

Cases Impairing Effective International Space Station (ISS) Commercial Utilization
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Introduction

The International Space Station (ISS) project, the largest and most sophisticated, international engineering project ever undertaken in the history of the world, presents many unique challenges to accomplish effective project management. One of the challenges is the commercial utilization of its space capabilities, including technologies, facilities and systems, aiming at improving the social and economic benefits of mankind. Built by a partnership of sixteen (16) nations, using thousands of engineers and costing about \$60 billion USD, the ISS will consist of hundreds of individual elements that come from all over the world. These elements will be launched into space using both the U.S. space shuttle and the Russian spacecraft. When fully assembled, the ISS will be the most visible man-made object in the history of mankind and most of the world's population will be able to see it with the unaided eye as it orbits about almost 400 km above the surface of the Earth. Figure 1 illustrates the final configuration of the ISS when completed, with contributing resources from international contributing partners. Since the beginning of the ISS project, there has been only minimal public discussion of the potential for ISS commercialization from participating countries. This would include discussions on how such commercial utilization would fit in with ISS project objectives. Interest in ISS commercialization increased in the industries of each participating country when their space agencies NASA (National Aeronautics and Space Administration), ESA (European Space Agency), NASDA (National Space Development Agency of Japan), CSA (Canadian Space Agency) and Rosaviakosmos (Russian Space Agency) began to outline their approach during the June 2001 ISS Forum in Berlin, Germany where eight hundred industrial, governmental and scientific leaders from twenty two countries gathered at the first international conference on the ISS utilization, including commercial one.(i.e., the kind of commercial opportunities the ISS can offer private industries and how its potential can be exploited for commercial and economic development, as interests in utilizing ISS for commercial purposes exist in Research and Development, Education and Entertainment, Tourism and Space Travel, the Media, Marketing, Advertising and Communication, Brokerage and Financing, etc., among others). Hence, a new and exciting market place offering boundless business opportunities is opening up with the best laboratory facility which is second to none. The development and market potential for commercial utilization is enormous.

The purpose of this paper is to examine and discuss current practical, common cases associated with ISS implementation decisions by participating countries due to unanticipated constraints and events likely to impair effective management of ISS commercial utilization. The paper will highlight the unique and contentious issues that have arisen due to decisions or events taking place among the ISS international partners and examine possible approaches for addressing these issues. The following key points will be presented:

- Evolution of ISS commercial utilization.
- Typical, current cases impairing effective ISS commercial utilization, resulting complications as well as approaches recommended for possible solutions to the management problems.
- Conclusion.

Evolution of ISS Commercial Utilization

The construction of the International Space Station (ISS) began in December 1998 when the U.S.-built Unity module was attached to the Russian-made Zarya module, already on orbit a month earlier. Since November 2000, the sixteen (16)-nation permanently orbiting laboratory in space has been established and construction has been progressing towards its completion, resulting in a shifted focus from its construction to its operation and utilization. In 1988, the ISS Inter-Governmental Agreement (IGA) which was signed by the United States, Europe, Japan and

Canada, has created the framework upon which the cooperation for the construction of the ISS, including the allocation of resources on the station, has been built. The IGA and a Memoranda of Understanding (MOU) spell out the responsibilities of each nation's participating space agency. This agreement was updated and re-signed in 1998 following Russia participation in the program. It also defines the percentage of commercial utilization rights of each country in accordance with its contributing resources in the ISS project. Under the current IGA and MOU, the allocation of commercial utilization rights would be: NASA (76.6%), Japan (12.8%), ESA (8.3%) and Canada (2.3%). The Russian Space Agency (Rosaviakosmos) retains one hundred percent (100%) of the resources it provides. It should be noted that very little has been said or written about these two documents which form the foundation of ISS space partners' resources contribution and, hence, commercial utilization rights.

Since the early days of the ISS construction planning approximately two decades ago, private sectors' involvement in ISS activities has increased significantly, resulting in the volume of commercial, space related activities surpassing government supported ones for the first time in 1996. The same commercialization trend is happening and having a significant impact on participating space agencies' yearly planning as well. As an example, in its 1998 Strategic Plan, NASA set an objective of stimulating the participation of at least two hundred private sector firms by 2002 and it also calls for 100% increase in the level of industry-committed resources for ISS utilization by 2005. Currently, NASA and ESA both have 30% of its resources intended for commercial use and both have started the process of setting up commercial conditions that will make it easier for private industries to reap the benefits from space investments; Canada adopted a policy of 50% of their ISS utilization resources available to private industries for commercial purposes. Commercial utilization requests are being offered to the world's industries for the opportunity to make proposals on how they would pursue the commercialization of those resources. Russia and Japan are working on similar plans for space commercial utilization although, in recent years, Russia's manned-space program has been financed almost 50% through selling orbital access to other governments' astronauts and, most recently, to millionaire tourists.

Over the years, although participating countries have started and confirmed their intentions to commercialize their ISS utilization rights, the ramification of commercial utilization in terms of each nation's understanding for implementation may be different from that of other nations. NASA's approach to commercialization is to seek out private sectors who will invest in providing necessary services or functions currently being provided by the government through public fundings whereas CSA approach does emphasize long-term industrial development of the space user community. In other words, ISS participating agencies may have varying definitions of and objectives for ISS commercial utilization. For the purpose of this paper, commercial utilization means the employment of private sector resources to generate revenues for the purpose of providing goods and services meeting the space agencies' requirements. As the ISS construction is approaching its completion, the time has come for private industries to participate in and optimize their commercially viable investments that will benefit humankind by improving the lives of ordinary people on Earth. Nevertheless, confusions surrounding ISS commercial utilization has existed within private industries and governments due to recent ISS related decisions and events by participating countries, decisions/events which could result in unexpected complication, impairing the effective management of ISS commercial utilization. This raises concern about the very specifics of how these decisions have been made and their impacts to the ISS commercialisation process. The following selected cases are identified with the said decisions/events, resulting problems and issues, the resolution of which could lead to improvements on ISS commercial utilization. They represent current, limited commercial activities identified, discussed and forecast with certain degree of accuracy. The cases are presented to illustrate the commercial utilization objective, decisions/events implication, resulting complication, and possible solution approaches recommended for the potential problems.

Cases Impairing Effective ISS Commercialization

Case 1: Research & Development (R&D)

- **Objective:** Finding private sector interests in space R&D which will contribute to improving life on Earth, e.g., research under microgravity conditions whose discoveries will help developing new diagnostic and therapeutic developments in medicine as well as testing new drugs in the battle against the various diseases.

- **Decision/Event:** NASA's 2001 decision to cancel a rescue vehicle, the Crew Return Vehicle (CRV), designed to ferry up to seven people back to Earth in the event of an emergency as well as plans to build crew quarters (dormitory module). This decision is in line with NASA intention of scaling back the ISS to wrestle it within a \$25 billion cost cap.
- **Complication:** The CRV will make it possible for at least six crew members to live and work aboard the ISS. Without the CRV and with a resulting, reduced crew of only three astronauts at any given time, the ISS primary focus of space station activity will be housekeeping, not first-class laboratory work. Notwithstanding, the fact that in a meeting of ISS partners held in Tokyo in December 2002, an all-agencies proposal called for a phased expansion of the ISS to accommodate a larger permanent crew beginning in 2006 or 2007, nothing seemed to be clear in terms of how many crew members will remain on-board the ISS, how much scientific research will take place, when the experiments should be launched as well as when and how crew members will be returned to Earth, etc. In addition, significantly expanding the ISS's capacity by 2006 will require that two Soyuz capsules remain docked to the orbital outpost at all times. This remains unclear how ISS partners will pay for the additional Soyuz vehicles to be built by the cash-trapped Russian Space Agency (Rosaviakosmos) as Russia's commitment to provide two Soyuz crew rescue vehicles a year is due to expire in mid 2006. In addition, the February 1, 2003 destruction of the Columbia shuttle during re-entry and the subsequent grounding of the remaining three shuttle orbiters will definitely delay the assembly of the ISS. All these complications will put private investors in the dark in terms of the planning and scheduling of their ISS commercial investments and utilization as there will not be any short-term mission to the ISS and how international space partners proceed, both strategically and financially with commercialization will depend a lot on what the Columbia investigation uncovers.
- **Possible solution approach:** Notwithstanding budget constraints and the Columbia disaster, NASA and ISS partners must keep their commitments in December 2002 to increase the space station crew to at least six by 2006 in order to make best use of the station laboratory for more scientific research and commercial utilization than the ISS can handle at present, as the chief rationale for the very existence of the ISS was that it would foster leading-edge research. They should consider steps to keep the station occupied in the absence of regular space shuttle flights by considering the purchase of Soyuz vehicles from Russia to continue the assembly of the station so planned space based research can be done as soon as possible since this has been considered a very risky business with a long payback time and, consequently, normalize the process of ISS commercial utilization. Although NASA is being impacted by the Iran Non-Proliferation Act, a three-year-old law that prohibits the American Space Agency from purchasing Russian space hardware unless the U.S. president certifies that Russian aerospace companies have not aided Iranian missile programs for at least a year, an alternative approach to follow to avoid the impact of the Act is possible, i.e., an exemption or a waiver from the Act due to an exceptional situation, like the Columbia disaster. The faster this matter will be resolved the more confidence the private industry community will have on the well-intentioned ISS commercial utilization process where ISS commercial customers are engaged in potentially profit-making objectives. The decision made earlier this year in which the ESA proposed a possible arrangement to buy Soyuz spacecrafts for ISS crew rescue, in exchange for a reduction in Europe's requirement to make cash payment to NASA for space station services, is a positive step to resolve this issue, one of the thorniest issues currently facing ISS partners.

Case 2: Education & Entertainment

- **Objective:** Attracting and fascinating large audiences to promote public awareness of space activity and its benefits for mankind through education and entertainment activities carried out by private industries. For education, activities to make younger people aware of what they can do on-board the ISS and how they can become the next generation of scientists, engineers or space travellers. For entertainment, private broadcasters could transmit programs from space.
- **Decision/Event:** Participating space agencies are currently embarking on education and entertainment projects, for individual reasons, to meet each agency's objectives. A film about the ISS was made by the IMAX Corporation and shown in theatres worldwide. Some members of the first ISS crew have already visited a number of schools in many of the participating countries.

- **Complication:** In contrast to the R & D area where the markets for commercial utilization are fairly identifiable, (e.g., the private industrial companies which had carried out microgravity, materials and life sciences projects over the years) the market for potential commercialization users in education and entertainment area from private industries can not be anticipated with certain degree of accuracy, resulting in incentives to develop the markets and seek out commercial opportunities were carried out individually by each participating agency. Moreover, the need to identify and approach public and private broadcasters for education and entertainment (Edutainment) has never been studied and examined thoroughly and jointly by all ISS partners, probably due to the fact that there was not any serious study associated with the existence of a commercial market in this area. It seemed there existed no coordinating effort among the agencies in this area. In addition, the entertainment industry represents a deeply controversial one. It is the focus of many policy battles over the issues related to the promotion of violence, alcohol, tobacco, pornography, materialism, and a number of other products and values that people do not approve of.
- **Possible solution approach:** The ISS is an integrated, multi-country structure. Consequently, what one country is doing is going to affect all other partners, particularly in this area. Commercial edutainment projects, whose market is still in need to be well-developed and whose activities will be under close scrutiny by worldwide media, the public and world decision makers, must be selected based on evaluation of the useful purpose of each proposed project by a joint committee of participating agencies. As the products and services in this area are information based deliveries (e.g., educators, publishers, producers and broadcasters etc.) the criteria for evaluation should include access to timely information, interaction with the ISS such as crew interaction, remote viewing, etc. Although education and entertainment may represent a significant growth area in commercial utilization, these are sensitive areas to the public. Education utilization must be concentrated on showing and making younger people aware of what they can do onboard the ISS, including science and geography lessons transmitted from space reflecting a rare opportunity to witness space based science as it happens. It will have the greatest impact on the students' personal development by exciting and challenging their interests in this new frontier of space. Commercial utilization approach by partnering with the entertainment industry must be carefully planned as this will reflect ISS partners' perception of democracy, freedom of speech and expression which may create controversies to the detriment of public support for the process of commercialization. Moreover, in order to establish effective commercial utilization in this area in parallel to the Research and Development one, an intensive market study must be carried out by each partner in their respective country to identify commercialization opportunities which will not impair the ISS's primary function of R & D. Also, training must be provided to those responsible for commercialization at participating agencies to better understand the meaning of customer services for commercial utilization of manned space flights. One possible scenario is to group various marketing organizations of participating countries into one unique entity for more effective coordination and interfacing effort with all commercial stakeholders.

Case 3: Tourism & Space Travel

- **Objective:** Commercialize space flights and promote space tourism and space travel by offering commercial guest missions of non-professional astronauts to the ISS and by focusing on trying to turn the unfinished ISS into a tourist destination.
- **Decision/Event:** To date, the Russian Space Agency has sent two space tourists to the ISS for commercial purposes. American businessman Dennis Tito was the first space tourist, paying a \$20M USD for a Soyuz flight and week-long stay aboard the orbital orbit. Mark Shuttleworth, a twenty-eight year-old Internet tycoon from Capetown, South Africa was the second person to have visited the ISS. In February 2002, NASA and ISS partners issued new rules for the selection of space travellers as well as for professional astronauts. This has an expansive section addressing conduct that would bar some visiting researchers or millionaire tourists from making trips to and from the ISS.
- **Complication:** Until the issuance of the above-mentioned rules, complication is associated with the non-existence of such a set of criteria, causing great concerns among station partners in terms of traveller's safety and space station security. Following the Tito and Shuttleworth flights to the ISS, two more candidates (Lori Garver and Lance Bass) have announced their intentions to compete for sponsorship-based bids to visit the ISS in the near future. In addition, for ISS partners to develop the technologies required to

provide the safe, reliable equipment needed to take the general public to space at an affordable price will be a big challenge. The loss in 1986 of space shuttle Challenger and its crew, including New Hampshire school teacher, Christa McAuliffe and this year's loss of the Columbia shuttle and its crew testified for considering all factors, particularly those pertaining to safety, affecting civil space tourism into consideration for any space commercialization approach.

- **Possible solution approach:** Although the U.S. Congress has passed the so-called Commercial Space Act in 1998 directing NASA to promote for-profit use of the ISS, NASA has done little in terms of having a commercialization plan addressing the tourism issue, particularly with regards to impacts to other ISS contributing partners. This has led to non-professional tourists being allowed to fly to the ISS without consent from all partners. As a market survey (Yankelovich Partners) indicated, the space tourism market could consist of 55 million people who would take a two-week vacation aboard a space shuttle that has all amenities of a cruise ship: it must be the right time now to prepare and release a Tourism Act for the ISS commercial utilization with concurrence from all participating space agencies since the ISS was not originally designed to house casual visitors and such activities are not in its charter or operations plan. This Act must define what a private-public space tourism partnership should be, emphasis on the safety of space travellers, (e.g., sections addressing consensus among ISS partners on tourist's selection criteria and process) and the flight costs, as sending people to space constitutes high risks in terms of reliability, safety and cost. Also, it is imperative that the partners need to invest enough resources to explain why they are sending non-professional astronauts to the ISS and develop the technologies that will make space tourism become safer and more economical. Notwithstanding, the market for space tourism could be big and with, perhaps, publicly-funded technology and privately-funded resources, the potential may become a given. Space tourism, consequently, could be a great market for the future. It will create profits that can be re-invested in space development activities.

Case 4: Marketing, Advertisements and Communications

- **Objective:** Finding private sector interests in marketing and advertising opportunities through various forms of corporate sponsorship as well as in communication which promises and has already proven outstandingly broad and significant usefulness.
- **Decision/Event:** In a draft report, NASA has adopted a process for granting and controlling the right of private companies to sponsor NASA missions and programs, i.e. NASA would seek corporate sponsors that could plaster their emblems and logos alongside NASA's and allow merchandising that promote NASA brand. As an example NASA may allow McDonald's to put its logo on the ISS gallery in exchange for the latter to promote space exploration to kids. It was in April 2001 that Mr. D. Tito and his cosmonaut crewmates filmed the first television commercial aboard the ISS on behalf of the sponsor, Ft. Worth, Texas-based Radio Shack. One of the top communications companies in Europe, Bikker Euro RSCG, had set up a program to match sponsoring companies with research projects on the ISS, which has maximized the company's public relation benefits.
- **Complication:** Assisting private corporations in their marketing efforts by using publicly-funded ISS facilities could create backlash. In addition, questions may be raised concerning the type of message the partners would like to send to the public through private industries, such as difficulty in controlling the branding issue of the corporations. For years, the communications area had taken the strongest foothold in the commercial utilization of space; communications satellites have extended our television capabilities to a world-wide basis. Communications, the most significant sought-after expansion of the ISS commercial utilization services to date could be compromised as prioritized commercial use due to the aggressiveness of private corporations' efforts in Marketing and Advertisements.
- **Possible solution approach:** The ISS partners must decide among themselves on images associated with the marketing, advertisement and communications aspects of the ISS commercial utilization and commit resources to accomplish this important objective. The images must be conveyed to attract a new generation of commercial partners and clients. The agreed-upon images must lead to a value added advantage for private companies to be willing and happy to use the names, logos, and other symbols to advance their marketing efforts, e.g., working with traditional players in global tourism to have the excitement of space more accessible to international tourism. As each ISS partner is involved in the ISS for different reasons,

each should communicate its wish to reflect the images and prioritized areas which will not impair the objectives of its involvement in the construction of this laboratory facility in the first place.

Case 5: Brokerage and Financing

- **Objective:** Finding private companies interested in ISS, not as end-users, but interested in brokering ISS access for other users, are going to reap the benefit of receiving a percentage of the business they arrange, as well as looking for private venture capital companies desirous to do business with those involved in ISS commercial utilization.
- **Decision/Event:** There exists no set of criteria for brokers interested in this space brokerage business. However, some participating agencies, notably ESA, has signed a commercial contract with Introspace of Hannover, Germany, that is paying two million Euros (\$1.7 M USD) to ESA for the right to find customers that want to use ESA's station resources. Introspace will receive a percentage of the business it arranges.
- **Complication:** Consensus among participating space agencies on this case has not been reached yet although there exists a wide variety of private companies that have expressed their interests in playing a brokerage role like Introspace for various reasons. Also, in the financial sector, realizing such a brokerage role can generate profitable businesses, venture capital groups or large banks may be interested and convinced of the soundness of ISS commercial utilization investments. However, since there is no guideline to show them how to approach ISS partners to discuss potential business opportunities and identification of potential legal problems arising out of commercial utilization of space, commercial ventures in this case will be slow to evolve, missing exciting phases of ISS commercialization.
- **Possible solution approach:** Guidelines on criteria pertaining to brokerage and financing activities on the commercial utilization of the ISS must be established as soon as possible to meet the growing demands in this evolving area. Many applications will require international acceptance either by treaty or by international cooperation and collaboration. However, the test of value for space commercial utilization will be the financial return to investors. Consequently, successful business cases on brokerage such as Introspace must be exposed and presented to interested parties to jump start this sector to take advantage of the wonderful commercial potential of the ISS facility. Realizing the immense potential that exists in this area and the cost for ventures in space is compatible with the economic return, private companies will definitely participate in this glamorous undertaking.

Conclusion

Although there are on-going cases impairing ISS commercial utilization, the ISS, which is mankind's largest scientific and technical project of international cooperation, is an extraordinary resource that has the potential to optimize commercial processes and develop better products using the unique, specific conditions in space. The market for ISS commercial utilization still needs to be developed and the market segments opened. It would involve a critical technology transfer period in which the technologies are commercialized, capitalized and turned into products. Market studies and analyses showed extremely good potential for this development; advertising and entertainment services sector could be opened up as long as they do not impair the ISS's primary research function. In addition, the commercial utilization of space, with its tantalising potential, is possible only in a reliable, uniform and legal framework. Consequently, in order to optimize the commercial utilization of the ISS' international resources, the station partners must create clear commercial, legal and user-oriented access conditions which should be easy, fast, safe and affordable to private industries, i.e., make ISS commercial utilization faster, safer, cheaper and easier for each commercial user desirous to access the ISS. A large consensus about the scientific and commercial utilization of the ISS resources must be obtained among ISS participating countries. A strong interest in using ISS resources for commercial utilization can, if nurtured properly, emerge in key business areas worldwide within the next decade, although the tragic accident of the Space Shuttle Columbia on February 1st, 2003 had major consequences for short-term commercial utilization activities and industrial involvement in this process. Poor implementation of this process will result in failure to capitalize on the tremendous commercialization potential of

the ISS. As a result, continued development and improvement of the implementation process is urgently needed to quickly start the planning process of obtaining the partners' commercial utilization objectives. Thus, an attempt has been made in this paper to present certain cases associated with what continues to be complicated issues impairing ISS commercial utilization. The cases presented were valued as much for the insights they provided as for the confidence ISS partners instilled in the commercial utilization process for the eventual availability of ISS resources for commercial purposes. They could be used by commercialization managers in bettering their management of the implementation process and also enable these managers and private investors/users to gain a valued understanding of certain problems and issued concerned commercialization stakeholders are currently facing in practice.

Never before has a management process been developed and marketed in an intensive and comprehensive way by participating space agencies as the ISS commercial utilization one. Let's hope that the many recent involvements of the private industry in the process, (e.g. companies ranging from hi-tech to media that are already benefiting from being onboard the ISS) will result in improvement of the lives of ordinary people on Earth which, after all, should be the ultimate objective of this international facility. As world attention and media scrutiny will be on the ISS as it develops and contributes to society development, it must now be the time for the private industries to play their part in realising the full potential of ISS commercialization by investing more in space-based business opportunities.

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