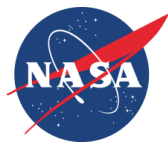




ISECG

INTERNATIONAL SPACE EXPLORATION
COORDINATION GROUP

Annual Report 2022



International Space Exploration Coordination Group – ISECG

ISECG was established in response to the “The Global Exploration Strategy: The Framework for Coordination” (GES) which was released in May 2007. This GES Framework Document articulated a shared vision of coordinated human and robotic space exploration focused on solar system destinations where humans may one day live and work.

The purpose of ISECG is to provide a forum to discuss interests, objectives and plans in space exploration and to support promotion of interest and engagement in space exploration activities throughout society. The work of ISECG results in documents, papers, findings, and recommendations that are critical in informing individual agency decision making. Since its beginnings, ISECG’s membership has grown from the original 14 to now 27 international space organisations, demonstrating the increasing global importance of space exploration.

INTERNATIONAL SPACE EXPLORATION COORDINATION GROUP

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All ISECG documents and information can be found on:

<http://www.globalspaceexploration.org/>

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1 Executive Summary

During 2022 global interest in space exploration has further grown and ISECG membership has expanded to 27 International space agencies. In 2022 ISECG celebrated its 15th Anniversary. In support of this significant milestone, a new 15th Anniversary ISECG logo was created and a short video of birthday wishes was recorded by the Chair, ISECG's member Space Agencies and astronauts from the International Space Station. The longer version now includes the ISECG working group co-chairs and thus the work, Agency members, working groups and status of ISECG was captured in video on its 15th year.

ISECG published a 2022 update of the Global Exploration Roadmap (GER) supplement, to include and share publicly the ISECG developed lunar surface concept of operations (CONOPS) for ISECG's lunar surface exploration scenario. This supplement was presented at the 73rd International Astronautical Congress IAC 2022 in Paris, France.

On 13th October 2022, senior managers from 17 Space Agencies met in person and virtually (for the first time since 2019) for a meeting of the International Space Exploration Coordination Group (ISECG). Hosted by the Canadian Space Agency, headquartered in Montréal, the purpose was to foster and build upon coordinated efforts in space exploration of the Moon and Mars, consistent with the Global Exploration Strategy and Roadmap.

In the area of advanced technologies, ISECG agency experts continued and finalised work analysing the technology gaps in the domain of Nuclear Power and Propulsion. The redaction of the report continues with expected publication in the first quarter of 2023.

Space agencies consider the work of ISECG supportive of their own national priorities, and during 2022 the Commercial Working Group and Emerging Space Agencies Working Group have progressed since their formation in 2021. This remains consistent with the desire by member Agencies to engage in focused international strategic exchange on commercialization opportunities and coordination to build new strategic partnerships especially with new emerging space Agencies.

The ISECG published four webnews articles and three presentations in 2022, addressing the following topics:

- ISECG Senior Agency Managers meeting Nov-Dec 2021 published January 2022
- ISECG Annual Report 2021 published May 2022
- 15th Anniversary of ISECG published September 2022
- ISECG Senior Agency Managers (13th October) meeting published November 2022

Presentations

- IAC-22,B3,1,11,x71565 - The 2022 Updated Lunar Exploration Scenario for the Global Exploration Roadmap (GER): the Growing Global Effort and Momentum going Forward to the Moon and Mars
- IAC-22,A3,1,14,x71745 - International Partnerships – Vision and Challenges of Emerging Space Agencies Working Group in ISECG
- IAC-22,A3,1,6,x72882 - The ISECG Science Working Group: Influencing Global Science Priorities for Robotic and Human Space Exploration.

ISECG always welcomes and remains open to new space agencies to join all collaborative efforts and work together to further the exploration of the Solar System.

2 Highlights, Achievements and Special Projects in 2022

ISECG Global Exploration Roadmap (GER) Supplement Update 2022

Following the release of the GER in January 2018 and subsequent release of the 2020 Lunar Surface Exploration Scenario Update ('GER Supplement'), ISECG released a new 2022 GER Supplement refining lunar objectives, updating mission plans and including the newly joined ISECG organisations.

The supplement reports updates to agency lunar exploration plans and refines the set of common objectives for a sustainable lunar surface exploration campaign. Informed by the ISECG developed lunar surface concept of operations (CONOPS) for ISECG's lunar surface exploration scenario, the supplement describes the architecture elements and the exploration campaign that progressively meet the lunar surface exploration objectives. This Supplement also includes a new chapter which characterises lunar scientific priorities enabled by exploration initiatives.

Technology and Gap Assessment Analysis

In the area of advanced technologies, progress in 2022 was highlighted by the efforts of the Technical Working Group's (TWG) gap assessment team, and the TWG's efforts in conducting a thorough high-level analysis of the Critical Technologies Portfolio against the technology development efforts of the TWG member agencies.

The TWG's gap assessment in "Nuclear Power and Propulsion" progressed to completion in 2022. This assessment unlocks key power and propulsion solutions for the exploration of the Moon, Mars, and beyond. The scope of this assessment report covers the areas of Radioisotope Power Systems, Small & Large Fission Reactors, and Nuclear Propulsion technologies. This Gap Assessment Report is currently undergoing member agency review for concurrence before public release in 2023, following ISECG endorsement.

The TWG also completed their High-Level Analysis effort in 2022, comprising of a scan of each element of the Critical Technologies Portfolio against the technology development efforts of the TWG member agencies. With this effort, TWG members seek to gain insights into the opportunities for international coordination and cooperation, along with specific recommendations for areas where significant gaps are still evident. This High-Level Analysis is a TWG internal effort that aims to promote further collaboration amongst member agencies and will also feed into future work to update the GER Critical Technology Portfolio.

TWG members would like to especially thank their colleagues at CNES (France) for graciously hosting their annual Face-to-Face meeting (Sept 2022) that contributed immensely to the progress of the team's efforts in 2022.

ISECG's 15th Anniversary

In 2006, a group of 14 International Space Agencies began a series of discussions on global interests in space exploration. Together they took the visionary step of elaborating a plan for peaceful robotic and human space exploration, focusing on destinations within the solar system where humans may one day live and work. In 2007 that vision was formalized into the ISECG charter and 15 years on ISECG celebrated its anniversary in November 2022. In support of this significant milestone a 15th Anniversary ISECG logo was created and a birthday video was made by the Chair, ISECG's member Space Agencies and astronauts from the ISS. A second longer version video was completed and with the inclusion of the ISECG working group co-chairs, the work, vision and collaborative spirit of solar system exploration of the Moon and beyond was thus captured in video.

3 Outlook for 2023

ISECG Working Groups

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

The ERWG will lead continued agency collaborative work related to strategic elements impacting future partnerships and collaborations, and those pertaining to any future updates of the Global Exploration Roadmap materials, in close cooperation with the working groups.

In particular, preparatory work identifying and planning the scope and activities leading to the GER update planned for 2024 will be done, including a facilitated discussion at the ISECG level on the Global Exploration Strategy to re-confirm its validity based upon its age and the increased number of ISECG participating agencies. Work will also include sharing analogue activity plans and emerging space agency capabilities through the Analogue Activities Team, including starting the development of a database of analogue activities jointly with IMEWG.

Fully aligned with the GER update preparatory work, the IAWG plans to investigate common communication and navigation architecture working with the Interagency Operations Advisory Group (IOAG) and International Committee on Global Navigation Satellite Systems (ICG), support of the SWG's study of science missions using proposed architecture element and supports the TWG in updating the GER critical technologies list.

Technology Working Group (TWG)

For 2023, the TWG will continue to advocate for coordination and collaboration in technology development efforts of individual ISECG space agencies in support of the updated GER, per the GER Supplement of 2022.

The TWG has identified its main workplan item for 2023 as being the updating of the GER Critical Technology Portfolio (2019), which will align the list to be congruent to the Lunar and Mars exploration plans reflected in the latest GER.

While the gap assessment team has completed their work in 2022, the Nuclear Power and Propulsion Gap Assessment Report will be set to release in 2023 following the appropriate endorsements by member agencies, and by the ISECG. The next gap assessment team to be formed will focus on the domain of Life Support Systems technologies, and this team will kick-off in the early to mid-2023 time frame. Member agencies are in the process of inviting the relevant subject matter experts and interested parties to join in this effort.

The TWG looks forward to working with all interested agencies to continue to unlock opportunities for international coordination and collaboration in space exploration technologies and innovation.

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

The SCWG will continue to implement and coordinate strategic communication of ISECG work, its products and services. A major activity in 2022 was the recognition of the 15th Anniversary of ISECG, celebrating and communicating this internally, to the wider space community. Noting the success

of this event we will consider how these activities and the use video productions of ISECG, might further the space exploration message and ISECG's contributions to communicating lunar and Mars exploration.

Strategically communicating to the broader public and how we might utilise social media in tandem with our member space agencies, is a topic for 2023. Further activities of the SCWG will comprise of the publication of ISECG news and milestones through webnews and the preparation of the ISECG Annual Report 2023. We will also review the ISECG internet and intranet website to bring on board more recent advances in website technology and content. With outcomes from the SCWG Engagement Tiger Team in 2021, the SCWG-TT will support the Benefits Tiger Team (as well as all ISECG working groups) to articulate a vibrant space benefits message to space professionals in both developed and emerging space agencies. The SCWG-TT will work to reach further into a growing space aware public, especially within the younger generations.

Science Working Group (SWG)

To aid inclusion of scientific goals and objectives into the ISECG community, the SWG has established chairs and a community of agency scientists in 2022. Following re-establishment in 2022, the SWG will assist with ensuring the alignment of updated ISECG products with the science community goals, including reviews of the new lunar supplement, science whitepapers and the ISECG Benefits documents

Emerging Space Agencies Working Group (ESAWG)

The ESAWG was confirmed as an official ISECG Working Group in May 2021 after an emerging space agencies tiger team was established to consider methods to integrate small and large agency activities to further the accomplishment of space exploration and GER goals. In 2021, the ESAWG organized monthly telecons to share on each agency's activities and WG's vision and supported presentation and/or plenary sessions to promote emerging space countries' exploration activities and public awareness.

Since 2021, the ESAWG has consolidated and matured, and is looking forward to collaborating with ISECG's working groups and develop beneficial activities including workshops, face-to-face meetings, and so on.

The ESAWG will continue to accommodate needs and perspectives of emerging space agencies in ISECG activities and establish networking with non-member emerging agencies and relevant expert groups associated with emerging space countries. An example of the above, is to invite in 2023 the United Nations Office of Outer Space Affairs (UNOOSA) to participate as a guest in some ESAWG's monthly meetings and to provide support and to promote the WG activities.

The ESAWG will aim to formulate collaborative exploration projects and exchanging new ideas and methods to promote collaboration among emerging agencies and with established agencies.

Commercialization Working Group (CWG)

The CWG was formed in September 2021 with a 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.

The CWG will aim to explore and define collaboration mechanisms, policy tools, procurement approaches, legal framework etc., that are required to facilitate the emergence of public-private partnerships.

Benefits Tiger Team (BTT)

The BTT is a new ISECG tiger team formed in Q3-2022 with the objective of evolving the 2013 ISECG white paper “Benefits Stemming from Space Exploration” into a new live document intended as a tool for space agencies to disseminate the benefits of space exploration.

With the first issue expected during Q4-2023, it is a collective and continuous effort by representatives of space agencies to articulate a shared perspective on these benefits through a basic framework integrating both common and agency-specific views. It will aid space agencies to collaborate, inform and engage relevant stakeholder communities (including agencies, industry, and academia), and guide policy and decision makers on the topic of space exploration benefits. It aims to outline a strong commitment to deliver benefits to humanity through increased consideration toward cooperative benefits management activities. This will be supported by showcasing contemporary examples and assessments of benefits enabled by space agencies.

Major International Events Related to Space Exploration in 2022

- **38th Space Symposium**
Colorado Springs/USA, 17th -23rd April 2022
 - **Global Conference on Space for Emerging Countries (GLEC 2022)**
Quito, Ecuador, 16-20th May 2022
 - **73rd International Astronautical Congress (IAC)**
Paris France 18-22nd September 2022
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Annex I

Publications

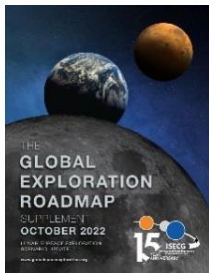
ISECG Webnews 2022

- ISECG Senior Agency Managers meeting 30th Nov and 2nd Dec 2021 reported in Jan 2022
- Publication of the “ISECG Annual Report 2022”
- 15th Anniversary of ISECG
- ISECG Senior Agency Managers meeting 13th October 2022

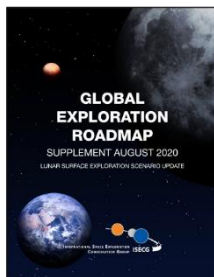
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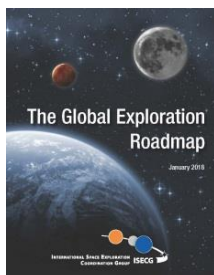
Major ISECG Documents



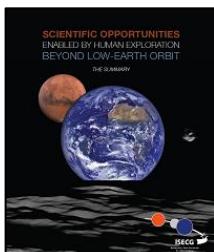
Global Exploration Roadmap, Supplement October 2022
– Lunar Surface Exploration Scenario Update



Global Exploration Roadmap, Supplement August 2020
– Lunar Surface Exploration Scenario Update



The Global Exploration Roadmap (GER), January 2018



Scientific Opportunities enabled by Human Exploration beyond Low Earth Orbit – The Summary
(summary version)

Scientific Opportunities enabled by Human Exploration beyond Low Earth Orbit – A ISECG Science White Paper
(full version)



Benefits Stemming from Space Exploration



ISECG Terms of Reference







Further ISECG documents and published papers can be found at [ISECG Publications](#).



Annex II

ISECG Members (status of March 2023)

ISECG AGENCIES WORLD MAP



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 Research Institute (KARI)
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

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 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 must hereby be recognised.

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 and Background

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 activities¹.

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

¹ In alphabetical order: AEB (Brazil), AEM (Mexico), ASA and CSIRO (Australia), ASI (Italy), CNES (France), CNSA (China), CSA (Canada), DLR (Germany), ESA (European Space Agency), GISTDA (Thailand), ISRO (India), JAXA (Japan), KARI (Republic of Korea), LSA (Luxembourg), NASA (United States of America), NOSA (Norway), NZSA (New Zealand), POLSA (Poland), PT Space (Portugal), ROSA (Romania), Roscosmos (Russia), SSAU (Ukraine), SSO (Switzerland), UAE Space Agency (United Arab Emirates), UK Space Agency (United Kingdom) and VNSC (Vietnam).

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).