation of space experiment and collection of result.

(2)Term of contract
The contract term shall be from the time after the candidate theme has been selected, to the time decided, in accordance with advancement of a series of works described above. Normally, a period of concrete preparation for the space experiment of one to four years will be needed before conducting the space experiment.

(3)Parties to the contract
Regarding the selected candidate theme, Japan Space Forum, with which JAXA has business consignment, will conclude a joint research contract with the organization to which the proposer

belongs, (hereinafter referred to as "the proposer organization").
If researchers other than the proposer are to join the space experiment and its preparations, Japan Space Forum may conclude a contract separately with the research organization to which the researchers belong, following discussion with the proposer. The details of this type of agreement will be discussed with the parties concerned after selection.

(4)Location
1) The location of the establishment of experiment plan/preparation for the space experiment will be, in principle, that of the proposer organization.
2) The location of the ground control experiment will be, in principle, either the Tsukuba Space Center of JAXA or that of the proposer organization.
3) The location of the post-flight experiment will be, in principle, that of the proposer organization.

(5)Support for research
In response to requests of the selected proposer, JAXA and Japan Space Forum will offer the following support for research:
1) Supply of information relating to drop facility, aircraft experiment, etc.
2) Coordination and technical support relating to supply of information on and utilization of JAXA's facilities
3) Supply of information on the space experiment
4) Support for establishing the space experiment plan

(6) Relation with the primarily selected theme of JEM pressurized module utilization
Regarding the primary theme of JEM pressurized module utilization during the initial period, which was adopted in the "First Solicitation for International Space Station Attached Japanese Experiment Module (JEM) Utilization Theme" in 1992, the scheduled timetable will be followed independent of the international Research Solicitation. The primarily selected theme will enter a joint research with JAXA (or Japan Space Forum) from the space experiment phase. In the case of the international Research Solicitation, however, joint research with Japan Space Forum will begin from the phase of preparatory research for the space experiment. To take advantage of this, the proposer of the primarily selected theme can apply to the international AO.

(7) Miscellaneous
Implementation of activities after the selection will be subject to acceptance of the related budgets in fiscal 2004.

8. Address for Inquiries and Others

Dr. Keiji Fukui
Secretariat of International Life Science Research Solicitation
c/o Space Utilization Research Department
Japan Space Forum

TEL: +81-3-3459-1653
FAX: +81-3-5470-8426
E-mail: life@jsforum.or.jp

* **Inquiries for the Research Solicitation will be accepted by e-mail, in principle, and answers will be sent separately by E-mail. Frequently asked questions, however, will be answered on the Home Page within one to two weeks. For those without access to E-mail, facsimile may also be used. Please avoid making telephone calls.**

URL: http://www2.jsforum.or.jp/jsforum/lifeao/english/index.html

○Downloading documents

The following application information can be found on the Internet Japan Space Forum Home Page. Download and use the forms (blanks) to prepare the application documents.

(a) "Flight Experiment Information Package 2004: FEIP" (English version)

(b) A set of forms for application documents (Application documents (JP-Form) specific to Japan, and the international application forms)

(d) Letter of Intent (English and Japanese versions)

(e)Guidelines on preparing application documents(Japanese).

9. Formats of Application Documents

The formats for research theme applications are given on the following pages.

(1) Letter of Intent
(2) Application forms Part I
(3) Application forms Part Ⅱ
JP-Form 1 –3
(4) Postcard to notify receipt of application documents

Postcard to Notify Receipt of Application Documents

For notifying the receipt of application documents, a postcard with the following contents must be attached (may be handwritten).

Postcard to notify receipt of application documents (Attach a 50-yen postage stamp, or use a government-printed postcard.)

(Front)

50 yen postage stamp

□□□ □□□□

or a government-printed postcard

Address of proposer

Name, section, organization of proposer

(Rear)

1. Name of proposer

2. Name of research theme

Date of receipt:	
Reception No.	jp-no.

(Note)

Hamamatsu-cho Central Bldg. 8F,
1-29-6, Hamamatsu-cho, Minato-ku,
Tokyo 105-0013
Secretariat of International Life Science Research Solicitation,
Space Utilization Research Promotion Department,
Japan Space Forum

(Note) Receipt date and number will be entered by Japan Space Forum.