ANNUAL REPORT

2024 Annual Report

May 2025

International Space Exploration Coordination Group

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Executive Summary

In 2024, the International Space Exploration Coordination Group (ISECG) made significant strides in advancing global space exploration efforts. As the year concluded, the European Space Agency (ESA) transitioned the leadership of ISECG to the National Aeronautics and Space Administration (NASA), marking the beginning of a new phase in international collaboration. Against the backdrop of dynamic exploration prospects, ISECG pursued an ambitious work plan covering a diverse range of topics, with a primary focus on laying the groundwork for an updated Global Exploration Roadmap (GER).

A key achievement of the year was the completion and publication of two flagship documents: GER 2024 and the Benefits Stemming from Space Exploration white paper. These publications serve as essential resources for communicating the vision, objectives, and tangible benefits of global space exploration efforts. Additionally, ISECG enhanced its outreach and accessibility by updating its website, where all published products—including five newly released publications—are now available.

The International Astronautical Congress (IAC) provided a valuable platform for ISECG member delegates to convene, exchange insights, and celebrate the release of these critical publications. The event underscored the strength of international cooperation in space exploration and reinforced ISECG's commitment to fostering collaboration among space agencies worldwide.

Looking ahead, ISECG remains dedicated to supporting the development of a robust and sustainable global exploration strategy, ensuring that international partnerships continue to drive innovation and progress in space exploration.

Highlights, Achievements, and Special Projects in 2024

The 2024 Global Exploration Roadmap

The GER is the flagship product of ISECG, which reflects a coordinated vision for long-term human and robotic exploration of the Solar System, common objectives, and shared principles for Space Exploration. The GER 2024 was published in August 2024 as a result of the effort of the entire ISECG community. Coordinated by the Exploration Roadmap Working Group and the support of the other working group co-chairs, GER 2024 was an update to the last edition from 2018 and built upon the two lunar supplements, released in 2020 and 2022. The comprehensive document incorporates the priorities of participating ISECG member agencies and depicts a common vision for Space Exploration through 2050.

GER 2024 begins with foundational activities in low Earth orbit, covers intensifying exploration activities—both human and robotic—on and around the Moon, and discusses preparation for initial human exploration of Mars. This edition of the roadmap presents an update to the overall exploration mission scenario and participating agencies' national exploration architectures and summarises upcoming and planned missions. It also discusses other potential destinations in the solar system, the synergies between robotic and human exploration activities, exciting work by emerging space agencies—both independently and through cost-sharing and collaboration with more established agencies—the scientific questions that space exploration aims to answer, the growing role of commercialisation in spaceflight, and efforts to develop the technologies that enable increasingly ambitious missions.

Benefits Stemming from Space Exploration – Second Edition

ISECG released the 2nd edition of *Benefits stemming from space exploration* in August 2024. The white paper examines benefits as a foundational rationale for investments in space exploration. It introduces a benefits model developed by the ISECG participating agencies as a collaborative effort to articulate a unified perspective on the positive socioeconomic impacts of space exploration. The document is intended as a tool for space agencies to inform and engage stakeholder communities, and to guide policy and decision makers. 16 space agencies provided benefit examples and success stories materialized through space exploration investments over the last decade, highlighting the importance for agencies to continue to collaborate on advancing the Global Exploration Roadmap to deliver benefits on Earth.

Technology Working Group

The recently updated Critical Technology List was highlighted in the Technology section (Chapter 8) of the GER 2024, spotlighting the various technology domains that enable human and robotic exploration of the Moon, Mars, and beyond. This chapter included a special page on In-Situ Resource Utilisation (ISRU) and the role of space resources activities in deep space exploration.

Technology gap assessments on current topics is also an important activity within ISECG. A dedicated action team of subject matter experts are reviewing recommendations from the Nuclear Power and Propulsion Gap Assessment Report (2023). 2024 has been very productive for the Life Support Systems gap assessment team, through their international collaborative team of subject matter experts. Their final report is set for release in 2025.

Outlook for 2025

ISECG Working Groups

Exploration Roadmap Working Group (ERWG) & International Architecture Working Group (IAWG)

In order to build on the benefit of synergies and complementarities between the Exploration Roadmap Working Group (ERWG) and the International Architecture Working group (IAWG), the two groups intend to merge portions of their respective mandate. ERWG will continue to promote the GER 2024 as a reference document for the entire sector, from stakeholders and decisionmakers to users at all levels. In coordination with SCWG, ERWG will provide GER 2024 at relevant events and conferences and will leverage multiple communication channels including but not limited to, agencies' social media platforms, organizational websites, and digital repositories. ERWG is currently assessing the feasibility of a survey to collect feedback and recommendations about the GER 2024.

ERWG is expected to serve as entry point in the coordination of ISECG with the International Mars Exploration Working Group (IMEWG). The two groups intend to pursue common objectives and vision on the future of Mars Exploration and the definition of potential areas of cooperation. As a first step, both teams will work in collaboration to update and expand the Analogue Database, produced by the ISECG Analogue Action Team.

In 2025, the ERWG will also focus on evaluating the concept of sustainability within the context of space exploration, recognizing it as a key aspect of the current exploration era. Building on existing definitions used by various agencies and across different aspects, the group will work toward developing and proposing a shared definition.

In 2025, IAWG will continue to mature aspects of the lunar surface exploration scenario, with a focus on power architecture. Understanding the benefits of infusing power infrastructure into the lunar surface scenario phases to support power infrastructure implementations will be beneficial in supporting the achievements of the lunar objectives and enabling future lunar commercialization opportunities. The IAWG will trade timing of need along with power resources needed, updating the lunar surface exploration scenario as it matures.

Jointly, ERWG and IAWG will focus on architectures and exploration scenarios, like interoperability and standardization for efficient and effective operations involving different actors.

Technology Working Group (TWG)

Extending from the recently updated Critical Technology List released in the Global Exploration Roadmap GER 2024, the focus for 2025 will be updating the Critical Technology Portfolio through a peer-reviewed process.

Concurrently, an action team continues to monitor the global landscape, following the guidance of the recent gap report from the Nuclear Power and Propulsion gap assessment team. The current active gap assessment team of experts are focused on life support systems; their anticipated gap report will be released in 2025.

Looking ahead, the TWG will identify and kick start their next technology gap assessment team for a detailed analysis and in-depth focus on a critical technology domain to be identified in 2025 by the TWG.

Strategic Communications Working Group and Tiger Team (SCWG-TT)

The major activities of the SCWG, in close cooperation with ISECG and its working groups, encompass a range of initiatives. These include the development of ISECG web news, the preparation of the ISECG Annual Report, and the facilitation of topical exchanges among agencies. Additionally, the SCWG explores the feasibility of creating diverse communication products such as videos, podcasts, recordings, and infographics to enhance the visibility of ISECG's accomplishments. Specific initiatives include the development of a digital welcome package, the preparation of a GLEX2025 paper and a presentation on the *Benefits of Space Exploration* White Paper and leveraging agency products or key messages to communicate the benefits of space exploration topics relevant to ISECG's needs. Furthermore, the SCWG aims to compile an inventory of evidence highlighting the benefits of space exploration by utilising agency reports, public reports, case studies, success stories, and publications.

Science Working Group (SWG)

In 2025, the Science Working Group will work on revising the previous Science White Paper (published in 2018) to reflect the updated themes presented in the GER 2024 Science Chapter. This revised white paper has been rescoped as a Science Collaboration and Coordination Plan and it will merge science priorities for ESAWG (a previous objective for the SWG). The document will dive deeper and define consensus on science objectives for the LEO, Moon, and Mars roadmap elements, identify key science gaps and opportunities, and foster broadened participation with Emerging Space Agencies. As part of this, SWG will survey the wider ISECG membership to understand how agencies may wish to be involved or represented in the development of this document, as well as to understanding existing strengths, opportunities, and overlaps (notably between science and technology and science and commercialisation).

Emerging Space Agencies Working Group (ESAWG)

In 2025, the Emerging Space Agencies Working Group (ESAWG) will focus on strengthening collaboration and engagement within the ISECG community. Key activities will include organizing a dedicated workshop for ISECG member agencies, fostering dialogue on emerging space exploration priorities, and establishing an internal partnership program to enhance knowledge transfer and share lessons learned. Additionally, the group will contribute to the Global Exploration Roadmap (GER) paper, which will be presented at GLEX 2025 by May. To further support emerging agency participation, ESAWG will enhance

coordination with other ISECG working groups, ensuring broader engagement and integration within the global space exploration framework.

Commercialisation Working Group

Building on the commercial LEO and post-International Space Station (ISS) case studies performed during 2024, and the collation of the commercial business enables database, 2025 will see the CWG focusing on synthesizing the information into a white paper, titled “Understanding the global shift in commercialization in LEO and beyond”. This white paper will look at explaining the different perspectives of commercialization with a consistent language, identify the different uses of commercialization, the roles for agencies and look to provide examples to inform why and how to support commercialization activities in space.

Annex I: Publications

ISECG Webnews 2024

- Collaboration Beyond Borders: Highlights from the ISECG December 2024 Meeting in Cologne
- Space agencies unite to celebrate Global Exploration Roadmap at IAC 2024
- Unveiling the Future: new edition of "Benefits stemming from space exploration" released
- The Global Exploration Roadmap 2024: a vision for Space Exploration – the International Space Exploration Coordination Group
- ISECG Annual Report 2023 published

ISECG Publications 2024

- Global Exploration Roadmap (IV edition)
- Benefits Stemming from Space Exploration (II edition)

Annex II: ISECG Members

Australia		Australian Space Agency (ASA) Commonwealth Scientific and Industrial Research Organisation (CSIRO)
Brazil		Agência Espacial Brasileira (AEB)
Canada		Canadian Space Agency (CSA)
China		China National Space Administration (CNSA)
Europe		European Space Agency (ESA)
France		Centre National d'Études Spatiales (CNES)
Germany		German Aerospace Center (DLR)
India		Indian Space Research Organisation (ISRO)
Italy		Agenzia Spaziale Italiana (ASI)
Japan		Japan Aerospace Exploration Agency (JAXA)
Luxembourg		Luxembourg Space Agency (LSA)
Mexico		Agencia Espacial Mexicana (AEM)

Norway		Norwegian Space Agency (NOSA)
New Zealand		New Zealand Space Agency (NZSA)
Poland		Polish Space Agency (POLSA)
Portugal		Portugal Space (PT Space)
Republic of Korea		Korea AeroSpace Administration (KASA)
Romania		Romanian Space Agency (ROSA)
Russia		State Space Corporation (Roscosmos)
Switzerland		Swiss Space Office (SSO)
Thailand		Geo-informatics and Space Technology Development Agency (GISTDA)
Ukraine (SSAU)		State Space Agency of Ukraine (SSAU)
United Arab Emirates		United Arab Emirates Space Agency (UAE Space Agency)
United Kingdom		United Kingdom Space Agency (UKSA)

USA		National Aeronautics and Space Administration (NASA)
Vietnam		Vietnamese National Space Center (VNSC)

Annex III: ISECG Working Groups

Exploration Roadmap Working Group (ERWG)

The ERWG leads the human spaceflight road-mapping effort, which is intended to establish a common roadmap, and common framework to promote partnerships in realising exploration missions. A summary of their work is communicated in regular updates of the GER.

International Architecture Working Group (IAWG)

The IAWG leads multilateral reference architecture work, develops shared requirements, identifies critical functions and technologies and shares innovative architectural concepts. The IAWG is currently building concepts to augment the GER mission scenario, focusing specifically on characterising human missions to the lunar surface based on robust international partner contributions.

Strategic Communications Working Group (SCWG)

The objectives of the SCWG are to provide a clear, consistent and coordinated communication of the ISECG mandate, its products and activities, to support the development of ISECG products, as well as to support the exchange amongst members on stakeholder engagement activities. Major activities of the SCWG include the development of ISECG webnews, the preparation of the ISECG Annual Report and the facilitation of topical exchanges amongst members. The SCWG is fostering an exchange on lessons learned and best practices among ISECG members in communicating and delivering benefits resulting from investments in space exploration.

Science Working Group (SWG)

The Science Working Group coordinates with the international science communities on exploration planning and activities as required for the generation of ISECG products. Through the development of the Science White Paper, the SWG has established a Science Advisory Group, developed links into the global science community and coordinated activities with relevant science organisations. The SWG will continue to do so, recognising the strong role of science and the scientific opportunities in future exploration efforts.

Technology Working Group (TWG)

The goal of the Technology Working Group is to identify and raise awareness on critical technology gaps related to the GER, and to advocate coordination and collaboration in technology development efforts of individual ISECG members in support of the GER. The TWG recognises the strategic nature of technology investments and the desire of members to focus investments to maximise their contribution potential while enabling meaningful and achievable opportunities for all participating ISECG members.

Commercial Working Group (CWG)

The CWG will focus on identifying new pathways that Government Space Agencies can engage with private space sector stakeholders. The members of the CWG range from emerging to well established Space Agencies, allowing a wide breadth of experience, knowledge as well as different perspectives to be applied to new space age where space exploration will see contributions from both public and private sectors.

Emerging Space Agencies Working Group (ESAWG)

The ESAWG will consider methods to integrate small and large agency activities to further the accomplishment of space exploration and GER goals. The ESAWG will aim to formulate collaborative exploration projects by coordinating with other ISECG WGs and exchanging new ideas and methods to promote collaboration among emerging agencies and with established agencies, and even some external organizations who will provide advice.

Annex IV: ISECG at a Glance

Scope

ISECG, the International Space Exploration Coordination Group serves as the forum where space agencies work together on means of strengthening individual exploration programs, facilitating collaborations and advancing the Global Exploration Strategy (GES) through the coordination of participating members' mutual efforts in space exploration. ISECG also supports promoting interest and engagement in space exploration activities throughout society. By the end of 2022, ISECG membership counted 27 government organisations responsible for space activities.

The **scope** of ISECG is broad and strategic. Its activities are based on the following principles:

- Open and inclusive
  - ISECG receives inputs from all interested space agencies that invest in and perform space exploration activities.
  - ISECG provides for consultations among all agencies with a vested interest in space exploration.
- Flexible and evolutionary
  - Existing consultation and coordination mechanisms are considered.
- Effective
  - ISECG workshops and products provide value to individual participating members.
- Of mutual interest
  - ISECG activities benefit all participants and respect national prerogatives.
- ISECG activities allow for optional participation based on the level of interest.
  - ISECG participants focus on developing non-binding products - findings, recommendations and other outputs as necessary – based on consensus.

Background

In May 2007, an initial group of 14 space agencies jointly released "The Global Exploration Strategy: The Framework for Coordination". It describes a shared vision of coordinated human and robotic space exploration focused on solar system destinations where humans may one day live and work.
The GES identifies a common set of exploration themes and benefits:

- New knowledge in science and technology
- A sustained presence – extending human frontiers
- Economic expansion
- A global partnership
- Inspiration and education

One of the many Framework document findings was the need to facilitate information exchange among individual agencies regarding their interests, plans and activities in space exploration. Therefore, the GES called for a voluntary, non-binding coordination mechanism

among interested space agencies. This call led to the establishment of ISECG by the participating agencies including the formulation of Terms of Reference (ToR).

The International Space Exploration Coordination Group (ISECG) is a voluntary, non-binding coordination forum of 27 space agencies with the common aim of advancing space exploration through exchanging information, objectives, and plans. ISECG participating agencies coordinate to develop consensus-based, non-binding products (e.g., roadmaps, white papers, and technical reports). ISECG member agencies are committed to fostering discussions among participating agencies and developing products that enable members to effectively plan space exploration activities. This work is implemented through working groups and guided by a group of senior agency managers from ISECG participating agencies.