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HUMAN SPACE EXPLORATION:
National Interests and the Global Exploration Enterprise

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Abstract

The Human Space Exploration Initiative (HSEI) at the Center for Strategic and International Studies (CSIS) will examine the uncertain future of human space exploration. The purpose of this initiative is to explore new international perspectives on the future of human presence in space, assess their relative prospects, and build a new common global vision and agenda for the future of human space exploration.

INTRODUCTION

The exploration of space has been one of humankind's most remarkable achievements in the last fifty years – the making of unimaginable dreams. For the first thirty years of the space age, exploration was a binary contest, driven by the Cold War superpower rivalry of the United States and the Soviet Union. This competition unfolded at a fever pitch in the 1960's, as the two nations raced to claim the next 'first': first man in space, first orbital mission, first man on the moon. This intense competition subsided after the Apollo 11 moon landing however, and both countries continued to make significant investments in their national space programs in the 1970's and 1980's. During this period, new countries began to develop their own space exploration capabilities. Within Europe, existing space programs within individual countries were consolidated through the birth of ESA in 1973; Asia, China, India and Japan have each invested in their own national space agencies, as have the Americas, Canada and Brazil.

A new era of space multi-polarity in the area of exploration emerged as a result in the late 1980's and 1990's, with the development of the International Space Station (ISS) as the primary example. To be certain, the relative balance of power among the countries that participated in ISS (USA, Russia, Europe, Japan, Canada, and Brazil) was uneven, with the two traditional space superpowers – the United States and the Soviet Union/Russia – supplying a disproportionate share of relevant expertise. However, beyond ISS political motivations and the program origins, the ISS held out promise as a brave new model for international cooperation on space exploration activities.

After nearly twenty years of delay and downscaled dreams, the ISS model has not lived up to expectations. At the operational level, there are numerous examples of successful cooperation among the ISS partners; however these important and valuable successes have been overshadowed by the strategic failures of cooperation at the political level. These strategic, political failures are not the fault of the administrators and negotiators who crafted the ISS agreements, nor are they due to problems with intercultural communication among the key partners. Rather, they are the direct and predictable result of the inherent and initial mismatch between countries' core **motivations and visions** for exploring space, and the lack of a guiding operational and decision-making framework that can turn these differences into a source of strength that will advance the mission, rather than a source of indecision and weakness that will retard it.

Any new large-scale exploration initiative where international cooperation is foreseen – whether it is something akin to the Bush Administration's plan to explore the Moon or Mars, or Europe's Aurora program, or China's stated goals for the coming decades – will need to be developed with an understanding of these core motivations from the initial conceptualization, design, and implementation of the exploration enterprise.

This paper develops a framework for examining and comparing these international motivations, and using them to inform the development of the international governance and mediation structures that will underlie the exploration activities. It must be noted that a country's

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motivations for the exploration of space are never defined once and for all; it is an iterative process whereby the motivation evolves over time.

The paper begins with a study of six key high-level motivational factors for space exploration: identity, political interests, security, economics, science and discovery. It then goes on to discuss and evaluate these motivations at the national level, based on interviews and conversations that we have had with leaders and experts from the United States, Europe, Russia, China, and Japan in the last year.¹ The paper concludes with a framework mechanism that illustrates how diverse interests can be coupled toward a common goal, in a way that avoids the discord and gridlock that has intermittently plagued the International Space Station.

A. MOTIVATIONS FOR SPACE EXPLORATION

- National identity
- Political interests
- Security
- Economic interests
- Science
- Discovery

These motivations overlap in their scope and definitions, and are interpreted in various manners by different people and countries. In this section, we provide a more detailed definition for each motivation, discuss their inter-relationships, and assess the relative importance of each for the various nations and space powers.

1. National Identity

Space exploration is both a statement and a tool of national identity. During the Cold War, both the United States and the Soviet Union tried to use space exploration in service of national identity, as a means of “keeping score” in this proxy conflict. For arriviste powers, the development of space assets has served notice of a new entrant on the world stage. Such expressions of national identity have both global and domestic audiences – intended not only to serve notice to the rest of the world, but also to harness national pride and fervor in the service of broader national aims.

Space contribution to “national identity” is in fact to be seen as a large “government-run PR operation”, whatever the nation. It is even a symbol created by the government to strengthen the national identity -unity, pride, independence, prestige, self-confidence-, in the same way that sports, e.g. the Olympic Games, stir national feelings. For example, each country has a different analysis, focus and press coverage of the Olympics games based on the fact that the games should above all flatter the values mentioned above. With the Cold War as a background it was easy to forge such a symbol, in the US or in the USSR (it is now more obvious in China): the whole nation participates in a collective effort to demonstrate its strength and capacity of organization. On the other hand, one can observe that once the need -and the related PR emphasis- to highlight national identity decreases, society tends to loose its interest for human flight. Hence, if space is used to serve “national identity,” one can wonder whether space program legitimacy comes only from political decisions.

At this point, the space community fails to mobilize around space exploration. Even when trying to reconnect with old Apollo era myths (e.g. the Bush Vision), the political environment is not there: space exploration is not currently a top symbol of national identity for US public, which focus on different priorities, and fails to stir public support.

¹ We have not conducted field visits to Canada, India, and Brazil, so we do not discuss them in this section. This should not be construed as a judgment that they are less important than the countries that we do discuss.

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2. Political Interests

Apart from the more abstract notion of national identity, countries are motivated by a number of concrete political interests when deciding to explore space, many of which have nothing to do with space exploration. This is space exploration in the service of foreign policy. Both the United States and the Soviet Union opened their space programs to astronauts from allied or nonaligned countries during the Cold War and after, as a way to fortify ties with such nations. After the Cold War, Russia entered into the ISS program. This move was seen to have a number of advantages: the strengthening of ties between former rivals, reduction in the overall cost for the ISS program, further knowledge from Russia's experience in human spaceflight via their own Mir program; and finally, a means to reduce the risk of Russian scientists with expertise in missile technology considering the sharing of such information with rogue states intent on acquiring weapons of mass destruction. China is using the Asia-Pacific Space Cooperation Organization (APSCO) as a diplomatic tool in its relationships with other Asian countries and trying to build its sphere of influence in the region. The European Commission increasingly views space activities as a means to build a common European identity. Take, for example, French space policy, whose origins were driven by national sovereignty and the independence of strategic interests. Now, these interests have been transferred through to ESA, an organization that is oriented more towards space development as well as being a political tool towards an increasingly integrated Europe (ESA/EU integration).

3. Security Interests

Security interests were the most important driver of space exploration activities during the Cold War in the Soviet Union and the United States. The technologies that could be used to send a man into space could also be used to deliver a nuclear missile to the other side of the world, or allow countries to spy on each other from a bird's eye perch in space. These interests were rarely if ever cited by political leaders when discussing the countries' human space exploration programs, but they were certainly important in their thinking. Also, by inspiring a generation to become aerospace engineers, the human capital base for defense-related R&D was significantly enhanced.

Security interests have become a broader concern for space powers in the last decade. Taking the example of the Iraq war in 1990-91 it was easily observed that communication capabilities were absolutely essential for national security. This recognition led to the development of the IGS and Galileo systems by Japan and Europe respectively. This step was regarded as a strategic initiative, a way for these countries to avoid dependence on the US for capabilities vital to national interest.

Government investment in space exploration is less likely to lead to security benefits today than during the Cold War, because of the increasing gap between exploration technology (driven by distance, endurance and survivability) and military space technology (driven by miniaturization and precision).

4. Economic Interests

Another set of motivations for space exploration are economic – both tangible and intangible. Since the beginning of the age of space exploration, the future economic potential of space has always had a powerful visionary hold, but has failed so far to be matched by reality. To date, space has offered commercial opportunities either once the technologies have been developed with government money and then transferred to the private sector or, in the case of the telecommunications, in an existing market. The space community failed to develop an economy of services related to space spin-offs or space technology (example: disappointments concerning commercial remote sensing or space telecommunications). It remains to be seen if new entrants into the space community, will be able to learn from this failure. To this regard, the lessons of China's involvement in the Galileo program should be extremely interesting.

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But there are many who believe that a new generation of space generation activities could provide the stimulus to create new industries in space. Examples of potential breakthrough industries include energy generation and transmission; mining of helium-3 on the Moon; and space tourism. Whether such industries might actually take root is open for question, and will be difficult without a solution to a number of key barriers, such as the cost of access to space and the dangers of deep-space radiation on human health.

There are also indirect economic interests at play. Investments in research and development for space-related technologies and systems have spin-off benefits. And people who have studied space technologies have made major contributions to science and technology in a number of fields, from microelectronics to bioengineering.

5. Science

The pursuit of purely scientific interests is another motivation for space exploration. What is the history--past and future--of the planet Earth, the solar system, the galaxy, the universe? Where did life on Earth originally come from: the ammonia cocktail of the primitive planet Earth, or via a transmission from a foreign planet such as Mars, as some have hypothesized? Is there life elsewhere in the universe, and perhaps even in our solar system? These questions are among the most difficult mysteries in science today, but humankind has made amazing progress toward answering them in the past 100 years due to advances in telescopes and unmanned missions to the far reaches of the solar system; they have inspired all of the world's space powers to invest resources in the pure pursuit of knowledge.

Scientists today are privileged to indulge their passions for science and simultaneously to provide something useful for society. With these privileges come responsibilities: society expects a return of knowledge and technology. Research within the field of space science and exploration is unique in itself; the results continually presenting the world with a new understanding of the cosmos, the Earth and ourselves. To answer society expectations nowadays, space exploration must keep bringing us new products and high technologies. This might explain the lack of enthusiasm of the scientific community toward human space exploration: in order to serve the society, rational perspectives should prevail and future space exploration should be done by robotics.

6. Discovery

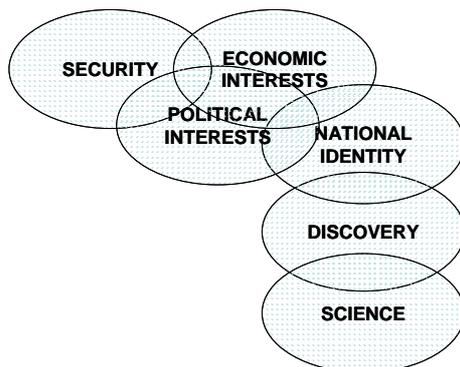
The last key motivation for space exploration is discovery – an almost primal motivation, driven by the thrill and mystery of the unknown and never seen. This is exploration for exploration's sake, and the belief that space exploration represents the next stage in human evolution. The human race has ranged outward from the African savannahs to inhabit the four corners of the world in a short blip of planetary history. Space is the next frontier to be charted, explored, and perhaps conquered in this narrative.

To be certain, the motivation for discovery is rarely, if ever, the sole motivation for space exploration; and it is sometimes used as a pretext to obscure other intentions. Lofty rhetoric about discovery and exploration does not always accord with the reality of state interests. There is nothing inherently wrong with this mismatch, but it needs to be openly discussed and acknowledged.

7. Relationship between Motivations

The boundary between the six key motivations is not discrete; the chart illustrates our notional understanding of the overlapping relationships among them.

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B. MOTIVATIONS AND NATIONAL INTERESTS

The six drivers of space exploration can be assessed at a national level and used to develop a concrete understanding of the national hierarchy-of-interests for space exploration. In the next section of the report, we take a country-by-country look at our perception of these interests, looking at China, the European Union, Japan, Russia, and the United States.

A number of factors affect why motivations diverge across countries. Some of these differences are due to fundamental differences in values and views of the world, whereas other differences have structural causes. The right-hand column of the chart below shows seven sample “national characteristics,” and the expected set of space exploration motivations that such a state would exhibit.

National Characteristics	MOTIVATING FACTORS					
	National Identity	Political Interests	Security	Economic Interests	Science	Discovery
Practical	*	**	***	**	*	*
Global-Minded	*	**	*	*	**	**
Prestige-Driven	***	**	*	*	**	**
Humanistic	*	*	*	*	***	***
Imperial	***	**	***	**	*	*
Technocratic	**	**	**	***	**	*
Growth-Focused	**	*	*	***	**	*

*** = Strong motivating factor ** = Moderate motivating factor * = Weak motivating factor

Other differences between motivations have structural roots, such as the relationship between a country’s political leadership and its space institutions; the role of legislators in influencing space activities; the way in which the country’s space institutions are funded; and the relative influence of various political constituencies.

The following assessments are based primarily on visits that we have made to each of the following countries to interview leaders and experts about their opinions on the future of human space exploration, as well as an extensive review of secondary literature on the countries’ space programs and political systems. The descriptions of motivations stated below are our own, and do not necessarily accord with the explicitly-stated interests and motivations of the various countries. We have tried to identify the national interests of each country, as opposed to the institutional interests of the countries’ space exploration complexes. Finally, these snapshots are

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not intended to be exhaustive in their analysis; rather, our purpose is to provide enough of a context to facilitate the discussion of a representative model for future international cooperation.

1. China

The successful launch of the Shenzhou-V in October 2003 marked the entrance of China into the small club of nations (and now one private sector company) that have put a human in space. This launch represented both the end of more than a decade of careful planning and the beginning of a new engagement in space activities.

As part of the HSEI, we met in May 2004 with space officials from a number of agencies within the Chinese program. During this time, China's plans for a space station and future missions to the Moon and Mars, with the possibility of establishing permanent settlements in the distant future, were described.

The most important factors motivating China toward these space exploration goals are its sense of national identity and economic interests. China has worked assiduously to assert its claim as a great power in recent decades, and has made extensive efforts to develop and project the symbolic manifestations of this claim. The Summer Olympics in Beijing in 2008 are one result of this; the decision to put a man in space is another.

China understands that such an expression of national identity also has practical benefits. China has studied the lessons of the Apollo program closely, and views the second-order economic effects of exploration to be worthwhile reasons to move forward with human space exploration. The Shenzhou-V launch is clearly motivating the development of the next generation of scientists and engineers in China, in prodigious numbers. We visited Beihang University², and were struck by the sight of hundreds of students in a deathly quiet study hall, intently poring through their science and engineering textbooks.

Security is another significant imperative for space exploration activities in China. The potential for regional conflict (with China either as an aggressor, a defender, or a peacemaker) and the importance of space-based assets for war today compels China's military to develop security-related space capabilities¹. In addition, China's space program is under the direct control of the General Armaments Division of the Peoples' Liberation Army (PLA), which creates institutional imperatives for space activities to serve security interests. However, very few technologies that directly support human space exploration have military applications, undermining the case that these exploration activities are driven by security interests.² But because of this organization and the strong political will behind, China might be the only country today to have the capacity to sustain a manned flight program.

Another important motivation is political in nature, tied to China's desire to develop and bolster a hegemonic role in the region. It formed the Asia Pacific Space Cooperation Organization (APSCO) as a forum to coordinate regional space cooperation, and enticed South Korea, Thailand, Singapore, Malaysia, Iran, Bangladesh, and Pakistan, among others, to join.

China is going through a reflection phase on the country's modernization and, therefore, on their related space activities. This effort led to the national integration of these activities and toward international cooperation. In terms of space activities, China developed several cooperation initiatives with Europe and Russia, but the United States remains its first-choice partner. Taiwan is at the core of the US/China relationship and the U.S. is following closely China's space-military related activities. The Chinese are fully aware of the technological gap with the US, and

² Formerly the Beijing University for Aeronautics and Astronautics

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are concerned by the U.S. military assets. U.S. analysts are deeply divided between those who expect a “spatial Pearl Harbor” and those who believe that China is steadily building a military program but is not yet a threat. Nonetheless, China will build its space capabilities regardless of U.S. cooperation, and the participation of Chinese officials in the last NASA workshop on space cooperation could presage the chosen path of cooperation instead of distrust and confrontation.

2. Europe

Space activities have been an important constituent element of national sovereignty for European countries. In France, the drive for advanced technology, the resulting spin-off technologies and the subsequent economic benefits have allowed France to achieve technological self-sufficiency. Space is now becoming increasingly a function of European (as well as still national) identity, with the European Space Agency and the European Union moving closer together and major projects such as Galileo, GMES and ITER organized now at the European level.

From the birth of ESRO and ELDO to the creation of ESA in 1973, the European space program, built in a post WWII spirit, has been dedicated to science projects where cooperation was seen as a way to promote peace. As ESA’s space program evolved, a special focus was placed in the area of earth observation and environmental monitoring. Through the execution of such programs, questions on ‘the existence of human kind’, ‘their relation to the Earth’, ‘the Earth’s relation to the Universe’ have been raised by ‘Earth-conscious’ Europe. Such reflections have been the basis for ‘The International Charter on Space and Major Disasters’ created by CNES and ESA. It must also be noted that today, CNES, is the only space agency to formally address the ethical issues pertaining to space exploration through a full-time advisor.

Next year, Europe’s vision for space exploration should be ready following the extensive study that was conducted via the program named ‘Aurora’. It appears as though Europe is now standing at a cross-road where on the one hand, they are keen to achieve their own vision and pursue their own goals, and on the other hand they feel the need to acknowledge US leadership and initiatives, thus placing them in a position of dependence towards NASA.

Europe fully intends to participate in ventures featuring international collaboration, as long as such a venture does not pose a threat to ESA’s own program. That is to say, such an international project would have to be integrated into a ‘common’ roadmap otherwise; it would not be possible to invest meaningful capacities. The ISS experience persuaded the Europeans to search for co-dependent forms of cooperation, therefore allowing for more of a balance between potential partners.

3. Japan

The end of WWII closed the door on Japanese militarism and set the conditions for a space policy that has been focused exclusively, until recently, on the peaceful uses of space. The 1969 Diet Resolution limits Japan’s space activities to commercial and scientific endeavors. Space is seen as a tool to improve the quality of life and economic conditions; examples of this include the importance of space assets for weather monitoring (important in a country with a high risk of natural disasters) and the high market penetration of GPS systems in automobiles. Recent shifts in the regional geopolitical environment (in particular the threat posed to the country by medium and long-range missiles from North Korea) have changed the country’s attitude toward security-motivated space technologies, and the country has invested in reconnaissance satellites as a result.

It is difficult in Japan to motivate the national will for certain types of space activities, in particular those related to human space exploration. Japan’s lengthy and traumatic period of economic stagnation, from the early 1990s to the present, has harmed its fiscal situation and reduced the country’s appetite for risk-taking. For a potential space initiative to take hold, it needs to satisfy one or more of the following motivating factors:

- Scientific research,
- Direct economic benefits (developing spin-off technologies from space investments),

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- Security enhancement (mostly in terms of natural disasters, but increasingly in terms of regional military threats).

These factors lead to clear support for unmanned activities (launch vehicles, navigation satellites, spy satellites, lunar and Mars unmanned missions), but do not lead to clear, direct support for future manned space activities. Furthermore, Japan is in a weak position to contribute to future international space exploration initiatives at present, due to its economic situations and two key near-term issues. First, it is focused on fixing its autonomous H2A to the exclusion of all other priorities at present. Second, Japan's difficult experiences with its module for the International Space Station will make it excessively cautious as it engages in major international initiatives in the future.

However, Japan will ultimately play some role in any future exploration initiative. But it would prefer to do so in a way that reduces its dependence on other countries. This means either developing best-in-class capabilities in a certain technological area that is on the critical path for future space exploration (such as solar power cells or robotic technology), or engaging on independent missions that complement other nations' activities, as part of a broader exploration architecture. Japan would prefer that any long-term exploration program is well-articulated and modular, and producing demonstrable results every two or three years, as a means to sustain public support.

4. Russia

The Soviet Union's strong and trailblazing legacy in space exploration is still a recent and formative memory for the leadership of the Russian space program. Space exploration was a key element of Communist ideology from Sputnik onwards, used to advance the idea that the Soviet Union was overtaking America and the west for global technological dominance. The fall of Communism was a shock to the system to the admirable Soviet space program, which remained strong throughout the 1970s and built the first permanent station in earth orbit (Mir) in the 1980s. The last fifteen years have been difficult for the now-Russian space program, hit simultaneously by the loss of funding and the withdrawal of the ideology with which it had been so closely identified. The Russian space program, proud but wounded, is only now beginning to renew itself and reassert a new path forward, as part of a renewed Russian identity.

Russia views human presence in space and related exploration activities as a critical element of its broader space program, and with the Space Shuttle grounded at present, maintains the only life line between the International Space Station and earth. It is wary of what will happen if and when there is a shift between the International Space Station and any new US-lead Vision initiative, because a gap in manned space exploration after ISS but before new manned lunar or Martian missions could make difficult to "restart" manned space exploration both for technical and political reasons.

Having lost an entire generation of aerospace engineers and technicians when the Soviet Union collapsed (the best and brightest looked for opportunities elsewhere, in areas like banking and law), Russia is challenged by the need to improve public support for space activities. There was strong public support during Soviet times for space activities, and this continued to some extent even into the 1990s. But when Mir was destroyed, the blow to public support of space activities was devastating.

Russia's space program has become increasingly enmeshed in international cooperation during the last decade, in part due to financial realities, and in part due to practical desires among Western space powers to harness its vast capabilities in the pursuit of broader missions. Cooperation has typically been more difficult at the political level than the operational level. Historically, Russia has been cautious toward the European Union, and has been much more like to want to work directly with member states such as France.

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5. United States

Space exploration activities have been an important (but not overarching) part of the national landscape in the United States since the Mercury program. The vast mobilization of resources for space activities declined as a share of the US budget after the Apollo program, but stayed large in actual terms, to the point today where the budget for NASA (\$16 billion/year) dwarves that of the world's other space powers...and this \$16 billion only accounts for the United States' civilian space activities, outside of the Department of Defense. At the same time, the support for space exploration in the United States is limited. Thirty years of seeming (not actual) stagnation have reduced the public interest in human space exploration, witnessed by the fact that television stations rarely covered space shuttle launches and landings except at the very beginning and in relation to the Challenger and Columbia tragedies.

All of the key imperatives for space activities identified in the previous section – political interests, economic interests, security, science, discovery, and identity – are important facets of the US space program, and find their manifestations in various parts of the large complex of space activities, many of which find themselves in competition with each other for resources. Advocates of human space exploration activities are often pitted against supporters of space science and unmanned probes. The Space Vision initiative launched by President Bush in January 2004 is *prima facie* an attempt to reinvigorate the impetus for discovery, but all of the other motivations are important elements of this initiative, if (in some cases) only below the surface.

The United States also has a growing and increasingly confident independent space sector, exemplified most recently by the flights of SpaceshipOne to win the X-Prize. The individuals and companies behind these endeavors often contrast themselves as an entrepreneurial counterpoint to the behemoth government-led space programs, and are much more driven by economic interests (by necessity) than the government. But it would be unwise to make too much of this distinction – the real difference is not public vs. private, but rather a battle of ideas between a “purist” vision of what space exploration could be vs. the reality of a complex bureaucracy with multiple outside stakeholders whose interests cannot be ignored.

As part of the new US vision for space exploration, NASA is developing a framework that will enhance the possibilities of international participation in future missions, and has met with a wide group of international partners to take the first steps at developing this architecture. This willingness to cooperate will not solve the structural imbalance that is the result of US dominance and leadership, which gives it alone the power to walk away from cooperative ventures. This imbalance and the growing discontent over past US breaches could push the world's other space powers to find other partners and bandwagon, perhaps with cash-limited Russia or ambitious China.

6. Summary

National Characteristics	MOTIVATING FACTORS					
	National Identity	Political Interests	Security	Economic Interests	Science	Discovery
China	***	**	**	**	*	**
Europe	**	**	**	***	**	*
Japan	*	*	*	***	**	*
Russia	**	**	*	**	**	*
United States	**	**	***	***	**	**

*** = Strong motivating factor ** = Moderate motivating factor * = Weak motivating factor

C. IMPLICATIONS FOR COOPERATION

This recognition of countries' different motivations is not a positive or negative judgment on them, but instead is an attempt to face reality, acknowledge differences, and find a way to harness them in the pursuit of common outcomes.

Within the broader space exploration enterprise there are several generic levels of activity, at each of which some degree of cooperation is possible. These are mapped out in the chart below. Countries can share common goals, such as the discovery of life beyond earth or a new source of energy in space. But they might choose to pursue these goals in different ways. Countries can have a common belief in the importance of certain destinations, but perhaps for different reasons. Countries can cooperate and work together on a single mission, but for distinct reasons. Or they can each be responsible for an element of a particular mission.



Cooperation at each or any of these levels has distinct benefits and challenges. To develop any large scale international endeavor, it is necessary to recognize these differences from the outset and develop the appropriate mode of cooperation, given the motivations and capabilities of the countries involved and the inherent characteristics and separability of the task or objective.

Many existing manifestations of international cooperation operate under a similar framework, including the European Space Agency and the International Space Station. But the difference between a success and failure is often a function of whether these differences are dealt with openly in the negotiations, or whether they are brushed over through compromise. A successful international cooperative venture is the result of a negotiation that finds the correct and appropriate level for international cooperation – not an attempt to negotiate on the belief that agreement and compromise are necessarily at all levels. Countries can have different goals for an international agreement and still serve as effective partners in an international venture, if there interests are appropriately aligned at another level.