

IAC-10.B3.8. – E7.7.7

**Merchants on orbit – challenge for diplomats on Earth.
Or about impact of commercial aspect of ISS operations
on the framework of international partnership**

Jakub Ryzenko

PIAP, Poland

&

Institute of International Relations,

Warsaw University, Poland

jakub.ryzenko@onet.pl

The paper analysis potential paths of commercial activities on the ISS and attempts to identify resulting challenges for the ISS partnership. Its purpose is to identify legal, political and organisational issues that may require attention in the coming years.

Recently announced US intention to substantially increase involvement of commercial entities in ISS operations may have a significant consequences, both for operational and political aspects of this international venture. Some challenges – like doubts about reliability of service – are relatively obvious. Some other, like influence on legal framework or evolution of traditional “non-exchange of funds” rule, are not so apparent and require much better understanding. Presence of commercial actors, driven by different logic and motivation, may change several equations.

This paper represents an independent analytical approach, aimed at identifying issues that may represent a significant challenge for legal and political aspects of ISS partnership. Its main intention is to map the most significant difficulties, but it does not intend to recommend solutions. Therefore in many cases the questions remain unanswered.

For that purpose of the analysis the paper explores two scenarios of different involvement of commercial actors in ISS future. In the first scenario commercial vehicles are used to provide crew and cargo transportation. The second scenario assumes a much wider commercial

involvement, projecting extension of ISS with commercially owned and operated module.

Commercial crew and cargo transportation

Availability of commercially developed reusable launch vehicles for both crew and cargo transportation may represent an opportunity to significantly reduce cost of ISS operations. At the same time it might become a source of new difficulties.

Current developments suggest that for a number of years the only companies capable to offer commercial logistic services for ISS will be of US origin. From a US policy perspective such situation is satisfactory, as a significant burden of ISS logistics remains responsibility of the US and fulfilment of those obligations will provide additional benefit in the form of supporting development of US industry.

However, this will become a political issue when extension of ISS operations beyond currently agreed horizon will be negotiated. US will be perfectly willing to conduct logistic operations contracting US companies to transport both crew and cargo. But for other ISS partners logistic arrangements will be more problematic. They can provide proportional upmass services using ATV and HTV vehicles,

even if using them may be more costly than contracting the existing US companies. However, at least as for today, they are not able to offer downmass capability nor crew transportation.

Direct contracting of US companies by international partners would be a politically difficult choice – the concept of supporting development of own industry remains at the foundation of space activities rationale and funding foreign companies is in clear contradiction to this principle. The more probable solution may be a new wave of barter agreements, where US government provides higher share of total ISS logistic services (both crew and cargo) and in exchange US receives different benefits from partners, from research opportunities to development of new hardware.

The alternative circumstances could be created by a decision taken by one or more partners to support development of own space transportation commercial companies. Such move would certainly be opposed by US, probably offering the more favourable conditions for “barter-based” logistics. But if a non-US companies space transportation companies manage to grow, their services may have an stabilising influence on ISS future. If at certain moment US decides to withdraw from ISS or limit its involvement, other partners having logistical services provided by own industry (potentially even jointly by cooperation of several non-US companies) may be more willing to continue station’s operations than in situation when they would still need to contract US companies.

When commercial space vehicles start servicing ISS, several new issues will arise.

Operating space vehicles will remain a risky profession. Even assuming new vehicles will have a ten times higher safety factor than space shuttle (let us assume risk of loss of crew: 1/2500), they are expected to be used regularly. If a commercial crew is expected to conduct 5 flight per year,

during 10 years service their statistical risk of loss of life will be 1/50.

Unless we are going to have available spacecraft with a much higher reliability, safety will remain one of the most significant issues. Also public reaction to disaster will still need to be taken into account by governments funding ISS operations. And from a very practical point of view, there will be need for a dedicated system of insurance for space crews.

The commercial crews will be professional, but they will not be government employees. What will be their status in light of rescue agreement? Will they be treated as other professional astronauts or are we going to end up with three separate legal categories of humans in space (the third category being non-professionals)?

Several research activities conducted onboard ISS might have a high commercial value and contracting companies will certainly require strict confidentiality, both for conduct of experiments and for information about their results. With a growing number of personnel onboard it may become necessary to establish limitations for freedom of access to some laboratory areas. The same will certainly be required, and probably to a greater extent, if there is a growing number of tourists onboard.

Companies providing commercial transportation will certainly be willing to seek additional sources of income. One of its sources may be launching of “piggyback” satellites on the way to ISS.

Certainly, this could not represent any direct danger to ISS, as any such operations would be strictly forbidden (most probably embedding appropriate restrictions during licensing of launches). But the unintended consequence of high number of such flight opportunities may be a significantly increased number of spacecraft on the orbital plane of ISS. In a

longer perspective, this may become dangerous, particularly in case of any future collision of satellites on that plane.

The other interesting issue may arise, should US transportation companies want to combine on the same flights ISS deliveries with additional services for military clients. How would such behaviour be regarded by other ISS partners?

In contingency commercial vehicles docked to ISS will certainly be used at discretion of ISS Commander or the Flight Director. The example of such situation may be use of vehicle's engines to modify ISS orbit, if there is a risk of collision with space debris and normal procedures cannot be followed for whatever reasons.

However, as transportation is provided as a service, the commercial vehicle will not be under command of those commanding the station. Therefore there is a need for special regulations, either embedded in contracts or in a form of separate general Code of Conduct, clearly defining rights and obligations of all "third-party" vehicles present at or operating around the station. Emergency situations will represent a significant part of those regulations, but there may also be need for some general rules of order.

Finally, as commercial vehicles will be becoming a major mean of crew transportation, the problem of emergency operation will arise also in this context. Currently it is assumed that professional astronauts will be ready to fly potentially dangerous evacuation missions or others involving additional risks to save people.

There is no reason to expect the situation will be different with commercial professional crews. However, appropriate prearrangements will be required for such cases, most probably based on voluntary declarations of crews and standing contracts for provision of emergency services. Furthermore, such arrangements

will also need to regulate compensations in cases when commercial company is expected to risk its vehicle.

And there is a question that will be particularly difficult to answer: who will take final decisions about conducting a high-risk operations – commercial vehicle commander or ISS Flight Director? And consequently: can Flight Director assume full availability and flexibility of use of commercial vehicle in contingency?

Commercially owned and operated ISS module

In a slightly more distant future there may be a growing interest in commercial participation in ISS operations. Such participation, when of sufficient scale, will naturally tend to take a form of developing a separate commercial module to be attached to ISS.

From a purely technical and operational point of view concept of a commercial ISS module may be more effective than development of a separate commercial space station. For a company willing to provide permanent services on orbit – whether a commercial laboratory or a tourist hotel – sharing of infrastructure, resources and logistic services with ISS might represent a significant advantage. It is not clear however whether those benefits would be sufficient to leverage several programmatic risks.

Not entering into business case of commercial activities, it should be noted that there are two separate organisational approaches that could be applied.

The first, traditional approach would require the company to negotiate with one of the partners a right to join this partner's segment of ISS. Consequently, from the ISS partnership perspective, commercial module would be regarded as an additional contribution of a partner nation. All contractual regulations would remain internal issue between partner and the company.

The alternative approach would require commercial company to become a full partner of ISS, similar in status to ESA or Japan. Certainly, the company would still need to be registered and licensed in a particular country, but its orbital infrastructure would be considered separately from this country's government segment.

The first approach appears to be simpler from organisational point of view, as it isolates the ISS partnership from increased complexity resulting from inclusion of a new partner, operating in a very different manner. It also saves the commercial partner a significant management overhead related to the full participation in the ISS management system.

Nevertheless, in reality this approach will not isolate the ISS partnership from most of the risks related to commercial participation. It is unlikely that any government will be willing to guarantee stability of commercial partner activities. And if no, the risk of disturbances resulting from changes of business model or even bankruptcy will still be a risk for the whole partnership. However, as long as commercial participant would be behind "firewall" of particular partner, the risks might be not fully appreciated nor monitored by the whole partnership.

It seems probable that in initial phases of the commercial participation in ISS, as long as it is limited in scale, "interfacing by the government" might be a preferred model. With growing scale of commercial activities – and consequently, growing influence on the whole station – separate partnership might become the optimal organisational solution, at least from governments perspective.

Furthermore, the very decision to participate in the ISS, instead of developing autonomous commercial infrastructure, would involve several business risks for the company.

Firstly, as history of ISS shows, station operations regularly face multitude of difficulties and changes, often unexpected and rapid. They result in instability and uncertainty of environment for commercial operations. On the other hand, as they generally result from technical issues, similar difficulties might appear if separate commercial station is developed. And ISS, by its scale and gathered experience, may be a more stable platform for business operations.

Secondly, there is a different understanding of risks for continuous operations by governmental agency and commercial company. For the government agency lack of available resources and reduces operations may be bearable for a relatively long time. For a commercial player it would immediately cease commercial activities and may relatively easily lead to the bankruptcy.

Finally, even as the ISS partnership is built on high number of formal regulations, it has an enormous inherent flexibility. Conditions of cooperation were modified several times. And probably only thanks to this character the ISS managed to survive and operates today. Unfortunately, for the commercial company a need for flexibility of contractual rules represents a highly increased uncertainty of business conditions. And consequently, it significantly increases business risk and costs of operations.

Therefore, it is not clear today whether for commercial companies participation in ISS would represent a more favourable solution than development of separate, less complex commercial station.

Commercial participation may be also seen from another perspective. Certainly, addition of commercial module represents an increase of complexity of the ISS, both in technical and organisational terms. But it may also bring some benefits for the ISS partnership as a whole.

Firstly, it may increase the research potential of the station. If commercial

module is a laboratory, it is obvious. But even hotel module for tourists might open interesting options. Increased number of people present in microgravity would certainly represent an opportunity for more extensive research and wider research base. Furthermore, from experience with space tourist that have flown until today, it could be safely assumed that most of guests would be willing to participate in some experiments and even conduct some training programs. As a result, first years of space tourism could bring better understanding of human behaviour in space and push forward our knowledge in space medicine, literally without paying a penny of public money.

Secondly, from a purely operational point of view, larger space station would require higher number of logistic operations. But this could also result in combining government and commercial operations, making them more effective and less costly. Demand for resources would be higher – but also a number of generated resources would increase. As a result, commercial participation in the larger station, if appropriately planned, might increase station robustness and resilience.

* * *

This paper is intended as an input to discussion on potential consequences of commercial ISS operations. Therefore it presents a number of questions, but it many cases does not attempt to seek answers. Nevertheless, several of those questions require consideration in a relatively short time. And the answers will influence a shape of the commercial space activities in coming years.