No Exchange of Funds – The ESA Barter Agreements for the International Space Station

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In the course of the past three years, ESA has engaged in a series of barter agreements with parties outside the Agency within the framework of the International Space Station (ISS) Programme. These agreements formalise exchanges of goods and/or services between the participating parties without a corresponding financial transaction, i.e. without an exchange of funds. This article discusses the rationale for establishing such arrangements, their main elements and their key benefits.

The rationale

The following barter agreements have been concluded so far:

- Arrangement between the European Space Agency and the Russian Space Agency concerning Cooperation in the Development and Operations of the Service Module Data Management System (DMS) for the Russian Segment of the International Space Station (ISS), and of the Space Vehicle Docking System - signed in March 1996.
- Memorandum of Understanding between the European Space Agency and the United States National Aeronautics and Space Administration Enabling Early Utilisation Opportunities of the International Space Station - signed in March 1997.
- Arrangement between the European Space Agency and the Italian Space Agency on the Exploitation of Common Features of the Pressurised Modules Developed by the Parties - signed in April 1997.
- Barter Contract for the ESA Provision of a Super Guppy Transport (SGT) in Exchange for NASA Provision of Shuttle Services - signed in August 1997.
- Arrangement between ESA and NASA regarding Shuttle Launch of Columbus Orbital Facility and its Offset by ESA Provision of Goods and Services - signed in October 1997.
- Memorandum of Understanding between NASDA of Japan and the European Space Agency on Hardware Exchange for Utilisation of the International Space Station - signed in November 1997.
- Arrangement between the National Aeronautics and Space Administration of the United States of America and the European Space Agency concerning ESA's Provision of Cupola 1 and 2 in Exchange for NASA's Provision of Shuttle Launch and Return Services for Five External European Payloads (signature cycle in progress).

The element common to all of the barter agreements implemented so far is that goods and/or services are exchanged by the parties involved without a corresponding financial transaction. For ESA, this approach is especially interesting in those cases where it avoids the need to make cash payments to non-Member States, and instead permits that money to be invested with European industry. In addition, the barter agreements have made it possible for ESA to fix the costs associated with early utilisation of the ISS by European users prior to the start of the operations with ESA's Columbus Laboratory (ESA/NASA Early Utilisation MOU), as well as the costs for launch and transportation services provided by NASA (COF Launch Barter, Super Guppy and Cupola Barters), thereby avoiding any risk of later price escalations.

The main benefits of these barter arrangements for Europe can be summarised as follows:

- No transfer of funds to non-Member States.
- Increase in work for European industry.
- Reduction of technical and financial risks.
- Contribution to standardisation and commonality throughout the ISS Programme.
- Strengthening of the ISS cooperation and partnership.

For a barter arrangement to be successful, it must be beneficial to both partners. It can therefore be assumed that our ISS partners will also benefit through, for example, risk reduction, development-cost reductions (or even complete avoidance thereof) and other technical or cost advantages.

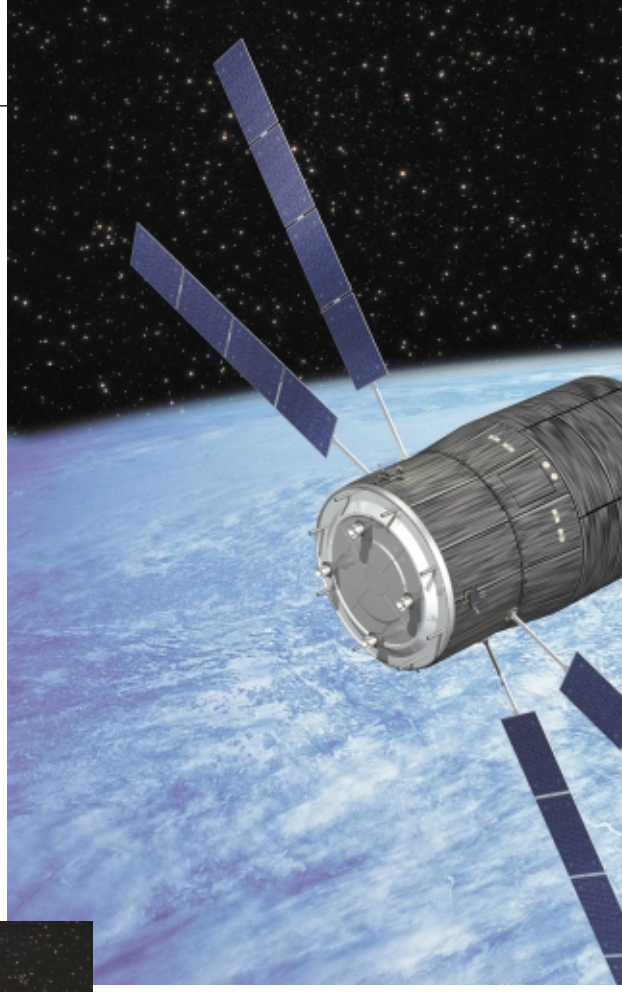


Figure 1. The International Space Station

The agreements

ESA/RSA DMS-R MOU

With this agreement, ESA committed itself to providing Russia with the Data Management System (DMS-R: on-board avionics as well as the necessary ground-support system) for the Russian Service Module (RSM). Russia, for its part, agreed to provide ESA with two flight sets of the active part of the Docking System to be installed on ESA's Automated Transfer Vehicle (ATV), as well as spares and ground equipment. Although this agreement is more of a political and strategic nature (supporting the development of technology for peaceful purposes in the Russian Federation), its financial and technical benefits for Europe should not be underestimated:

– The cost developing Docking Systems for the ATV would have been considerably higher than the cost for the DMS-R, which is the recurring cost of the data management system for the Columbus module and ATV, with RSM-specific adaptations.

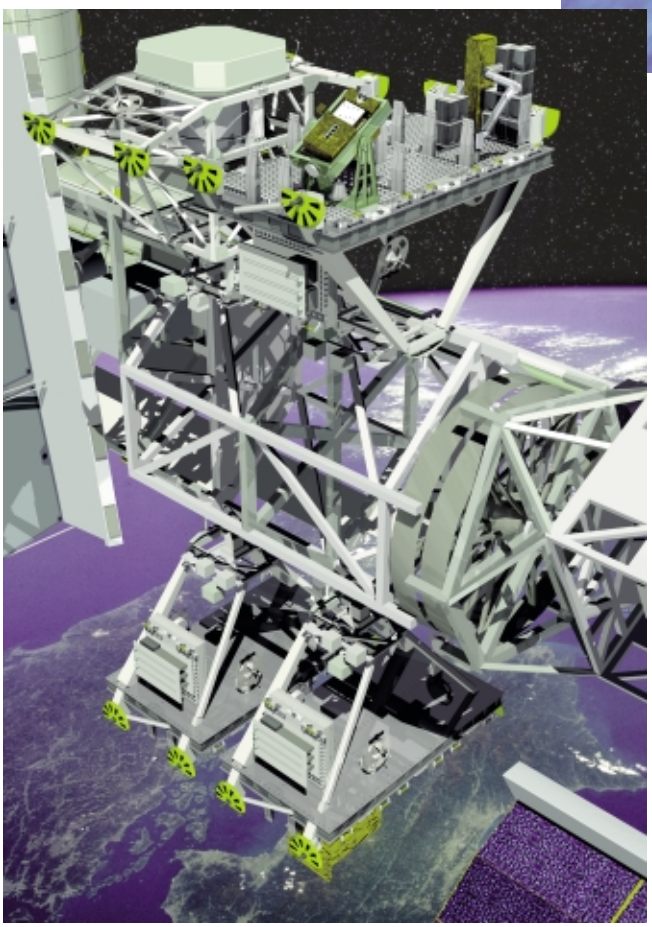


Figure 2. In return for providing the Data Management System for Russia's Zvezda Service Module, ESA received the Docking System for its Automated Transfer Vehicle (ESA / D. Ducros)

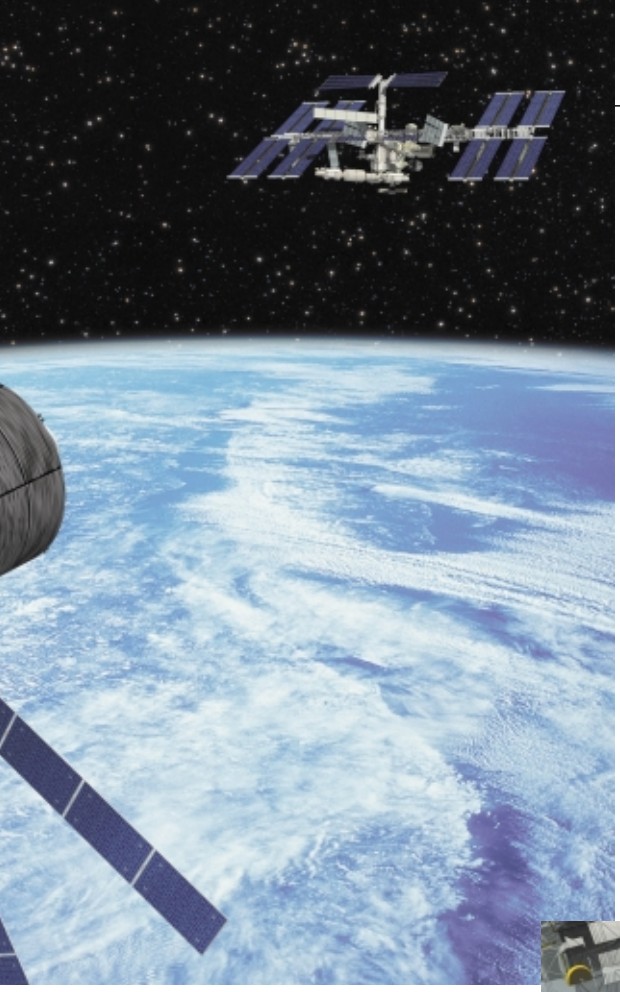
– The alternative of buying the Docking Ports directly from Russia presented a high risk of price uncertainty (significantly increased by the volatile political situation in Russia since 1996).

ESA/NASA Early Utilisation MOU

The primary objective of this barter was to ensure that the European User Community would gain early utilisation access to the Space Station, prior to the Columbus Laboratory's availability in orbit. Through this agreement, ESA has obtained access to three external payload sites – located on the ISS Truss – for three years, and to the equivalent of 1.5 equipment racks for 1 year; two flight opportunities for ESA astronauts are also guaranteed. In exchange, ESA has developed 'Laboratory Support Equipment' for NASA – the Microgravity Science Glovebox (MSG), the Minus Eighty Degree Freezer (MELFI) and the Hexapod – and implemented adaptations to the Columbus Mission Data Base (MDB) to be used as part of NASA's ISS Ground Segment.

Beyond the primary objective of this arrangement, this barter has proved to have several other particularly interesting features:

– The open-ended cost associated with the early usage of the internal and external NASA facilities on the ISS has been fixed at a level considered both affordable and fair.
– An investment in European technology development has been implemented (rather than spending European tax payers' money in the USA).

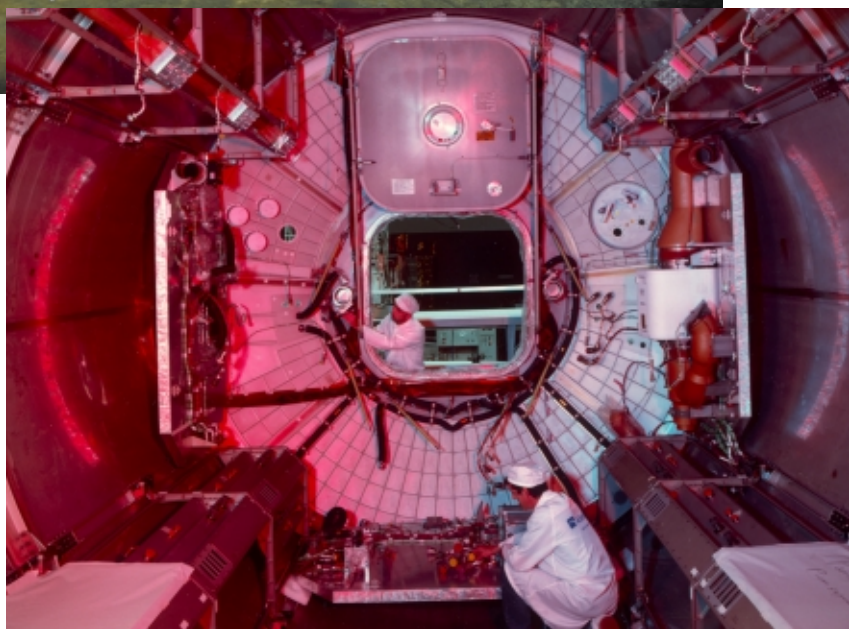


ISS elements between different NASA centres. It resulted in the provision by NASA to ESA of standard Shuttle services for ESA internal payloads, up to a total of 450 kg, in the period until end-2001 (starting with STS-95, launched in October 1998). ESA, in turn, made all the necessary arrangements with Airbus Industrie, including the payment of an ESA-negotiated price, for the transfer to NASA of a Super Guppy Transporter and associated equipment, spares and services.

This arrangement:
- avoids cash payments to the USA for Shuttle transportation services, via the spending of a fixed amount in Europe
- allows the European User Community to continue basic and applied microgravity research through to the year 2001, despite ISS delays and the shortage of utilisation resources during the first years of ISS assembly.

Figure 3. As part of the ESA/NASA Early Utilisation MOU, the Agency has access to three payload sites on the Truss (ESA / D. Ducros)

Figure 4. An arrangement with ASI has seen ESA provide the environmental control and life support system for Italy's MPLM, in exchange for the primary structure of the Columbus module (Alenia Aerospazio & ESA / D. Ducros)



- Investments already made (i.e. the MDB) have been fully exploited to the overall benefit of the Space Station Programme, standardising on a unique (European) ground database system (and opening the door to further standardisation and possible licensing, e.g. to NASDA in 1998).

ESA/ASI ECLSS for MPLM MOU

Through this arrangement, ASI is providing ESA with the Primary Structure of the Columbus module (derived from the ASI-developed Multi-Purpose Logistics Module, or MPLM), whilst ESA is providing ASI with the Environmental Control and Life Support System (ECLSS) for the MPLM (an adaptation of the ECLSS for the Columbus module). This arrangement has ensured:
- optimisation of industrial development within Europe, with the associated cost benefits (ECLSS manufacturing at recurrent cost plus adaptations, versus full development of a primary structure for the Columbus module)
- stronger commonality and standardisation within the ISS Programme.

ESA/NASA Super Guppy Barter

This specific barter originated from a NASA request for ESA to support their negotiations with Airbus Industrie for the acquisition of a Super Guppy aircraft for ferrying large critical

ESA/NASA COF Launch Barter
Through this arrangement, NASA will launch the Columbus module and its initial payload on the Shuttle for ESA, as compensation for the latter's provision to NASA of fully integrated Node-2 and -3 ISS Modules, Cryogenic Freezer and Crew Refrigerator/Freezer equipment for ISS, spares and sustaining engineering for the Laboratory Support Equipment items provided by ESA to NASA under the Early Utilisation MOU, and hardware/support for software development and integration in the NASA ground software test and integration facilities for ISS.

The key benefits of this arrangement for Europe are:
– the procurement at fixed conditions – avoiding the risk of price uncertainties and cash payments to NASA – of the launch of the Columbus laboratory
– the creation of additional industrial work for Europe in high-technology domains.

Figure 5. ESA is providing the Station with two Cupolas and, in a separate agreement with NASA in part return for launching Columbus aboard the Space Shuttle, Node-3, seen here in the centre of the illustration. The Crew Rescue Vehicle, at left, may become part of a later arrangement between ESA and NASA (ESA / D. Ducros)

ESA/NASDA MOU on Hardware Exchange
Within the framework of this MOU, NASDA is providing ESA with 12 International Standard Payload Rack (ISPR) flight units for use on the ISS. ESA, for its part, is providing NASDA with one MELFI Freezer identical to those developed by ESA for NASA in the context of the Early Utilisation MOU.

The main benefits for Europe of this barter are:
– a financial investment in Europe instead of the USA (it was previously planned to purchase the ISPRs from the NASA ISS ISPR supplier) or Japan
– a competitive, fixed procurement as compared to the estimated procurement cost for 12 ISPRs in the USA
– full exploitation of the investments made in Europe for the development of MELFI for NASA.

ESA/NASA Cupola Barter
The main elements of this barter are:
– provision by NASA to ESA of Shuttle transportation services for five external European payloads, and allocation to ESA of 68 kg of additional launch mass on the Columbus laboratory launch
– delivery by ESA to NASA of the Cupola-1 and -2 ISS elements, with associated spares and sustaining engineering; ESA will also enhance the Columbus module payload support in the areas of thermal control and Ethernet connectivity.

The main benefits of this arrangement are:
– procurement at fixed conditions of the transportation services for five ESA external payloads
– avoidance of cash payments in the USA (and price uncertainties) for Shuttle transportation services.

Conclusions
The rationale for the implementation of the barters, as illustrated in the previous paragraphs, varies from case to case and involves a range of programmatic considerations. The financial significance of the barters implemented so far should not be underestimated. Price uncertainties and/or lack of pricing policies, changing political and economic conditions, and schedule shifts are all risk factors that have been taken into account when considering the merits of each of these barters, and in fact supported the finalisation of most of them by favouring a firm commitment today versus the uncertain future pricing conditions of tomorrow.

The implementation of the barter agreements just described has made it possible to allocate additional, technologically challenging work to European industry worth more than 300 MEuro. As far as the total benefit associated with the barters concluded so far is concerned, a final balance taking into account all of the various parameters will only be possible once these projects have actually been completed. Nevertheless, one can already say today that the introduction of the barter arrangements has helped a lot in reducing costs for the partners, has helped to streamline the development efforts and to increase the spirit of partnership in this global programme and, above all, is a very practical means of implementing cooperation on the basis of no exchange of funds. esa