

International Institute for Space Commerce: Responding to the Need for Strategic Thinking in the Commercial Space Sector

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ABSTRACT

With the growth of the new space economy, the need for a think tank dedicated to the study of space commerce facilitators has been identified. Bringing together experts from academia, government, the media, business, and international and nongovernmental organizations, International Space University has employed its extended network of people and resources to help meet this need. As illustrations of just some of the issues arising in this new space economy, three different challenges are illustrated: the rising average age of the space workforce, particularly in the traditional spacefaring countries, the macroeconomic changes resulting from the present economic crisis, and the interrelationship of entrepreneurial ventures and the regulatory environment. The role of the International Institute for Space Commerce in studying these and other challenges will be outlined, as well as a number of forecasts of potential trends.

INTRODUCTION

With traditional roots in the public sector, space activities have developed over the last few years into a viable commercial activity supporting the investment of private capital. In its yearly report the satellite industry (based upon research of the Tauri Group) estimates the commercial space turnover in 2012 at over 189 billion dollars, an increase of 7% compared with 2011,¹ still excellent in view of the present economic context.

This figure is in line with *The Space Report* figures, estimating commercial space sales worldwide in the order of 48% in 2012,² with the total space market estimated well over 300 billion dollars. It clearly shows the growth of the commercial space sector, presently nearly equivalent to the public space market.

This rapid growth, which is remarkable in a time that many sectors have been suffering strongly from the *crash of 2008*, shows the solidity of the sector but also raises a number of questions. In view of the space sector's public-oriented roots, strategic studies and thinking on space activities have been mainly focused on this public utility function. Excellent work is done in many institutes both in the United States

(George Washington University, George Mason University, Baker, Eisenhower) and in Europe (e.g., the European Space Policy Institute) with a focus on the strategic importance of the space sector mainly from a dual-use perspective. Unfortunately, less emphasis has been placed on strategic thinking in the context of commercial space activities.

More and more activities that were once the province of governmental activity are now being taken over gradually by private initiatives. If we consider exploration, for example, with initiatives such as the Google Lunar X-Prize, we immediately realize that rules and regulations originally developed for a context dominated by government activity may need a paradigm shift.

The importance of this issue has been particularly evident in the United States, where the Federal Aviation Administration (FAA) has taken a leading role in developing regulations for the burgeoning space tourism industry. Working with a mandate to provide protection for uninvolved people in the vicinity of launch sites, and to guarantee that consent of space flight passengers is truly "informed," the FAA has also been tasked to facilitate the development of the new industry. Its actions thus deserve to be closely studied for insights to practices to be continued or avoided as launch operations in other locations such as Sweden, Singapore, or the UAE come online.

Recognizing the need for serious study of the business issues that will impact the private commercial space flight industry, the Isle of Man, an autonomous dependency of the British Crown and an important player in the new space economy through financing, insurance, and leasing operations, invited the International Space University (ISU) to cooperate in launching a think tank designed to explore the emerging commercial character of space activity. This think tank has been created and is known as the International Institute of Space Commerce (IISC).

IDENTIFYING THE CHALLENGES

A number of challenges are known and can therefore be studied in advance. Foremost among these is the influence of geopolitical forces on the evolution of private commercial space ventures. Although the trend toward private commercial activity is dramatic, it remains that the space sector is still largely driven by public activities. *Figure 1* shows the effect of major public policy initiatives on aggregate space expenditure in the United States since 1963.

Given the impact of these factors external to the private market, we have sought to take them into account in our attempts to analyze the international prospects for commercial space ventures over the near and medium term. Of immediate importance in this effort will be the

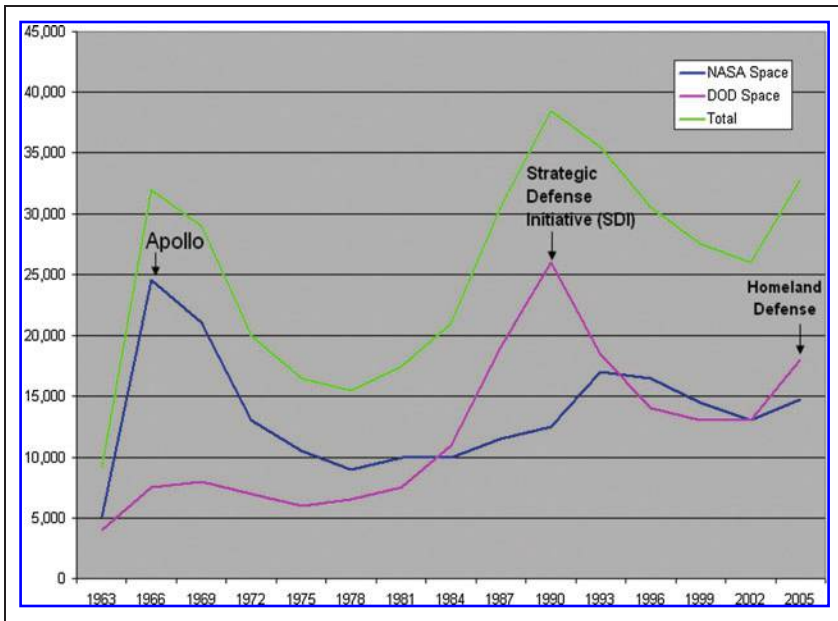


Fig. 1. Public space expenditure in the United States. (Source: PROSPACE: The American Space Program, 2007.)

geopolitical context in which the new ventures evolve. Here we look to the work done by the OECD working group forecasting the evolution of world condition over the next two decades, where three scenarios were developed based upon political and energy-driven assumptions³:

- “Smooth sailing”—based upon the assumption that a global world order will be implemented under the benevolent guidance of international organizations and where free markets and democracy become gradually the acceptable universal model for national institutions.
- “Back to the future”—under this scenario three major economic powers will strive to dominate the world (United States, Europe, and China).
- “Stormy weather”—where strong disagreements between major powers lead to a gradual erosion of international institutions and increasing conflicts.

The OECD working group ultimately selected the first scenario as their baseline, and in terms of consistency we will do the same in our discussion here.

In a smooth development scenario, we can make reasonable forecasts based upon incremental continuity of economic factors. The planned studies of the aforementioned IISC are projected in coherence with these parameters and therefore assume increasingly global stability.

As an illustration, we will describe here three elements under consideration for further studies:

- The space workforce
- International space activities shifts
- Regulatory changes needed

THE SPACE WORKFORCE

Whereas the aging factor of the space workforce is a considerable concern, in particular in the United States, replacement of the workforce by adequate staff is a problem worldwide. In particular, in Western countries we note for years a declining interest in science and engineering and a resulting reducing number of graduates in these disciplines.

This has even led to concerns from a strategic perspective, as expressed inter alia at the 2005 Dwight D. Eisenhower National Security Symposium,⁴ but is also a concern for future commercial space activities.

In a survey done by ISU⁵ on the European space workforce, it turned out that some 50% of the vacancies were hard to fill in the space sector because of a lack of candidates with the appropriate skill set. As far as hard skills are concerned, whereas the space sector still searches in the first place for good engineering skills, we can also note from *Figure 2* that there is an increasing request for a combination of skills and hence for applicants with more than one degree in the sector. In particular, a combination of solid engineering and physics backgrounds with an additional business degree (such as an MBA) is in high demand.

Obviously, an even bigger obstacle seems to be formed by soft skills, also because these are in general not taught in traditional (science and engineering) curricula. In particular, communication skills, after analytical thinking (see *Fig. 3*), are highly in demand and considered as one of the major obstacles in recruitment.

Whereas analytical thinking is an evident prerequisite to succeed in technical or scientific studies, the other soft skills are less essential contributors toward earning a degree. Group dynamics and presentation skills, as an example, can be strongly improved by workshops and feedback sessions, but this is rarely organized in classical curricula, even if the needs are recognized.

It is also worth noting that, on the basis of a range-based question, the demographic distribution in the sector in Europe is reasonable (*Fig. 4*), with some 54% of the employees younger than 45 years.

INTERNATIONAL SHIFT OF SPACE ACTIVITIES

There are many indications that the present financial crisis may accelerate the growth of emerging space nations. From a strategic perspective, such growth factors may become reality in the next few decennia that analysts are considering not only the next generation of economically powerful countries (BRIC = Brazil, Russia, India, and China) but also already the next emerging group.

A research team⁶ identified a new series of countries as the next group of emerging countries, namely (in alphabetic order), Bangladesh, Egypt, Indonesia, Iran, Korea, Mexico, Nigeria, Pakistan, Philippines, Turkey, and Vietnam. The selection was done on the basis of present performance and growth environment scores, which measures 13 components (such as demographics, education levels,

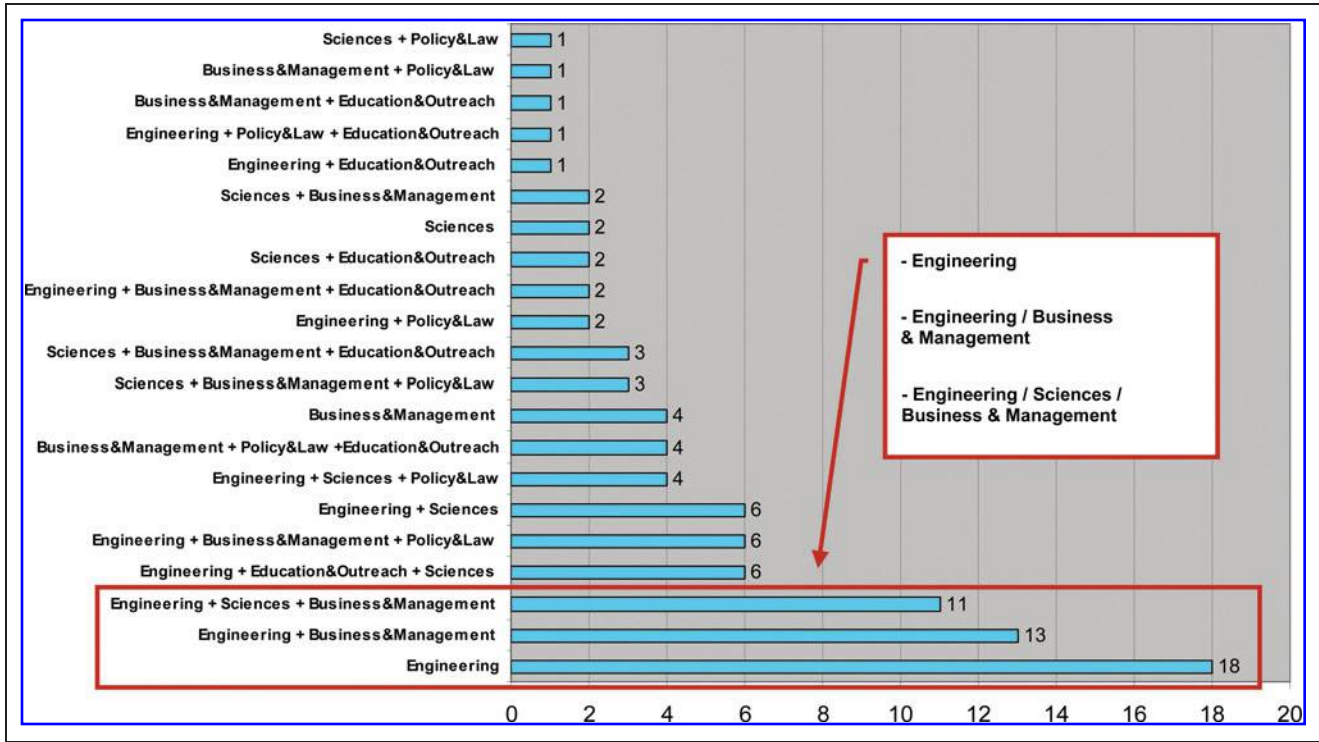


Fig. 2. Combination of the hard skills requested.⁵

trade openness, government deficits, external debt, equity market indices, and inflation control). This group of countries is labeled the N-11 (Next 11).

The forecast timing when some of these countries would overtake the traditional G7 countries is depicted in Figure 5. As space ex-

penditure bears a relation with the GDP of the respective countries, it looks evident that this economic shift will result in shifts in public space expenditure as well (and resulting shifts in space capacity in the respective countries). In order to try to quantify this shift, a GDP-related extrapolation was made for 2030 as shown in Figure 6 (whereby ROW stands for rest of the world). We can clearly see the considerable growth of the BRIC countries by 2030 and the upcoming economic power of the N-11 countries, whereby this latter group will gain more rapid momentum the decennia after. Note that the countries are grouped in blocks as it is assumed that shifts within the blocks may happen but the overall value will be more constant.

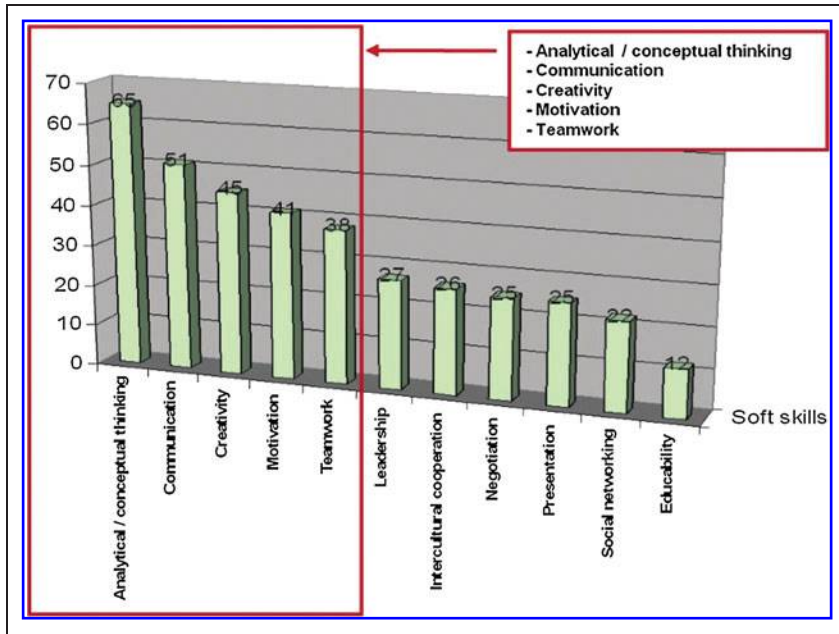


Fig. 3. Ranking of the soft skills in function of frequency mentioned.⁵

REGULATORY FRAMEWORK CHANGES

Of particular interest to participants in the commercial space sector is the regulatory environment in which their activities will be carried out. This has been articulated most publically in the emerging space tourism industry, but there are several other areas of endeavor in which it will be a critical path item as well.

Much of the early work in space tourism regulation has fallen to the FAA in the United States. This is because of a confluence of factors, including a U.S. policy position calling for a combined role of regulation and industry growth promotion that has

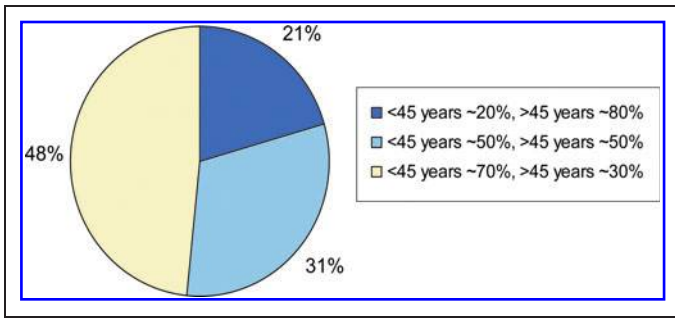


Fig. 4. Demographic data of the present space sector according to the International Space University questionnaire.⁵

created a fertile field for communication between industrial and governmental leaders. The impulse to the suborbital flight industry supplied by the U.S.-based X-Prize competition, the leading role played by U.S. companies in designing and building spacecraft for this industry, and the expectation that much of the early activity in suborbital tourism will originate in the United States have all created a natural environment for regulatory action in that country.

The U.S. regulatory solution has been based on three important principles that deserve to be looked at closely by authorities elsewhere.

1. Human suborbital space flight is an experimental activity that should not be held to the same safety standards for participants as commercial flight in aircraft any more than we expect technical mountain climbing in the high peaks to be as safe as a walk in a city park.

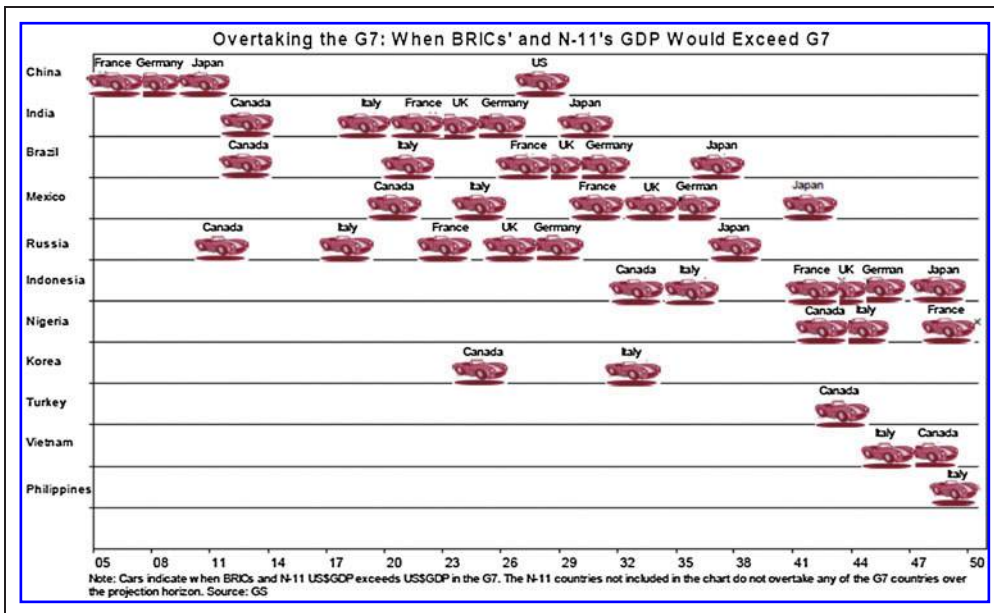


Fig. 5. Comparing the GDP evolution forecast. (Source: ref.⁶).

2. Because of principle number 1, operators have an absolute obligation to ensure that participants have provided informed consent before their participation in flight.
3. Risks to uninvolved persons must be reduced to as close to zero as possible with the same attention to detail as would be expected of the operator of any aircraft or airport.

Although the full effect of these emerging regulations remains to be evaluated once flights actually begin, one very important effect is already clear. By creating a reasonable, well-articulated set of rules, the FAA has provided enough certainty about the regulatory environment for entrepreneurs and investors to pursue the suborbital tourism market. With a moratorium on new regulation in effect through 2012, there is sufficient time for the industry to establish an initial presence in the market and for the regulator to acquire more real-life information. What may emerge after 2012 will depend heavily on experience between now and then, but importantly, experience is being given the chance to accumulate.

Relative to regulation, other potential industries are far less mature. Some examples here might be off-earth mining, orbital energy production and distribution, and nonterrestrial communications. These areas share the important characteristic of being of transnational interest with one element or another falling into incompletely explored territory of international responsibility.

As just one example, who should regulate issues of miner safety in some future asteroid mining activity employing a multinational workforce? Are the American workers subject to U.S. Occupational Safety and Health Administration rules? Do the French have to quit work after 35 hours of duty in any week? Although individual governments may seek to implement mining operations depending on their interpretation of the limits of the Outer Space Treaty, no commercial investor is likely to risk their capital in such an uncertain environment without legal and regulatory clarifications.

Recognizing that lack of regulatory clarity can be as stifling to a market as excessive regulatory zeal, the IISC intends to support continuous study of regulatory issues affecting the commercial space sector recognizing fully that an important if subsidiary source of international law as stated in the Statute of the International Court of Justice is the “writings of the most qualified publicists” in an area of legal concern [Statute of the International Court of Justice, Article 38(1)(d)]. It is the intention here to ensure that among the qualifications present in the analysis is included expertise on the interface of commercial and regulatory interests.

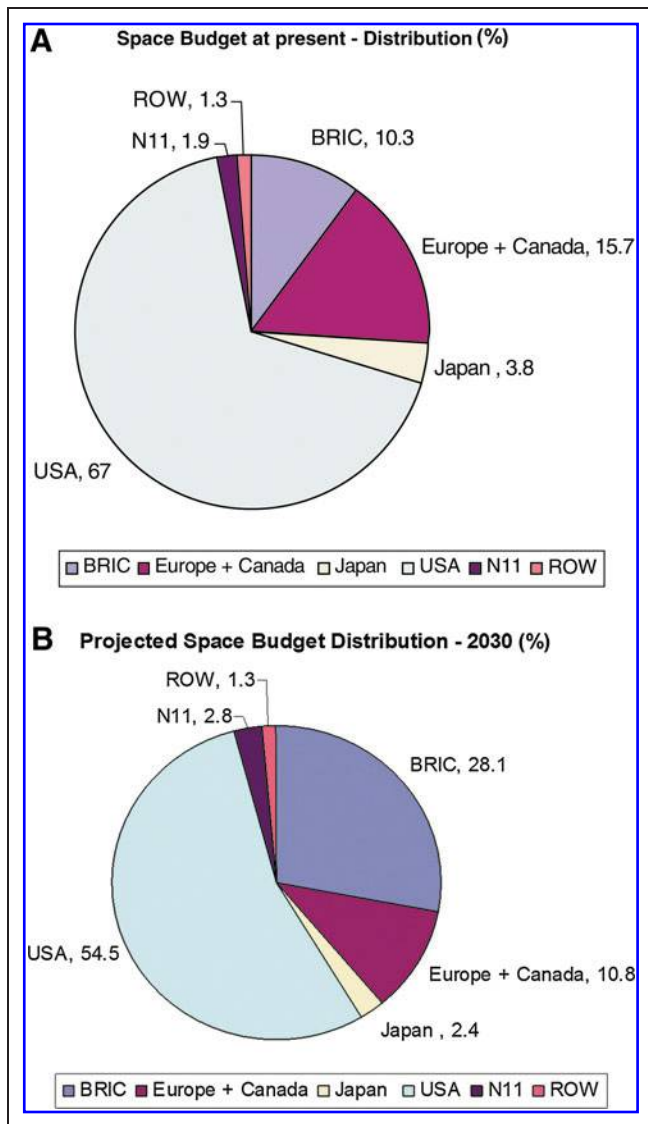


Fig. 6. Forecast evolution of space activities per region between now (A) and 2030 (B). (Source: International Space University.)

INTERNATIONAL INSTITUTE FOR SPACE COMMERCE

Recognizing that a new institute is itself subject to regulatory approvals, ISU worked in close cooperation with the government at the Isle of Man to fulfill all regulatory requirements to make the institute operational. Duly registered on the Isle of Man, with offices located on the campus of the International Business School in the Isle’s capital city of Douglas, the institute was formally inaugurated on October 4, 2008, in the presence of the first Korean astronaut, Dr. Soyeon Yi, and space veteran George Abbey.

The objectives of the institute can be summarized as follows: The institute’s mission is to become the leading think tank in the study of the economics of space. It is intended to be the intellectual home for the industry and space academia around the world for which it shall

perform studies and evaluations and provide services to all interested parties with the ultimate aim to promote and enhance world’s space commerce to the general public.

The vision is for the institute to act as a resource for all, being an international and nonpartisan think tank drawing upon new ideas and solutions to existing and future problems the space industry faces by drawing together experts from academia, government, the media, business, international and nongovernmental organizations, and, most notably, those from the ISU and its extended network of people and resources.

In order to implement this vision, a dedicated website has been prepared. An important feature of the website content will be the material on space commerce-related items written by ISU students and alumni. Indeed, as formal publications may have a lead time that is not compatible with the rapidly changing environment, this medium will allow publishing articles relevant to this field in a much more rapid cycle (the website can be accessed at www.iisc.im). The new space economy will require a solution and answers for many emerging questions, and IISC intends to make a substantial contribution to this as a think tank, serving this new venture and the space sector associated with it.

OUTLOOK

Targeting space exploration, many authors have attempted to analyze present trends and focus on the ongoing trends, summarized recently as follows⁷:

- The decision of the Obama administration to commercialize access to the International Space Station will have a considerable change in emphasis toward space commercialization, as it will also create a dependency of the operations on the commercial sector.
- A number of space activities are developing independently of government funding—Space-X, suborbital space tourism, but also the Google lunar prize are some examples of this new space economy. Here, the commercial entities are not waiting for directives from governments but even make the initial investments when they believe that there are profitable markets. Even where large contracts support the cash flow, in most of these cases all the capital at risk is private and the contracts are based purely on performance and service delivery.
- The decision to revisit International Traffic in Arms Regulations (ITAR) is ongoing. Although the full impact of this change is not yet known, a consequence for international space activities is certain.
- Increased awareness of space debris issues, increased density in orbits, and the emerging interaction with (orbital) personal space-flight is another factor that will require new regulatory frameworks.

Translating this into trends for the commercial space sector, we can predict the following possible effects for the current decade:

- Increased commercialization on the basis of initiatives independent of governments
- Increased availability of private risk capital in space activity
- Alternate financing mechanisms for traditional space activities (see also ref. ⁸)

- More independent initiatives of commercial companies in exploration activities
- Increased outsourcing from space activities from government agencies to commercial entities
- In the vested markets space companies will seek more government support, for example, via Public-Private Partnership concepts
- Increased global competition because of both relaxed ITAR and new players entering the market (in particular China and India on the large system end and many smaller countries developing niche specialties in support of the need for components on the other end)
- A more global space economy fueled by new partnerships, supported by the more global U.S. space policy
- An increased number of mergers and acquisitions, in order to create stronger consortia to cope with this increasing competition
- A higher need for regulating commercial space activities, implementing the basics as outlines under the existing treaties but with more commercial focus
- The need for the commercial space sector to tackle the space debris problem
- A more complicated environment for insurers and reinsurers as spacecraft and debris density begins to complicate the assessment of risk in orbital operations

The latter may seem to be controversial, but the increasing number of space debris avoidance maneuvers for commercial spacecraft operators and the increased commercial risks of a collision are enhancing the probability that private companies will involve themselves in the challenge of active debris removal.⁹

Similarly, the growing interest in on-orbit servicing and possible recycling of components from defunct satellites in orbit will bear careful attention as a possibly disruptive technology in spacecraft life extension. The proposed U.S. Phoenix mission may provide a demonstration test case in the next 2 or 3 years.

CONCLUSION

There is no doubt that the new space economy will require a number of evaluations and studies to facilitate progress. The IISC has been established as a think tank for this purpose and plans to analyze a number of issues in order to support the space commerce sector with independent assessments. As important issues examined preliminarily, we can illustrate this with the following examples.

As far as the space workforce is concerned, the aging factor is a lesser concern in Europe compared with the United States, where deferred retirements are more common. Still, in all Western countries there is a strategic issue related to this because of the declining number of science and engineering students. Moreover, a number of skills are sought strongly by the space sector (such as communication skills), and, besides engineers, there is a growing need to recruit applicants with combined technical and business-oriented degrees. It is evident that specialized space education will have to adapt to these needs from the sector.

Economic shifts, expressed in terms of GDP, are considerably changing the business environment. Such shifts will quickly become

evident in terms of rapid growth of the BRIC countries, whereas already a new series of countries, labeled the N-11, is earmarked to become part of a second wave. Space commerce needs to adapt to such changing environment, including the strategic choice of export markets.

Regulation is itself an important part of the geopolitical environment confronted by investors, established companies, and entrepreneurs. Although excessive regulation is a threat to new and experimental endeavors, lack of regulatory clarity can also be stifling. What is needed for the emerging space industry and regulatory officials alike is an enhanced body of research and analysis that can assess where regulation may be needed to bring clarity and order to the field and how such regulation might emerge in an environment where national exercise of territorial sovereignty off Earth has been explicitly forbidden.

A number of trends can be forecast. Commercial space activities will continue to grow, facilitated by more openness toward globalization and relaxation of the present hindrances such as export control. This will also lead to bigger and more transnational, even transcontinental, commercial space entities.

After 50 years of bearing most of the load for funding and planning space activity, space-faring governments now have new commercial partners emerging who are willing to share some of the risk and bear part of the cost of extending humanity's reach beyond Earth's atmosphere. Whether this partnership brings synergy or conflict, success or disappointment may well depend on how much we can learn about how it will change the economic foundations of the space sector.

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