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Cooperation in space: An international comparison for the benefit of emerging space agencies

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ABSTRACT

This paper provides a comparison of models for international cooperation by space states. By analysing the successes and failures of these models, recommendations about international cooperation have been presented for the benefit of emerging space agencies, for example, the Australian Space Agency. As international cooperation in space is very wide-ranging in nature, this paper also researches and analyses a number of specific topics intended to provide valuable insights for emerging space agencies. The paper draws upon the learnings of emerging space nations and established space actors. Reasons for international cooperation are examined, along with the legal frameworks used to support it. Examples of international cooperation in space projects are reviewed along with international committees promoting cooperation. The use of international cooperation in helping solve a major 'space challenge' facing the world is examined and a framework for evaluating potential cooperative initiatives is proposed. This report emerged from the research conducted in Space Ready: The Launchpad For Emerging Agencies which provided policy recommendations for new space states from a comparative analysis of the aims, structure, funding, and activities over 14 different space agencies. The report was written during the 2018 International Space University's Southern Hemisphere Space Studies Program, in which students from 15 countries with diverse academic backgrounds were able to provide insider perspectives on the space agency of their countries.

1. Introduction

1.1. Aim

To provide a comparison of international cooperation by space states and make recommendations for the benefit of emerging space agencies.

1.2. Objectives

1. Present research of:
   - Reasons and agreements for international cooperation to understand its purpose and the legal framework that can support it.
   - International cooperation by emerging space nations and established space actors.
   - International cooperation in space projects.
   - Existing international committees promoting cooperation.
   - International cooperation helping solve 'space challenges' facing the world.
   - Frameworks for international cooperation.
2. Critically compare and analyse the research from Objective 1 and present key findings.
3. Present recommendations for the benefit of emerging space agencies based on the outcomes of Objective 2.

1.3. Link to the International Space University

International cooperation was a key concept addressed in Space Ready: The Launchpad for Emerging Agencies [1] delivered during the International Space University's 2018 Southern Hemisphere Space Studies Program (SH-SSP). This paper researches international cooperation in further detail. Consistent with the SH-SSP report, it examines both emerging space nations and established space actors to present recommendations for the benefit of emerging space agencies.

1.4. The importance of the topic

The importance of international cooperation was declared in the early days of the space industry by the Outer Space Treaty. In talking about cooperation, it states that it "… will contribute to the development of mutual understanding and to the strengthening of friendly relations between States and peoples" and that there "shall be freedom of

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Acronyms/abbreviations

ADS	Airbus Defence and Space
APRSAF	Asia-Pacific Regional Space Agency Forum
ESA	European Space Agency
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GNSS	Global Navigation Satellite Systems
LEO	Low Earth Orbit
IADC	Inter-Agency Space Debris Coordination Committee
ISRO	Indian Space Research Organisation
ISS	International Space Station
ITU	International Telecommunication Union
SH-SSP	Southern Hemisphere Space Studies Program
UK	United Kingdom
UNCOPUOS	United Nations Committee on the Peaceful Uses of Outer Space
USSR	Union of Soviet Socialist Republics
USA	United States of America

scientific investigation in outer space, including the Moon and other celestial bodies, and States shall facilitate and encourage international cooperation in such investigation" [2].

If we look to a key learning from history, Som [3] observes that "the space race that occurred between the Union of Soviet Socialist Republics (USSR) and the United States of America (USA) is an ill-suited model for long-term sustained space exploration because it was too costly and too resource-intensive for a single nation to bear … The success of a sustained space exploration strategy lies … in international cooperation, space policy, and public support." Early agreement with this position came from the USA who sought international cooperation with the USSR, even in light of Cold War tensions [4].

Finally, the Secure World Foundation [5] statement "that international cooperation is rarely pursued haphazardly but is instead often part of larger policy and strategic considerations" provides context for the importance of the topic for governments still today.

1.5. Nature and scope of this paper's contribution

As international cooperation in space is very wide-ranging in nature, this paper researches and analyses a number of specific topics intended to provide valuable insights for emerging space agencies. The paper draws upon the learnings of emerging space nations and established space actors. Reasons for international cooperation are examined, along with the legal frameworks used to support it. Examples of international cooperation in space projects are reviewed along with international committees promoting cooperation. The use of international cooperation in helping solve a major 'space challenge' facing the world is examined and a framework for evaluating potential cooperative initiatives is proposed.

From this research and analysis, recommendations are made about international cooperation for the benefit of emerging space agencies.

2. Methods

The following methodology was used in preparing this paper:

1. Sourcing and presentation of the research for each objective.
2. Critical comparison and analysis of the research.
3. Presentation of summary and recommendations for the benefit of emerging space agencies.

3. Results and discussion

Before examining international cooperation by individual states, it is first important to consider the reasons to cooperate and the legal frameworks used to facilitate this.

3.1. Reasons and agreements for international cooperation

"International cooperation in space activities has been an important principle from the very beginning of the space age." It can "build trust and confidence … and contribute to the realisation of fundamental principles of space law." [6].

The Secure World Foundation [5] proposes two categories of reasons why countries cooperate and three enabling types of agreements. The framework in Fig. 1 is derived from this information and includes examples of each.

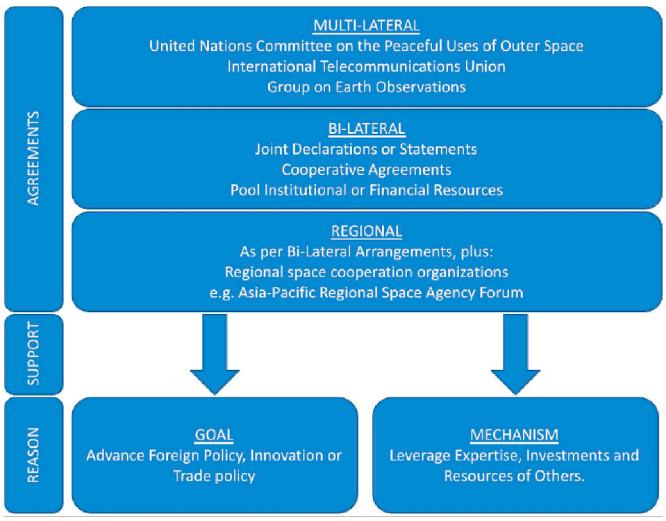

Fig. 1. International cooperation – reasons and agreements.

3.1.1. Reasons

Examining the 'reasons' first, when states have international cooperation as a 'goal', it can be for driving "larger policy objectives and be part of a strategy to advance foreign policy, innovation, or trade policy goals." [5].

When the reason is a 'mechanism', international cooperation can enable states "to leverage the expertise, investments, and resources of others in the development of programs, whether through the direct acquisition of hardware or the joint development of technical capacity." [5].

Section 3.2 of this report will examine the reasons and agreements of the range of states studied in this report.

3.1.2. Agreements

Turning to examine 'agreements', states, universities and commercial organisations use regional, multilateral and bilateral agreements to provide a legal framework for international cooperation. Agreements typically include, as a minimum, the following provisions:

1. The application of the four UN space treaties and international law.
2. Cross-waiver of liability.
3. Criminal jurisdiction.
4. Exchange and transfer of goods and technical data.
5. Protection of intellectual property rights.
6. Dispute resolution [6].

Zhao [6] notes that while the principle of international cooperation as set out in the Outer Space Treaty is well accepted, it wasn't until the resolution of the United Nations General Assembly [7] that further aspects of international cooperation were defined in the form of formal requirements and guidelines.

3.1.3. The influence of militarising space

A country's policy about the militarisation of space can greatly complicate international cooperation. It can influence a country's willingness to cooperate with another, especially if it believes it is, or could become, under threat of hostilities. Diplomacy becomes an important aspect in reaching agreement with another country. Countries "have to identify areas of common interest, craft agreements, and rally the political leadership needed to implement the agreements." [8].

3.1.4. Summary

Understanding a nation's reasons for international cooperation – be they goals and/or mechanisms – and any influence from national policies regarding the militarisation of space – is important clarity for an emerging space agency to determine.

It is important for an emerging space agency to understand the available types of agreements as well as the matters concerning international cooperation in the Outer Space Treaty and subsequent UN resolutions given they set the legal basis for international cooperation.

3.1.5. Recommendations

1. Establish internal agreement on the reasons for international cooperation.
2. Establish an appropriate legal framework through the use of agreements such as a bilateral or multilateral as it is essential for supporting international cooperation.

3.2. Emerging space states and established space actors

Table 1 in Appendix 1 provides a comparison of the international cooperation research against the aspects of the framework in Fig. 1 plus some other distinguishing features.

The table shows that a country will typically have commitment to international cooperation in at least one of space legislation, space policy or supporting strategy. It can be deduced that this is beneficial to:

1. Enable the government to be clear of its requirement of the space agency and why (potentially including the reasons for international cooperation as discussed in Section 3.1.1 of this report).
2. Empower the space agency to foster international cooperation.
3. Demonstrate its commitment nationally and internationally.

It is also preferable that a space agency measure and publicly report its cooperative efforts as South Africa does, for example, in its Annual Performance Plan 2017/18 [9]. This transparency provides further incentive to the space agency for it to remain committed and continue to demonstrate its desire both locally and internationally for cooperation.

The other key finding is that India has some key differentiators from the other countries. It does not have national space laws [10] or a national space policy [11]. However, India's space program hasn't suffered as a result. The lack of these items does not indicate a lack of vision [11]. Evidence from the Indian Space Research Organisation (ISRO) website and the Department of Space Annual Report clearly demonstrate the importance of international cooperation to India's space program.

The available research did not explain the reasons for this, so information was sought from ISRO representative, Mr. Santanu Sinha. He advised that ISRO "during its formative years, had been lucky to have extremely dynamic leaders, at the helm of affairs, who had substantial international exposure. They realized the importance of international co-operation in helping a developing country acquire cutting edge space capabilities. This understanding was passed on, successfully, to subsequent generations of home grown leaders." [12].

3.2.1. Summary

There are benefits for having:

- Space legislation, supporting policy and strategy that includes commitments to international cooperation along with public reporting of progress.
- Leaders with substantial international exposure, who understand the importance of international cooperation and can instil this within others.

3.2.2. Recommendations

1. Establish requirements and measures for international cooperation in legislation, government policy and the agency's strategy along with regular public reporting of progress.
2. Employ leaders with substantial international exposure, who understand the importance of international cooperation and can instil this within others in the agency and government.

3.3. Space projects

This section reviews cooperation between space agencies on a science-focussed project and between a country and a foreign commercial partner. It builds on the research by providing practical examples of international cooperation at work on major initiatives with the intent of deriving learnings for emerging space states.

3.3.1. International Space Station (ISS)

3.3.1.1. Introduction. The ISS is in a low earth orbit (LEO) about 400 km above the Earth [13]. "Developing effective international cooperation" features as one of its primary objectives, along with "the development of a world-class orbiting laboratory for conducting high-value scientific research, providing access to microgravity resources … developing the ability to live and work in space for extended periods and to provide a test bed for developing 21st Century technology." [14] With assembly commencing in late 1998 [14] there have been "more than 115 space flights conducted on five different types of launch vehicles to connect different modules that had been built on different continents around the world and had never even been integrated together until they reached space." Extensive international cooperation has been needed to enable integration of these modules in space to support the range of critical systems needed to support the astronauts and cosmonauts on board [13].

The following provides a summary of the key points of the research relating to international cooperation.

3.3.1.2. Agreements. 15 countries signed agreements on 29 January

1998, “establishing the framework for cooperation among the partners on the design, development, operation and utilisation of the Space Station” [15].

3.3.1.3. Achievements and benefits. NASA [16] says that the ISS's “greatest accomplishment is as much a human achievement as it is a technological one - how best to plan, coordinate, and monitor the varied activities” of an international partnership of space agencies that “provides and operates the elements of the ISS.”

Ruttley, Robinson et al. [17] describe a series of benefits of the ISS:

- The development of “processes, culture, and relationships that strengthen the future of exploration”.
- Enabling an environment where countries can take greater risks to advance scientific discoveries.
- Leveraging the technical and financial resources of each other to perform research and experiments not possible by one country.
- “The impact of the benefits to each partner agency is nearly doubled when the activities have been collaborative.”

Looking to the future, Ansdell, Ehrenfreund et al. [18] suggests that “a key stepping stone for a sustainable global space exploration program is the enhanced exploitation of the ISS”.

3.3.2. Commercial cooperation – Airbus Defence and Space (ADS) and ISRO

3.3.2.1. Introduction. Aliberti [19] observes that ADS “has established itself as the prime foreign industrial partner of ISRO” in a 2006 agreement between Astrium (formally a separate entity but now merged into ADS) and ISRO with its commercial arm – Antrix.

The partnership aims “to jointly offer communications satellites in the market segment around 4 kW of payload power and with a launch mass of 2–3 tons” [20]. Airbus builds the payload and Antrix the satellite's platform “to offer cost-effective solutions to telecommunications operators” [19].

3.3.2.2. Benefits. From the research, it can be deduced that Antrix's intended benefit is access to Airbus' technical capabilities in building the payload.

Airbus gets access to skilled low-cost labour. These combined enable the delivery of more competitively priced satellites [19].

3.3.2.3. Challenges. “The Airbus–Antrix venture has been absent from the commercial market, primarily because of technology transfer and product-liability issues as well as Antrix's difficulties in keeping up with India's domestic demand for telecommunications satellites” [19].

3.3.3. Summary

The ISS's scientific achievements and benefits to participating agencies are only possible through international cooperation and are more cost effective.

Commercial partnerships can offer faster access to technical capabilities but there can be challenges in making the agreement viable.

3.3.4. Recommendations

1. Consider participating in cooperative space projects to access scientific ventures only possible through international cooperation.
2. Consider engaging in commercial partnerships to gain faster access to technical capabilities.

3.4. Existing international committees promoting cooperation

There are a range of international committees that foster and encourage cooperation. Participation is “a way to exert leadership” and ensure a country's views are represented at “the international level”. It is also “a way to share information of a country's space activities and learn of the activities of others … participation may thus influence policy debates at the national level” [5].

For these reasons, presented below is a range of international committees promoting cooperation, including one regionally focused committee.

3.4.1. UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS)

This committee set the legal framework for international space cooperation (e.g. in the Outer Space Treaty) and continues to evolve it today. It has been in existence since 1958, as at 2017 had 84 member states along with intergovernmental and non-governmental permanent observers and is the sole UN committee responsible for examining international cooperation for the peaceful uses of outer space [21].

Given the breadth of influence it holds within the realm of international cooperation, membership of UNCOPUOS is important for the nations of emerging space agencies to contribute to its decisions and gain understanding and learning opportunities of the legal frameworks for international cooperation.

3.4.2. International Telecommunication Union (ITU)

The ITU is an example of a committee requiring international cooperation for managing the sharing of essential resources (e.g. the “equitable access to the electromagnetic spectrum and orbital resources with regards to satellite services”) and the setting of standards for telecommunication services. It has members from 193 countries and almost 800 private sector organisations [22].

Given the essential nature of its responsibilities and depth of membership, it is important for the countries of emerging space agencies to have representation on this committee to have a voice on the global stage on telecommunication matters and ensure its country can access, for example, essential services such as the ability to request frequencies for satellite communications.

3.4.3. Group on Earth Observations (GEO)

The GEO is an example of a committee using international cooperation to bring together over 100 countries on an important global issue. It seeks “to increase interoperability between the various Earth observation systems” and “realise a future where decisions and actions, for the benefit of humankind, are informed by coordinated, comprehensive and sustained Earth observation information and services” [23].

For emerging space agencies whose strategy includes, for example, improved decision making from earth observation data for major issues like disaster management or climate change, membership of this committee will benefit it through improved access to data, learnings from other nations (that may in turn influence e.g. policy decisions at a national level) and being able to influence the decision making at an international level.

3.4.4. International Committee on Global Navigation Satellite Systems (GNSS)

This committee was created in 2005 and is an example of using voluntary international cooperation to facilitate improved standards – in this case for GNSS “in order to ensure greater compatibility, interoperability, and transparency” for the benefit of the global community [24].

Given the wide-ranging benefits of GNSS, emerging space agencies can benefit from influencing the conversation on GNSS standards at the international level, sharing the experiences of their own nation and, particularly for those with less developed capabilities, gaining knowledge from others.

3.4.5. Asia-Pacific Regional Space Agency Forum (APRSAF)

This is an example of a regionally focussed committee, making it worthy of examination to provide greater breadth to this research.

It "was established in 1993 to enhance space activities in the Asia-Pacific region." Notable is that membership includes not just space agencies and governmental bodies, but also non-state actors e.g. international organisations, private companies, universities, and research institutes [25].

It facilitates the sharing of space activities and plans from across the region with its members and supports "international projects as solutions for common issues, such as disaster management" [25].

A committee like this can offer emerging space agencies from the region opportunities to share information of activities that are relevant to them both and learn from those of others. Participating in projects that solve common issues can provide the benefit of not only solving the particular issue, but also building trust and confidence between nations' space agencies.

3.4.6. Summary

The key themes of international committee membership are:

- Representation of a country's view and influence on the decision making at an international level for matters relevant to the emerging space agency.
- The opportunity to share information and learn from others.
- Improving relationships with other space agencies, as well as other space actors, and leveraging this for the benefit of the agency more generally (i.e. not necessarily limited to the purpose of the particular committee).

3.4.7. Recommendations

1. Become an active member of relevant international and regional committees:
   - To ensure the country's view is represented at the international level.
   - For opportunities to share information of a country's space activities.
   - To learn from the activities of others.
2. Develop inter-agency relationships to build trust and confidence as well as seek learnings about the experiences of other agencies with international cooperation for the benefit of establishing better cooperative agreements.

3.5. 'Space challenges' facing the world - space debris

3.5.1. Introduction

"Space debris is generally defined as the non-operational satellites, spent rocket stages and other bits and pieces created during the launch and operation of satellites." It is a significant issue as each could destroy an active satellite in a collision. "The USA military currently tracks approximately 23,000 pieces of … debris larger than 10 cm." [5].

The following provides a summary of space debris research related to international cooperation.

3.5.2. Inter-Agency Space Debris Coordination Committee (IADC)

The IADC was formed by the United States, Japan, European Space Agency (ESA), and the Russian Federation as an outcome of bilateral discussions about the threat of orbital debris [8].

It is focused on worldwide coordination of activities related to debris in space. "Its primary purpose is to:

- Exchange information on space debris research activities between member space agencies.
- Facilitate opportunities for cooperation in space debris research.
- Review the progress of ongoing cooperative activities.
- Identify debris mitigation options." [26].

It works on a consensus basis, meaning all members must agree for a decision to be made [27]. The IADC has a set of guidelines for best practices in debris mitigation and, in conjunction with UNCOPUOS, the Space Debris Mitigation Guidelines which the UN approved in December 2007 [8].

Johnson [27] suggests that the IADC's creation of mitigation guidelines (all be them non-binding) is a sign of its success. A key success factor is IADC's membership being space agencies – thus giving them direct access to their governments to get the necessary support. "The handling of space debris policy at the international level has been an atypical, bottom-up approach", starting with the technical community, then their respective governments, the aerospace industry and finally with the UN "to bring consensus to a highly complex subject" [27].

3.5.3. Legal and related issues

McCormick [28] makes a number of observations on legal related matters regarding space debris. First of all, the consequences for creating debris "need to be clarified in an internationally binding resolution". Liability for space debris "has yet to be fully defined".

Secondly, McCormick [28] recommends that an international review board be created, charged with:

- "Conducting an assessment of state practices of implementing debris mitigation plans".
- Prescribing penalties for non-compliance.
- "Fine or assign other consequences for any entity found to have intentionally created debris or failed to execute measures to avoid the creation of debris".

McCormick [28] also proposes that "given the complexity of the issues involved in space debris, an international space policy accompanied by binding resolutions and a sound long-term strategic plan, which includes legal action regarding the creation, proliferation, mitigation and remediation of orbital debris must be created."

3.5.4. Summary

"Solving the challenges of space debris will require close coordination and cooperation among the engineers and scientists working on the technology, as well as the lawyers and policymakers developing policy and regulatory oversight." [5].

It can be deduced that international cooperation is essential to solve issues concerning space debris. The IADC clearly plays an important role in international coordination of activities related to space debris issues. There are also a series of key legal matters that are unresolved that are limiting the resolution of some issues of space debris.

3.5.5. Recommendation

1. Understand the role, legal requirements, relevant international committee(s) and importance of a country in playing its part in solving world-wide space challenges.

3.6. A framework for evaluating international cooperation

Given there are so many aspects to consider with international cooperation, a framework to support evaluation of a potential cooperative activity with another country may be useful for an emerging space agency. The framework, presented in Appendix 2, adapts the best aspects of two existing frameworks [29,30], applies them more broadly by being for the purpose of any civil international cooperative activity (compared to the existing frameworks' scope of 'space exploration') and includes learnings from other research in this paper. An emerging space agency may choose to adapt it further for its own specific context.

A comparatively lower risk approach for an emerging space agency undertaking its first international cooperative efforts is proposed to be:

- The provision of short-term niche capabilities (refer Step 4 in the framework in Appendix 2) in which it is highly experienced, to an established space actor experienced in international cooperation and for items not on a project's critical path so that any issues do not immediately critically impact the initiative.

The objective of a lower risk approach is to increase the chances of early cooperative success to:

- Be a catalyst locally for future cooperative arrangements.
- Establish international credibility and trust.
- Understand other countries' way of working and culture.
- Learn about the implementation of international agreements.
- Deliver some economic benefit.

3.6.1. Summary

A framework, such as the one presented in Appendix 2, can offer a structured process to evaluate potential international cooperation activities.

Providing short term niche capabilities in which it is highly experienced to an established space actor experienced in international cooperation and for items not on a project's critical path may be a comparatively lower risk approach for an emerging space agency undertaking its first international cooperative efforts.

3.6.2. Recommendations

1. Use a structured process, such as the framework proposed in this paper, to evaluate potential international cooperation activities.
2. Consider a lower risk approach when undertaking an agency's first international cooperative efforts to increase the chances of early cooperative success.

4. Conclusions

The following summarises the recommendations for emerging space agencies presented in this report.

Topic	Recommendations
Reasons and Agreements for International Cooperation	Establish internal agreement on the reasons for international cooperation. Establish an appropriate legal framework through the use of agreements such as a bilateral or multilateral as it is essential for supporting international cooperation.
Emerging Space States and Established Space Actors	Establish requirements and measures for international cooperation in legislation, government policy and the agency's strategy along with public reporting of progress. Employ leaders with substantial international exposure, who understand the importance of international cooperation and can instil this within others in the agency and government.
Space Projects	Consider participating in cooperative space projects to access scientific ventures only possible through international cooperation. Consider engaging in commercial partnerships to gain faster access to technical capabilities.
Existing International Committees Promoting Cooperation	Become an active member of relevant international and regional committees: • To ensure the country's view is represented at the international level. • For opportunities to share information of a country's space activities. • To learn from the activities of others. Develop inter-agency relationships to build trust and confidence as well as seek learnings about the experiences of other agencies with international cooperation for the benefit of establishing better cooperative agreements.
'Space Challenges' Facing the World – Space Debris	Understand the role, legal requirements, relevant international committee(s) and importance of a country in playing its part in solving world-wide space challenges.
A Framework for Evaluating International Cooperation	Use a structured process, such as the framework proposed in this paper, to evaluate potential international cooperation activities. Consider a lower risk approach when undertaking an agency's first international cooperative efforts to increase the chances of early cooperative success.

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Appendix 1. International Comparison Research Summary

Table 1
International comparison research summary.

Agency Type	Malaysia	South Africa	United Kingdom	Brazil	India	Canada	USA
	Emerging	Emerging	Emerging	Established	Established	Established	Established
Agency - Year Established	2003	2010	2011	1994	1969	1990	1958
Space Legislation?	No	Yes	Yes	Yes	No	Yes	Yes
Legislative purpose for international cooperation?	No	Yes	No	Yes	No	Yes	Yes
Space Policies	National Space Policy 2030	National Space Policy National Space Strategy Annual Strategic Plan 2015/2020	Civil Space Strategy National Space Policy Corporate Plan	National Policy for the Development of Space Activities National Program of Space Activities	Citizen's Charter Satellite Communication Remote Sensing Data	Space Policy Frame-work	National Space Policy Strategic Plan 2018
Policy supports international cooperation?	Yes	Yes	Yes	Yes	No	Yes	Yes
Reasons	Goal and Mech-anism	Goal and Mech-anism	Mech-anism	Mechanism	Goal and Mechanism	Goal and Mechanism	Goal and Mechanism
Agreements	Bi-lateral, Multi-lateral.	Regional, Bi-lateral, Multi-lateral.	Multi-lateral, Bi-lateral.	Bi-lateral, Multi-lateral.	Bi-lateral, Multi-lateral.	Co-operation (with ESA), Bi-lateral, Multi-lateral.	Bi-lateral (Space Act Agreements), Multi-lateral.

Appendix 2. A Framework for Evaluating Potential International Cooperative Space Activities

Table 2
Summary of a framework to support evaluation of a potential international cooperative space activity.

Stage	Stage Name	Step	Step Name	Summary
1	Prerequisites	1	Select the Nation(s) for a Cooperative Activity	The emerging space agency's country is to be known as the 'primary nation'. Select the nation(s) with whom a potential international cooperative activity is to be assessed – to be known as the 'partner nation(s)'.
		2	Internal Agreement to Cooperate	The primary nation needs a) agreement that the activity cannot readily be delivered without a partner nation b) political willingness to consider international cooperation.
2	Assessment	3	Data Collection	Collect primary and partner nations' technological capabilities and policy goals as basis for determining the motivation and ability for a cooperative endeavour.
		4	Identify Appropriate Cooperative Schemes	Select from: 0 – Non-cooperation 1 – Short-term niche 2 – Long-term niche 3 – Critical path 4 – Parallel missions 5 – Multinational institutional.
		5	Detailed Assessment	Assess the effects of feasible cooperative schemes against: ● 'Technical parameters' of cost, schedule and performance. ● 'Policy parameters' - the political utility of the primary and partner nations.
		6	Identify Preferred Cooperative Schemes	Choose each nation's preferred cooperative schemes in priority order based on the best mix of technical and policy considerations.
		7	Identify a Win-Win Cooperative Scheme	Choose the optimal cooperative scheme for the primary and partner nations – or decide that a cooperative effort should not proceed.
3	Implementation	8	Establish Strategies, Agreements and Behaviours	Establish a coordinated strategy to engage in joint projects. Establish appropriate agreements e.g. bi-lateral. Consider what memberships and decisions are required of regional or international committees to enable or expedite the activity. Create a 'common language' as a basis to agree how technical capabilities can inter-operate. Establish a series of desired 'principles' or 'behaviours'.
4	Monitoring and Benefits Realisation	9	Monitor and Adjust	Monitor for any changes that could affect the cooperative effort and adjust the approach as needed.
		10	Benefits Realisation	Measure and monitor the realisation of benefits and adjust the approach as needed.

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