



Starlab and the Center for Space and Aviation Switzerland and Lichtenstein Pathways to Space Commercialization

Call for Proposals for Access to Microgravity for Market Readiness Maturation

Step-1 Questions and Answers

- 1. I'm currently prototyping a cognitive measurement device to provide transparency to the operational directors about the operational readiness level of the astronauts. I want to apply for the Pathways to Space Commercialization. Since the project doesn't align with the prelisted categories, I decided to check and understand if this project aligns with your interests.**

We are interpreting that a "cognitive measurement device" would indicate that a human subject may be required. If so, this is not part of the scope of this Call. This Call is for experiments being performed inside the GAP hardware.

- 2. Can a small solid substrate or material coupon be placed inside an FPA so that a liquid formulation or precursor can interact with, deposit onto, or form a coating on the substrate after on-orbit activation? If so, are there dimensional, material, surface-area, or geometry limitations for such solid coupons?**

Yes, this may be implemented (payload example: "Space Biofilms"). The size limitation is the 1.35 cm inner diameter of the FPA.

- 3. In addition to the published total fluid capacity of approximately 6.5 mL, are detailed internal dimensions, chamber-volume ranges, wetted materials, and chemical-compatibility requirements available to proposers for preliminary experiment design?**

See answer to question 40. The materials are borosilicate for the FPA glass barrel, Bromobutyl for the septa, and ultem for the insert. Each selected team is responsible for testing the compatibility of these materials with their experiment's constituents.

- 4. The FPA is described as allowing sequential mixing of two to four fluids, while eight FPAs are housed within one GAP. Can each FPA be activated or terminated independently, or are all eight FPAs actuated simultaneously through the GAP mechanism? How many separate on-orbit activation/mixing events can normally be accommodated during a mission?**

All eight FPAs are actuated simultaneously. The number of on-orbit mixing events is determined by the number of chambers you use. Please see answer to question 40 for more details.

- 5. For selected projects, does the award include flight-equivalent FPAs/GAP hardware, or equivalent support, for terrestrial 1-g control experiments? If not, would proposers be expected to procure or fund the ground-control hardware separately?**

Yes, for each GAP flown to space, one GAP will be provided for ground control. This also includes the FPAs that go inside, and support equipment like FPA inserts and septa, as needed. The objective is for the PI & Team to have equivalent ground controls to flight. BioServe will only pay for shipments within the United States. International shipments need to be covered and taken care of by the selected team under coordination with BioServe.

- 6. What temperature ranges and storage conditions should proposers assume during pre-launch handover, ascent, on-orbit storage/operation, return, and post-flight sample recovery? Is temperature-controlled operation available to projects selected under this specific CFP, and what are the typical pre-launch handover and post-return sample-recovery timelines?**

The hardware can support a -4C to +37C range. Proposers may request different temperatures at different stages of flight (e.g. launch ambient, activation on orbit then transfer to +37C on ISS, then termination and return ambient to ground). Typical temperature requests for this hardware are +4C, Ambient (~+25C), and +37C. However, proposers are reminded that simplicity of their temperature (and otherwise) requirements will help them score higher in the "Technical and Operational Feasibility" evaluation criterion described on Page 10 of the Calls For Proposals.

- 7. The CFP states that flight hardware, payload integration, upmass, downmass, launch, crew time, and on-orbit operations support are included only as specified in the Award Agreement, while internal project costs are not funded. Could you please clarify whether there is any application fee, required cost share, or other mandatory payment by the selected team, and identify any typical costs that awardees should expect to cover themselves, such as ground-control hardware, sample shipment, compatibility testing, travel, or integration-related activities?**

There is no application fee, required cost share, nor any other mandatory payment from the selected team. The selected team will have to cover the costs of their experimental design maturation (e.g. performing tests in their lab to find the final details of how they want to use and fly their FPAs), flying to the launch site (e.g. Kennedy Space Center) to integrate their science into the flight FPAs, and shipping of items from their lab to the launch site. BioServe will make their best effort to support the badging process for a member of the selected team to gain access to the NASA funded government facility for the pre-flight integration. Post-flight, BioServe will ship samples to a location within the United States, but not abroad, therefore the selected team will be responsible for international shipping costs, if necessary. Ground control hardware (FPAs and GAP) will be shipped to selected team, which they can use for experimental design maturation. This hardware must be shipped back to BioServe at the conclusion of the experiment. International shipments will need to be coordinated with BioServe and will have to be covered by the selected team.

- 8. Can a European SME act as the lead applicant, with academic, technical and/or industrial partners from other European countries participating in the project?**

For Starlab's GAP, yes. For Starlab+CSA's GAPs and as described on page 4 of the Calls for Proposals, in addition to the requirements for the Starlab GAP, applicants must demonstrate a substantive connection to the Canton of Zurich. This requirement may be satisfied either by (i) a Principal Investigator affiliated with an institution or company based in the Canton of Zurich, or (ii) an active and demonstrable collaboration between the applicant or proposal team and an institution or company based in the Canton of Zurich. Co-Investigators and other team members may be based outside the Canton of Zurich, provided that all applicable Eligibility Criteria and export control and sanctions screening requirements are met.

9. In particular, would participation by a Swiss academic or technical partner be acceptable within an applicant-led international consortium?

Please see answer to question 8.

10. At Step 1, what level of definition do you expect regarding consortium members, subcontractors and technical partners? Do all parties need to be formally confirmed at this stage?

Team members described in Step 1 are not conclusive; these may be finalized in Step 2. However, to be eligible for the Starlab+CSA GAPs, applicable team-related requirements need to be met in both Step 1 and Step 2 proposals.

11. For a protein crystallisation experiment using a GAP-type configuration, could you confirm the currently supported or validated FPA configurations available through the programme?

Please see the answers to questions 3 and 40.

12. If eight FPAs are available within a GAP, can each FPA be configured with a different crystallisation condition, allowing multiple conditions or formulations to be evaluated within the same flight experiment?

As long as the volumes in each chamber are maintained equivalent throughout the eight FPAs, then yes, different contents may be loaded in different FPAs in a given GAP. Please see the answer to question 40 for more details.

13. Are sequential mixing schemes involving three or potentially four solutions technically possible within the FPA architecture - for example, protein, precipitant, cofactor/additive and an activation or termination solution?

Yes. We suggest looking for published articles using this hardware to find more examples of how it has been used in the past. Please see the answer to question 40 for more details.

14. To what extent can the experimental configuration be customised during the later technical-development phase if the proposal is selected?

Experimental design maturation is an expected phase of this project. This will take place between proposal selection and flight readiness. The selected team will perform tests in their lab to identify what conditions they want to use for their spaceflight opportunity.

15. Are matched ground controls expected to be performed by the applicant, by Starlab, or through a coordinated protocol between both parties?

BioServe will provide ground control hardware (shipped within the United States). The selected team will load and perform their own ground controls with this flight-equivalent hardware.

16. Are there specific restrictions regarding proteins, buffers, precipitants, cofactors, metals, cryoprotectants or other reagents that applicants should take into account at the Step 1 stage?

Per the "Technical and Operational Feasibility" evaluation criterion, lower toxicity and biosafety level (BSL) items will score higher than those that have higher toxicity or BSL. Fixatives usually used in spaceflight and in this hardware include 4% paraformaldehyde (PFA) or RNAProtect (for preservation).

17. Could you provide guidance on the expected temperature environment and available temperature-control options during: pre-launch handover and storage; launch; on-orbit operations; experiment termination; return; and post-landing sample recovery?

Please see answer to question 6.

18. What microgravity exposure duration should applicants currently assume for experiments under this call, and how much flexibility is expected to exist around experiment duration?

This is unknown at this stage because manifest cannot take place until all end-user (selected team) requirements have been conveyed to NASA. Selected teams can plan on a 2-week minimum and 6-month maximum duration on orbit.

19. Is active or passive in-orbit termination of protein crystallisation experiments supported - for example, through the introduction of a termination/stabilisation solution or temperature change?

Yes.

20. For returned biological samples, what is the anticipated timeline between landing and release/delivery of the samples to the applicant or designated analytical laboratory? Would applicants be able to define specific post-flight handling requirements where sample integrity is time- or temperature-sensitive?

Based on previous flight, a selected team may assume a 2-4 day period between splashdown and samples being shipped by BioServe to a location of the selected team's choosing within the United States. Yes, the selected team may indicate specific post-flight requirements. However, the more requirements or more complex requirements a proposal has, the lower it may score in the "Technical and Operational Feasibility" evaluation criterion. Additionally, BioServe will use best faith effort to meet requirements, but can not guarantee specific requirements can be accommodated post return to Earth until the requirements are known and communicated to NASA.

21. For proposals involving commercially sensitive pharmaceutical-development information, what mechanism does Starlab recommend for discussing confidential information beyond Step 1? Would an NDA or equivalent confidentiality framework be available before detailed technical disclosure is required?

Yes, NDAs can be set up.

22. We would appreciate clarification on the commercial framework of the programme: Which elements of payload development, integration, launch, on-orbit operations and sample return are covered by the award? Which costs should applicants expect to fund directly? If a proposal successfully completes the full selection process, does the award include a committed flight opportunity, subject to successful technical integration and safety review, or would flight allocation be subject to a subsequent commercial or scheduling decision?

Elements covered and not covered under this award are described in the answer to question 7. As indicated in the Calls for Proposals, the selected team will be scheduled for flight as indicated in more details in the Award Info section of the Calls for Proposals (page 5).

23. Can small plants, seedlings or exposed root systems be accommodated within the experimental hardware?

Yes. Also, please see answers to questions 13 and 40. However, custom lighting is not available and there is no active gas or humidity control within the FPA/GAP hardware. We suggest looking for published articles using this hardware to find more examples of how it has been used in the past.

24. Can investigators introduce a controlled liquid or atomized nutrient-delivery mechanism, or whether experiments must use the standard FPA fluid-delivery architecture?

Selected teams will use the FPA/GAP hardware. No other mechanisms may be included.

25. What approximate experimental volume, fluid volume and plant/root dimensions are available?

Please see the answer to question 40.

26. Can imaging and/or environmental measurements be collected during the experiment?

Temperature inside the GAP will be recorded at a TBD frequency (e.g. once every 30 minutes from pre-launch handover to BioServe, to post-return handover to selected team). Pictures taken by the crew of the outside of the GAP (e.g. four pictures per GAP to image all FPAs) may be requested.

27. Whether an investigation focused on microgravity fluid behaviour and root-zone water/nutrient delivery, with the longer-term objective of developing a scalable plant-growth subsystem for future commercial space stations, would fall within the intended scope of this CFP?

Yes, if completed within the FPA/GAP hardware.

28. Can an individual or early-career researcher based in Guatemala serve as PI? Is an affiliation with a university, company or other registered organization required, and if so, can that organization be a small or non-profit entity?

For the Starlab GAP, yes. For the Starlab+CSA GAPs, only if the CSA-related team requirements are fulfilled as described in page 4 and elsewhere of the Calls for Proposals. There are no specific requirements on what types of affiliations the team must have;

however, per the "Facilities & Equipment" evaluation criterion, the proposing team needs to clearly convey that they will have access to the labs, equipment, etc., needed for the experimental design maturation, performance of the ground controls, and acquisition and analysis of the data post-flight.

29. My concept involves the post-thaw recovery of cryopreserved mammalian cells/tissue in microgravity. Would an investigation that includes a freeze-thaw step fall within the eligible research area of "mammalian cells and tissues"? And does the offered hardware/flight profile allow for cold or frozen stowage of samples before activation, or should the experiment be designed to run at ambient/incubated conditions only?

No. The hardware can only support 4C to +37C. Keep in mind that the more requirements or more complex requirements a proposal has, the lower it may score in the "Technical and Operational Feasibility" evaluation criterion.

30. How much detail is expected on the business case or commercialization pathway at Step 1, versus the scientific and technical rationale?

Please refer to the Evaluation Criteria (pages 9 and 10 in the Calls for Proposals) as a guide on how much detail to give to each aspect.

31. Can an FPA chamber hold a particulate slurry or a solid-phase capture medium, or must all chamber contents remain single-phase liquids compatible with the plunger/bypass mechanism?

Yes, gases, liquids, slurries, and solids may be loaded in FPA chambers. Please refer to the answers to questions 4, 12, 40, and 41 as a complement to this answer.

32. For a 4-chamber configuration, is the 6.5 mL total split evenly across chambers, or can proposers request custom per-chamber volumes?

Yes, custom per-chamber volumes may be requested. However, the 6.5 mL total volume includes the septa that separate each chamber, so the more chambers there are, the less available volume per chamber for fluids. Additionally, the chamber that spans the bypass, generally contains a larger volume of fluid compared to the other chambers. Please see the answer to question 40 for more details.

33. Is there a pre-approved or restricted reagent list for chamber contents (e.g., for antibiotic-based fixation), and if so, is it available for review?

No, there is no such list. Please refer to the answer to question 16 for more details. Also, proposers are recommended to look for published literature of previous experiments using the FPA hardware as guidance.

34. What temperature range/profile does the incubator housing (CGBA/SABL) maintain over the mission?

CGBA is no longer available on board the ISS. Please refer to the answer to question 38.

35. What is the typical window between activation and sample return/fixation, and can proposers specify sub-stage durations (e.g., growth-phase length) within it, or is timing fixed by mission operations?

Yes, proposers may request specific timelines between reaching orbit and activation, subsequent mixing events (including termination), and return from orbit. Spaceflight timeline is TBD per the answer to question 18.

36. How far ahead of launch must samples be loaded into the FPAs, and under what storage conditions in the interim?

Handover to NASA is TBD but can be assumed to be 72 hours before launch. The selected team must schedule their FPA loading steps so that they can hand over to BioServe at L-72 hrs at the launch site (expected to be Kennedy Space Center). Please refer to the answers to questions 6 and 7 for more details.

37. Separate from the gas-exchange membrane option, can a semi-permeable membrane or filter (e.g., ~0.22 μm) be placed at a bypass point between two chambers, to allow selective passage of solutes while retaining particulates or cells, or is the bypass mechanism limited to open, unfiltered fluid transfer?

No, this is not possible under this solicitation.

38. What temperatures ranges can the hardware support?

4C to +37C.

39. What is the maximum volume the hardware can support?

6.5 mL. See the answer to question 40 for details.

40. How is the hardware configured?

The FPA can mix 3 or 4 sequential fluids with total volume no more than 6.5 mL. An FPA has 7.20 cm of its length available for the experimental volume (and 1.35 cm inner diameter). From this volume, proposers must subtract the volume taken by the septa that separate each chamber. Each septum is 0.65 cm in height. Additionally, Chamber A must span the length of the bypass which is approximately 2 cm in length.

41. Can each of the 8 FPAs loaded in one GAP be loaded with different volumes?

No, all 8 FPAs loaded into one GAP must have each compartment of fluid loaded to the same volumes as the other 8 FPAs (unless it is a passive payload with no on-orbit mixing).

42. Do the FPAs/GAP allow for gas exchange?

The FPA/GAP hardware has limited gas exchange capabilities. It may also be set up for no-gas exchange.

43. Previous seed experiments: Are there reference protocols or publications describing seed germination in the offered configuration, including seed loading, available growing space, hydration and gas exchange?

Please see comments throughout this document on usable volume and gas exchange of the GAP/FPA hardware. There are no general reference protocols available for seed germination within the FPA. Protocols should be developed by the science team in consultation with BioServe and after ground testing within the hardware.

44. Solid substrates: Can FPAs accommodate seeds together with a small quantity of granular mineral substrate? What restrictions apply to particle size, substrate mass and containment? Would an immobilized substrate or support matrix be required?

Yes, and restricted by the inner diameter of the FPA and the volume in the chamber. A support matrix (e.g. agarose gel) may be used but is not required; this depends on the experimental objectives. Substrate or support matrix must also be able to move within the FPA during activation and termination steps.

45. Lighting and environmental conditions: Is illumination available, or would experiments remain in darkness? What temperature control and gas-exchange options are included? Are gas-permeable membranes available within the award?

Yes, light may be provided when the GAP is incubating inside of the SABL incubator during the ISS phase of flight (i.e. not during launch or return). However, this lighting is not standard lighting for plant growth and cannot be changed from its current configuration. You may refer to BioServe's SABL hardware for details on temperature control. Instead of using a "solid insert" at one end of the FPA, a "gas exchange insert" with 0.22 µm gas exchange membrane may be used. However, gas exchange is limited to the air within the GAP hardware at the time of integration, as the GAP is a sealed container.

46. Duration and activation: What germination/incubation durations can be supported? What prelaunch holding period should we plan for, and can hydration be initiated in orbit while keeping seeds dry beforehand?

The selected team will integrate their science in the FPA hardware at the launch site, likely KSC, and hand over to BioServe 72 hours before launch (T-72 hr). The GAPs will remain in a dark, temperature-controlled environment from this handover through launch. Once in orbit, some GAPs may be transferred into a SABL facility within the ISS if temperature control or light cycles are needed. The GAP may be used to transfer a liquid from a second chamber (the first one being the one holding the seeds) if needed.

47. Fungal inoculation: Could an identified, non-pathogenic fungal strain be included, subject to safety review? What strain documentation and containment requirements would apply?

Yes. An SDS will be needed. The FPA and GAP can provide several levels of containment.

48. Observations and sample preservation: Are in-flight photographs or other observations possible? Which termination, preservation and return conditions are available, and could live return or freezing be considered instead of chemical fixation?

Yes, photography from outside the GAP may be requested up to twice during the time in orbit. Temperature conditions are provided elsewhere in this Q&A document (e.g. see question 6). Live return is possible, depending upon temperature requirement for return

49. Step-1 readiness and costs: Can Step-1 propose ground feasibility tests as an initial project phase without presenting new preliminary experimental results? Which costs associated with configuration modifications, ground reference hardware and preflight validation would fall to the proposing team?

Yes, an experimental design maturation process from project kickoff is expected, as the selected team defines the details of their protocol towards flight readiness, and this is at the cost of the selected team. As described elsewhere in this Q&A document, BioServe will ship matching ground control hardware (FPAs, GAP) within the United States. International shipping must be paid by the selected team and coordinated with BioServe.

50. Can viable 3D-bioprinted, stem-cell-derived organoids be accommodated within the GAP/FPA system?

Yes.

51. Can organoids be bioprinted and prepared terrestrially before launch and subsequently exposed to a pharmaceutical compound within the FPA during the ISS experiment?

Yes.

52. Does this flight opportunity provide access to, or compatibility with, an on-orbit 3D bioprinting capability, or should proposers assume that organoids would need to be prepared before launch?

Organoids would need to be prepared before launch.

53. What are the principal FPA constraints relevant to organoid experiments, including sample dimensions and volume, culture media, temperature, gas exchange, viability duration, pharmaceutical introduction, fixation/termination, and biological containment?

All of these questions are responded to across this Q&A document.

54. Can the eight FPAs within a GAP be allocated among different treatment and control conditions or exposure durations?

Yes. Please refer to other answers in this document, including questions 4 and 40.

55. Can returned organoid samples be preserved for post-flight analyses such as histology, transcriptomics, proteomics and metabolomics?

Yes.

56. If invited to Step 2, will BioServe provide technical consultation to help selected teams adapt their proposed biological experiment to the GAP/FPA flight hardware?

ABioServe Project Manager will provide training and respond to questions from the teams that were selected for flight, but not to support teams preparing their Step 2 proposals. Proposing teams, however, will have a period of time after being invited to prepare a Step 2 proposal to submit questions through the Starlab website.

57. Are there restrictions on particle size, solids loading, particle concentration, or suspension viscosity?

Yes. Please refer to other answers in this document, including question 44.

58. What carrier fluids, binders, or liquid media are compatible with the FPA?

Thousands of FPAs have been used in space since the Space Shuttle. Please use published work that has used the FPA hardware for examples of what has been used in the past. Most reagents commonly used in life sciences labs may be used, keeping in mind the toxicity and biosafety level of the constituents. See answer to question 16 for more details.

59. What is the usable sample volume within each FPA?

Please refer to the answer to question 40.

60. Are there limitations associated with abrasive or irregularly shaped mineral/ceramic particles?

Yes. Please refer to other answers in this document, including questions 44 and 58.

61. What mixing or activation operations can be performed in orbit, and can samples be maintained for an extended period after activation?

This question is responded to across this Q&A document.

62. Are samples expected to be returned to Earth for post-flight characterization, and if so, are there specific requirements regarding the physical state of returned samples?

Yes, the GAP is scheduled to return to Earth for de-integration and data acquisition and analysis. There are temperature constraints as described in the answer to question 6 and others.

63. Is a matched 1-g ground-control experiment using identical FPA/GAP hardware included or supported as part of the flight experiment, or would the proposing team be responsible for establishing its own ground-control configuration?

Yes, one matching ground control will be provided at no cost to the selected team. BioServe will ship within the U.S. as described elsewhere in this document.

64. Multiple proposals. May the same PI or institutional team submit two (or more) separate Step-1 proposals under this call, and could both be considered for award?

Yes, and both will be considered.

65. Zurich collaboration requirement. For a proposal led by an institution outside Switzerland, what evidence is expected at Step 1 to demonstrate an "active and demonstrable collaboration" with a Canton of Zurich institution? Is a defined technical role with an in-kind contribution sufficient, or is a formal letter or signed agreement required at this stage?

A letter of support or intent, on the Swiss organization's letterhead, suffices. This letter shall indicate that if the proposing team is selected, the Swiss partner(s) commits to perform their part of the work as described in the proposal, and have the required support from their institution, as applicable, to perform their part of the work.

66. Scope of implementation support. Beyond flight hardware, launch, downmass, crew time and on-orbit operations, which payload-development and verification activities (e.g., hardware loading, experiment verification tests) are covered by BioServe, and which must be funded by the proposing institutions?

Hardware loading at the launch site and experiment verification test (EVT) will be supported by BioServe but are performed and results presented by the selected team. Costs related to experimental design maturation (i.e. defining the details of what will be flown) are covered by the selected team. BioServe will ship, within the U.S., FPAs and

related hardware for these tests to take place during the experiment plan maturation phase, which takes place at the selected team's labs.

67. Ground controls. Does the award include equivalent FPAs and support for synchronized ground-reference experiments? If so, are ground controls run by BioServe at its facility, or may they be run in the proposing team's laboratory following the flight timeline?

As described in other answers, BioServe will provide the selected team with FPAs and related hardware for ground controls. Ground controls are performed by the selected team at their lab.

68. Shipment of biological material. Can BioServe receive live yeast cultures shipped from outside the United States (e.g., Argentina or Switzerland), and which party is responsible for import permits and shipping?

International import/export must be fully addressed by the selected team, in the cases when this applies. In the case described in the question, the selected team shall find a third party in the U.S. (e.g., a collaborator at a university in the U.S.) who may serve as importer. The U.S. third party may then send yeast samples to BioServe in Colorado, following any applicable rules and laws. The case of export will be equivalent; post-flight, BioServe will only ship within the U.S.

69. Sequential activations. How many sequential mixing events can be performed in each FPA during the mission? Can activation, addition of a treatment and termination occur at three independently scheduled times?

Yes. Please refer to other answers in this document, including questions 4 and 40, and others. Yes, each of these fluid transfers may take place at different times; however, all eight FPAs are activated at the same time during each of these GAP activation events.

70. Common GAP operation. Must all eight FPAs within a GAP be activated and terminated simultaneously, or can different FPAs follow different schedules? May the eight FPAs contain different yeast strains, media or treatment solutions while sharing the same activation times?

Yes. Please refer to other answers in this document, including questions 4, 40, 70, and others. Constituents within each FPA may vary, as long as the volumes of chambers remain equivalent across FPAs if activation(s) is/are being performed.

71. Chamber configuration. Which two-, three- or four-chamber FPA configurations are available under this call, and what are the allowable volumes for each chamber within the 6.5 mL total capacity?

Yes. Please refer to other answers in this document, including questions 4 and 40, and others.

72. Gas exchange and gas generation. Will the FPAs use the standard limited-gas-exchange configuration, or can gas-permeable membranes be provided? Can proposers specify the initial headspace volume and gas composition? For fermentative cultures that generate CO₂, what is the maximum allowable gas production or internal pressure per FPA?

Gas exchange membranes may be used as described across several answers in this document. Proposers may describe specific gas compositions and headspace volume. For fermentative cultures that generate CO₂, the selected team will need to characterize gas pressure during their experimental design phase and coordinate with BioServe to determine the permissible limits. In turn, these limits will help the selected team define their final experimental design.

73. Pre-launch handover. What is the expected interval between sample handover and on-orbit activation, and can the loaded FPAs be held at 4 °C during that period?

As described in detail in other answers, the selected team will hand over the integrated FPAs to BioServe 72 hours before launch. BioServe will be present at the lab at the launch site to solve questions the team may have. The time between reaching the ISS and the first possibility to perform an activation is still TBD, but proposers may assume no earlier than 1 day and no later than 4 days from docking.

74. What incubation temperatures can be supported on orbit, and what is the maximum interval between activation and termination (we anticipate incubations of several days)? Will temperature logs be made available to the investigation team?

Please refer to the answers to other questions in this document, including questions 6 and 38, for details on temperature. Yes, temperature logs may be requested. A temperature logger may be installed inside the GAP for this purpose.

75. Is chemical fixation required before return, or may cultures be terminated by refrigeration or freezing and returned viable for viability and phenotype-recovery analyses? What cold-storage and downmass conditions are anticipated?

Please refer to the answers to other questions in this document, including questions 6 and 38, for details.

76. Is the FPA/GAP limited to endpoint analysis after return, or are any in-flight measurements (e.g., temperature, optical density, oxygen) available? Could the crew photograph selected FPAs after a mixing event? What is the anticipated time between sample return and handover to the investigation team?

Temperature may be recorded during all phases of flight, and pictures from outside the GAP may be requested, as described in more detail in other answers in the document. Post-flight handover timeline is still TBD, but proposers may assume samples will be shipped to a location in the U.S. generally within 48-96 hours from splashdown.

77. Would a pre-validated, dilute oxidizing agent (e.g., low-concentration hydrogen peroxide) be acceptable as a treatment in one FPA chamber, subject to standard safety and material-compatibility review?

Please refer to other answers in this document, including questions 16, 20, and 33.

78. Can a 0.22 micrometer filter or similar filter (for straining out contaminant common in biological workflows) be fixed to the last chamber of a FAP to essentially strain out all particulate larger than the filter?

For this flight opportunity, no.

79. Do the SABL or CGBA refrigeration units support freezing up to time of return to Earth, or through the entirety of sample return process? That is, can we count on frozen cells staying frozen until they are ready to be processed on Earth, pending unexpected hardware failure, or mission requirement etc.? If yes, then can these samples be frozen for -20C or do they have a temperature constraint?

CGBA is no longer available on orbit. Please refer to other answers in this document, including question 6.

80. Is there an ability for BioServe to measure optical density (i.e. OD 600)? If so, in which chambers, and how frequently?

For this flight opportunity, no.

81. Is there an ability for BioServe to measure fluorescence? If so, at what excitation and emission wavelengths? If yes, in which chambers of the FPA?

For this flight opportunity, no.

82. How long does it take to move fluid from one chamber to the next?

It depends on the column height of the second chamber, the one holding the fluid being transferred into the first chamber. As an example, a ~1 cm column height will only take about 10 seconds for the crew to transfer during the GAP activation. The crew may be requested to shake the GAP after an activation to ensure proper mixing if required.

83. Is there any ability to extract fluid from an FPA for "organ on a chip" testing while still in microgravity? The assays we are considering are very small, quick to report, and require very small amount of fluid <1 mL.

For this flight opportunity, no.

84. Besides the FPA/GPA and SABL, is there any other BioServe hardware available in this solicitation, such as the BioCell or SPOC?

For this flight opportunity, no.

85. Do all components that end up in the FPA have to start the flight inside the FPA, or is there a capability of putting anything in the individual chambers once in flight? Can a reporter ligand that has to remain frozen or dry until experiment activation be added to the FPA, or does it have to start inside the FPA from launch?

All constituents must be in the FPAs at time of launch. However, constituents may be separated by septa and transferred from one chamber to the next at times determined and requested by the selected team.

86. What access do we have to the hardware prior to flight to test experiments?

Please refer to other answers in this document, including questions 5, 14, and 15.

87. Can individual FPAs in one GAP be advanced/stopped at different times, or do they advance all at once?

The FPAs all advance and stop at the same time. Please refer to other answers in this document, including questions 4 and 40.

88. Can the FPA chambers be loaded fully with fluid (i.e. no headspace for air or bubbles that would slow/degrade mixing)?

Yes, chambers can be loaded with a liquid, a gas, or a combination thereof. Please refer to other answers in this document, including question 12.

89. Could we run synchronous ground trials in identical hardware?

Yes, as described in more detail across this document.

Important Notice – Non-Binding Q&A

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