

Announcement of Opportunity (AO) for Low Earth Orbit based Microgravity Experiments

1. Introduction:

The Indian Space programme has grown from humble beginnings to achieve our vision of utilization of space for societal development. The seeds sown more than six decades ago have fructified to yield indigenous capabilities to achieve independent access to space along with a plethora of space-based services which are transforming India. The space science and exploration missions undertaken during the next level of growth of the space programme such as the Chandrayaan-1, Mars Orbiter and Astrosat missions, are yielding valuable scientific data and are contributing to the global knowledge base on the cosmos.

As ISRO is planning human space flight mission from LEO in near future, ISRO seeks inputs from the national scientific community on scientific investigations in a low earth orbit.

2. Objective of the AO

To conduct scientific experiments in microgravity platform in low earth orbit, ISRO seek scientific proposals from the national scientific community through this AO. The opportunities to conduct microgravity experiments would be available on two occasions (tentatively) after about 24 months and 30 months respectively. The proposed work could be a continuation of existing research, preparatory activities for potential short duration (1-7 days) experiments on microgravity platforms, or a wholly new concept requiring a microgravity environment. Proposals could be from the following broad research areas as mentioned in section 2.1 below :

2.1 Experimental categories

SI No.	Categories
1.	Astro biology/ Astro chemistry
2.	Space Medicine (including testing of medical equipments)

3.	Fundamental Physics
4.	Fluid and Materials
5.	Life sciences in space environment
6.	Life Support and Bio Waste Management
7.	Space Hazards (in LEO) prediction: modelling /monitoring/ mitigation strategies.
8.	Sensor Development (Biomedical, Environment monitoring, monitoring for toxic gases etc.)
9.	Micro-biology experiments such as biological air filters, biosensors etc.
10.	Space to ground communication technologies.
11.	Any other relevant or related areas

3. Microgravity Platform:

The proposed orbit for microgravity platform is expected to be in an Earth-bound orbit at an altitude of around ~ 400 km around Earth. The microgravity scientific experiments will be conducted remotely (commanded from the ground if required). The enclosure/platform for conducting the experiments will have the normal room temperature (tentatively 0-40 deg C) and pressure conditions (tentatively around 1 atmospheric pressure at sea level) experienced on Earth. Normal space environment (thermal, vacuum and radiation) conditions will be experienced for those payloads which required to be placed outside the enclosure. The instruments should be able to survive vibration and acoustics loads during launch and return to earth.

4. Internal and External payloads:

The internal and external payloads are defined as follows:

4.1 Internal payload:

The payloads which are required to be inside the enclosure/platform for conducting experiments are classified as internal payloads. The environment experienced by these payloads when in orbit have been mentioned in section 3 above. These payloads are expected to experience a more benign environment (reduced gravity, limited launch vibrations, shock and exposure to space radiation) compared to regular satellite platforms. In addition, the availability of nominal laboratory-scale thermal and pressure environments during flight, should result in a faster developmental route from ground-based laboratory experiments to qualification as an internal payload. Payloads are expected to undergo vibration, acoustic, electromagnetic qualification levels to be set by ISRO.

4.2 External payload:

Payloads which are required to be outside the enclosure are classified as external payloads. These payloads will experience the harsh space environment (thermal, vacuum, radiation) and must be space-qualified and undergo thermal-vacuum test in addition to vibration, acoustic, electromagnetic tests, etc.

5. Eligibility:

Proposals are solicited from interested scientists/ technologists/ academicians within India for novel microgravity experiments and research in Low earth orbit (LEO). This Announcement of Opportunity (AO) is open to all academic institutions in India.

6. Submission of the proposal:

The Principal Investigator (PI) of the proposal should (i) provide necessary details of the instrument which can address the scientific problems and (ii) be capable of bringing together the instrument team and lead the team for developing a space qualified instrument.

The Proposal to be submitted in the specified format given in Annexure-A. The summary table given in Annexure-B also must be filled. The complete proposal with all the relevant details

to be submitted through the Head of the institution (send the advance copy in “Word” and the signed pdf copy by speed post/email) to:

Director,
Space Science Programme Office
ISRO Head Quarter, Antariksh Bhavan,
New BEL Road,
Bangalore-560231
Email: sspo@isro.gov.in , **Sub:** Attn. Microgravity:

The last date for receiving the proposal is 20 Dec, 2018.

7. Review of the proposal

In order to identify the most optimum suite of experiments, the proposers may be requested to interact with a review committee as and when required. The final selected proposals are expected to incorporate suggestions made by the review committee.

8. Important note:

1. Any update or modifications to the AO draft will be reflected in the revised AO which will be posted on www.isro.gov.in under ‘Updates’. The proposers are requested to check the above URL periodically to keep themselves updated.
2. Preference will be given to those proposals which meets the time frame of 24 months and 30 months (tentative) of respective opportunities of two microgravity flights. The proposed payload should be submitted 5 months before the respective flight for doing necessary environmental tests and integration into the flight platform.
3. The flights for providing microgravity platform are time critical and PIs are expected to strictly adhere to agreed-upon delivery schedules.

9. Terms and Conditions:

1. ISRO reserves the right to scrutinize or reject any or all proposals received in response to this AO, or modify a proposal at any stage of consideration.

2. ISRO reserves the right to choose any payload(s) from the proposals received in response to this AO, depending upon need, novelty of intended applications, technical suitability to the mission, delivery schedule and quality & reliability factors.
3. ISRO reserves the right to schedule any payload for a particular mission, based on relevant technical factors including mission analysis, qualification, analysis etc.
4. ISRO reserves the right to access and utilize the data from scientific experiments conducted onboard the microgravity platform.
5. The research / academic institute shall not hold ISRO responsible for any harm or bodily injury or death to its personnel involved in the experimental mission or for any partial or total loss or damage of the experimental module or for any loss of equipment or property during payload module realization, testing and flight phases.
6. Scientific experiments to be conducted by selected payloads shall not be allowed to carry any chemical or nuclear substances, biological samples that are prohibited by the COSPAR guidelines on planetary protection.
7. It shall be declared and ensured by the PIs of the selected payloads, that any/all experiments proposed to be conducted onboard Indian mission shall not result in any harmful contamination of the outer space environment.
8. All selected proposals will have reviews before the flight by Reliability and Quality (R & Q) Team from ISRO. ISRO reserves the right to cancel the selected experiment from flight if it poses risk in any form to quality and safety aspects of the mission.
9. Scientific results obtained from experiments by PIs or any other, shall not be allowed to be used for marketing/business purposes without prior permission from ISRO. ISRO reserves the right to accord permission on such cases, considering the overall national interests.
10. Any/ All Intellectual Property Rights such as patents, copyrights, design rights etc. acquired by the research academic/institute (payload) or the PI, through the design and realization of payload modules and results of experiments conducted onboard the ISRO mission, shall be jointly owned by ISRO and the research institute, regardless of funding support from ISRO or otherwise.

11. Any commercialization of such IP rights shall be done by the research institute only with the consent / permission of ISRO, on specific terms and conditions, which shall be determined on a case by case basis by ISRO as per its standard practices for such activities.

Format for submitting the proposal

- 1. Category of Institution: (and partners, if any)**
 - a. Government Institute
 - b. Private Institute
 - c. Non-profit research/teaching institute
- 2. Contact Details:**
 - a. Institution: Postal address, Telephone number, Website
 - b. Contact Point (Principal investigator or project team leader) : Name, Phone number, Mobile number, Email.
 - c. Number of years of PI or project team leader before superannuation.
- 3. Mission objective**
 - a. Scientific/Experimental
 - b. Technology demonstration
 - c. Any other (to be specified)
- 4. Source of funding:** (Please provide all relevant details. Document support to be submitted when asked)
 - a. Sponsored by Government department or Ministry
 - b. Under any sponsorship (please specify)
 - c. Collaboration with a foreign university or agencies.
 - d. Any other source
- 5. Details of the proposal:**
 - a. Executive summary (around two pages)
 - b. Scientific/Experimental/Technological objectives
 - c. Detailed scientific/technological justification
 - d. Anticipated results and significance compared to contemporary research
- 6. Payload details:** (Please provide all relevant details)
 - a. Internal or external payload
 - b. Mass, Power, Volume, Dimension, Unregulated Power Supply requirement of the experiment
 - c. Total hours required for the experiment in microgravity

- d. Requirement of on board data storage. Whether real time data transmission capability required and if so, total volume of data to be transmitted.
 - e. Whether the experiment to be repeated in subsequent flight of microgravity? If yes, please provide a detail scientific justification of the same.
 - f. Mechanical and electrical design of the payload.
- 7. Infrastructure available with the institution for the proposed payload:**
- a. Technical and Scientific team with domain experts (including research students)
 - b. Collaborating institutions
 - c. Laboratory facilities
 - d. Details of available test equipments and test facilities.
 - e. Available fund
- 8. Requirement of additional infrastructure**
- a. Manpower
 - b. Fund
 - c. Laboratory facilities for development, qualification and calibration
 - d. Test equipments and test facilities
- 9. Nature of support sought from ISRO**
- a. Funding support (limited funding support from ISRO)
 - b. Technical consultancy
 - c. Clean room support
 - d. Environmental test support
 - e. Any other, project related support
- 10. Schedule of realization and delivery**
- a. Detailed PERT chart and time schedule for completion of Laboratory Model / Verification model, which should have the same design and approximately same size as Flight model.
 - b. Detailed PERT chart and time schedule for development, testing and calibration of Qualification Model (Should be identical in Mass, Volume and Design as Flight Model and should undergo all environmental tests) and Flight Model from T0, assuming T0 being the date of approval for the project proposal.

- c. Calibration plan
- d. Plan for data processing and analysis
- e. Half year wise budget detail

**11. Past experience of the team on the research on Micro-gravity experiment
(Experimental, theoretical, numerical and observational)**

12. Any other special requirement

SUMMARY TABLE

1	Title of proposal	
2	Principal Investigator and official designation	
3	Category (select from 2.1)	
4	Primary science objectives	
	i. New Science	
	ii. Extension/ Improvisation to the previous findings	
	iii. Supplementary / complementary science	
5	Instrument specifications required to meet proposed science objectives	
6	New technologies to be developed (if any)	
7	Critical components procurements / availability issues (if any) for realizing the instrument	
8	Expected maximum mass of the payload	
9	Expected maximum raw power (assume a 70% efficiency for DC-DC units)	
10	Maximum operational duration (ignore potential losses from spacecraft constraints) of the experiment to achieve targeted science	
11	Commanding operation and monitoring requirements	
12	Science Data	
	1. Storage requirements (on board)	

	2. Data transmission rate requirements (if any)		
	3. Latency		
13	Institutional Infrastructure (for proposed activities)		
	(a) Human resource details:		
	1. Science	Total required	Total available
	2. Technology	Total required	Total available
	(b) Relevant test facilities		
	(c) Any other		
14	Budget requirements		
15	Schedule – time frame for delivery	Qualification Model	Flight Model
16	List of non-space grade components		

Declaration:

I/We declare that all the information/ technical details furnished above are factually correct to the best of my/our knowledge.

I/We further declare that, I/We would utilize the financial resources provided under this proposal by ISRO/DOS for the proposed scientific and experimental activities.

Signature

Name

Date & Place

Official Seal