CALL FOR IDEAS

SPACE EXPLORATION AS A DRIVER FOR GROWTH AND COMPETITIVENESS: OPPORTUNITIES FOR THE PRIVATE SECTOR
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SUMMARY

To date Space exploration is an institutional domain lead by space agencies. However, in the recent past an increasing number of private sector initiatives have been created. ESA is investigating new ways to partner with the private sector to facilitate the realisation of exploration ambitions. Space exploration might become a domain offering business opportunities for private companies.

ESA has a consolidated strategy to participate in the ambitious global Space Exploration undertaking. The ESA Space Exploration Strategy is driven by the following strategic goals, namely: (i) “Science”, (ii) “Economics” (knowledge and technology), (iii) “Global cooperation”, and (iv) “An inspirational dimension”.

ESA, together with its international partners, intends to participate in:

- Sustained exploitation of human-tended infrastructures in Low Earth Orbit beyond 2020, for advancing research, technologies and operations knowledge, and as an integral element of the plan for enabling human exploration of deep space;
- Missions that return samples from the Moon and Mars;
- Step-wise extension of human presence beyond Low Earth Orbit to the surfaces of Moon and, ultimately, Mars.

ESA is looking into novel ways to advance its strategic goals for Space Exploration, based on strategic partnerships with the private sector, including entities from the space and non-space industry, based on clear and mutually agreed objectives. Such partnership would entail the co-operation of both ESA and the strategic partner, each investing its own resources, experiences and skills at agreed levels for exploiting this partnership to their mutual benefit. The results of this partnership may lead to products or services to be put on the market by industry with longer term objective of commercial viability.

Consistent with the ESA Space Exploration Strategy, examples of areas of interest for ESA are related, but not limited, to:

- User-driven Exploitation of Low Earth Orbit Infrastructures
- Lunar and Mars Exploration
- Joint Research and Development:
- Inspiration

1Reference to all information and background documents related to this CFI is listed under chapter 4.
The Call For Ideas (CFI) presented in this document is a first step in a process for shaping the development of the ESA policy for strategic partnerships with the private sector in the field of Space Exploration and the development of an associated enabling framework. Promising partnership ideas will be identified and the proposing teams will have an opportunity to further mature the idea together with ESA with a view to implementing concrete pilot partnership initiatives. Thus, this CFI represents a unique opportunity for the private sector to shape and engage in the future global space exploration undertaking, as strategic Partner.
CALL FOR IDEAS

1 GOAL OF THIS CALL FOR IDEAS

1.1 Innovative partnership in support of ESA’s Space Exploration Strategy

With this Call for Ideas (CFI), the European Space Agency intends to assess the interest of the private sector to participate in the implementation of the Agency’s Space Exploration Strategy via innovative partnerships, and leverage on resulting economic opportunities. To date Space Exploration is an institutional domain lead by space agencies. However, in the recent past an increasing number of private sector initiatives have been created. This CFI is a first step in a process for shaping the development of an ESA policy addressing strategic partnerships with the private sector in the field of Space Exploration and the development of the associated enabling framework. Promising partnership ideas will be identified and the proposing teams will have an opportunity to further mature the idea together with ESA with a view to implementing concrete pilot partnership initiatives. Thus, this CFI represents a unique opportunity for the private sector to shape and engage in the future global space exploration undertaking, as a strategic Partner.

1.2 Strategic Partnership

For the purpose of this CFI, a Strategic Partnership is intended as a commitment between ESA and the private sector, including space and non-space industry, to short medium or longer term relationships based on clear and mutually agreed objectives. It seeks the full co-operation of both partners, each of them investing its own resources, experiences and skills in exploiting these arrangements to their mutual benefit. The results of this partnership may lead industry to release onto the market products or services with a longer term objective of commercial viability. Other European organisations (e.g. research organisation, academia) and non-European industry of countries that are part of the International Space Station (ISS) Intergovernmental Agreement (IGA) or whose space

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2 The private sector is understood as the part of the economy that is not state controlled, and is run by individuals and companies for profit. The private sector encompasses all for-profit businesses that are not owned or operated by the government.

3 Intergovernmental Agreement on the International Space Station: The International Space Station is a co-operative programme between Europe, the United States, Russia, Canada, and Japan for the joint development, operation and utilisation of a permanently inhabited Space Station in low Earth orbit. The legal framework defines the rights and obligations of each of the countries and their jurisdiction and control with respect to their Space Station elements.
agencies participate in the International Space Exploration Coordination Group (ISECG)\(^4\), may be member of the proposing teams/consortia provided they do not lead the proposal.

Some key characteristics of a Strategic Partnership as understood by ESA are listed below:

- It is an agreement between partners;
- It entails contributions in money, or in-kind, e.g. workforce, know-how, and/or facilities (e.g. test centres) from all Parties;
- Its purpose is to allow each Partner to advance its strategy goals in a more efficient and effective way;
- There is a proportional sharing of risks between the partners;
- The expected socio-economic benefits foreseen by the partnership are clearly identified and shared by both partners.

The proposing teams/consortia are free to identify potential contributions by ESA. For the purpose of illustration, the Agency can contribute the following to the private sector:

- A branding opportunity with the label “Space Solutions”;
- Technical expertise and facilities in support of demonstration of technologies (e.g. through getting access to the ISS; ground based facilities (such as ESTEC test facilities, European Astronaut Centre training facilities and Concordia) or in the frame of other ESA space missions).

Considering that this CFI, if successful, can inform the evolution of ESA’s programmatic framework for space exploration, the Agency might in the future invest financial resources through the selected partnership idea(s).

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\(^4\) The International Space Exploration Coordination Group (ISECG) was established in response to "The Global Exploration Strategy: The Framework for Coordination" developed by the following fourteen space agencies: ASI (Italy), CNES (France), CNSA (China), CSA (Canada), CSIRO (Australia), DLR (Germany), ESA (European Space Agency), ISRO (India), JAXA (Japan), KARI (Republic of Korea), NASA (United States of America), NSAU (Ukraine), UKSA (United Kingdom), Roscosmos (Russia). "Space Agencies" refers to government organisations responsible for space activities.
1.3 Potential areas/themes for submission

Consistent with the ESA Space Exploration Strategy, potential partnership idea themes for submission are introduced below. These themes shall be considered as examples, with the understanding that partnership ideas retained will be consistent with ESA’s Space Exploration Strategy and that they do not need to be limited to these examples.

- **Low Earth Orbit (LEO) Infrastructures**

  LEO is currently the only destination within reach and permanently occupied by humans on board the International Space Station (ISS). Research on board the ISS advances knowledge in the fields of life and physical sciences and the ability for humans to live and work in an hazardous environment. ISS is also used as a platform for technology demonstration, Earth Observation and Space Science. For the benefit of and complementing primarily science-driven LEO exploitation activities, ESA welcomes partnership ideas regarding:

  - Improved (e.g. lower cost, shortened time to access, more regular download) and sustained (post 2020 and post-ISS) access for European user community to research infrastructures in LEO for advancing European research and development interests.

  - New ideas for utilisation of ISS, maximising its potential to drive innovation, economic development and inspiration to prepare Europe’s role in a future international human exploration endeavour.

- **Joint Research and Development**

  ESA Space Exploration activities are based on targeted involvement in international missions of interest for achieving ESA strategic goals. ESA’s capabilities need to be advanced and demonstrated in order to secure future European participation on the critical path of individual missions. Exploiting technological synergies between missions to different destinations (Moon/Mars), Space Exploration and other space applications and space and Earth applications ensures economies of scales for a more cost effective mission.

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5 ESA will continue sustained exploitation of LEO post 2020, through either ISS extension (until 2024 or 2028) and/or participation in utilisation of other human tended platforms existing beyond 2020 and beyond ISS, be they government-owned platforms (e.g. Chinese Space station) or commercial tended infrastructures (e.g. orbital robotic capsules).
and contributes to fully exploiting the potential of Space Exploration to drive innovation for the benefit of space and terrestrial applications. With this in mind, ESA welcomes partnership ideas contributing to:

- **Enhancement of the technological capabilities of Europe in the priority fields identified in the ESA Space Exploration Strategy** for securing attractive ESA roles in future mission scenarios taking into account early on the potential for exploiting synergies with terrestrial or other space applications.

Research conducted in ground-based analogues and on board the ISS are instrumental to advance knowledge on the effect of space on the human body and leads to risks’ mitigation for further human exploration of the solar system. In this respect ESA welcomes partnership ideas contributing to:

- **Better understanding risks for an astronaut’s health and performance associated with Space Exploration missions targeting Moon and Mars and developing effective risk mitigation approaches and techniques, e.g. by exploiting potential synergies with terrestrial application in the field of health.**

**Exploiting the inspiration potential**

Space Exploration offers a unique and evolving perspective on humanity’s place in the Universe. It addresses fundamental human questions about the origin, the uniqueness and the destiny of humankind. ESA welcomes partnership ideas offering:

- **New means and mechanisms for fully exploiting the potential of Space Exploration to inspire society, in particular the young generations to expand the limits of our knowledge, to study natural sciences and engineering and to accentuate the values of global cooperation in space.**

- **New approaches for engaging new stakeholder communities in the conduct of Space Exploration and the exploitation of the inspirational value gained (e.g. humanities (philosophy studies) and cultural communities (literature, museums, music etc...).**

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6 See chapter 4 Technical and Background Information
✓ **Lunar and Mars Exploration**

There is an international consensus on the important role of the Moon as a stepping stone towards human missions to Mars. Lunar exploration is pursued today with diverse robotic missions in orbit and on the surface. Early human exploration missions in the next decade will likely target the Lunar vicinity as a first step in the sustainable extension of human presence beyond LEO. Lunar exploration will realise a key step in further integrating human and robotic capabilities. Mission to the Moon will also address how the use of in-situ resources (ISRU) may affect future exploration strategies.

Mars is the ultimate international goal for human exploration in this century (cf. Global Exploration Roadmap (GER), version 2). Currently space agencies are focusing on the robotic exploration of Mars with rovers on the surface (e.g. NASA Curiosity, ESA ExoMars) and orbiters (e.g. ESA’s Mars Express). The next main international objective in preparation is a Mars Sample Return campaign.

ESA welcomes partnership ideas leading to:

- Increased knowledge of Moon (and possibly Mars) in preparation of future human missions, including knowledge related to the environment, hazards as well as the feasibility of utilising in-situ resources in support of future human missions (cf. Strategic Knowledge Gaps for human exploration developed and maintained by ISEC7).

- Access to the lunar surface for the European community (e.g. Physical, Material and Life Sciences Community, Technology and Technology Demonstration community, space science, Earth Observation, Telecommunications and Navigation communities, Astronomy community).

- Services in support of future exploration missions such as e.g. those related to transportation to the Moon, communications at the Moon, navigation and logistics.

See section 3.2 below
2 SUBMISSION AND EVALUATION

2.1 Requirements and Deadline for Submission

Interested parties should send, to the email address partnership.ideas@esa.int, the following:

- **Letter of Interest** (not binding nor mandatory), preferably by **April 3**, mentioning the name and affiliation of the proposer, the title of the submission, the proposed teams/consortia and a short description (10 lines maximum) of the partnership idea. Submission will be acknowledged within 10 working days of receipt.

  **NB:** ESA invites proposing teams/consortia to also include in their Letter of Interest any questions for clarification they have. ESA plans to organise a (virtual) Information Day April 28 to provide information for proposing teams/consortia, not familiar with the Agency’s activities and Space Exploration programme, critical for the maturation of their submission.

- **Partnership Idea submission**, by May 26, using the attached form in Annex 3. Your submission will be acknowledged within 10 working days of receipt.

2.2 Evaluation Approach

Proposing teams/consortia are expected to provide evidence that their partnership idea contributes significantly to advancing ESA strategic goals for Space Exploration. As a minimum, ideas retained will include the following:

- Motivation to set up a partnership activity, in particular in terms of expected benefits to all parties;
- Description of the partnership objectives and content;
- Description of the partnership scheme, of the risk-sharing approach and of the expected contributions of the parties;
- Description of the future business/market opportunities for the private partner;
- Description of the expected broader socio-economic benefits;
- Description of relevant past and on-going work;
- High-level description of relevant programmatic information (schedule, costs).

Once received, the submissions shall be reviewed by an ESA experts’ panel. Recommendations of the review panel will be assessed by ESA and the most promising partnership ideas will undergo a further technical and programmatic assessment.
The experts’ review will consider the following major evaluation criteria:

- **Relevance to the ESA Space Exploration Strategy**
  This encompasses in particular the contribution of the partnership idea for advancing the overarching strategic goals of ESA’s Space Exploration strategy, the consistency of the partnership idea with the other elements of the strategy and the alignment with ESA areas of interests.

- **Background and Experience of proposing team/consortium**
  This encompasses the relevance and potentially complementarity of skills in the team’s composition as well as a clear and feasible vision of the project for the short and long term.

- **Feasibility and level of maturity of partnership idea**
  This encompasses the preparatory work conducted in support of the partnership idea and the technical and programmatic (management approach, costs, planning) feasibility of implementing the idea.

- **Suitability of partnership model proposed**
  This encompasses the partnership model proposed (e.g. kind of contribution foreseen from each Partner(s) in terms of financial contributions, assets, manpower, know-how, risks), the motivation to advance the partnership ideas and description of the mutual objectives expected to be advanced both for the proposing team and for ESA.

- **Partnership benefits and Existence of a Business Case**
  This encompasses the expected benefits/returns for the Partners and the outline of future business/market opportunities for the private partner.

- **Potential socio-economic benefits**
  This encompasses a description of the broader expected socio-economic benefits.

- **Alignment with ESA ethical standards**
  This Call is not aimed at particular non-space sectors or domains but explicitly excludes activities promoting, or being related to, alcohol, tobacco, religion, politics, intolerance, violence, firearms, pornography, obscenity, gambling or illegal drugs.

  In addition Partnership ideas submitted via this Call should not be in conflict with the Space Agreements, policy, and legal aspects or any law or treaty, e.g. launch of missiles, use of military hardware in force.
2.3 Feedback to proposers

Reception of the proposed partnership ideas will be acknowledged within 10 working days of submission. Based on the open questions raised in the Letter of Interest (see 2.1 above), ESA will organise a virtual information day to enable bidders to mature their ideas with a clear understanding of ESA Space Exploration Strategy and of the potential themes for submission. After review of received ideas by an internal ESA experts’ panel, ESA will present the result of the Call in a dedicated workshop planned for the July 2015 timeframe. Selected idea may then be matured jointly by the proposing team and ESA with the goal to initiate pilot activities.

Applicants whose partnership idea present a major interest may be contacted for further information on their concept and may be invited to provide support for further analysis.

It is important to note that this CFI is not part of a formal selection process for further programme procurement. If successful, the outcome of this CFI may lead to the implementation of focused activities targeted at maturing the definition of selected partnership ideas. Furthermore, the result may inform ESA’s programmatic planning for implementing its Space Exploration Strategy and inform related decisions by ESA Member States at the next ESA Council at Ministerial level (CM-2016).
2.4 CFI Schedule

The figure outlines the three steps of the CFI implementation process (1. Identification of partnership opportunities, 2. Consolidation of partnership opportunities, 3. ESA evaluation) and highlight key milestones.

2.5 Contact and Submission Address

European space and non-space industries interested in this Call for Ideas are invited to submit their proposal using the attached form in Annex 3. This proposal is not legally binding.

For questions related to this Call for Ideas please contact:

strategic.planning.office@esa.int

The proposals should be prepared in electronic format AS ONE SINGLE FILE (Microsoft Word (.doc) or Adobe Acrobat (.pdf)) and have a maximum length of 10 pages. To facilitate transmission of the file, the total file size should be no more than 15 MB (including pictures).
Submission of proposals should be made by email to the email address.

partnership.ideas@esa.int

2.6 Intellectual Property Rights and Confidentiality

The Agency does not expect proposals to contain elements that are protected by intellectual property rights or subject to specific non-disclosure obligations, resulting in limitations for ESA’s use of the information and data contained in the proposal in exchanges with its partners (ESA Member and Cooperating States, international partners and industrial entities) and in the frame of future ESA activities. If by submitting an idea, the Proposer nevertheless wishes to attach restrictions to the use by ESA of elements of the proposal, these restrictions shall be clearly stated and justified in the proposal.
3 BACKGROUND

3.1 ESA Exploration Strategy

The ESA Strategy for Space Exploration is the main reference document for submission of ideas.

- **Goals**
  
  (i) “Science”: Strengthening European excellence in scientific research through opportunities for in-situ investigations, and the development of relevant instrumentation and enabling technologies.
  
  (ii) “Economics” (knowledge and technology): Contributing to the competitiveness and growth of the European industrial sector by pushing the frontiers of knowledge and developing new technologies able to be applied in other fields of economic value.
  
  (iii) “Global cooperation”: Establishing a global (worldwide) cooperative framework to carry out several specific Space Exploration projects, involving in each case interested partners, and pursuing common goals relevant for humanity as a whole. And
  
  (iv) “An inspirational dimension”: Attracting society, and in particular young generations to expand the limits of our knowledge, to the study of natural sciences and engineering, to the values of global cooperation in space, and to the preparation of sustainable human presence in the solar system beyond Earth.

- **Destination-based approach**

  ESA activities and planning in Space Exploration are focused on three priority destinations: Low Earth Orbit, Moon and Mars. These destinations answer the following criteria:

  (i) Accessibility and resulting ability to implement a series of robotic and/or human missions developed incrementally, each mission building on the results/experience achieved by previous ones;
  
  (ii) Ability to achieve human (planetary surface) mission within the next 20 to 30 years;
  
  (iii) Potential for advancing knowledge gain and addressing priority science questions;

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8 Cf. “Resolution on Europe’s space exploration strategy”, covering ESA’s three destinations for exploration (LEO low-Earth orbit, Moon and Mars)
(iv) International context and opportunity for establishing international partnerships.

3.2 International Context

Exploration of space is a global undertaking. At programmatic level, the International Space Exploration Coordination Group (ISECG)\(^9\) is an important space agencies’ forum for advancing a common and global vision on the next steps in implementing Space Exploration. The Global Exploration Roadmap (GER) highlights the efforts of ISECG participating space agencies to prepare for human and robotic exploration of destinations where people may someday live and work.

The latest version of the GER (v.2) builds on the vision for coordinated human and robotic exploration of the solar system. This edition includes a single reference mission scenario that reflects the importance of a stepwise evolution of critical capabilities necessary for executing increasingly complex missions to multiple destinations, leading to human exploration of Mars.

In order to prepare for future human missions, system and mission planners desire data that characterize the environments, identify hazards, and assess resources.

For the purpose of this CFI it is important to underline that ISECG participating agencies have worked to identify Strategic Knowledge Gaps (SKGs) associated with future human destinations. In consultation with key independent analysis/assessment groups from NASA, ESA Topical Teams, and JAXA experts, the list has been integrated and grouped by areas of knowledge for each destination. The list of SKGs has been prioritized on the basis of crew/mission risks, relevance to mission scenario, and applicability to more than one destination.

The high-level SKGs are reported in the tables to be found under the following link:


It contains information on the gaps and their priority. It also identifies specific measurements which would contribute to filling the gaps. The SKG work is intended to inform the definition of objectives for future robotic missions and ground-based activities.

\(^9\) Link to the ISECG website is referenced chapter section 4.
3.3 Evolution of ESA

The ESA Resolution on the Evolution of ESA, approved at the last Council meeting at Ministerial level in December 2014, addresses also the evolution of ESA’s relations with Industry. This resolution notes that established space powers have introduced new models of cooperation between governments and industry and invites the ESA Director General to make proposals prior to the next ESA Council meeting at Ministerial level planned for 2016 on:

- The most promising opportunities to adapt the relationship between ESA and industry in cooperative endeavours which balance the share of responsibility, cost and risk with a view to optimising the economic value of their respective investments.
- Innovative ways to procure and support R&D, allowing for prompt decisions for programmes or technology developments when industrial success is at stake, including models currently being used around the world to stimulate lower cost R&D such as prize funds;
- Ways to maximise synergies between European institutional and worldwide commercial space market; and
- Further development of ESA programmes and activities to support the sustainable development of European industry in the domain of downstream space applications and services, in an end-to-end perspective.

10 “Resolution on ESA evolution”, covering the vision for ESA until 2030.
4 TECHNICAL INFORMATION AND BACKGROUND INFORMATION

4.1 ESA Space Exploration Strategy

- Resolution on ESA Space Exploration Strategy
  http://esamultimedia.esa.int/docs/corporate/Final_resolutions_1_2_3_from_CM_2014_Releasable_to_the_public.pdf
- ESA Space Exploration Strategy
- European User Requirements for Utilisation of LEO post 2020

The two documents listed below are accessible via:

hsoftp.estec.esa.int
name: pideas   password: MzW32d7T

4.2 Evolution of ESA

4.2.1 Resolution on ESA Space Exploration Strategy

http://esamultimedia.esa.int/docs/corporate/Final_resolutions_1_2_3_from_CM_2014_Releasable_to_the_public.pdf

4.3 ISECG

Background documents on ISECG listed below can be found under the following link:

http://wwwglobalspaceexploration.org:

- ISECG Global Exploration Roadmap GER version 2 (see also:
- ISECG Benefit White Paper
- List of Strategic Knowledge Gaps (SKG’s)
4.4 Other relevant documents

- Alex Gerst Mission Video
  http://www.esa.int/Our_Activities/Human_Spaceflight/Blue_dot

- Destination Moon Video
  http://wsn.spaceflight.esa.int/?v=MTQyMDgwMDYwMw

- Ethical standards

  Useful links to space policies, agreements, treaties, etc. are given below:

  - http://www.unoosa.org/oosa/COPUOS/copuos.html
  - http://www.esa.int/SPECIALS/ECSL/SEM1691XDYD_o.html
### Annex 1 - Acronyms

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<th>Description</th>
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<td>Call For Ideas</td>
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<tr>
<td>D-HSO</td>
<td>Directorate of Human Space Flight and Operations</td>
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<td>ELIPS</td>
<td>European Programme for Life and Physical Sciences</td>
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<td>ESA</td>
<td>European Space Agency</td>
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<td>GER</td>
<td>Global Exploration Roadmap</td>
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<td>IGA</td>
<td>InterGovernmental Agreement</td>
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<td>IPR</td>
<td>Intellectual Property Rights</td>
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<td>ISECG</td>
<td>International Space Exploration Working Group</td>
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<td>ISS</td>
<td>International Space Station</td>
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<td>LEO</td>
<td>Low Earth Orbit</td>
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<td>PB-HME</td>
<td>Program Board for Human Space Flight and Exploration</td>
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<td>PPP</td>
<td>Public Private Partnership</td>
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Annex 2 – Adopted Technology Readiness Level Scale

**DEFINITION**

The Technology Readiness Level (TRL) scale is used to describe the maturity of a Technology. The scale goes from Level 1 through Level 9, as shown below:

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Annex 3 – Partnership Idea Proposal in support of ESA Space Exploration Strategy

I express my interest in the Call for Ideas “Space Exploration as a driver for Growth and Competitiveness: opportunities for the private sector”.

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<thead>
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<td>Organisation (Industry/ University/ Research Centre/ National Institution/ Entrepreneurs/ International partner):</td>
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**Motivation to set-up Partnership Activity/Partnership benefits:**
(Maximum 0.5 page)
Summarise the motivation of the proposing team to propose the set-up of the partnership activity and expected benefits for all parties.

**Partnership Objectives and Content:** (Maximum 2 pages)
Summarise the objectives to be achieved through the partnership, activities to be jointly conducted, how it is relevant for advancing ESA’s Space Exploration Strategy and how it is consistent with the international planning for Space Exploration.

**Partnership Scheme:** (Maximum 1 pages)
Describe the partnership scheme with detail of foreseen contribution by the proposer and of expected contribution by ESA and risk sharing assessment. Describe potential associated business plan.

**Background:** (Maximum 1 pages)
Describe how past and on-going work by the proposing team has informed the definition of partnership idea, what specific competences the proposing team can bring to the partnership.
**Programmatic Information: (Maximum 1 page)**
Provide a high-level plan for implementing the content of the partnership idea including a high-level assessment of the resources required and the implementation schedule as well as major identified risks.

**Socio-economic benefits: (Maximum 1 Page)**
Describe the potential benefits of implementing the Partnership idea in terms of economic growth, market opportunity, fostering of competitiveness for the proposing team/consortium.