



British Embassy
Berne

MICROGRAVITY FOR BIOPHARMA

From dialogue to pilot opportunities

Report from the UK-Swiss Microgravity Biopharma Dialogue
held in Berne, Switzerland, 29 June 2026.



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Berne

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NOTE ON THE REPORT

This report acts as a record of the Microgravity Biopharma Dialogue, distils the main themes raised by participants, and sets out recommendations for policymakers. It focuses on what would make microgravity credible to biopharma decision makers, and on the pilot activity needed to test that proposition.

It is written primarily for UK Government policymakers, as well as for wider industry, regulatory, funding and research stakeholders.

The report draws on the workshop discussions, on collated participant post-workshop feedback, and on a follow-up online session for participants to review the draft report.

The workshop was held under the Chatham House Rule; the report thus includes anonymised views with comments not attributed to individuals, and workshop participants agreed to this approach.

This report and its recommendations should not be interpreted as a statement of UK Government policy, funding commitments or agreed programme priorities.

FOREWORD

The United Kingdom and Switzerland have long been at the forefront of discovery and innovation. We share world-class strengths in life sciences, research, engineering and entrepreneurship, and a belief that ambitious ideas are worth exploring. Together we are well placed to shape emerging fields at the intersection of technologies with the potential to transform how we understand and improve human health.

Microgravity research sits at one of these emerging frontiers. The conversations that took place during the UK-Swiss Microgravity Biopharma Dialogue in Berne in June demonstrate the value of bringing together people who do not routinely work alongside each other: pharmaceutical researchers, space innovators, regulators, academics and policymakers.

The British Embassy is proud to have convened this international dialogue and to have enabled an open, practical exchange of ideas.

Embracing creativity and ambition, this workshop epitomised a shared willingness to challenge assumptions, to learn from one another, and to explore possibilities that none of these communities could unlock alone. It helped move the question on from what space can offer to what pharma needs.

As technologies develop and access to space evolves, the opportunities for collaboration between space and life sciences will only grow. Our challenge will be to match curiosity with evidence, ambition with practical action, and innovation with strong partnerships.

I hope this report encourages further discussion, new collaborations and fresh thinking, and helps turn the Dialogue into focused next steps. As likeminded partners and friends, the United Kingdom and Switzerland are ideally placed to work together to help shape the future of this groundbreaking field.

James Squire
His Majesty's Ambassador to Switzerland and Liechtenstein
September 2026

EXECUTIVE SUMMARY

Microgravity is not short of scientific promise. The question for this report was whether it can become a credible tool for biopharma research and development (R&D). The UK-Swiss Microgravity Biopharma Dialogue was convened to examine that issue directly. It brought together representatives from biopharma, space companies, academia, regulators, funders and government. Rather than attempt a full landscape review of microgravity applications, the Dialogue asked a narrower question: what would make microgravity relevant enough to a pharmaceutical company for it to commit time, expertise, data or funding?

The discussions showed that commitment will depend on whether microgravity can answer a defined pharma problem, produce evidence a development team can use, and justify the cost, time and risk of working in orbit.

Participants recognised potential value in formulation, tissue engineering, disease modelling, drug discovery and biomarker work. They were also clear that microgravity is not yet part of routine pharma decision-making. It is still poorly understood by many of the teams that would need to commission experiments. The evidence base is fragmented. The application of regulatory, quality and operational requirements to specific in-orbit models requires further clarification, alongside practical questions concerning intellectual property, data sharing, cold chain and maintenance of sterility (where relevant) and sample return.

The Dialogue therefore pointed to a practical next step, which is to define where a pharma user would have a reason to act, not simply to restate the benefits of microgravity. Participants repeatedly came back to the same adoption test: can this be done better, faster, more cheaply, or only in microgravity, and can that be shown in a form that a company could defend internally?

A cross-cutting proposition was that microgravity could generate more decision-relevant data in a shorter time, supporting earlier decisions across formulation, screening, disease modelling and discovery. The pilot will need to test where this advantage is real and material.

Two use cases emerged as the strongest basis for further work. The near-term use case is drug reformulation, particularly where microgravity-enabled crystallisation or formulation insight could support a higher-concentration, more stable or more convenient form of an existing high-value therapy. The strongest version of this opportunity is narrower than any broad claim about manufacturing medicines in space: can microgravity help solve formulation problems that affect delivery route, stability, patent life, patient convenience, cost of administration or market protection?

The second use case is organoids and disease models. This has significant potential, particularly where microgravity may enable more physiologically relevant models, faster maturation, disease-mechanism insight or biomarker discovery. However, the commercial case is less mature. Participants raised questions about reproducibility, disease-target selection, Earth comparators, data requirements and the time needed to build robust models. Organoids should therefore be treated as a medium-term pilot area, developed after disciplined scoping rather than positioned as the first major programme.

The workshop findings recommend a pilot-definition phase focused primarily on drug reformulation, with a smaller scoping track on organoids. The first phase should comprise confidential 1:1 engagement with pharma companies, a focused follow-on workshop and work packages on business case, IP, regulatory pathway, evidence standards and infrastructure requirements. Defining those questions will be key to developing a potential pilot programme.

The preferred model discussed by participants was a challenge-led, consortium-based programme, based on a series of repeatable work packages and informed by confidential 1:1 pharma scoping. Bilateral projects between a space company and a pharma company may be faster and should be encouraged where there is a clear commercial fit. But they may not generate the shared evidence, standardised requirements, regulatory confidence or market signal that the sector needs, because the progress will be incremental and not likely to be widely shared. A consortium model is more complex, but better aligned with the public sector role: to tackle market failures and the adverse impact to society and citizens.

Recommendations in brief

-  Explore a pilot-definition phase for drug reformulation, focused on assessing the strength of the use case, delivery model options and evidence requirements.
-  Validate the workshop findings against a broader evidence base, including UK Space Agency RFI responses, engagement with additional pharmaceutical companies, and assessment of international activity, before implementing priority use cases.
-  Consider a challenge-led consortium model for a first pilot use case, supported by confidential 1:1 scoping with pharma companies to protect commercially sensitive information.
-  Structure the first phase around requirements and evidence. The programme should define which product characteristics, cost thresholds, data outputs, regulatory touchpoints and infrastructure capabilities are needed for the case to close.
-  Build IP, molecule anonymisation and data-sharing into the programme from the outset. These are practical adoption conditions, not legal details to be left until later.
-  Create a regulatory and quality work package that treats microgravity as a potential extension of controlled R&D infrastructure, while testing evidence, traceability, returned-sample and quality requirements.
-  Invest in publication, standardisation and reproducibility. Participants repeatedly identified peer-reviewed evidence, shared controls, Earth comparators and transparent reporting of both positive and negative results as prerequisites for pharma confidence.
-  Assess whether organoids and disease-model applications merit further investigation once disease targets, Earth comparators, data requirements and potential beneficiaries have been defined.

1. INTRODUCTION

Two industries, one opportunity

The opportunity for microgravity in biopharma sits at the intersection of two sectors with very different operating cultures, each with very limited awareness of the other. Space companies and research groups can point to distinctive physical and biological effects in orbit. Biopharma companies, by contrast, make investment decisions through product, portfolio and development-team logic. A proposition that is scientifically plausible may still fail if it does not answer a specific R&D question, fit a development pathway, or produce evidence in a form that a company can use.

This distinction shaped the Dialogue. Participants were asked which use cases were commercially compelling, why microgravity should be used rather than terrestrial methods, what evidence decision-makers would need, and what role public sector intervention could play in making a pilot credible.

The discussion pointed to a clear adoption challenge. **Microgravity should be framed as a set of pharma-led challenges where the orbital environment may provide a distinctive answer, rather than as a space capability looking for a market.** That requires a more precise translation between the physical condition, the experimental technique, the scientific output, the business case and the eventual user.



BACKGROUND CONTEXT: WHAT MICROGRAVITY CHANGES

Microgravity is of interest to pharmaceutical development because it reduces or removes several effects that shape experiments on Earth, including sedimentation, buoyancy-driven convection and gravity-induced mechanical stress, enabling different results to what can be produced terrestrially.

This can include:

- No sedimentation - particles, cells and crystals don't sink or settle.
- Almost no convection - no buoyancy currents; transport is by slow, even diffusion.
- Reduced shear / mechanical stress - cells aren't pulled down or need stirring to stay suspended.
- Surface tension dominates - fluids behave by internal forces, not gravity.
- Containerless processing - samples can float free of defect-seeding walls.

For biopharma, these effects may be relevant to protein crystallisation, formulation, 3D cellular self-organisation, tissue models and disease-relevant biology. This report uses only the background science needed to explain the workshop findings and recommendations.

2. WORKSHOP RECORD AND SOURCE BASE

The Microgravity Biopharma Dialogue took place in Berne, Switzerland, on 29 June 2026. It brought together a curated mixed group of biopharma, space, academic, regulatory, funding and public sector participants. This was a deliberate departure from the more common pattern of the space sector discussing pharmaceutical applications without pharma representatives in the room.

The UK and Switzerland share common strengths in science and innovation, global life science clusters, deep space research expertise and existing bilateral innovation funding initiatives; it was considered a natural fit to convene experts from these two countries for an inaugural international dialogue on microgravity and life sciences.

The workshop opened with short scene-setter presentations, then moved into two structured rounds of small-group discussions. The first round focused on opportunities, use cases, evidence and business case.

The second focused on blockers and enablers, covering partnerships, infrastructure, finance, skills, regulation, standards and IP. Findings were then synthesised across the groups, rather than reported group by group. A full methodology is included in the Annexe.

It is to be noted that the workshop did not include representation from certain types of stakeholders who could provide additional input and viewpoints, and who could usefully test the points raised in the discussions and the recommendations made in this report. Organisations such as payers/health systems, charities, patient-facing organisations or wider end-users, as well as financial investors, could be invited to comment on the report and to participate in follow-on activity.



3. CORE FINDING

Microgravity must answer a specific pharma problem

A repeated theme across the discussion was that microgravity must articulate a solution to a defined pharma problem in a way that is not possible, not practical, or not sufficiently fast on Earth.

This point came through in several forms. In one group, the question was put bluntly: why does this need to be done in space? Another framed the internal decision test in sharp focus: the issue is not only whether money exists, but whether the argument can be made for spending it.

Elsewhere that same test was framed around the development team: the team would have to say that a study could only be done in space, or that doing it on Earth would take more time, cost more, or not answer the question at all.

This has two consequences for policy. First, awareness-raising alone will not be enough. Pharma needs evidence, comparators and a path into its own workflows. Second, participants identified de-risking the translation process as one possible role for government, subject to evidence of need, additionality and strategic fit. The next stage should turn broad technical possibilities into evidence packages linked to specific use cases.

“Why does this need to be done in space?”

Microgravity Biopharma Dialogue,
29 June 2026, Berne, Switzerland



WORKSHOP SIGNAL

Participants highlighted the difference between scientific promise and internal pharma adoption. A compelling microgravity proposition needs to be framed around product development, evidence, time, cost, regulation and portfolio fit. The strongest route is bottom-up, through the technical (e.g. biology or chemistry) leads who define what studies are needed for specific products or development programmes.

4. IDENTIFYING THE OPPORTUNITY

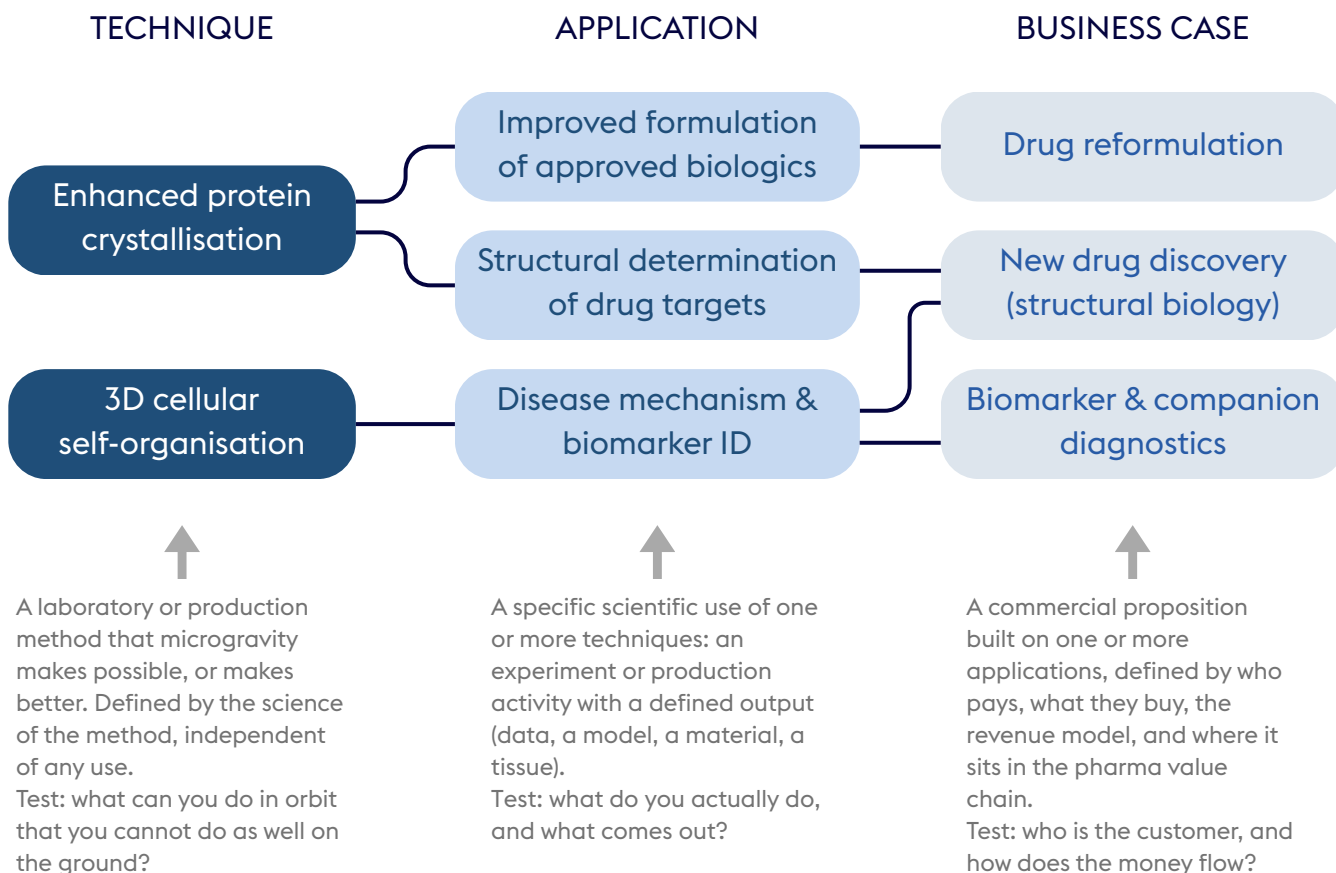
The workshop discussed several possible areas of application: protein crystallisation, drug reformulation, drug screening, tissue engineering, organoids, disease models, biomarkers, regenerative medicine, ageing and novel datasets for discovery were mentioned. The discussion did not produce a single agreed hierarchy, nor should it be read as a formal prioritisation exercise. It did, however, reveal which propositions felt closest to a pharma-facing business case.

All four groups discussed protein crystallisation among their top use cases, and three identified drug reformulation as a near-term realistic business case. Two of the groups selected this as one of their top use cases. Organoids and tissue models were also widely discussed, though the specific business cases for pharma were less clearly defined. One group identified “more data, faster” as the strongest overarching proposition. This was described as a supply-side business case, offering a potential source of value across several pharma use cases: generating more decision-relevant data in a shorter time could support earlier go/no-go decisions in discovery and development. Participants applied this logic to drug-substance stability, early formulation work, drug screening, disease models and biomarker discovery.

The proposition remains to be demonstrated: the data would need to be scientifically rigorous, comparable with terrestrial methods and delivered quickly enough to affect a real pharma decision.

Across the four breakout groups, participants described use cases at different levels. Some began with the space-based technique, for example protein crystallisation in microgravity. Others began with the scientific output, such as a better-resolved structure or an identified biomarker. Others began with the commercial position, such as asking what a reformulated drug would be worth to a manufacturer or a health system. Each is a legitimate description of a use case, but they sit at different points in the value chain. While this led to a fuller view of the supply chain, it made it challenging to compare one group’s work to another’s.

To address this challenge, the workshop material was mapped into a three-layer model that differentiates between the microgravity-enabled technique, the scientific application and the business case for pharma. The model’s purpose was to synthesise the findings in order to give the pilot programme a clear, common structure around specific pharma business cases. The model shows the pathway between the space capabilities and the resulting pharma business cases. The three-layer model was a post-workshop analysis of the discussion rather than what was agreed in the room, further details of which can be found in the Annexe: Use Case Selection. The streams of the model relevant to the pilot programme are depicted below.



The three-layer model prevents the report from treating “use case” as a single category:

- The physical condition is not the same as the technique.
- The technique is not the same as the scientific output.
- The scientific output is not the same as the commercial business case.

A pilot programme should therefore begin by defining the layer at which it is operating and the decision it is intended to support.

The clearest near-term area was drug reformulation for high-value drugs, linked to crystallisation.

In several groups, it emerged as one of the few areas where participants could draw a relatively clear line from a microgravity-

-enabled experiment to a potential pharma decision, business case or development pathway. The important point is that the business case sits beyond the scientific technique. Protein crystallisation may be the method, but reformulation is the commercial proposition.

Organoids and tissue models were also repeatedly raised, but in a different way.

They were seen as potentially valuable across discovery, disease modelling and biomarker work. While outside pharma, tissue engineering for the medical devices market was also highlighted as an opportunity for this technique. Participants noted that it can take years to build robust disease models, that disease expertise is essential, and that Earth-based systems may already be sufficient in some areas.

Developing complex disease model organoids may be more challenging than engineered tissues for defined applications, such as biomarker validation, diagnostics, reference materials and quality controls, which potentially have different or shorter pathways. The organoid opportunity therefore needs sharper target selection and definition before it becomes a pilot programme.

Several other areas were treated as out of scope for a near-term pharmaceutical programme:

- **Manufacturing finished drugs in space.** Participants were cautious, and some saw this as premature for pharma adoption, even where space-sector participants pointed to experiments already flown.
- **Space as a general research environment,** without a specific pharmaceutical problem attached.
- **Applications that depend on astronauts handling samples by hand,** which were not seen as feasible until the process can be automated.
- **Ageing and cosmetics,** which generated interest in some discussions as a potentially promising area where microgravity brings differentiated advantages compared to Earth, but were seen by others as sitting outside immediate pharmaceutical priorities.



5. NEAR-TERM PRIORITY: DRUG REFORMULATION

5.1 Reformulation is the strongest first pilot area

Drug reformulation is the strongest near-term pilot candidate because it creates a relatively direct line between microgravity-enabled science and a pharma business case. It can start from an existing drug, a known market, a defined formulation problem and an existing regulatory and commercial context. This is materially different from asking pharma to invest in open-ended space biology.

The discussion linked reformulation to several possible sources of value:

- patent-life extension (helps pharma companies preserve enough market exclusivity to recoup the high costs and risks of developing new medicines)
- protection against generic or biosimilar competition

- improved delivery
- new IP
- more convenient patient delivery
- changed administration (reduced service burden where a medicine can move from hospital infusion to a simpler delivery route)

These are issues that pharma, payers and health systems already understand.

Participants also stressed that value depends on the specific drug, market and development constraint, for example where the gains achieved by changing the administration from hospital-based to patient-based are valuable enough to justify the extra complexity. It will be important to use the pilot to establish a more precise definition of the opportunity.

Any future assessment of this use case for a near-term pilot should set aside claims about producing finished medicines at scale in orbit and rather ask whether a microgravity step can generate a crystal form, formulation insight or data package that changes how an existing drug can be developed or reformulated on Earth.



BACKGROUND CONTEXT: REFORMULATION IN THIS REPORT

Drug reformulation means taking an existing or advanced medicine and changing its physical form, concentration, stability profile or administration route to improve its clinical, commercial or operational value. The most discussed microgravity route is crystallisation or formulation work enabling a higher-concentration or more stable biologic, moving from intravenous infusion to subcutaneous administration (i.e., moving from a medicine given into a vein, usually in a hospital setting, to an injection given under the skin, which is simpler to perform and can be done closer to the patient's home but which requires a different formulation of the drug). The pilot should test this proposition in a disciplined way rather than assume it will apply broadly.

5.2 Commercial logic and limits

The commercial logic is strongest where the drug is high value, where delivery is burdensome, where patent or exclusivity dynamics matter, and where formulation constraints create a real development problem. One group linked reformulation to “enhanced stability” and “changed administration routes”, stressing that value depends on “the drug in question and the specific issues”.

Participants discussed high-value biologics, including monoclonal antibodies and therapies in oncology or rare disease, as areas where low-volume, high-value products may be more plausible than high-volume commodity manufacturing. The strongest signal was for high-value drugs, where the returns or savings may justify the complexity of a microgravity step. The economic case is strongest where changing concentration, stability or route of administration could materially affect patient convenience, administration costs, lifecycle management or market and patent protection.

The workshop also exposed the limits; a reformulated product must sit within the health-economic reality of the target market and its payer. In one discussion, participants compared drug and administration costs in public and private settings, including the additional cost of hospital-based intravenous administration

and the likely ceiling for a more expensive alternative. Participants also highlighted the difficulty of comparing costs and savings across healthcare systems, for example increased drug costs against savings from fewer hospital appointments. The conclusion was clear that a space-enabled step must not produce a formulation that is clinically attractive but economically unadoptable.

The relevant regulatory considerations will depend on the role of the microgravity activity. Using microgravity to generate information that informs an Earth-based formulation may raise different considerations from producing or processing material in orbit for use in a medicinal product. Where a product, starting material or intermediate is produced, altered or processed in space and returned for further manufacture or use, existing medicines legislation and quality frameworks provide the regulatory starting point.

Product-specific consideration would be needed regarding classification, critical quality attributes, traceability, transport and return arrangements, and the regulatory significance of the in-orbit step.

These distinctions matter because they affect cost, time, evidence requirements and senior management confidence.

WORKSHOP SIGNAL

Participants linked the microgravity reformulation opportunity to high-value products where simpler administration could deliver benefits for patients and health systems, but stressed that any gains must outweigh the additional regulatory cost, time and complexity of introducing a microgravity step.

5.3 What a pilot would need to establish

- Which product characteristics make a candidate suitable: value, dose, route of administration, stability problem, formulation constraint, lifecycle stage and IP position.
- What the microgravity step is expected to produce: a crystal form, concentration insight, stability data, formulation route, process parameter or comparative dataset.
- What Earth comparator is required, including whether current methods can already answer the question well enough.
- What evidence would persuade the relevant pharma decision maker, including biology lead, development team, formulation specialist, commercial lead and internal regulatory function.
- What cost ceiling the microgravity step would need to meet in public and private health systems.
- What timelines, including the time required to obtain data and to access launch, would be required for the microgravity step to be useful within real pharma development timelines.
- The likely regulatory touchpoints and the quality documentation that may be relevant to the defined operating model, including returned-material handling and traceability where applicable.
- How confidential product information can be protected while still generating reusable evidence for the sector.



6. MEDIUM-TERM OPPORTUNITY: TISSUES, ORGANOIDS, DISEASE MODELS & BIOMARKERS

Tissues, organoids and disease models generated substantial interest, but the discussion was more exploratory. Participants saw potential for microgravity to support more realistic 3D tissue behaviour, disease mechanisms, biomarkers and drug testing. **The attraction is clear: if microgravity produces models that are closer to human biology, or generates faster readouts of disease processes, it could improve discovery decisions and reduce reliance on weaker models.**

The workshop also raised hard questions. What does “better” mean for a space-grown organoid? Is the useful effect caused by microgravity, radiation, altered circadian conditions, handling, culture medium or some combination of factors? What is the Earth comparator? Would the relevant product be a disease model, a biomarker, a diagnostics asset, a drug target, a service or a dataset? Would drug

discovery and diagnostics need the same data, or different evidence packages?

Participants noted that robust organoid models can take significant time to build and cannot be developed in isolation from disease experts. One discussion described a meaningful model as taking around three years to develop and stressed the need to work close to the disease area where the model would be applied. Organoids are therefore an important but less immediate pilot area. Further scoping is needed to define the disease target, model system and likely user.

“What does ‘better’ mean?”

Microgravity Biopharma Dialogue,
29 June 2026, Berne, Switzerland

WORKSHOP SIGNAL

Participants described organoids and tissue models as relevant across the discovery pipeline, but also cautioned that models need focus, time and disease expertise. The implication is that an organoids pilot should start from a disease question, not from a generic assumption that space-grown organoids will be useful. Post-workshop feedback also indicated that diagnostics, biomarker validation and standardised biological reference materials may represent a distinct translational pathway within tissue engineering, potentially requiring different evidence packages, development timelines and commercial models from complex disease-model organoids.

7. BARRIERS THAT DETERMINE THE PILOT DESIGN

The discussion identified design requirements for a credible pilot programme; participants felt that without this activity, pharma were unlikely to move closer to adoption. These could be tested against evidence from other engagement activity.

7.1 Internal pharma adoption

Participants outside pharma repeatedly described the challenge of finding the right person inside a pharma company. Senior leaders may be interested in frontier technologies, but the practical decision to commission a study often sits with a development team or functional (e.g. biology) lead responsible for a specific product or mechanism. These individuals need to see a direct link between microgravity and the studies required to advance their programme.

This can be identified as a blocker: pharma has few internal champions who really

understand microgravity, and the biology leads who would commission relevant studies do not routinely meet the space community. That is important because the deciding audience is not a generic corporate function; it is the team that owns a product, mechanism or development question and can judge whether microgravity offers an answer worth pursuing.

This is why broad messaging to pharma is insufficient. The pilot must map the internal decision path: who defines the study need, who owns formulation or biology, who controls the budget, who carries regulatory risk, and who would defend the decision to senior management. One participant's comment that it is "not even the cost, it is the justification" captures the point. **A small off-strategy investment can be harder to secure than a much larger on-strategy spend.** In post-workshop feedback, one participant pointed to technology evaluation agreements as the route pharma normally uses to assess an external technology. The scoping phase should test whether that is the right entry mechanism for a microgravity study and if the timescales are appropriate.

WORKSHOP SIGNAL

Participants described pharma budgets as "tightly controlled and tightly focused on advancing pipeline assets", with little margin for activity that is "unproven and unknown". Post-workshop feedback made the same point from a different angle: the key pharma audience is the functional leads, not only the most senior executives. A consortium or PPP approach could help lower the risk to make it easier for technical leads to commit from their budget.

7.2 Evidence, publication and reproducibility

Participants raised a lack of published evidence, noting that many microgravity studies may remain unpublished because they are not seen as high-impact enough for academic incentives, while commercially sensitive findings may be held back until IP protection is secure, and negative results may not be published at all. Pharma participants highlighted that their teams regularly look for published, searchable, reproducible evidence, often mediated through internal experts and literature reviews. One pharma participant said their teams “go by publications” and “read [published technical literature] all the time”, and that artificial intelligence (AI) tools increasingly pull in and summarise published knowledge. The point is that publishable, searchable evidence can trigger internal thinking and make a microgravity study easier to justify. The gap is therefore about more than an absence of data; it is also about whether relevant findings become visible to the people inside pharma who could act on them.

Participants also described a mismatch between the evidence the field can currently produce and the outputs academia is incentivised to prioritise. One participant referred to the “big push for four-star papers” (four-star papers being the top grade in the UK's Research Excellence Framework, meaning work

judged ‘world-leading’ in originality, significance and rigour), noting that smaller pilot studies may still be useful to industry but judged too narrow to attract publication support. A related comment was that institutions may refuse to pay publication costs if a paper is considered “two-star”, even where the judgement may not fully reflect its value to an emerging field. Encouraging PhD researchers to publish smaller papers was raised as one practical route to making the evidence base visible sooner, at the same time as supporting future talent.

Practical constraints compound this. Participants pointed to high open-access costs, weak publication routes, and a need to present relevant case studies within mainstream pharma conferences rather than only in a space-sector forum. Possible workarounds cited include publishing on BioRxiv (a non-profit biology preprint repository), other open searchable routes, or a dedicated microgravity-for-pharma journal, collection or evidence hub.

The chicken-and-egg problem is that pharma needs to see evidence before committing, but the strongest evidence may require pharma-relevant experiments. The recommended pilot programme should therefore treat evidence generation and publication as a central work package, defining common protocols, Earth comparators, reporting standards and publication principles, including how to capture negative or inconclusive results where these can help build the wider evidence base.

WORKSHOP SIGNAL

Participants noted that even where precedents exist, there is “not a lot of published information that people can use”. Feedback also pointed to the need for a systematic review of the literature and for “first major datasets” to be produced for pharma.

7.3 Standards, quality and repeatability

Participants stressed the need to make microgravity routine, reliable and controlled. The point was often expressed in plain terms: for pharma, space “needs to become boring”, in other words just another controlled laboratory environment in which an experiment can be run, documented and trusted. Data generated in an unfamiliar environment is only useful if the experiment, chain of custody, controls and documentation are credible.

The standardisation question applies at multiple levels: hardware, protocols, culture conditions, media composition, temperature control, handling procedures, transport conditions, control experiments, payload qualification, sample return, Earth-side analysis, data formats and quality documentation.

It will help distinguish between a technical failure and a biological result. It is particularly important for organoids and disease models, where reproducibility is already difficult on Earth.

It also matters for reformulation, where understanding and controlling relevant product quality attributes will be central to development and regulatory assessment.

This can be framed as a comparable dataset problem. If each mission uses different hardware, protocols, handling conditions or reporting standards, results from one run cannot easily be compared with another. In that scenario, the evidence base may grow in volume without becoming more useful for business-case or regulatory decisions.

“Space needs to become boring.”

Microgravity Biopharma Dialogue,
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WORKSHOP SIGNAL

Workshop discussion linked trust to “plan-ability, standardisation, controls” and the ability to generate the same reliable result more than once. One participant summarised the destination well: make it routine, repeatable and no longer exceptional.

7.4 Infrastructure and access

Access to space has improved, but workshop participants did not treat it as solved. They raised questions about launch cadence, cost, late access, biological sample preparation, cold chain, clean-room access, space-qualification facilities, safety approvals, risk-assessment paperwork, sample return, landing-site facilities, export controls and reliance on non-European launch routes. If companies must depend on limited or non-European launch routes, the resulting delays and logistical complexity could become a major source of frustration for large pharmaceutical companies and prevent microgravity studies from fitting within normal development timelines. Participants also noted that life-science users may need practical infrastructure that is not always designed into launch systems by default, including cold stowage and late access to the rocket.

The infrastructure question is also changing because the International Space Station, which has provided a shared research platform, is approaching retirement. Commercial space stations may create new opportunities, but they are not yet a settled replacement for routine life-science work.

Participants were cautious about use cases that depend on astronauts handling biological samples by hand rather than automated. Pharma is likely to judge orbital infrastructure by how routine, controlled, repeatable and reliable it is, rather than its novelty. Participants also raised the issue of bespoke hardware: if each experiment requires purpose-built equipment and repeated space-qualification, cost and time increase and standardisation becomes harder.

Several participants contrasted pharma's need for speed with the timescales historically associated with space projects. One participant described a NASA pharma collaboration which they said took several years to reach orbit; samples were sent twice, but the results remained too confusing to extract much value. That type of timeline may be acceptable for exploratory research, but not for live development programmes. The pilot must therefore define the time-to-access and time-to-data requirements that space providers would need to meet.

WORKSHOP SIGNAL

One group identified speed as a central business-case hook; if speed is to become a credible source of value, access to microgravity must be sufficiently frequent, simple, predictable and automated to produce data within pharma development timelines. Another group highlighted cold storage and late-stage access to launch vehicles as specific life science requirements that may not be built into launch infrastructure by default.

7.5 Regulation, IP and data sharing

Uncertainty about how existing regulatory and quality requirements would apply to specific in-orbit operating models came through as both a barrier and an area where further clarity could support development.

Participants asked how existing regulatory and quality frameworks would apply to microgravity experiments, returned material, intermediates and reformulated products; what types of evidence and quality information may be relevant to particular use cases; and how applicable Good Laboratory Practice (GLP) or Good Manufacturing Practice (GMP) requirements and pharmaceutical quality systems would interact with an orbital platform. Early engagement through appropriate regulatory and scientific advice routes was repeatedly seen as important to clarify the relevant considerations for a defined product and operating model.

Governance questions also sit around the microgravity elements themselves. Participants raised uncertainty over who owns, operates and is responsible for orbital platforms, launch and return infrastructure, and landing locations.

That has practical implications for import and export controls, VAT or customs treatment, liability, ownership of returned material, and the responsibilities that attach to privately operated or shared platforms.

IP and data sharing are equally central. A pilot that depends on real products or molecules cannot expect pharma companies to reveal commercially sensitive information in an open consortium without protection. The report therefore recommends a layered model: confidential 1:1 scoping to identify real product constraints, followed by anonymised or aggregated challenge statements that can be used in a consortium setting. The programme should define background IP, foreground IP, data ownership, publication rights and rules for shared platforms before technical work begins.

There is also a data-visibility problem. The information needed to target reformulation opportunities, for example which formulations matter, relevant health-economic assumptions and commercially sensitive molecule information, often sits inside pharma and is not shared. Any pilot will therefore need mechanisms for anonymising or abstracting product-specific information, so that real demand can shape the programme without exposing commercially sensitive data.



WORKSHOP SIGNAL

Participants described reformulation as potentially valuable for IP and patent life, but also highlighted the need to protect sensitive product information. Feedback was explicit that engagement with pharma would need to happen on a 1:1 basis, protected by non-disclosure agreements, to translate specific use cases into microgravity R&D programmes.

7.6 Skills

Participants identified a shortage of people equipped to design and deliver work at the intersection of microgravity and biopharma. The required skill set extends beyond conventional space engineering or life-science research. Projects may need expertise in experimental biology, payload design, automation, sample handling, space qualification, data analysis and pharma development processes. Participants noted that these capabilities are rarely combined within one team, making it harder to turn a scientific question into a robust experiment that can operate in orbit and produce useful evidence.

Participants proposed a combination of formal education and practical exposure. Suggestions included university modules, postgraduate or mature-student courses, placements, summer schools, continuing professional development and short industry programmes. Examples raised included space-focused university courses, the Swiss Space Medics course, and life-science companies hosting students or professionals to explain the drug-development cycle.

Participants also saw academia as a useful intermediary between the two sectors. One proposal was for pharma to support PhDs working on defined industry challenges and testing whether space-based approaches could provide solutions. This would develop cross-sector capability while producing work linked to genuine pharma demand.

The pilot programme could provide a practical setting for this skills development. Challenge-led placements, PhDs and short training programmes could bring together biology leads, space engineers, regulatory specialists and researchers around specific work packages. Participants also stressed the value of interdisciplinary teams, shared terminology and access to a wider pool of experts, particularly where researchers can assess biological risks but lack the engineering, space-qualification or operational expertise needed for an orbital project.



WORKSHOP SIGNAL

Participants called for sustained, hands-on skills development around real microgravity biopharma projects. The aim should be to build people and teams able to take an experiment from biological question through to payload design, operation and analysis. Academia can be an enabler, through industry-led PhDs (with funding source to be determined) and targeted education; universities “should create modules, create education possibilities for these types of topics”. Participants suggested cross-sector recruitment, university modules, placements, professional training and pharma-supported PhDs focused on real-world development challenges.

7.7 Financing and the role of government

The workshop made clear that private-sector appetite is not yet sufficient to carry the early risk alone. Several participants compared microgravity biopharma to other frontier technology areas where public-private structures help carry risk until evidence, standards and markets mature. The relevant gap is not simply research funding, it is the stage between promising prototype and credible, standardised, scalable offer.

The funding gap is partly a stage-of-development problem, corresponding to a known technology readiness level (TRL) 4-6 'valley of death', where a prototype needs to be standardised, qualified and scaled before many investors or large companies will engage. This is acute in microgravity biopharma because start-ups and academic groups may be expected to generate proof-of-concept data, but often lack the risk capital to make that data robust, repeatable and pharma-relevant.

Government does not need to subsidise every experiment or act as a broker for isolated commercial discussions. Its greater added value is in creating the conditions for credible adoption: convening users and suppliers, supporting shared evidence, defining requirements, aligning regulators, and de-risking the first programmes that can demonstrate whether the business case is real.

Since early risk is unlikely to be carried by large pharmaceutical companies, given tightly controlled pipeline budgets and the need to justify investment through established governance and quarterly earnings calls, participants considered that public intervention that might help to address some of the technical, regulatory, evidence and demand risks identified would be most effective if delivered at the outset, thereby allowing time to build confidence in the process and its ability to deliver outputs.



WORKSHOP SIGNAL

Participants questioned whether another evidence-gathering workshop would be enough to achieve a step-change. One contribution argued for a pilot that tasks people to interrogate a defined problem and deliver outputs, rather than simply meeting again to discuss the opportunities.

8. RECOMMENDATION: A REPEATABLE PILOT-LED PROGRAMME

The main recommendation emanating from the discussions held during the workshop is to consider establishing a pilot-led programme to rapidly evaluate promising use cases, starting with drug reformulation. This scoping phase should consider the wider evidence, strategic fit, affordability and available delivery mechanisms. The goal should be to identify and develop the specific market-driven opportunities while establishing the pathways required for full commercialisation, including building towards some form of consortium.

The recommended programme is structured so that the pilot project framework can easily be replicated for subsequent use cases, to give clarity on requirements, outputs and timelines. A single overarching framework could thus support multiple challenge-led calls covering reformulation, and subsequently organoids or disease models, or other use cases. This would allow common standards and capabilities to be developed on market-driven opportunities with clearly-defined scientific and commercial objectives.

The programme should first define the challenge and evidence requirements for each pilot use case, and should be explicitly demand-led.

Its first questions should be:

1. What problem would be valuable enough for a pharma company to care about?
2. What evidence would be needed to show that microgravity is the right route to solve it?

The first pilot could be used to establish common evidence standards, Earth comparators, regulatory expectations, infrastructure requirements and IP arrangements. Later pilots could then build on this foundation rather than creating a series of disconnected, one-off experiments. This would strengthen the long-term value of the overall programme and provide a clearer pathway from pilot activity to an investable European capability.

8.1 Delivery model options

The relative merits of different types of delivery models were touched on at various points during the workshop and post-workshop feedback, which we have summarised as follows:

Model	Description	Advantages	Risks or limits
Bilateral 1:1 projects	A pharma company and a space company work together on a confidential challenge.	Faster to establish; easier to protect molecule-specific information; better fit for portfolio-specific problems; may suit companies already prepared to engage.	Outputs may remain private; limited contribution to wider evidence base; does not solve market-wide demand generation; risks repeating fragmented one-off experiments.
Challenge-led consortium or PPP	A public sector-convened programme brings multiple pharma, space, academic and public sector actors around a defined challenge, common evidence framework and staged funding.	Creates shared requirements and evidence; gives government a clear value-adding role; can include regulatory and infrastructure discussions; helps suppliers understand demand; can generate public-good outputs.	Longer and more complex to establish; requires careful IP and data-sharing design; may deter pharma if confidentiality is weak; needs a credible coordinator and clear decision gates.
Recommended hybrid	Confidential 1:1 scoping identifies real pharma problems, then these are translated into anonymised challenge statements for a consortium-based pilot-led programme.	Balances confidentiality with shared evidence; reduces the risk of generic challenge statements; gives space suppliers usable requirements; allows public funding to support outputs beyond one company; allows time to build trust and buy-in from pharma companies.	Requires disciplined governance and trusted facilitation; must avoid creating a workshop-only process with no technical follow-through.

8.2 A proposed gated programme structure

A gated structure could help support proportionate decisions and limit premature commitments. The gates serve as a way of forcing the programme to answer the right questions before committing further funding, rather than purely as a project management device. The following graphic illustrates how a gated structure could work in a future pilot programme:



8.3 Work packages for the pilot definition phase

Clear ownership will be needed across the overall programme, with different organisations contributing according to their expertise, remit and available resource. Responsibility for individual work packages could sit with organisations that already hold the relevant expertise, for example the Medicines and Healthcare products Regulatory Agency (MHRA) could contribute appropriate regulatory expertise and engagement through its established functions via the Innovation Office and formal advice routes. The UK Space Agency's Unlocking Space Portfolio* has relevant experience and targeted workstreams that could inform further evidence gathering, requirements definition and convening.

The work packages on the following page are recommended on the basis of the workshop discussions, and are provided for illustrative purposes.

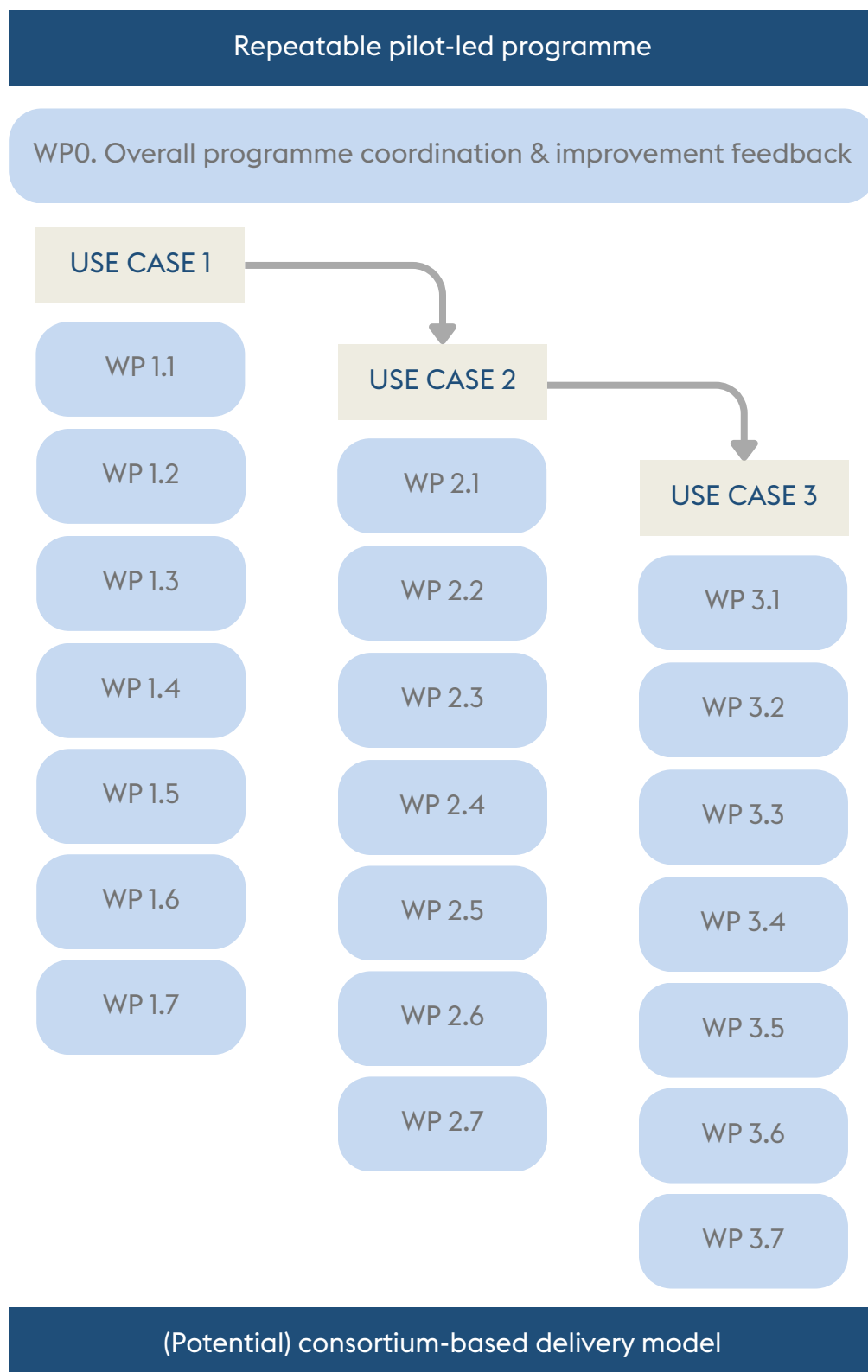


* The Unlocking Space programmes focus on engaging potential customers of space in new markets, by taking a demand-led approach to directly tackle barriers to adoption. The Unlocking Space for Business programme has funded an in-orbit demonstrator feasibility study mapping out the process for manufacturing pharmaceuticals in space [<https://www.gov.uk/government/news/new-studies-for-manufacturing-advanced-materials-in-orbit>], and has been working collaboratively with MHRA to clarify the regulatory pathway for in-orbit manufactured pharmaceuticals [<https://www.gov.uk/government/news/uk-sets-out-world-leading-pathway-for-space-manufactured-drugs>].

Work package	Purpose	Key output
WP0. Programme coordination	Coordinate the delivery of the overall pilot-led programme, ensuring the WPs are tailored to each use case.	A successfully-delivered series of repeatable pilots that could enable the programme to evolve into a more formal consortium if desired.
WP1. Pharma demand scoping	Engage confidentially with relevant pharma development, formulation and biology leads to identify real problem types.	Anonymised challenge statement and candidate product characteristics.
WP2. Business case and health economics	Quantify value relative to delivery route, administration cost, lifecycle management and payer constraints.	Cost ceiling and value-case model for Gate B.
WP3. Scientific evidence design	Define the experimental question, controls, Earth comparator, data outputs and reproducibility requirements, including biological and technical success criteria before flight, with appropriate redundancy and failure mode planning.	Proposed evidence and protocol framework for the defined use case, for discussion with relevant scientific, industry and regulatory experts.
WP4. Regulatory and quality pathway	Map regulatory touchpoints, returned sample issues, classification, quality systems and documentation needs.	Use case regulatory considerations note and a structured set of questions for discussion through appropriate regulatory engagement routes.
WP5. IP, data and confidentiality	Resolve background IP, foreground IP, molecule anonymisation, publication and shared data rules.	IP and data-sharing framework suitable for a PPP.
WP6. Infrastructure requirements	Translate pharma needs into requirements for access, late loading, sample return, cold chain and Earth-side analysis.	Requirements statement for space suppliers, launch sites and funders.
WP7. Communications and publication	Ensure evidence is discoverable by pharma decision makers and credible to the wider field. Access support so start-ups and academic teams can present at pharma-facing conferences, which participants raised as a cost barrier.	Publication and dissemination plan, including handling of negative results, and identification of support mechanisms to allow microgravity researchers to present at pharma conferences.

The work packages are repeatable for subsequent use cases, sitting beneath the coordination work package WP0 whose work also includes ensuring improvement feedback from each use case to subsequent ones. The goal will be rapid development and maturing of use cases, outputting requirements to supporting capability areas, and laying the ground-work to establish commercial arrangements.

Ultimately this could enable a decision to take forward under a more formal consortium model the most promising use cases that need further investment, if considered appropriate.



8.4 First pilot use case: drug reformulation

The goal should be to test whether microgravity-enabled techniques such as crystallisation can create a commercially and scientifically credible route to improved formulation of high-value therapies.

In post-workshop feedback, one pharma participant suggested that an initial case study on reformulation could be further focused around a high-value monoclonal antibody or other large-molecule biologic, to help demonstrate the potential value of microgravity-enabled crystallisation for higher concentrations, improved stability, subcutaneous administration, and lifecycle management. This specific focus suggestion has not been tested with other pharma participants, but could be explored during the initial scoping phase of the pilot.

Proposed objectives:

- Define the product characteristics and formulation problems most likely to justify a microgravity approach.
- Quantify the value case, including delivery route, patient convenience, administration cost, lifecycle management, IP, payer considerations.
- Identify the evidence needs of pharma developers, funders and infrastructure providers, and the evidence and quality considerations that may be relevant to regulatory assessment.
- Identify the minimum technology and capability requirements for access, payload preparation, late loading, cold chain, sample return and Earth-side analysis.
- Test whether a shared challenge-led model can protect confidential pharma information while generating reusable sector evidence.
- Create a go/no-go decision point before any substantial technical commitment or investment.



Is there a credible commercial route to improved formulation?

8.5 Follow-on pilot use case: organoids and disease models

Based on analysis of the workshop discussions, this report recommends a second pilot area could focus on organoids, disease models and biomarker work. This has a different value chain and a different evidence problem from the reformulation pilot use case, but could be addressed using the same work package approach.

The central question is whether microgravity produces a disease model or biological readout that is more predictive, faster, more human-relevant or otherwise more decision-useful than terrestrial models.

The answer will vary by disease area, cell type, platform and endpoint. A generic organoids pilot would therefore be too broad. The first step is to identify one or two disease contexts where terrestrial models are demonstrably weak and where microgravity has a plausible advantage.

Question	Why it matters	Recommended next step
What disease problem should anchor the pilot?	Without a disease target, the output is too generic to persuade pharma or diagnostics users.	Convene disease experts, pharma biology leads and model developers to shortlist target areas.
What is the Earth comparator?	The pilot must show whether microgravity adds value over current organoid, spheroid, organ-on-chip or other terrestrial models.	Define comparator models and success metrics before mission planning.
What is the data product?	Diagnostics, drug discovery and target biology may require different data outputs.	Define whether the output is a biomarker, target hypothesis, validated model, screening data or service.
How will reproducibility be demonstrated?	Organoid work is already sensitive to protocol variation. Microgravity adds another layer of complexity.	Use standardised protocols, multiple replicates and Earth controls. Agree biological and technical success criteria before flight.
Who would use the result?	A model has value only if a decision maker can act on it.	Map likely users and funding route before technical design.

9. RECOMMENDATIONS

A Move from workshop output to pilot-definition phase

The workshop findings provide a strong case for considering a structured pilot-definition phase focused on drug reformulation. Dialogue participants suggested this would be most successful if it includes confidential 1:1 pharma scoping, a focused workshop, and work packages on business case, evidence, IP, regulation and infrastructure. Participants were clear that another open-ended discussion would not be enough. The output should be a decision-ready pilot proposal, as opposed to another general conversation. This should be tested further through additional evidence, e.g. from the UK Space Agency RFI and the Unlocking Space Portfolio.

B Use public intervention where it adds distinctive value

The workshop findings indicated that any public intervention would be most beneficial if it goes beyond brokering meetings between individual companies to address market coordination failure where the private sector cannot shoulder risk alone, for example by creating shared requirements, reducing early evidence risk, bringing regulators into the conversation, and supporting mechanisms for translating commercially sensitive demand into sector-wide learning. Since drug reformulation may have relevance beyond high-income health-system efficiency, including possible implications for remote, crisis-affected or lower-income settings if stability, administration route or cold-chain requirements can be improved, there could be interest shown in supporting the global health impact of a pilot programme in this area.

C Organise interventions based on pharma demand

The programme is likely to be most impactful if it is built around the questions a pharma development team would ask: what product problem is being solved, why can it not be solved on Earth, what evidence is needed, what does it cost, how fast can it be done, what are the likely regulatory and quality considerations, and when should appropriate advice be sought?

D

Design the programme around confidentiality and IP

No credible pilot will secure meaningful pharma input unless confidentiality is robust. The programme should begin with IP, data-sharing and molecule-anonymisation terms, including clear treatment of background IP, foreground IP, platform-generated data and publication rights. This should be treated as an entry condition for pharma participation.

E

Treat regulation and quality as early enablers

The programme should provide for early engagement with relevant regulators through appropriate routes, not to seek premature endorsement or approval, but to identify applicable regulatory touchpoints and clarify the evidence, quality and traceability considerations relevant to the defined use case. The goal should be to support developers in designing microgravity activities that can generate reliable and appropriately controlled evidence for R&D and, where relevant, subsequent medicinal product development.

F

Fund standardised evidence generation

Participants agreed that support should prioritise reproducible, comparable and publishable evidence. This includes shared protocols, Earth comparators, agreed endpoints, data standards, and publication of learning that can be found by the biology leads and development teams who make decisions in pharma. The evidence gap came through as one of the most persistent adoption barriers.

G

Preserve ambition while using decision gates

Programme recommendations should be ambitious, but not speculative. A gated programme allows the field to move quickly where the case is strong and stop where it is not. A well-designed negative result would still provide value by clarifying which applications are not ready, and why.

H Use the pilot to define microgravity infrastructure requirements

The pilot should produce a clear requirements statement for access to microgravity, including cost, cadence, late loading, payload preparation, clean-room or lab access, sample return, cold chain and Earth-side analysis. These requirements should be defined from the life science user perspective, rather than added after launch infrastructure has already been designed. They should also identify the risks, such as where bespoke hardware, import/export constraints, liability, VAT or platform ownership issues could affect delivery. Increasing access to European launch capability in particular was seen as a priority by workshop participants, with pharma said to be unlikely to engage fully if access to launch is confined to one or two countries outside the region and unpredictable in both cost and timelines.

I Develop organoids as a second-wave programme

Organoids and disease models should remain a priority, but not as the first major pilot. The next step should be a focused scoping exercise to define disease targets, Earth comparators, data use and likely buyers.

J Build translation capacity between pharma and space

The workshop showed that few people can translate convincingly between development biology, formulation, regulatory pathways and space operations. Cross-sector training, placements, challenge workshops and targeted conference activity that reaches biology leads and development teams, not only space audiences, were all suggested. Academia can act as a bridge between the worlds of space and pharma and can be employed in discussions on microgravity to act as a translator. A shared, cross-sector taxonomy would be valuable as a reference “dictionary” to support the engagements and the pilot programme: to allow user requirements to be translated into technical, regulatory and commercial interventions. As part of building cross-sectoral translation capacity, support could be offered – particularly to start-ups and academics – to attend conferences and workshops outside their usual sector.

10. KEY RISKS AND MITIGATIONS

Below is an illustrative summary of some of the key risks touched on during the discussions:

Risk	Why it matters	Mitigation
The pilot becomes too generic	A broad “microgravity for pharma” programme will not produce decision-relevant evidence.	Define one reformulation challenge and one organoids scoping question, with clear go/no-go gates.
The pilot loses momentum	If space companies become impatient and pharma companies lose interest, the programme’s achievements will be lost.	Agree clear work package ownership, assign an appropriately-resourced body to oversee the programme, and plan regular communications and touchpoints.
IP concerns block sharing	Companies may resist naming molecules, constraints or health-economic assumptions.	Use anonymised challenge statements, clear legal terms and layered data access.
Evidence is not trusted	Results may be too small, bespoke or poorly controlled to influence pharma decisions.	Standardise protocols, comparators and reporting before technical work begins.
Uncertainty over the application of regulatory and quality requirements delays progress	A lack of clarity about the regulatory significance of particular in-orbit activities, or the applicable quality considerations, could deter investment or delay development decisions.	Identify likely regulatory touchpoints early and use appropriate scientific and regulatory advice routes as the product and operating model develop.
Infrastructure cannot meet requirements	Access may be too slow, costly or operationally unsuitable for biological samples.	Use the pilot to define clear requirements that can support targeted supplier selection and orbital mission planning.
The programme overpromises	A programme that promises too much will lose credibility with pharma.	Use careful language and retain gated decisions.

11. CONCLUSION

The Dialogue confirmed that microgravity biopharma is neither a mature market nor a speculative curiosity. It sits in a more demanding middle ground. The science is promising, the infrastructure is improving, and there are credible early examples. But the pathway to pharma adoption is still underdeveloped. Lack of awareness of microgravity among pharma companies, and an inadequate understanding of pharma among space companies, was raised repeatedly in the workshop as a barrier; this inaugural UK-Swiss Microgravity Biopharma Dialogue played a significant role in starting to break down the silos and encourage meaningful exchange between pharma and space actors.

The most important contribution of the workshop was to shift the question from what microgravity can do, to what pharma would need before acting. The answer is practical: a defined problem, a credible advantage over Earth-based methods, a reproducible evidence package, a protected route for commercially sensitive data, and a business case that can be justified within product development decisions.

The drug reformulation pilot recommended by this report would test exactly that. If taken forward, and if public intervention is considered necessary and proportionate for delivery, it should be framed as a disciplined, demand-led programme, not a symbolic space mission, to determine whether microgravity can solve a valuable formulation problem and what conditions would be needed for that to become a repeatable route for industry. It would also help provide valuable negative results, identifying where microgravity would not add value, clarifying which applications need better comparators, and assessing areas in which public sector intervention would not be required or justified.

If successful, the pilot would do more than advance one use case. It would create a model showing how microgravity applications can be translated into pharma-relevant propositions: specific, evidence-led, commercially literate and regulator-aware. That is the key step needed to move the field from interest to adoption.



ANNEXE

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Methodology

Preparation

The workshop goal was to leverage UK-Swiss relationships in microgravity and biopharma to put the right people in the same room, cross-pollinating between the two industries. Participants were individually selected for an invitation, and careful attention was paid to balancing the number of participants from pharma, space, academia and the public sector, and to capping the total number of participants below 30 to allow for meaningful discussions.

Participants completed a registration form before the event, selecting up to 3 priorities from 9 topics and stating their objectives for the workshop. Two online pre-meets were held, one hour each, and participants joined whichever suited them. These covered introductions to each other, a familiarity poll and open questions on what they wanted to get out of the day.

The results shaped the agenda, exercises and the group allocations. Agenda, participant biographies and pre-reads were circulated in advance. Pre-reads included a copy of the Satellite Applications Catapult report “Beyond Earth - Unlocking the Potential of Microgravity: A New Frontier for the Biopharmaceutical Industry” (29 July 2025)*, which was used as a baseline for organising the workshop and upon which this report seeks to build.

The workshop

The Dialogue was held in Berne on Monday 29 June 2026 from 14:30-20:30 Central European Time (CET).

Three scene-setter presentations of eight minutes each opened the session, given by the Satellite Applications Catapult, Roche and MHRA. Two rounds of small-group discussion followed, each 60 minutes plus a 10-minute wrap-up, and the day closed with a 30-minute plenary in which each group reported back and the room agreed priorities for the report.

Discussion round one ran four parallel groups on a single exercise, discussing the “WHAT & WHY?” - opportunities, use cases, and business case. Round two ran four parallel groups on two distinct topics, each discussing “HOW - BLOCKERS & ENABLERS”, with two groups focusing on partnerships, infrastructure, finance and skills, and the other two on regulation, governance, standards and IP. Groups were mixed across biopharma, space, academia, regulators, funders and public sector, to ensure representation of each participant type within a group, and were reshuffled between rounds so that participants worked with different people.

Each group worked to a printed template. In round one, participants were asked to select their top three use cases, arrange them from least to most interesting to pharma, then select one as a group to build the business case in more detail: why it is a commercial opportunity, what evidence a decision-maker would need, and by when. In round two they were asked to fill in a blockers and enablers grid and to identify next steps.

* [<https://sa.catapult.org.uk/news/unlocking-the-potential-of-microgravity-a-new-frontier-for-the-biopharmaceutical-industry/>].

Discussions were held under the Chatham House Rule, which participants agreed to at registration. As a result, nothing in this report is attributed to a named individual.

Four notetakers each covered one round-one and one round-two group. Sessions were audio recorded and AI-transcribed, producing eight transcripts including the plenary, since one group's discussion did not successfully record. Two transcripts had large segments with significant errors due to background noise.

Analysis

The full record of the discussions, comprising the note documents, the transcripts, the plenary and the completed group templates, was read group by group and written up with the source, timestamp, verbatim quote and a confidence rating attached to each finding. AI tools (primarily Anthropic's Opus 5 Model) were used to search and cross-reference the material and to group candidate findings across it. Every resulting statement was traced back to a named source and checked against it by hand. Recordings and transcripts were also reviewed by hand to check for gaps. Claims that could not be traced or attributed were removed. The transcripts and notes were synthesised into a set of findings that was reviewed by the facilitators and notetaker team to check they reflected their memory of the workshop.

The report was structured to convey the key findings in an accessible, digestible format to decision-makers at high level. The findings and recommendations were synthesised and written up to suggest a concrete plan to take forward into future work, rather than simply reporting a read-out of the workshop. The methodology behind the key decisions and recommendations is described below.

Use case selection

A three-layer model was developed by the analyst to organise the output of the first round, covering use cases and opportunities. It separates the physical conditions available in orbit, through the **techniques** they enable, from the **applications** and from the **business cases** those applications could support. It is intended as a starter-for-ten to define common terminology and differentiate between business cases and outputs in different parts of the same value chain. Each element of the model was traced back to the record and marked according to whether it was raised in the room, drawn from published material, follows logically from something the room said, or is the authors' own addition.

Priority use cases were selected in two stages. In the room, each group ranked and chose its own use case and recorded its reasoning. In analysis, opportunities were then weighed by how many of the groups raised them, how far each group took them, and whether the room appeared to converge. The model helped to compare outputs across groups, where different terminology appeared to be used to describe the same opportunity.

The version of the model presented in this report is a subset of the full model showing only those pharma opportunities that were updated. The subset has been reviewed in line with the rest of the report. The full version of the three-layer model is available on request but has not been reviewed or validated by workshop participants, so should not be used for decision-making purposes in the context of this report.

Pilot-led programme design

The proposed pilot programme was designed against the blockers and enablers identified in discussion round two, so each element answers a gap the workshop identified. It is built as two parallel challenges, one for each priority use case, because the two have different value chains, evidence problems and timelines. Each challenge runs the same three stages on its own clock, separated by go/no-go decision gates. The gates are designed so that the business case can fail: it passes the central gate only if the commercial case closes in at least one scenario, and stops or starts again if it does not. Gate outputs are intended to support the report's other recommendations, so that the specific requirements the use case-led programme produces are released to the supporting functions rather than staying inside it.

It is assumed that the supporting functions have their own development plans and roadmaps that this pilot could feed into, such as technology and capability development (e.g. the UK Space Agency (UKSA) In-Orbit Servicing, Assembly & Manufacturing (ISAM) In-Orbit Demonstration (IOD) Programme, and the ISAM Capability Development Programme). As part of the UK Government's implementation of the Space Regulatory Review (SRR), relevant government regulatory sandboxes and pathway clarification activities are being innovated, including the Re-entry Regulatory Sandbox and MHRA-UK Space Agency collaborative work to map the medicines regulatory pathway.

Review

A first draft was reviewed internally by the report authors and by the workshop notetakers, who checked the account against their own records of the discussions they observed. Their comments were incorporated. The revised draft was circulated to all workshop participants on 21 August 2026 for comment. Written responses were received from 10 of the participants, with a further 4 participants joining an online oral feedback call. All comments received have been addressed in this version. No participant disputed the report's account of the discussion, and all feedback received was supportive of it.

Caveats of the report

This report is a readout and analysis of a one-day workshop, together with recommendations for next steps. It is not a formal research study. No formal literature review, market analysis or primary research was commissioned, and that was out of scope for this engagement.

The analysis applied a single lens: what problem does pharma have, and can microgravity answer it better than the alternatives? That lens has limits. Capabilities not linked in the workshop to a specific pharma business case may be under-represented here but could prove valuable. A supply-side view focused on what microgravity can enable and how market opportunities might aggregate across sectors, could produce different priorities. One example raised in post-workshop feedback was the sale of microgravity-derived datasets to computational drug discovery and AI companies. Adjacent opportunities outside pharmaceuticals, including wider life sciences, were also discussed, with tissue growth for medical devices the clearest example. The pilot selection focused on the strongest near-term pharmaceutical business cases, on the basis that a customer-led approach is more likely to accelerate commercial maturity, with potential spillover into other markets.

Findings are synthesised across the discussion groups and the analysis, rather than reported group by group. This was a choice for brevity and readability. Per-group findings and the underlying evidence trail exist and can be made available on request.

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**Published by
British Embassy Berne
7 October 2026**