

# Columbus Begins its Voyage of Discovery





*Columbus is removed from its shipping container in the Space Station Processing Facility. In the background is Japan's Kibo module*

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**T**he Columbus laboratory was delivered to NASA's Kennedy Space Center in Florida on 30 May, to be prepared for launch in September 2007. As Europe's largest single contribution to the International Space Station, Columbus will host a wide range of important experiments for years to come.

### Development

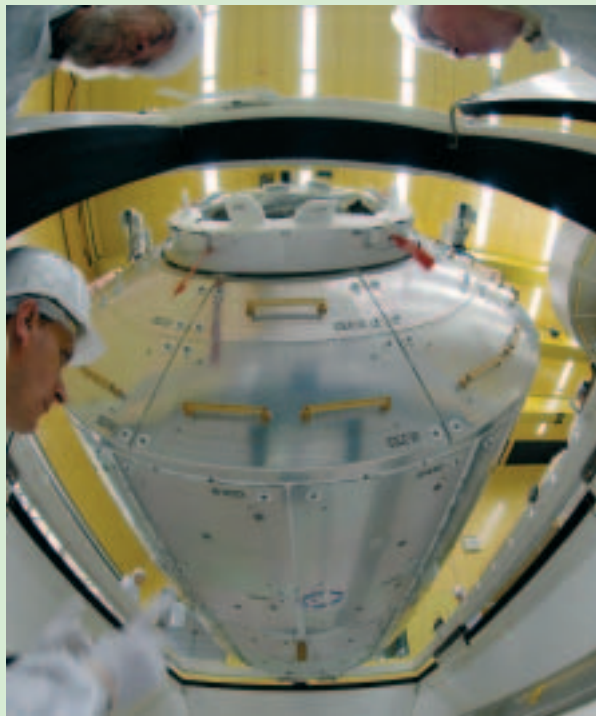
Columbus development began in 1996 with the signature of the 'Phase-C/D' contract between ESA and prime contractor EADS Space Transportation (DASA at the time). Phases-C and -D are the detailed development and manufacturing phases of a spacecraft, concluding with delivery to the launch site.

In parallel with development of the module, work also began on the scientific payload racks: Biolab, Fluid Science Laboratory (FSL), European Physiology Module (EPM) and the European Drawer Rack (EDR).

Along with the usual challenges of a conventional Phase-C/D programme, the Columbus engineers had to cope with changing multiple interfaces as the rest of the International Space Station (ISS), including its Node-2 in-orbit



*At a ceremony to mark the delivery of Columbus by EADS Space Transportation to ESA in Bremen on 2 May, German Chancellor Angela Merkel expressed her view that research under weightlessness has brought incredible progress to the various disciplines involved and considered the scientific possibilities provided by the Columbus laboratory as being of inestimable value*



*Columbus is loaded into its transport container in Bremen (ESA/S. Corvaja)*



*Loading the cargo plane at Bremen Airport*



*Columbus arrives at the Space Station Processing Facility on 31 May*



*Columbus is removed from its shipping container.*

physical host, and the distributed multi-national ground system were developed at the same time.

The Preliminary Design Review for the whole system took place at the end of 1997. Shortly after, the Exposed Payload Facility was added to the design and work began on the SOLAR telescopes and the European Technology Exposure Facility (EuTEF) external payloads. At the end of 2000, the design phase was completed and

Columbus passed its Critical Design Review.

When the contract was signed in 1996, the target launch date was 2002. But delays in the Russian ISS segment, in particular the Zvezda Service Module, required the Columbus schedule to be slowed for a launch in October 2004. That period saw several modifications: an autonomous Ku-band terminal, a 100 Mbit/s Local Area Network and the Digital Video System.

In February 2003, the tragic loss of Shuttle *Columbia* and its crew meant another delay, this time of 3 years. During this period, the programme completed its qualification process, with a successful Qualification Review of the whole system completed in late 2004.

### Shipment

Following a Final Acceptance Review, consent to ship the module and its



*Columbus lands on the Shuttle runway at KSC on 30 May*



*In the background is Japan's Kibo module*



*Columbus Project Manager Bernardo Patti waits for Columbus to be hoisted from its container*



*Alan Thirkettle, ESA's ISS Programme Manager, marks the arrival of Columbus at its launch site*

internal payloads to KSC was given in early May. The 4.5 m-diameter cylindrical module was packed into its transportation container at EADS Space Transportation in Bremen (D). On 28 May, the container was loaded onto an Airbus A300-600 Beluga heavy-lift aircraft at Bremen Airport. With overnight stopovers in Iceland and Canada along the way, and short refuelling stops in Edinburgh, Greenland and Cleveland, Columbus touched

down shortly after 15:00 local time on 30 May at the Shuttle Landing Facility at KSC.

Columbus was unloaded from the Beluga and transported to the Space Station Processing Facility. The Beluga flew back to Turin (I) with the empty transport container which will be used in early 2007 for the shipment of Node-3, the last major European-built element and now nearing completion at Alcatel Alenia Spazio.

## Launch Campaign

The launch campaign was initially planned to last 7 months but has now been divided into two phases. During Phase-1, from June to August 2006, Columbus will have its arrival inspection, undergo a leak test in the KSC Large Vacuum Chamber and complete a series of interface tests that are essentially 'fit checks' between the module's berthing system and NASA's Node-2 simulator.



Columbus is installed in its processing stand. Almost hidden at far right is Node-2, which Columbus will be attached to on the ISS

Around March/April 2007, about 6 months before launch, activities will resume with Phase-2's final health check of the systems, replacement of the water in the cooling loop and the hand-over to NASA for integration of the module into Shuttle *Endeavour*.

### The Challenges Ahead

Columbus is scheduled for launch in September 2007. Shortly before, a number of critical activities have to be completed in addition to those mentioned above:

- acceptance of the SOLAR and EuTEF external payloads, together with their end-to-end test campaigns;
- validation of operational procedures

for system and payloads and the completion of the end-to-end test campaign with NASA;

- simulations required for ground operator/flight controller training and certification;
- commissioning and readiness of the Columbus Control Centre (at DLR Oberpfaffenhofen in Germany) and the associated User Support Operations Centres throughout Europe;
- training astronauts and cosmonauts for the launch of Columbus (ISS flight 1E) and the subsequent on-orbit commissioning and science operations during ISS Increment-16.

Some open issues also need to be resolved:

- selection of crewmembers on ISS flight 1E for a long-duration flight of an ESA astronaut during Columbus commissioning;
- accommodation of the experiment manifest in the payload rack facilities (Biolab, FLS, EPM and EDR);
- the potential use of Columbus spare mass capacity for carrying extra cargo to the ISS on 1E; every kilogramme of cargo is so important now that Shuttle retirement is approaching.

*Late news:* Hans Schlegl was announced on 21 July as the ESA astronaut to accompany Columbus to the ISS. See the *In Brief* section in this issue for more information.