IMPEDIMENTS AND MITIGATIONS TO ISS COMMERCIAL UTILIZATION

ISS COMMERCIALIZATION STUDY RESULTS

During the course of our meetings, the CSVAT members supplied our team with numerous first hand experiences of failures and frustrations in commercial space activity. From this history and KPMG's own analysis, we have distilled a list of key impediments that hinder the commercial use of the ISS. We have also developed a series of recommended mitigations to these impediments.

It is important to recognize that even with the full resolution of these impediments there is no guarantee that commercial utilization of the ISS will occur. It is clear however, that without mitigation or full resolution of these impediments, minimal effective commercial activity will take place on the ISS.

The impediments discussed herein represent only the most significant impediments identified through the development of this report; additional impediments may yet appear, and will have to be proactively dealt with as they are uncovered.

AWARENESS

Awareness Impediments

- Lack of awareness regarding the history of microgravity research on Shuttle and other facilities is an impediment to commercial activity on the ISS. If the benefits of space-based research are not understood, then meaningful value cannot be attached to it.

- Currently the wide variety of ISS facilities, functions and capabilities are not well understood by the prospective non-aerospace user communities. These would include not only use of the pressurized laboratories but the external payload sites and other non-traditional uses as well.

Awareness Mitigations

- Continue to support the CSCs, currently the most effective NASA organizations for promoting the commercial value of space-based research to industry. By building long-term relationships between industry and academia, the CSCs encourage industry investment in space research. As a result, the CSCs are in a position to provide highly targeted outreach in the short-term, which increases awareness of commercial ISS opportunities within some of the most promising industry sectors.

- Developing and executing a comprehensive and targeted marketing strategy to increase potential ISS utilization by the commercial sector will help resolve impediments due to lack of awareness. An essential component of the strategy should be focused on effectively communicating information regarding the history of microgravity research, its success stories, the valuable capabilities of the ISS and the attributes associated with those capabilities. The communications efforts should target the decision-makers of all the potential user communities including traditional aerospace and non-aerospace industries by:
  - Publishing articles in the appropriate trade and industry journals;
  - Giving presentations regarding Shuttle successes and ISS capabilities at relevant, trade and industry conferences;
  - Conducting town hall meetings with ISS and industry representatives to promote ISS opportunities and its potential value;
  - Aggressively promoting success stories relevant to ISS capabilities.

POLICY AND REGULATORY

Policy and Regulatory Impediments

- The necessary information regarding ISS-related policies and regulations on such things as pricing, exclusivity, proprietary information, resource allocation, scheduling and other relevant issues need to be resolved. A firm understanding of the policies and regulations derived from the resolution of these issues are critical to the private sector decision-makers. Without this information, the potential commercial users are unable to compare the costs, risks and feasibility of conducting space-based R&D with terrestrial alternatives. Most importantly, it makes it difficult to determine the value of utilizing the ISS for their organization.

- The current design versus performance-based specifications - created to ensure an environment of operational safety that define the Space Shuttle and the ISS - conflict with time-critical commercial users. Unless this conflict can be resolved, while still preserving necessary safety features, NASA's operational constraints will continue to limit commercial utilization of the STS and the ISS.

Policy and Regulatory Mitigations

- It is essential that policies and regulations be developed and communicated to the potential user community as early as possible. The sooner those issues are resolved, the greater the likelihood of early commercial participation. By taking into consideration the needs of the potential user community during the development of the commercial operations policies and regulations, the ISS may find itself a more competitive, attractive and user-friendly service.

- Reduce the constraints on operation and utilization of the Shuttle and ISS by allowing for reasonable program risks. Regulatory procedures and processes should be evaluated with an eye to reducing the total burden and duration of the entire process, while still maintaining sufficient safety standards.

FINANCIAL

Financial Impediments

- The price of access to the ISS for the traditional customer by utilizing the Shuttle is just too high. It would be difficult to justify the expense of going to the ISS for almost any purpose if the customer must face the $7,500 - $10,000/lb. cost of Shuttle transportation.

- The perception of the current regulatory process for using the Shuttle and the ISS is considered to be time intensive and hence expensive. In the commercial world, time-value of money relationship is paramount. Even if there were no delays in Shuttle launch schedules and the paperwork and review processes went smoothly, the overall system would still be too lengthy and complicated in its current state. Industry R&D timetables are structured around the commercially driven, extremely rapid lifecycles they face, not currently compatible with Shuttle turnaround times. In contrast, the NASA process for manifesting a payload on the Space Shuttle can take as much as 24 months, thereby making the experiment results largely irrelevant in the fast-paced world of commercial product development.

- A fundamental lack of available capital to finance private commercial activities in the areas of microgravity research and other space-related activities, given the available terrestrial alternatives for investment, is a factor that will limit the potential commercial success of the ISS until the cost/benefit calculations are better understood.

Financial Mitigations

- Continue to explore and implement new mechanisms for reducing the costs associated with using the Shuttle and the ISS. The Shuttle is perceived to be one of the largest components of the potential total expense of the ISS. Reducing costs will not be an easy task but given the significance of the issue, it will be necessary.

- A significant reduction in the time required to manifest, integrate, launch and return a commercial payload is necessary to improve the utility of the ISS for commercial customers. Reducing the lead and turnaround times will make the ISS a more attractive option and will be fundamental to fostering private sector demand for the ISS. This would also include ensuring the

consistent availability of the Space Shuttle and the ISS for commercial customers until such time as alternative methods to access the ISS (e.g. RLV's) come into service.

- NASA and legislators may want to consider various potential tax credits that may assist in the creation of stronger commercial markets for the ISS. The CSVAT and KPMG believe that tax incentives could provide encouragement for investment in commercial activities aboard the ISS.

TECHNICAL

Technical Impediments

- The ISS was designed primarily to meet the needs of government research. As a result, some in the private sector R&D community question the value of the ISS for conducting commercial activities. Some of the capabilities that will become available on the ISS are already crudely, but relatively inexpensively, simulated on Earth (e.g., vacuum chambers, drop towers, bioreactors, etc.). The truly unique attribute of the ISS - extended duration, human-tended microgravity – is not at this time fully understood and thus not in wide demand by the private sector.

- For microgravity research on materials or drugs, the results must be usable in a production environment on Earth, otherwise there is no value in conducting the research until long-term commercial facilities are available in space.

- The private sector has not shown interest in conducting pure scientific research not tied to a measurable return on investment. While there are some research areas in which applied R&D could be conducted on the ISS, the ISS is primarily designed for conducting basic R&D. This is in direct conflict with the industry trend away from basic, towards more rapid turnaround applied R&D.[4]

- The limited resources on the ISS in terms of available power, rack space, crew resources, data and other communications packages etc., are perceived as a barrier to commercial growth in its current configuration.

Technical Mitigations

- Emphasize the specific attributes of the ISS that are not reproducible through any other technology means and target efforts to show how beneficial the ISS could be to the individual segments of the potential user community. By providing the specific information that addresses the needs of that customer segment, the value of the capability will be more easily understood by the user.

[4]National Science Foundation, Division of Science Resources Studies - "National Patterns of R&D Resources: 1998", NSF99-335, by Steven Payson

- In order to encourage companies to consider investing in use of the ISS for conducting basic R&D, create a mechanism for translating the R&D output into commercially marketable products. As an example, in the area of pharmaceuticals, R&D gathers research data on the ISS for dissemination to the private sector, which can then be used for products and services developed on the ground. Unless the terrestrial value and transferability of space-based R&D can be demonstrated to companies, the level of their interest will not improve from today's extremely low levels.

- NASA should strive to improve upon existing mechanisms such as the CSCs, promoting broader industry/academic consortium participation to spread the risk and cost of conducting basic R&D. This would also provide the important benefit of rapidly disseminating news of successful research and any "home-run" successes to the larger commercial user population.

- Look for opportunities to augment ISS capabilities so they are more closely in line with private sector needs (e.g. enhanced communication systems, power supply or other dedicated commercial facilities, etc.).