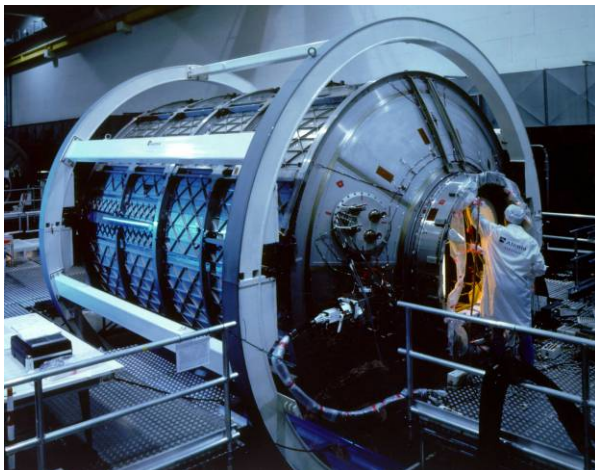


## Columbus Laboratory Agreements

### ***Columbus Development Agreement***

The approval of Europe's participation in the ISS, which included Columbus, came in October 1995 at the ESA Ministerial Council in Toulouse, France. This approval led to the signing of the €658 million contract to develop Columbus with prime contractor Daimler Benz Aerospace, (now part of EADS Astrium) in March 1996. At the time it was the largest single contract ever awarded by the Agency.

Maximum use was made of 'common' European and ISS items in the Columbus development in order to reduce costs. As they were the prime contractor for the MPLMs for the Italian Space Agency, Alenia Spazio (Now part of Thales Alenia Space) became a major subcontractor in the Columbus programme, with provision of the primary Columbus structure.



To help reduce costs the Columbus laboratory shares its primary structure with the Multi-Purpose Logistics Module, pictured above. (Image: Thales Alenia Space)

Another common item was the Columbus Data Management System, which used the same elements as those developed by ESA for the Russian Service Module (the ESA DMS-R contract). The contract for the Columbus Data Management System was one of only two classical subsystem contracts that were placed: the Data Management System with Matra Marconi Space and the Environmental Control and Life Support System with Dornier, both companies subsequently becoming part of EADS Astrium. All other units are subcontracted at the equipment/assembly level, thus eliminating a management layer in part of the programme.



The Data Management System. (Image: EADS Astrium)

In addition to the companies that became part of EADS (Aerospatiale, Daimler Benz Aerospace, Matra Marconi Space) and the companies that became part of Thales Alenia Space (Alenia Spazio, Alcatel Bell Space and Defense, Alcatel Space Industries, Officine Galileo), other contracting companies that were involved in the industrial consortium to develop Columbus include: Kayser-Threde, OHB and Draeger Aerospace from Germany; French companies Sotarem and Secan; Italian companies Space Software Italia and Microtecnica; Spanish company Sener; Spacebel from Belgium; Dutch companies Origin B.V. (now Atos Origin) and Hollandse Signaal AG (now part of Thales Nederland); the Swiss company CIR (now part of Syderal); Roving and Terma from Denmark; and Cap Gemini in Norway. There were also a few additional elements from non-European companies such as common ISS items including the hatch and Common Berthing Mechanism from Boeing.

### ***ESA/ASI Cooperative Agreement on Manned Spaced Modules***

In 1997, ESA and the Italian Space Agency (ASI) signed an agreement to cooperate on the development of manned space modules. Under this arrangement, ESA would provide the Columbus-derived Environmental Control and Life Support equipment for ASI's three Multi-Purpose Logistics Modules, which were developed for NASA by ASI to be used as pressurised cargo containers to travel in the Shuttle cargo bay. In exchange ASI would provide the Columbus primary structure, derived from that of MPLM. In this way, each agency was relieved of the development of significant portions of major subsystems, thereby saving tens of millions of Euros.

## Agreements and Industry

### **Columbus launch agreement**

The launch of Columbus is covered by a barter agreement with NASA signed on 5 March 1997. Originally Columbus would have been launched on an Ariane 5 though downscaling of the laboratory and the cost saving influence of using the MPLM principle structure for Columbus lead to the switch to a Shuttle launch. Under this agreement, in exchange for NASA launching Columbus and its initial payload aboard the Space Shuttle, ESA provides two of the Station's three Nodes (ISS connecting modules), spares and sustaining engineering for the Laboratory Support Equipment items provided by ESA to NASA under the Early Utilisation Memorandum of Understanding, and hardware/support for software development and integration in the NASA ground software test and integration facilities for the ISS. ESA also placed responsibility for developing Nodes-2 and -3 with ASI in order to utilise the same structural concept as the MPLMs and Columbus.

### **Columbus Control Centre Agreement**

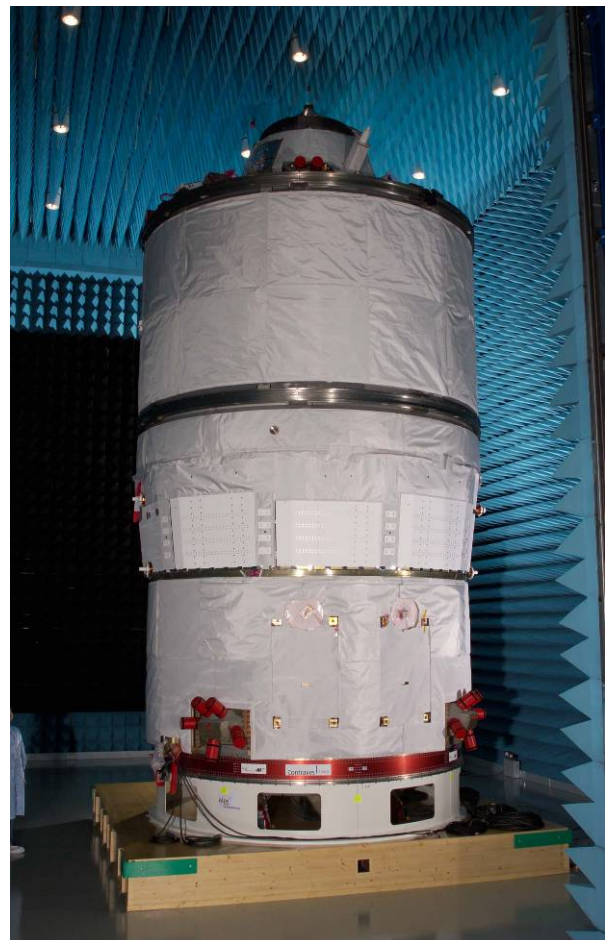
On 31 March 2003 ESA signed the 37.7 million euro contract to develop the Columbus Control Centre with DLR, the German Aerospace Center at Oberpfaffenhofen, near Munich, Germany. Under this contract DLR would be responsible for the design, construction, integration and configuration of the Columbus Control Centre, recruiting and training of the operations team, and qualification of the European operations ground infrastructure on behalf of ESA.

Following the first period of initial operations of the Columbus Laboratory, DLR will take responsibility under a further ESA contract for management of the centre and coordinate and support all on-orbit operations of the Columbus laboratory on behalf of ESA. This includes coordinating the different centres responsible for individual Columbus experimental facilities, and operations of the European communications network, including ATV communications support.

### **ISS Exploitation Agreement**

With the development of Columbus nearing completion, plans were put into place governing European exploitation of the ISS. This led to the signing of a €1 billion contract between ESA and EADS Space Transportation (Now EADS Astrium). The contract covers initial exploitation activities, in particular preparations for the operations of Columbus. Regarding the initial exploitation activities, the contract dealt with the European

experiment facilities for the International Space Station as well as with the experimental programme that will be executed by the astronauts onboard the Station. The contract also covers activities in the fields of the European flight control team and crew training, ground facility maintenance and engineering support for Columbus.



'Jules Verne' the first ATV to fly to the ISS, following testing in the Electromagnetic Compatibility Chamber at ESTEC. Additional ATVs will be produced for ESA under an agreement with EADS Space Transportation (Now EADS Astrium).  
(Image: ESA)

A part of the contract also covers the production of additional Automated Transfer Vehicles (ATVs), the European spacecraft, which will act as an ISS cargo ship, and further be used for reboosting the ISS to higher orbital altitudes to counter the effects of atmospheric drag and remove waste from the station. This contract was signed on 13 July 2004.

## Columbus Payload Agreements

### ***Columbus Payload Rack Agreement***

ESA signed a hardware exchange agreement with NASDA (now JAXA). Within the framework of this Memorandum of Understanding NASDA provided ESA with 12 International Standard Payload Racks (ISPRs) for use in the Columbus laboratory on the ISS. In exchange ESA provides NASDA with one MELFI Freezer identical to those developed by ESA for NASA in the context of the Early Utilisation Memorandum of Understanding.



Flight Unit 2 of MELFI at the Kennedy Space Center in Florida with the Expedition 11 Crew. JAXA is provided 1 MELFI freezer in exchange for 12 International Standard Payload Racks.

### ***Biolab***

The prime contractor for Biolab is EADS-Astrium in France. Major subcontractors in the development include OHB in Germany who were responsible for producing the training model at EAC, and Roving in Denmark who were responsible for the science reference model at the Facility Responsible Centre. Other principle contracting companies for Biolab subsystems include Bradford Engineering in the Netherlands,

NTE in Spain, Carlo Gavazzi Space and Ferrari in Italy, Verhaert and Logica in Belgium, and Rosys, Treff and Hamilton in Switzerland.

### ***Fluid Science Laboratory***

The prime contractor for the Fluid Science Laboratory is Alenia Spazio in Italy (Now part of Thales Alenia Space). The major subcontractors in the project include DASA (now part of EADS) and OHB in Germany, Verhaert in Belgium, Sener in Spain, and MARS Center and Carlo Gavazzi Space in Italy. A cooperative agreement added the Microgravity Vibration Isolation System, developed by the Canadian Space Agency.

### ***European Physiology Modules***

The prime contractor for European Physiology Modules is OHB in Germany. Major subcontractors include Carlo Gavazzi Space in Italy, Verhaert in Belgium, and EREMS in France. Cooperative agreements also added Cardiolab, developed by CNES and DLR.

### ***European Drawer Rack***

The prime contractor for the European Drawer Rack is Alenia Spazio (Now part of Thales Alenia Space) in Italy. Major subcontractors include OHB and Kayser-Threde in Germany, Bradford Engineering in the Netherlands and OCI in Switzerland.

### ***European Transport Carrier***

The industrial organisation for the European Transport Carrier is the same as for the European Drawer Rack.

### ***EuTEF***

The prime contractor for EuTEF is Carlo Gavazzi Space in Italy.

### ***SOLAR***

The prime contractor for SOLAR is Alenia Spazio (Now part of Thales Alenia Space) in Italy.

### ***ACES***

The prime contractor for the ACES payload is EADS-Astrium in Friedrichshafen in Germany.

## Astronaut Flight Opportunities

The ISS Intergovernmental Agreement (see ISS General Information) provides the framework for design, development, operation and utilisation of the ISS. It was signed by the participating States on 29 January 1998.

The subsequent Memorandum Of Understanding signed between ESA and NASA on the same day, which covers relevant ISS responsibilities, obligations and rights includes the flight opportunities being used by Léopold Eyharts and Hans Schlegel.

Under this Memorandum Of Understanding between ESA and NASA one ESA astronaut is allotted to fly on the mission for Columbus assembly and system verification. This is the flight of ESA astronaut Hans Schlegel.

Leopold Eyharts will fly under another Article of the agreement, within which ESA has the right to provide permanent crew for the Station from the time it begins to share common ISS system operations responsibilities i.e. from the time that Columbus is commissioned at the Station. After this occurs 8.3% of the crew time available for utilisation will be allocated to ESA. Of the crew flight opportunities for the astronauts of NASA, CSA, ESA and The Government of Japan, 8.3 % will be available for ESA astronauts.