Press Release – 16th of December 2020

IGLUNA shooting for the Moon

Nine IGLUNA students presented the initial phase of their lunar mission "SCALE" to a team of ESA specialists involved in the preparation and assessment of the agency's future space missions. The mission brings together three experiments developed during the 2020 edition of IGLUNA by students from the universities of Berlin, Aachen and Warsaw. Their goal? To send their experiments by 2028 to the Moon for a 14-day mission.

Over the past three months, IGLUNA students have been assisted by experts from the Concurrent Design Facility at the European Space Agency (ESA) to plan the phase 0 of their lunar mission. The mission, named "SCALE", brings together the projects SAMPLE (Warsaw University of Technology), AMPEX (RWTH Aachen University) and Celestial (Technical University of Berlin). The aim of the mission is to operate for 1 lunar day (i.e. 14 terrestrial days) in order to test a module for the automated cultivation of plants, a device to produce fibres from lunar soil and a lunar communication system. SCALE will operate aboard a Lunar Lander and the experiments are planned to be brought back to Earth when the mission is complete.

The phase 0 of a space mission corresponds to the evaluation of needs and constraints and the analysis of the feasibility – technical and strategical – of the mission. The students worked on the first key aspects of the mission such as definition of the concept of operations, development schedule and financing of the project. They also had to choose the landing site and the model of the Lunar Lander. Finally, they adapted their modules to take into account the new technical constraints of the mission, such as mass, lunar temperatures and cosmic radiation.

At the heart of the future space missions

The review of the phase 0 was carried out by an ESA's Concurrent Design Facility (CDF) team, hosting the technical experts supporting the preparation of the agency's future space missions. The CDF brings together representatives of several space disciplines and evaluates on average between 15 and 20 mission studies per year. These studies are usually requested by internal ESA Programmes Directorates, space industry consortia or national space agencies.

Welcoming IGLUNA students to assist them in their lunar mission project was an unconventional activity for the CDF. The implementation of this mentoring programme was initiated following the wish of the Director General of ESA, Jan Wörner, to support the education of future European engineers and to encourage international and multidisciplinary missions. It also responds to the agency's vision to establish a permanent lunar base by 2030 and to develop the technologies that will bring this project to life.

A step further for IGLUNA students

Coordinated by the Swiss Space Center, IGLUNA enables students from all over the world to develop and collaborate on innovative space technologies for one year. In March 2020, they were invited to submit their ideas to ESA for a lunar mission on the Open Space Innovation Platform (OSIP). The most advanced and scientifically valuable projects were then selected by the Concurrent Design Facility (CDF) appointed team and the Swiss Space Center. The students have since worked together on their mission until the final review by the CDF experts on the 10th and 15th of December 2020.

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Milestones of the SCALE Mission ("Sample Celestial Ampex Lunar Endeavour")

- 2020: Phase 0 – CDF Review
- 2021: Phase A – Concept and technology development
- 2022: Phase B – Preliminary design
- 2023: Phase C – Final design and fabrication
- 2026: Phase D – Assembly, testing and launch preparations
- 2028: Phase E – Launch and operations

Mission members

Name	Role	University
Ryszard Zawila	Team leader SAMPLE and Mechanical & Thermal engineer	Warsaw University of Technology
Juan Carlos Arañó Romero	Team leader AMPEX	RWTH Aachen
Mayank	Team leader Celestial	TU Berlin
Maneesh Kumar Verma	Mission architect	TU Delft
Udit Kumar Sahoo	Mission analyst and Risk engineer	TU Berlin
Dimitar Boev	Cost engineer	RWTH Aachen
Guhan Sundaramoorthy	Communication and Data engineer	TU Berlin
Gabriela Mystkowska	Electrical engineer	Warsaw University of Technology
Jillian Oduber	Graphic designer	TU Delft

Coordination

Name	Role	Entity
Gabriela Ligeza	Project coordinator	Swiss Space Center
Ilaria Roma	Head of Systems and Concurrent Engineering section	Concurrent Design Facility, ESA ESTEC
David Binns	CDF Team leader	Concurrent Design Facility, ESA ESTEC
Ana Cipriano	System Engineer and Review team leader	Concurrent Design Facility, ESA ESTEC
Jasper Fluck	System Engineering trainee	Concurrent Design Facility, ESA ESTEC

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Communiqué de presse – 16 décembre 2020

IGLUNA vise la Lune

Neuf étudiants d'IGLUNA ont présenté la phase initiale de leur mission lunaire « SCALE » à une équipe de spécialistes de l'ESA impliqués dans la préparation et l'évaluation des futures missions spatiales de l'agence. La mission regroupe trois expériences développées lors de l'édition 2020 d'IGLUNA par des étudiants des universités de Berlin, Aix-la-Chapelle et Varsovie. Leur but? Envoyer leurs expériences sur la Lune d'ici 2028 pour une mission de 14 jours.

Au cours des trois derniers mois, des étudiants d'IGLUNA ont bénéficié de l'aide des experts du Concurrent Design Facility de l'Agence Spatiale Européenne (ESA) pour planifier la phase 0 de leur mission lunaire. La mission, appelée « SCALE », regroupe les projets SAMPLE (Ecole Polytechnique de Varsovie), AMPEX (Université Technique de Rhénanie-Westphalie) et Celestial (Université Technique de Berlin). La mission a pour but d'opérer pendant 1 jour lunaire (soit 14 jours terrestres) afin de tester un module de culture automatisée de plantes, un dispositif pour produire des fibres à partir de sol lunaire et un système de communication lunaire. SCALE opérera à bord d'un atterrisseur lunaire et les expériences devraient être ramenées sur Terre une fois la mission terminée.

La phase 0 d'une mission spatiale correspond à l'évaluation des besoins et des contraintes ainsi qu'à l'analyse de la faisabilité – technique et stratégique – de la mission. Les étudiants ont travaillé sur les grandes lignes de la mission, définissant le concept des opérations, l'agenda et le financement du projet. Ils ont également dû choisir le site d'alunissage et le modèle d'atterrisseur lunaire. Enfin, ils ont adapté leurs modules en prenant compte des nouvelles contraintes techniques de la mission telles que la masse, les températures lunaires et les radiations cosmiques.

Au cœur des futures missions spatiales

La revue de la phase 0 a été menée à bien par une équipe du Concurrent Design Facility (CDF) de l'ESA regroupant les experts soutenant la préparation des futures missions spatiales de l'agence. Le CDF regroupe des représentants de plusieurs disciplines spatiales et évalue en moyenne entre 15 et 20 études par année. Ces études sont habituellement soumises par des directions internes de l'ESA, des consortiums de l'industrie spatiale ou encore des agences spatiales nationales.

Accueillir des étudiants d'IGLUNA pour les assister dans leur projet de mission lunaire relève donc d'un caractère inhabituel pour le CDF. La réalisation de cet encadrement a été initiée suite au souhait du Directeur Général de l'ESA, Jan Wörner, de soutenir la formation des futurs ingénieurs européens et d'encourager les missions internationales et multidisciplinaires. Il répond également à la vision de l'agence d'établir une base lunaire permanente d'ici 2030 et de développer les technologies qui donneront vie à ce projet.

Une étape supérieure pour les étudiants d'IGLUNA

Coordonné par le Swiss Space Center, IGLUNA permet à des étudiants du monde entier de développer et de collaborer sur des technologies spatiales innovantes pendant un an. En mars 2020, ils ont été invités à soumettre à l'ESA leurs idées pour une mission lunaire sur la plateforme OSIP (« Open Space Innovation Platform »). Ce sont ensuite les projets les plus avancés et ayant la plus grande valeur scientifique qui ont été sélectionnés par l'équipe désignée du Concurrent Design Facility et du Swiss

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Space Center. Les étudiants ont depuis lors travaillé ensemble sur leur mission jusqu'à la revue finale par les experts du CDF les 10 et 15 décembre 2020.

Etapes de la mission SCALE (« Sample Celestial Ampex Lunar Endeavour »)

- 2020: Phase 0 – Revue CDF
- 2021: Phase A – Concept et développement des technologies
- 2022: Phase B – Définition préliminaire
- 2023: Phase C – Définition détaillée et production
- 2026: Phase D – Réalisation, tests et préparation du lancement
- 2028: Phase E – Lancement et opération

Membres de la mission

Nom	Rôle	Université
Ryszard Zawila	Chef d'équipe SAMPLE, gestion des systèmes thermiques et mécaniques	Ecole Polytechnique de Varsovie
Juan Carlos Arañó Romero	Chef d'équipe AMPEX	Université Technique de Rhénanie-Westphalie
Mayank	Chef d'équipe Celestial	Université Technique de Berlin
Maneesh Kumar Verma	Architecture des systèmes	Université de technologie de Delft
Udit Kumar Sahoo	Gestion des risques et analyse de la mission	Université Technique de Berlin
Dimitar Boev	Gestion des coûts	Université Technique de Rhénanie-Westphalie
Guhan Sundaramoorthy	Gestion des données et télécommunications	Université Technique de Berlin
Gabriela Mystkowska	Systèmes électriques	Ecole Polytechnique de Varsovie
Jillian Oduber	Graphiste	Université de technologie de Delft

Coordination

Nom	Rôle	Organisation
Gabriela Ligeza	Coordinatrice de projet	Swiss Space Center
Ilaria Roma	Cheffe de la section Ingénierie de systèmes CDF	Concurrent Design Facility, ESA ESTEC
David Binns	Chef de projet CDF	Concurrent Design Facility, ESA ESTEC
Ana Cipriano	Ingénieur système et chef de l'équipe d'évaluation	Concurrent Design Facility, ESA ESTEC
Jasper Fluck	Stagiaire ingénieur système	Concurrent Design Facility, ESA ESTEC

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Pressemitteilung – 16. Dezember 2020

IGLUNA zielt auf den Mond

Neun IGLUNA-Studenten präsentierten die Erstphase ihrer Mondmission "SCALE" vor einem Team von Spezialisten für zukünftige Weltraummissionen der ESA. Die Mission vereinigt drei Projekte, welche während der IGLUNA 2020 Edition von Studierenden an der Universität Berlin, Aachen und Warschau entwickelt wurden. Das Ziel? Die drei wissenschaftlichen Experimente sollen bis 2028 für eine 14-Tage Mission zum Mond zu geschickt werden.

Über die vergangenen drei Monate planten die IGLUNA Studenten mit der Unterstützung von den Experten des Concurrent Design Facility (CDF) der Europäischen Weltraumorganisation (ESA) die Phase 0 ihrer Mondmission. Die SCALE-Mission vereinigt die Projekte SAMPLE (Technische Universität Warschau), AMPEX (RWTH Aachen) und Celestial (Technische Universität Berlin). Die drei Experimente, welche während eines Mondtages, bzw. 14 Erdtagen, getestet werden sollen, sind ein Modul für die automatisierte Kultivierung von Pflanzen, ein Gerät zur Herstellung von Fasern aus Monderde und ein Mond-Kommunikationssystem. SCALE wird an Bord eines Mondlanders ausgeführt, mit dem Ziel, die Experimente nach Abschluss der Mondmission wieder zur Erde zurückzubringen.

Die Phase 0 einer Weltraummission dient der Einschätzung der Anforderungen und Einschränkungen, sowie der Auswertung der technischen und strategischen Durchführbarkeit der Mission. Hierfür erarbeiteten die Studenten die ersten entscheidenden Aspekte ihrer Mission, wobei sie unter anderem das Betriebskonzept, den Zeitplan und die Finanzierung des Projektes definierten. Auch den Landeplatz und das Modell des Mondlanders galt es mit Bedacht auszuwählen. Abschliessend mussten die Studenten ihre Module den technischen Einschränkungen der Mission, wie z.B. Masse, Mondtemperatur und kosmischer Strahlung, anpassen.

Im Zentrum der zukünftigen Weltraummissionen

Die Begutachtung der Phase 0 wurde durch das Concurrent Design Facility (CDF) Team der ESA durchgeführt, welches aus technischen Experten in der Entwicklung von zukünftigen Weltraummissionen zusammengesetzt ist. Das CDF vereinigt Vertreter verschiedener Raumfahrt-Disziplinen und beurteilt im Durchschnitt zwischen 15 und 20 Missionsstudien pro Jahr. In Auftrag gegeben werden diese Studien meist von internen ESA Programmdirektionen, Konsortien der Raumfahrtindustrie oder nationalen Weltraumbehörden.

Die Einladung der Studenten zur Unterstützung ihrer Mondmission unterscheidet sich von den konventionellen Aktivitäten des CDF. Die Umsetzung dieses Mentorenprogramm wurde auf Wunsch des ESA Generaldirektors Jan Wörner initiiert, mit dem Ziel, die Weiterbildung von zukünftigen Ingenieuren in Europa zu unterstützen und interdisziplinäre Missionen weltweit zu fördern. Des Weiteren unterstützt das Programm die Vision der Weltraumbehörde, welche bis 2030 eine permanente Mondbasis bauen und die dafür benötigten Technologien entwickeln will.

Ein weiterer Schritt für die IGLUNA Studenten

Unter der Koordination des Swiss Space Centers ermöglicht IGLUNA Studierenden aus aller Welt über ein Jahr hinweg die kollaborative Entwicklung von innovativen Raumfahrttechnologien. Im März 2020

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wurden Studierende dazu aufgefordert, sich mit ihren Ideen für die Mondmission bei der Open Space Innovation Platform (OSIP) der ESA zu bewerben. Anschliessend wurden die fortschrittlichsten und wissenschaftlich relevantesten Projekte von dem CDF-Team und dem Swiss Space Center ausgewählt. Seit dieser Auslese arbeiten die Studenten gemeinsam an ihrer Mission bis zur abschliessenden Prüfung durch die CDF-Experten am 10. und 15. Dezember 2020.

Meilensteine der SCALE-Mission ("Sample Celestial Ampex Lunar Endeavour")

- 2020: Phase 0 – CDF Begutachtung
- 2021: Phase A – Konzept- und Technologieentwicklung
- 2022: Phase B – Vorentwurf
- 2023: Phase C – Endgültiger Entwurf & Produktion
- 2026: Phase D – Montage, Testdurchläufe & Startvorbereitungen
- 2028: Phase E – Raketenstart & Inbetriebnahme

Mitglieder der Mission

Name	Funktion	Universität
Ryszard Zawila	Teamleiter SAMPLE und Maschineningenieur	Technische Universität Warschau
Juan Carlos Arañó Romero	Teamleiter AMPEX	RWTH Aachen
Mayank	Teamleiter Celestial	TU Berlin
Maneesh Kumar Verma	Missionsarchitekt	TU Delft
Udit Kumar Sahoo	Missionsanalyst and Risikoingenieur	TU Berlin
Dimitar Boev	Kosteningenieur	RWTH Aachen
Guhan Sundaramoorthy	Kommunikations- und Dateningenieur	TU Berlin
Gabriela Mystkowska	Elektroingenieurin	Technische Universität Warschau
Jillian Oduber	Grafikdesignerin	TU Delft

Koordinatoren

Name	Funktion	Organisation
Gabriela Ligeza	Projektkoordinatorin	Swiss Space Center
Ilaria Roma	Leiterin der Abteilung Systems and Concurrent Engineering	Concurrent Design Facility, ESA ESTEC
David Binns	Teamleiter CDF	Concurrent Design Facility, ESA ESTEC
Ana Cipriano	Systemingenieurin und Begutachtungs-Teamleiterin	Concurrent Design Facility, ESA ESTEC
Jasper Fluck	Systemingenieur Trainee	Concurrent Design Facility, ESA ESTEC

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SCALE MISSION BROCHURE

Sample Celestial Ampex Lunar Endeavour

Contents

Introduction

The space exploration industry has undoubtedly seen one major trend towards the end of the 2010s: the re-emergence of the space race to the moon. Not only have most of the major space agencies put moon missions back on their agenda, but also a number of commercial lander providers have emerged following the Google Lunar X Prize competition. These lander companies are on the brink of beginning regular operations to the moon, which opens doors for many interested parties, such as universities and other research institutes, which would not have had the opportunity of conducting their research on the moon otherwise. This has inspired countless technologies to be investigated and further developed for our future as humans on the moon.

The SCALE (Sample Celestial Ampex Lunar Endeavour) mission combines three diverse technologies to be demonstrated in a mission to the moon. SAMPLE is a life-sustainment experiment, Celestial is a communication system, and AMPEX will test the manufacturing of fibres made of lunar regolith. These systems started as university student projects in the IGLUNA campaign, an initiative by the Swiss Space Center and supported by the European Space Agency. During IGLUNA, students are guided in the design and development of innovative projects for the future of space exploration. The SCALE mission aims to bring these three products, which had their beginnings as student projects, to their destined spot on the moon.

SAMPLE payload

The SAMPLE (Semi-Autonomous Modular Plant and other Life-sustaining Experiment) aims to enable the storage of biological specimens in extreme conditions outside of a human habitat.

SAMPLE can be used for the cultivation of edible plants during a space exploration mission, for example on the moon. Sustaining non-human life in space raises several issues. Human habitats on a space exploration mission must provide conditions required for survival. Those conditions are very strict, resource consuming and demand careful control. Some biological samples, however, do not pose such strict requirements and so there is no need to store them in the main human habitat. Space in the habitat is also scarce and insufficient for the cultivation many plants. There should be a separate space designated for this purpose, with conditions designed for the specific species. There is also a need for experimentation towards sustaining life directly on the surface. Such early experiments can be conducted on non-human species, with the goal of developing reliable technologies which can later be applied to human bases.

SAMPLE addresses these issues by proposing a modular solution, with each module able to adjust to the very specific conditions required by the life inside. The modules are designed to be as autonomous as possible, by using a closed cycle of matter, which has had promising results in applications on earth. The modules will be appropriately insulated against heat loss and radiation and equipped with remote devices to control the internal conditions and with sensors recording the scientific data of the experiment.

Parameter	Value
Dimensions	[TBD]
Mass	< 55 kg
Expirement duration	7 days at minimum
Power (nominal)	50 W
Power (peak)	100 W
Radiation (plants)	8.3 uGy/h
Working temperature	15 to 25 °C
Heat emission	50-100 W

Celestial payload

Celestial aims to enable cis-lunar communication to support a growing space economy, by providing communication and antenna systems for an earth-moon communication link through a data relay small satellite constellation.

Celestial aims to enable cis-lunar communication to support a growing space economy. In the long-term Celestial will offer a communication link service between earth and moon based on a data relay small satellite constellation, thus aligning with strongly increasing lunar exploration and commercial activities. In the short-term Celestial's products will find applications for satellites in earth orbits as well. This will be in the form of communication and antenna systems. These systems will be deep space-qualified which will make currently unexploited orbits accessible. The products will also find many use cases in non-space industry sectors thus increasing the application potential of Celestial's core technology.

Parameter	Value
Dimensions	350x350x15 mm^3
Mass	< 0.6 kg
Satellite form factor	1U
Antenna	Rx & Tx
Data transfer rate	3 Mbps
Power	< 2.5 W
Temperature	-100 to 150 °C
Frequency	X & S band

Celestial's communication system and patch antenna have already been developed and will soon fly to Low Earth Orbit. The next step is to test its application as a phased array antenna system, which is the aim of Celestial on the SCALE mission. This will allow for an increase in the mission flexibility through its low powered reconfigurable communication system. as well as enhancing communication capabilities of lunar missions by relaying data to multiple satellites using this multi-beam array antenna. Celestial will also serve as the communication system for the SCALE payloads, which can alleviate some responsibilities from the lander regarding the SCALE operations. As mentioned, Celestial will work with relay satellites, and is designed to be adaptable to the satellites that are or will become available in the lunar orbit.

AMPEX payload

AMPEX (Aachen Modular Planetary Exploration) aims to demonstrate the technological capacity for the manufacture of continuous material fibres from lunar regolith, and thus the economic viability of extra-terrestrial infrastructures made of in-situ resources. AMPEX is supported by the MoonFibre project of RWTH Aachen University.

The transport of payloads into space, e.g. for research missions or the construction and supply of manned lunar stations, poses immense economic challenges in addition to technologically complex tasks. With payload costs of 1.1 million €/kg to the lunar surface and space projects requiring large freight volumes, weight reduction is essential. However, raw materials from the moon or Mars in the form of regolith are suitable for producing habitat building materials and thus reducing freight costs for further missions into space. For this purpose, continuous mineral fibres, e.g. basalt fibres, can be utilized in situ to produce fibre composites, thermal insulation, filters and hydroponic mineral wool for plant cultivation, among other things. However, this requires a spinning unit that can be operated under the extreme space conditions.

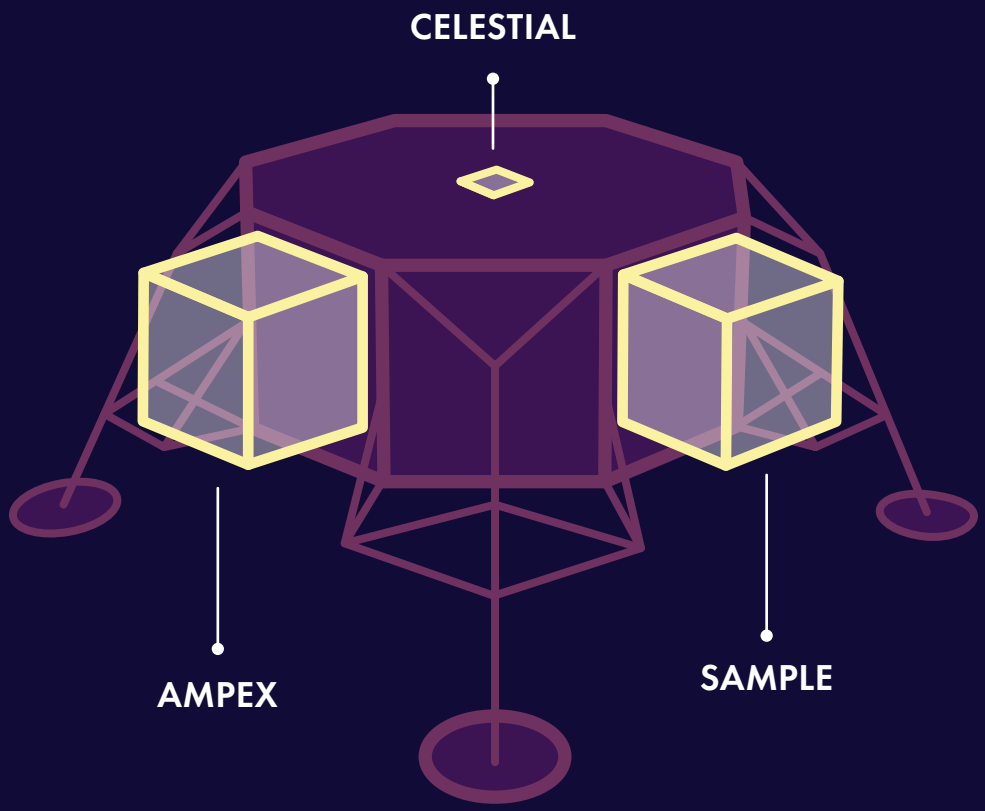
The goal of AMPEX is to demonstrate a miniaturized spinning unit to produce mineral continuous fibres on the moon. The overall design is realised with an edge length of 30 cm. The system serves as proof of concept of the ISRU spinning technology, that will be demonstrated on SCALE. The result is a functional prototype of a basalt fibre spinning plant, that can be upscaled to larger plants in the future. This first mission of AMPEX will use prepackaged lunar regolith simulant, whereas later versions will use the regolith itself.

Parameter	Value
Dimensions	500x500x500 mm^3
Mass	< 55 kg
Exp. duration	< 3 hrs
Power	< 600 W
Working material	Moon regolith simulant (prepacked)
Working temperature	1270 ± 20 °C (inside crucible)
Heat emission	[TBD]

Payload integration

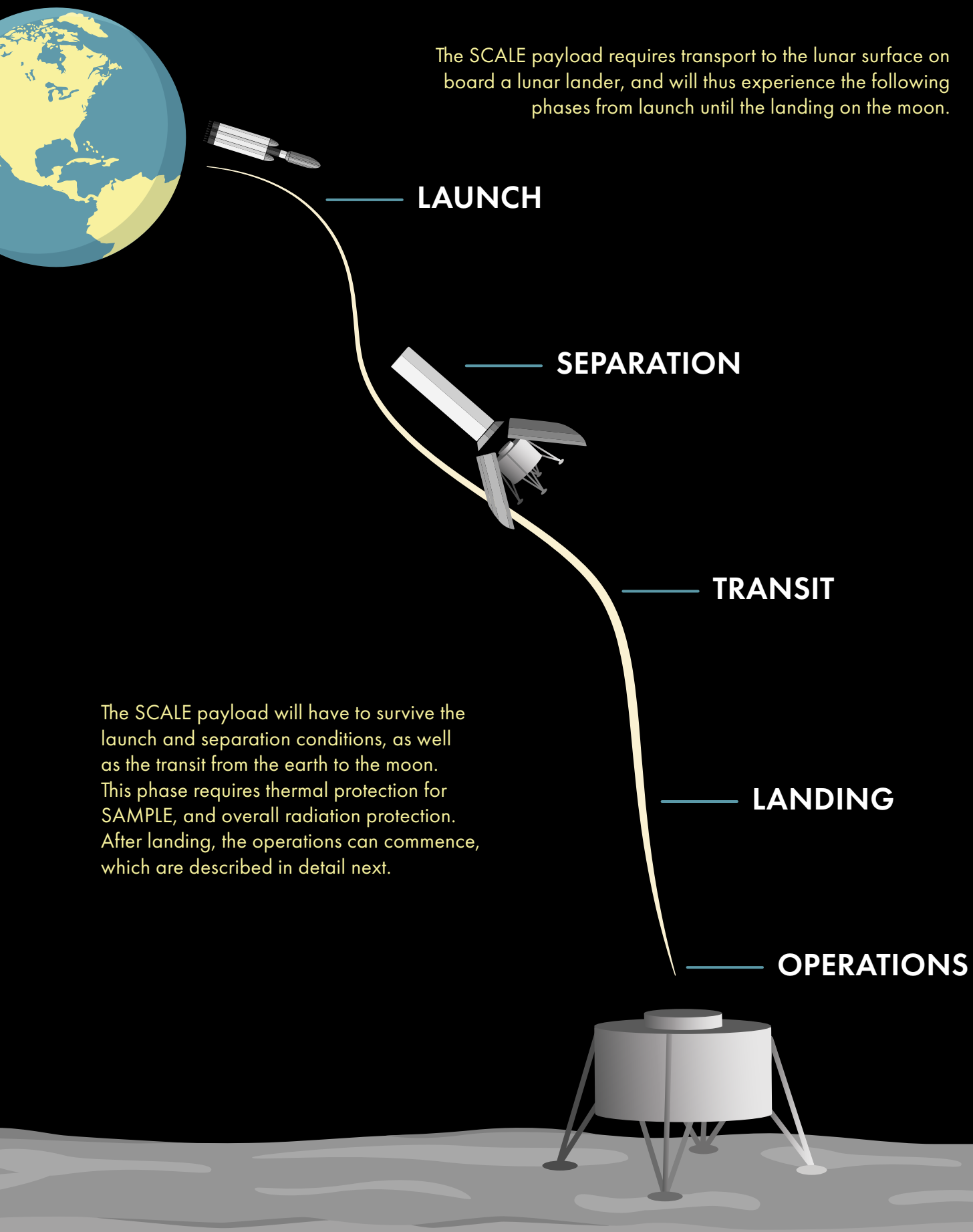
SCALE combines the SAMPLE, Celestial and AMPEX payloads into one payload group that aims to fly on a single mission to the moon. The three individual payloads are integrated into one system that will handle its operations, power distribution, data handling and thermal control. This central system will then interface with the lander to transfer its resources to the payloads as needed. The physical integration of the SCALE system and individual payloads to the lander will depend on the options provided by the lander itself, and is thus open for discussion. Due to the high power demand, in part due to the strict thermal conditions needed by some of the payloads, SCALE may also be equipped with its own batteries to meet the power demands. This will also depend on what the lander is able to provide.

Parameter	Value
Landing site	Shackleton crater rim
Mission duration	1 lunar day (14 earth days) at minimum
Total mass	±125 kg
Total power (maximum)	600 W
Orientation	±5° maximum tilt
Temperature (storage)	[TBD]
Temperature (operations)	[TBD]
Heat emission	[TBD]
Data transfer rate	[TBD]



Mission phases

The SCALE payload requires transport to the lunar surface on board a lunar lander, and will thus experience the following phases from launch until the landing on the moon.



The SCALE payload will have to survive the launch and separation conditions, as well as the transit from the earth to the moon. This phase requires thermal protection for SAMPLE, and overall radiation protection. After landing, the operations can commence, which are described in detail next.

Operations

DAY 0 — Lander lands

DAY 1 - 4 — Lander initial commission & operations, Comission of SCALE payload

DAY 5 — SCALE payload operations start

6 HRS

AMPEX

The AMPEX operations will consist of heating, spinning, cooling, and subsequent transfer of data. After the experiment, AMPEX will not be used for the rest of the mission.

CELESTIAL

Celestial will test its own operations on the moon during the SCALE mission, and will also serve to transfer data for the other payloads. Therefore, Celestial will start its operations together with AMPEX, and will be used for data transfer as needed throughout the mission.

2x12 HRS

SAMPLE

After the AMPEX operations, SAMPLE will commence with its first day cycle, in which lamps are turned on to simulate the earth day time, which will last for 12 hours. After the day, the night cycle will start, also lasting 12 hours. The lamps will be off during the night, and an active heating system will keep the plants at the correct temperature.

DAY 6

DAY 7-13 — SAMPLE will execute its Day-Night cycles 7 times in total

DAY 14 — End of mission: Decommission of SCALE

Roadmap

2021 **Phase A**
Concept & Technology Development

2022 **Phase B**
Preliminary Design

2023 **Phase C**
Final Design & Fabrication

2026 **Phase D**
Assembly, Testing & Launch Preparations

2028 **Phase E**
Launch & Operations

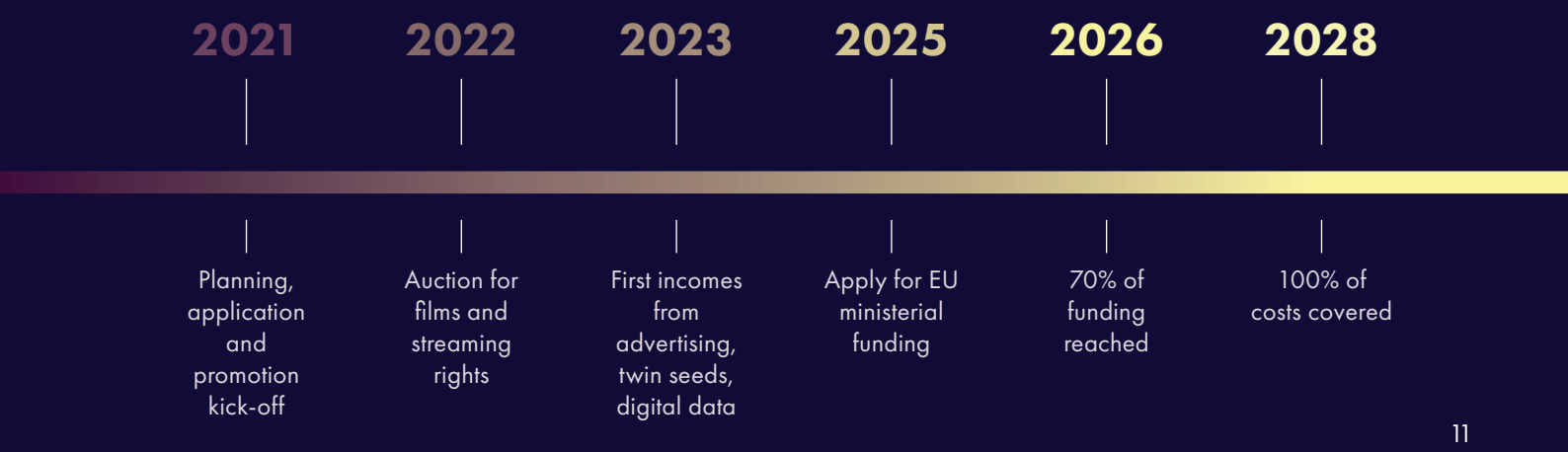
Business plan

SCALE will apply for ministerial and other sources of funding to make this mission possible. To further aid in securing this mission, SCALE will pursue several business opportunities that will provide diverse revenue streams over the course of the years towards the mission.

The SCALE mission combines three payloads that started out as university projects by student teams. Though some teams have branched out to become start-ups already, SCALE will require a long-term business model to secure funds to ensure that the mission can go through its life cycle and successfully arrive on the moon.

Several revenue streams have been identified that can be pursued to achieve this goal. The first is advertising, namely offering commercial companies advertising space on and throughout the mission, which is a popular trend among upcoming space missions, especially to the moon. Next, it is planned to film a documentary regarding the SCALE mission, its development over the upcoming years, and of course highlighting its beginning as a student project. The rights for this documentary would be sold to the highest bidder. Similarly, the launch and the mission can be livestreamed, and the rights for airing this can also be sold to the highest bidder. Having a camera livestreaming the growth of the Sample plants is also being considered.

The next concept in the SCALE business model is to provide a platform to customers to send their encrypted digital data to the moon, which can either be seen as a novelty, or an investment to be retrieved in the future. Lastly, SCALE plans to sell twin seeds of the Sample payload. The seeds growing inside the experiment on the moon will have twins back on earth. Space enthousiasts can buy and grow their own "space" plants, which may be especially exciting and inspiring for children. These multiple revenue streams would be in addition to any ministerial funding and other sources of funding that would be acquired for the SCALE mission.



Contact

SCALE is a part of the IGLUNA campaign organised by the Swiss Space Center.
For more information about the mission, please feel free to reach out.

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SAMPLE

AMPEX 20