International Space Cooperation: Economy As A Main Driver

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Introduction

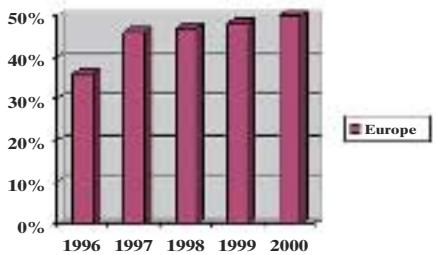
International cooperation is evidently highly influenced by geopolitical climate. Projects such as the International Space Station stem from a political will and are generally used as vehicles for broader cooperation. However, they also result in economic savings as well as interesting cross-cultural exchanges.

In this regard, international space cooperation makes "economic sense" since people from various cultures have developed different skills in different technologies. By pooling these skills, individual countries do not have to acquire them at high cost; they benefit from the expertise of the group as a whole.

One of the most significant changes in space activities over the last 40 years is the transfer from public to commercial space activities. If we consider the example of Western Europe, we can note the steady growth over the last years as per Figure 1.

In the year 2000 the 50% mark was reached, meaning that half of the Western European space turnover was privately funded. If this is compared with the nearly 60% commercial space expenditure in the USA, it seems inevitable that this figure is destined to gradually increase.

FIGURE 1



GROWTH IN COMMERCIAL SPACE BUDGET IN EUROPE

Commercial companies obviously have different goals from public, state-owned entities. If the products evolving from a satellite service cover different areas of the world, as is certainly the case with Low or Medium Earth Orbit satellites, commercially-driven companies will try to sell the services to all entities within the footprint of the service, irrespective of national borders.

Therefore, we need to make a distinction between international cooperation driven by the public sector, which has an economic dimension but carries a more paramount geopolitical motive, and the purely economically driven motives of the private sector.

International Cooperation in the public sector: the ISS example

International cooperation between space agencies certainly has an economic dimension. Similar to strategic alliances in industry, agencies have increasingly accepted the concept that know-how in certain areas is more easily obtained by cooperation than by developing it with one's own resources.

It should be emphasized here that in addition to the obvious economic considerations, the safety and reliability factor also plays an important role. NASA's interest in participating in a series of MIR flights was certainly based upon this aspect. Many years of operating the MIR station as a "closed-loop" system have led to the accumulation of considerable experience in Russia in the field of logistics and also in the handling of anomalies.

An example of this is the problem of leaks in the MIR cooling system due to a form of unforeseen material fatigue, which led in turn to a redesign of the International Space Station cooling loops. In the past, this type of information was unfortunately not exchanged, leading to a number of incidents which may have been at least partially avoided.

The International Space Station is the best example of such cooperation at present. Complete "building blocks" have been delivered by the partners based upon their respective experiences; just to quote a number of obvious examples in this respect:

- The base modules, provided by Russia, are based essentially upon similar modules with proven record on MIR.
- Approach maneuvers are improved by U.S., GPS-based technology.
- The Russian Soyuz capsules, used as rescue vehicles on board ISS, also have a record of proven reliability from the MIR era.
- The US Shuttle is providing a flexible upload capacity, which was lacking in the MIR concept.
- The Canadian robotic arm is a further development of the Canadian supplied robotic arms on board the Space Shuttle.
- Columbus, the European module, is strongly based upon the proven and successful Spacelab concept.

Cooperation is continuing along these lines. As an example the development of a rescue vehicle for ISS with bigger capacity, X-38, is a project involving a number of agencies as can be seen in Figure 2.

FIGURE 2

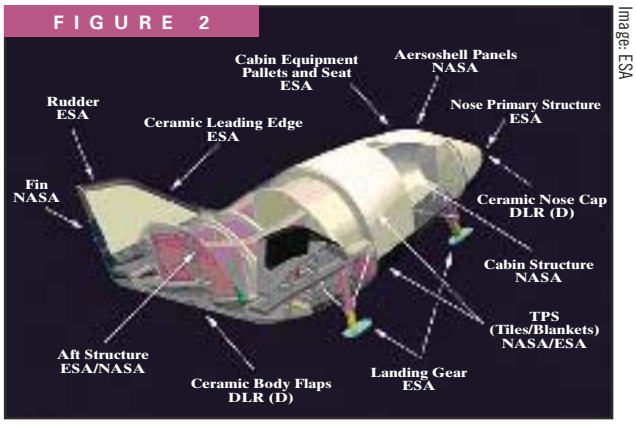


Image: ESA

THE X-38 PROJECT:
AN EXAMPLE OF INTERAGENCY PROJECT COOPERATION

It is impossible to ignore the higher political, even philosophical, dimension in this type of public international cooperation. The Apollo 18-Soyuz coupling in 1975 was a clear example of the same type of signal regarding international cooperation and, at that time, an important triumph for political détente.

This philosophical dimension was underlined in the text that the 1977 Voyager deep space capsule carried on board as a message of hope "on behalf of the people who inhabit the planet Earth":

We human beings are still divided into nation states, but these are rapidly becoming a single global civilization. . . . We hope someday, having solved the problems we face, to join a community of galactic civilizations.

International contacts are influenced by a number of factors, which complicate this process. One can distinguish between the following cross-cultural elements:

- Material culture and standards
- Language
- Aesthetics
- Education
- Religion, beliefs and attitudes
- Social organization
- Political life

The major source of conflicts and communication problems during international contacts are due to the "self-reference" criterion and to the confusion which arises when confronted with a different culture which deviates considerably from this criterion. Far too often language is considered as the only cultural difference, but the following are among a number of communication-related features which could lead to grave misunderstandings:

- The American OK sign (round finger) means zero in Europe, money in Japan and is even a vulgar gesture in Russia
- To say "no," people shake their head from side to side in Europe, jerk their head back in the Middle East, wave a hand in front of the face in the Orient and shake a finger from side to side in Ethiopia
- Whereas the color black signifies death in many countries, white represents death in Japan and many Asian countries.

In a confined environment such as on board a space station where there are few alternatives, it is evident that the effect of any aggravating, culture-specific factor will be amplified. The influence of psychological effects on crew behavior and performance has been studied in depth. By respecting the other parties' cultural values, potential problems can be compensated and with sufficient knowledge of unfamiliar cultures, likely tensions can be anticipated and the prime objectives achieved.

Closer to practice is the book published by Gesteland (see Further Reading). Here a distinction is made using the following parameters:

Relationship-focused business cultures:
People prefer to do business with persons they are familiar with; indirect, polite communication; lawyers play a consulting role.

Deal-focused business cultures:
Clear business language preferred (no small-talk introduction); direct, frank communication; negotiations often led by lawyers.

Formal, hierarchical business cultures:
Often "protocolarian rituals," formal interpersonal communication; status and titles are valued.

Informal, egalitarian business cultures:
Informal behavior is not seen as disrespectful, use of first names.

Polychronic business cultures:
Schedules and deadlines are more flexible, meetings are frequently interrupted.

Monochronic business cultures:
Punctuality is very important, schedules and deadlines are rigid; meetings are seldom interrupted.

Reserved business cultures:
People speak softly; little physical contact and eye contact; few hand and arm gestures.

Expressive business cultures:
People speak quite loud; physical touching and intense eye contact; vigorous hand and arm gestures.

If we make the link to space activities, we could for example distinguish some major ISS partners, as described in the referenced book.

From this table we can deduce:

- The ISS participants cover a wide scale of differences
- Russian and American styles are almost opposite
- On average, Europeans are situated between both, being largely a mixture.

The problems described above make the challenge even more interesting. It should be remembered that not only will the astronauts have to learn to work together, but so will thousands of people preparing the project on the ground. This will have an obvious multiplicator effect when families of such differing cultures meet in social events and it is even likely that longstanding friendships will emerge from this situation.

The "Working Together in Space" aspect is now accepted as a general motivation for every manned project. The International Space Station is considered as an interesting "social testbed" in this respect. Therefore, the somewhat less than optimal efficiency which occurs when working together in this environment may be considered a small price to pay if it eventually contributes to better mutual understanding and maybe, fostering of peaceful cooperation between nations.

International Cooperation in the private space sector

Strategic alliances in industry

Having recognized the global commercialization trend, industry anticipated international cooperation initially by forming strategic alliances. U.S. industry began preparing itself early on for this commercial market by mergers. Out of the 20 major U.S. space companies existing in 1980 only three were left in 1997.

This merging process came about in two phases. The first was a vertical approach, whereby the spacecraft manufacturers expanded into the operator market or the launcher market, in order to create independence.

Early examples of this are: Lockheed acquired Marietta (Atlas and Titan launchers) as well as GE Astro Space (comsats). Boeing acquired Rockwell (Delta, GPS, and Shuttle) and expanded further with Sea Launch and Teledesic.

Advantages perceived from this merging process are mainly:

- Ability to support turnkey services
- More competitive position
- Better feedback from market requirements.

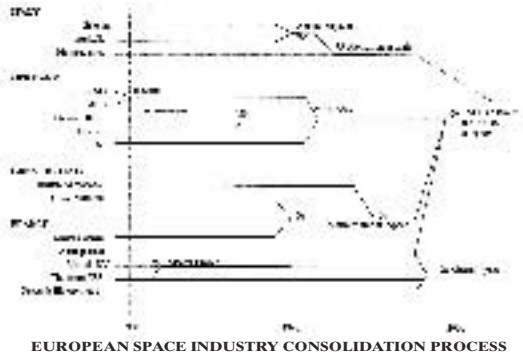
During the second phase, the major companies, through mergers and takeovers, consolidated their position. In the U.S., this has led to basically three giant companies (Lockheed, Boeing and Raytheon). The advantages of such conglomerates are:

- Possibility to offer "package deals"
- Economies of scale, mainly in production
- Risk investment possibility (e.g. Boeing invested $600 million in SeaLaunch)

In Western Europe, the main space companies had already been gradually "end-to-end" structured as a result of ESA's prime contractorship policy. Therefore, the recent tendency, as shown in Figure 3, further emphasized the forming of two conglomerates:

- EADS (fifth worldwide space company in 1999, excluding operators and service providers) with its main space entities being EADS Launch Vehicles (US $M 686 space revenues in 1999) and Astrium (US $B 1.7 revenues in 1999)
- Alcatel Space (ninth worldwide space, US $B 1.7 revenues in 1999).

FIGURE 3



EUROPEAN SPACE INDUSTRY CONSOLIDATION PROCESS

Transcontinental alliances

The next steps in the direction of international cooperation are transcontinental alliances. SeaLaunch is undoubtedly one of the most striking examples, because in this specific case cooperation has led to an innovative concept.

Table 1 summarizes the composition of the consortium and the respective involvement. The business model is based upon 6-7 launches per year, with a potential to increase to 11 after 2001.

Company	Part.	Country
Boeing	40%	U.S.
RSC "Energia"	25%	CIS
Kvaerner	20%	Norway
Yuzhnoye	15%	Ukraine

TABLE 1 : SEA LAUNCH CONSORTIUM COMPOSITION

It is evident that composing a consortium of this type would not have been possible without a geopolitical environment conducive to it. Indeed, restrictions on strategically sensitive technologies in the past would never have allowed the companies in question to undertake such cooperation.

Other examples of transcontinental alliances are strategic alliances such as:

- Alcatel (F), Loral (U.S.) and NPO-PM (Russia)
- Starsem: Aerospatiale and Arianespace (F) with RAKA and Progress (Russia)
- OHB (D) with Fiat-Avio (I) and Yuzhnoe (Ukraine).

Technological alliances such as:

- Joint venture between Lockheed Martin and Khrunichev for the construction of launch boosters
- A United Technologies (UTC) and Energomash joint

venture for the production of a new booster rocket engine, the RD-180.

Geographical alliances, e.g.:
- ASTRA - AsiaSat merger in 1998
- EurasSpace Joint Venture between Astrium and the China Aerospace Corporation.
- EuropStar Joint Venture between Alcatel (F) and Loral (UK)

There is no reason to doubt that this trend will continue during the next decade. Enterprises with "end-to-end" capacity, such as those resulting from the mergers described above, will penetrate the different markets even further, where at present such capacity is not readily available. In order to increase their chances of success, they will most probably enter into partnerships with local companies. Such combinations will satisfy both parties: the prime company will be able to deliver its main product and the local partner deals with local interfacing, while benefiting from the technology transfer.

Facilitators for International Cooperation

Regulatory Framework

A number of international standards relative to space legislation are ratified by States and are therefore compulsory rules. This is in particular the case for five conventions:
- The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies (10 October 1967). Also referred to as Outer Space Treaty (OST).
- The Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Object Launched in Outer Space (3 December 1968).
- The Convention on International Liability for Damage Caused by Space Objects (1 September 1972).
- The Convention on Registration of Objects Launched in Outer Space (15 September 1976).
- The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (11 July 1984).

These agreements all date from the "pre-commercialization" period and have limited reference to commercialization. On the other hand, resolutions adopted by the UN General Assembly, do not represent a legal obligation such as, for example:
- The Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and Interest of all States, Taking into Particular Account the Needs of Developing Countries (16 December 1996).

Only some countries have adopted relevant national legal instruments, as shown in Table 2.

Such national legislations are important, as states are still responsible and liable at the international level. However, only an international organism would be able to deal with the rules of trade between the states and fully open the way for international commercial cooperation.

The World Trade Organization (WTO) looks like the most probable candidate for fulfilling the role of an internationally recognized regulatory body. It was established in 1995 and has 135 member states. At present, only telecommunication services are expressly mentioned in the WTO texts, but it can be forecasted that this will expand soon.

International and intercultural oriented staff

International cooperation also requires the availability of internationally oriented staff. Besides the obvious parameters such as language skills, this also involves an intercultural spirit. Socio-cultural differences will always remain, but in cooperative projects the commercial objectives must prevail.

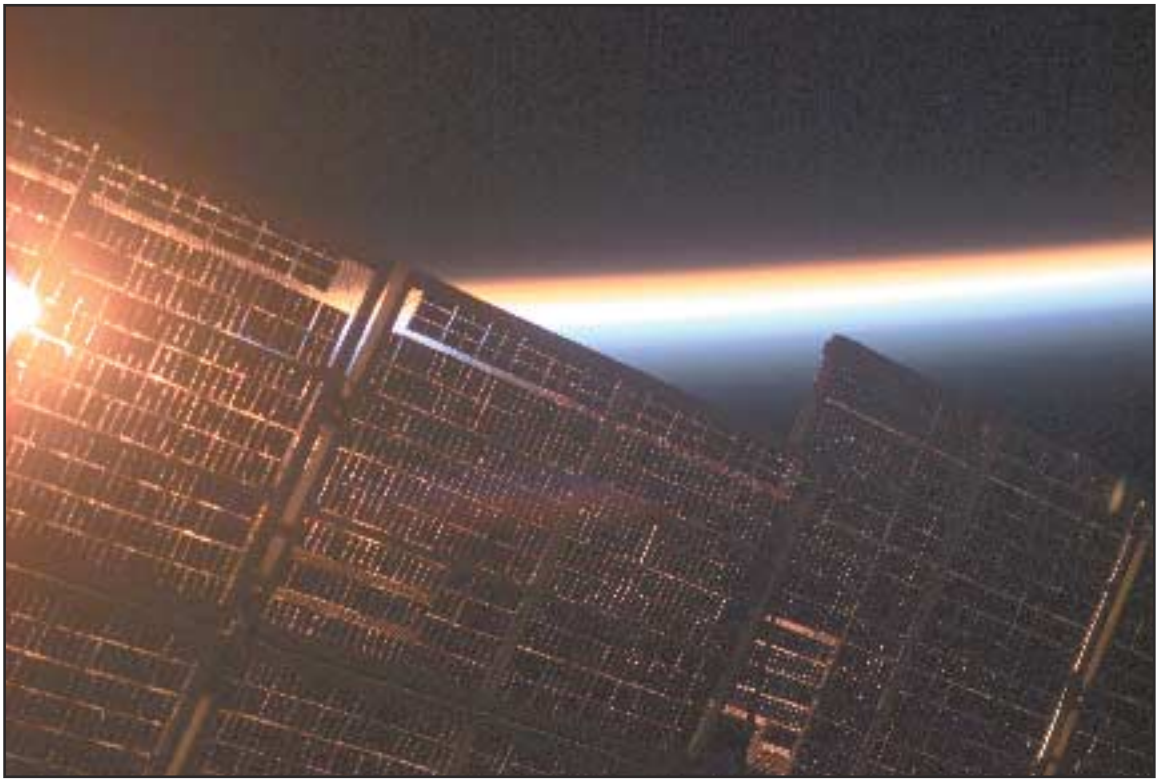
This influences the present training of future space professionals. At the International Space University, it has led to adopting what is known as a "3I" approach, representing
- International
- Interdisciplinary
- Intercultural dimensions.

Students from various nationalities (see figure 4) are brought together to benefit from programs which are delivered by permanent and part-time faculty and by lecturers drawn from the academic, government and industry sectors from around the world. This international mix, which is an important element of the student admission process, is equally important from a networking perspective. At present 1700 ISU graduates are in touch with each other, throughout all organizations, and catalyze international contacts in this way.

Country	Space legislation	Date
Australia	Act About Space Activities, and For Related Purposes	23 December 1997
Russian Federation	Law on Space Activities	20 August 1993
Republic of South Africa	Space Affair Act	6 September 1993
Sweden	Act on Space Activities	1998
United Kingdom	Act on Space Activities	1986
USA	Commercial Space Launch Activities Act (amended in 1988)	30 October 1984
USA	Land Remote Sensing Policy Act	14 June 1905
USA	Commercial Space Act	28 October 1998

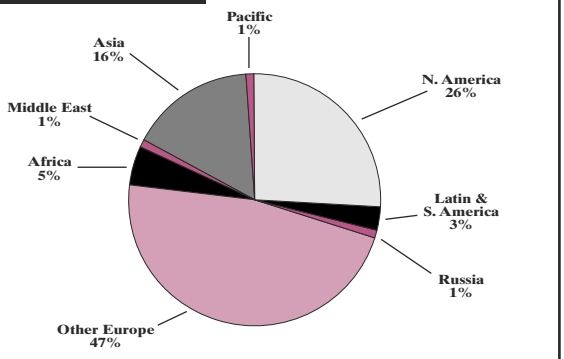
TABLE 2 : NATIONAL SPACE LEGISLATIONS

Photo: NASA/JSC



The far horizon as seen from the ISS.

FIGURE 4



GEOGRAPHICAL DISTRIBUTION OF ISU STUDENTS (1998-2001)

Important to note is also the fact that the interdisciplinary character of the students is maintained by selecting students with different backgrounds, as can be noted from Figure 4. For international cooperation this is of paramount importance in view of the differences in educational systems in the various countries. Indeed, some countries have more specialized and disciplinary-oriented educational programs, which may later lead to communication problems in a more interdisciplinary-oriented business environment.

Conclusion

Although there is a common economic driver, there are main differences in striving towards international cooperation from the public and from the private point of view. For space agencies, geopolitical considerations are evidently the paramount driver, but these are often based upon the philosophical aim to improve cross-cultural relations in general.

For the private sector the rationale is quite different: there is no doubt that the present commercialization trend will continue. Specifically in countries with a high need for space-related services, but a low local availability of the related technical know-how, there will be an increasing demand to provide the end-to-end services in the short-term. Indeed, the time to develop the necessary know-how within such countries is considered too long and preference will be given to contract the full services to experienced space enterprises, preferably involving a local partner for liaison aspects.

Industry has identified this opportunity and has prepared itself in two phases, first by forming strategic alliances and currently by constructing transcontinental ventures. From this point of view, we can safely state that this type of international space cooperation stems from international space business opportunities.

The speed with which this will evolve will depend on the environmental conditions and primarily on the regulatory framework needed to facilitate commercialization. It is assumed that the WTO will play an important role in this process.

Another factor is the training of internationally oriented staff for the space sector. Also here initiatives such as the International Space University may provide solutions and act as a catalyst for international cooperation by providing internationally oriented and interculturally trained space professionals.

Further Reading

Peeters, W., *Space Marketing* (Kluwer, Dordrecht, 2000);
Gesteland, R., *Cross-cultural Business Behaviour* (Copenhagen Business School Press, 1999);
ISU, www.isunet.edu