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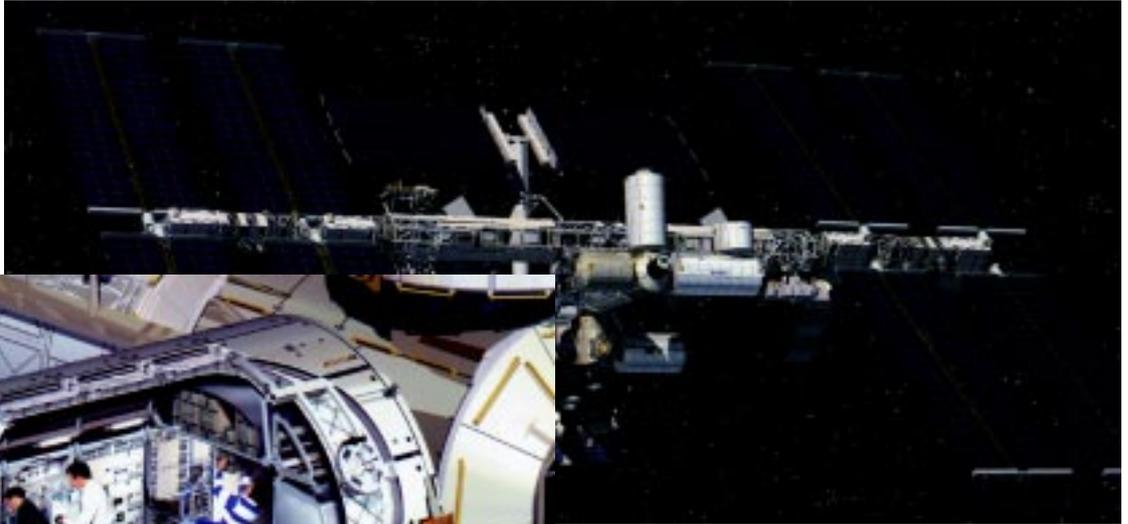


Photo: ESA

## European Participation in the International Space Station Following the Columbia

### Crews

The most pressing problem has already been solved: Whom to send to the station on the next Soyuz taxi flight? Spanish ESA astronaut Pedro Duque had been scheduled to visit the ISS for about ten days in late April along with Russian cosmonaut Gennady Padalka. The grounding of the shuttle fleet has left the resident Expedition 6 crew of Kenneth Bowersox and Donald Pettit (USA) and Nikolay Budarin (Russia), who were supposed to return to Earth on shuttle flight STS-114/ULF-1 in March, only one possibility of coming home - the currently attached Soyuz TMA-1 spacecraft. Padalka and Duque were to fly up on Soyuz TMA-2 and return in TMA-1.

The current expedition crew will now come home in May on TMA-1, after about six months in orbit. They will be replaced by Yuri Malenchenko (Russia) and Edward Lu (USA), who along with Russian Alexander Kaleri had been training for a long time as the planned Expedition 7 crew.

Conceivably, Duque could have accompanied Malenchenko and Lu for the long term stay, but without visiting shuttles the ISS would not be able to support a full three man crew beyond this August. (The shuttles generate most of the drinking water on the station. The water is a byproduct from the hydrogen/oxygen fuel cells that power the shuttle's electrical systems.) Therefore, Duque has been bumped from this flight and been reassigned to the next available one, Soyuz TMA-3, in October 2003 along with Michael Foale (USA) and Alexander Kaleri (Russia). Dutch ESA astronaut André Kuipers, who was training to fly on that

On February 1 2003 the American space shuttle Columbia disintegrated during reentry, killing all seven astronauts on board and bringing the shuttle program to a halt. While there seems to be sufficient political and public support that the program will eventually continue once the cause of the accident has been determined and necessary corrections made, a number of problems must be addressed before the shuttle resumes flying.

The main problem is that NASA and its international partners have a space station to run. Although Russian vehicles will facilitate continued operation of the International Space Station (ISS) through 2003, difficulties will arise during 2004 if money is not raised to increase the production rate of these vehicles and the shuttle is grounded for a prolonged period. This article aims to discuss some of the issues confronting the European Space Agency (ESA).

mission, will have to wait until Soyuz TMA-4 flies in spring 2004.

ESA has agreed to pay Russia for both Duque's and Kuipers' flights this year, even though Kuipers will not fly until 2004. Russia had budgeted an income of about 40 million dollars from ESA for the two flights, and if payment for Kuipers' flight had been delayed, Russia would have had an even harder time honoring its commitments to the station project. The Russians' other main income of foreign space dollars, the program for flying commercial tourists as passengers on taxi flights to the ISS, is on hold indefinitely.

Swedish ESA astronaut Christer Fuglesang was supposed to participate on shuttle mission STS-116/12A.1 in July 2003. This mission has been delayed indefinitely along with all other shuttle flights, but Fuglesang will continue training.

## Resupply

Since the shuttle's cargo and passenger capacity is greater than that of Russia's Progress and Soyuz vehicles respectively, its presence will soon be sorely missed. Russia had been scheduled to launch three unmanned Progress vehicles to the ISS this year, in addition to the two manned Soyuz vehicles already mentioned. (The first Progress was launched on February 2.) If the shuttle remains grounded through 2004, one additional Progress vehicle will be needed this year to facilitate continued operation, and no less than six in 2004, twice the number originally envisioned.

Russia has promised to stick to its original obligations, but has made it clear that financial support from the other station partners must come forth in the very near future if it is to be able to increase the Progress production rate in time to meet the new demands. Lead times for Progress production is reportedly about 18 months, so it is imperative that a solution be found soon. The Russian Space Agency has reached an agreement with the Russian government that allows it to spend Russian ISS funds allocated for the second half of 2003 during the first half. This will probably allow the fourth Progress vehicle to be launched in 2003, but doesn't solve the funding problem for 2004.

NASA has asked ESA to determine whether it would be feasible to move up the scheduled maiden launch in September 2004 of its Automated Transfer Vehicle (ATV), an unmanned cargo vehicle. The ATV is thereafter supposed to be launched regularly every 15 months or so beginning in 2006. An earlier introduction would help reduce the dependence on Progress, but ESA sources don't see much of a chance that an earlier launch would be possible. However, it is increasingly likely that ESA will be

asked to supply more ATVs than the nine vehicles currently planned, both because it would add flexibility to the resupply of the ISS and because past and future delays will stretch the operational lifespan of the station beyond the originally foreseen fifteen years. In return, NASA would probably forego some of the fees ESA would otherwise be expected to pay for the use of ISS.

The planned Japanese cargo vehicle will not start flying until 2007 at the earliest, and the current Japanese funding crisis makes any acceleration of the schedule unlikely.

## Science

Prior to the Columbia accident, ESA had already been considering buying Soyuz vehicles from Russia to facilitate an increase in the number of astronauts the ISS can support.



The Soyuz can accommodate three astronauts, and as long as only one Soyuz is attached to the station at any time, that is the limit of the station crew size. NASA's cancellation of its planned crew rescue vehicle, originally scheduled for introduction in 2007 and able to carry seven astronauts, has delayed an increase in the crew size beyond three to 2010 at the earliest. That is the year when the planned Orbital Space Plane (OSP) with a crew size of probably at least four is to be introduced. (An OSP plus a Soyuz would permit a station crew size of seven.)

Until then, only astronauts from Russia and the United States are expected to be members of expedition crews. ESA's Columbus Orbital Facility, to be launched in October 2004, and Japan's Kiko laboratory, to be launched in 2006-2007, would not

**Full-scale Columbus engineering model shown at ESTEC.**

Photo:NSA



**Interior view of the full scale model of Columbus.**  
Photo: NSA

be fully utilized until European and Japanese astronauts are part of expedition crews. About 2-2.5 crewmembers are needed just to operate and maintain the station, so there is little room for science until the crew is expanded.

An interim solution, approved by the station partners late last year, would be to procure additional Soyuz vehicles until the OSP is ready. Two Soyuz vehicles docked to the station at all times would allow the crew size to double, but the Iran Nonproliferation Act prohibits NASA from buying Russian space hardware directly until the U.S. President can persuade Congress that Russia has ceased assisting Iranian nuclear power efforts for at least a year. On February 27 Nick Lampson, a member of the House of Representatives, introduced a bill that would enable a waiver of the ban, so that continued operation of the ISS could be facilitated. The condition for a waiver is that the lives of the crew are at risk or the continued operation of the station is threatened. White House sources have signaled that a request from NASA for a waiver would be viewed

favorably, but so far NASA is not considering such a request.

To facilitate earlier utilization of Columbus, ESA is looking at the possibility of buying Soyuz vehicles from Russia. In exchange, it is hoped that NASA will reduce or write off the amount

of money ESA is supposed to pay yearly for transport services on the shuttle. Whether this is possible remains to be seen, as ESA wants to make sure that such a solution is acceptable to Congress.



**The first of the planned ten ATVs, named Jules Verne, during tests at ESTEC.**

Photo: NSA

If ESA decides to buy Soyuz vehicles, it would possibly be part of a bigger package in which Russia is granted access to the European launch site at Kourou, French Guyana. For years Russia has expressed an interest in building a Soyuz launch pad at Kourou, whose near equatorial location would increase the Soyuz rocket's cargo capacity substantially. Now that the venerable Ariane 4 rocket has been retired, the fear that the cheaper, but otherwise comparable Soyuz would cut into Arianespace's market share is gradually subsiding. The cargo capacities of the Ariane 5 and Soyuz rockets are sufficiently different that no real competition between them is likely.

Early long term stays for ESA astronauts could also be part of the package. An expedition crew must always consist of at least one Russian and one American, both for technical and political reasons. So far, the third seat on the ISS has been filled by astronauts from these two countries on a rotational basis. Recently, Russia has offered to let ESA astronauts take one of its slots whenever two Russians are supposed to be on board. (The condition is that ESA buys Soyuz vehicles.) This would be of interest to ESA as it would enable the organization to make full use of the Columbus laboratory a lot sooner than if it had to wait for the availability of the OSP.

The question is: When will Columbus be launched? The October 2004 launch date will certainly slip into 2005 at the earliest. When the shuttle starts flying again, assembly of the truss and associated solar arrays must be completed and Node 2 installed before Columbus can dock with the station. If a cause of Columbia's destruction is identified and a remedy found during 2003, shuttles could return to flight in 2004. At least a year of assembly missions would then be required before Columbus could take to the skies.

The "if" is very big, however. Following the Challenger accident on January 28 1986, no shuttle flew until September 1988. While the pressure to return to flight is greater now because of the space station, NASA officials have repeatedly stated that the fault that brought down Columbia must be found and corrected before launches are resumed, no matter how long it takes.

A delayed Columbus launch would certainly have implications for European scientists planning to conduct experiments aboard the ISS. ESA was heavily involved in the STS-107 science mission that was about to end when disaster struck. The loss of scientific data that were not downloaded during the mission will be felt strongly in the European microgravity research community, and at the time of writing (March 4 2003) it is impossible to say with certainty when another chance to conduct these and other experiments will arise.