

ATV Evolution Scenarios



Artist's impression of Large Cargo Return scenario. (Image: ESA/D. Ducros)

With a mass of up to 21 tonnes at launch and up to 9 tonnes of on-board propellants and cargo, the Automated Transfer Vehicle is the largest orbiting space vehicle beside the US space shuttle. The ATV is also unique combining both the full automatic capabilities of an unmanned vehicle able to rendezvous and dock on its own, and the human spacecraft safety requirements when it is docked to the ISS.

After the space shuttle is retired in 2010 the cargo returning capabilities to Earth will be limited to only a few kilos with the Russian Soyuz capsules. The ATV is an excellent basis for developing a wide variety of new space vehicles whose evolution can range from simple to complex projects. Among them, ESA started two studies with different scopes.

The first study, within the General Study Programme of ESA, which began in early 2004, looked at the feasibility of three scenarios:

Large Cargo Return

In this scenario the pressurised Integrated Cargo Carrier would be replaced by a large cargo re-entry capsule with a thermo re-entry shield, able to bring back hundreds of kg of cargo and valuable experiments. Such a project could use the flight-proven concept of the Atmospheric Re-entry Demonstrator, which flew successfully in 1998. This scenario developed into a second and more detailed study, called the **Cargo Return Vehicle**, which would be able to dock on the US segment of the ISS and exchange the standard racks of the Station.

ATV Evolution

Crew Transport Vehicle

A second scenario would be a Crew Transport Vehicle, which would require more complex modifications. The Integrated Cargo Carrier would be transformed into a re-entry capsule for crew transportation, which could be used, in a first phase, as a crew rescue vehicle for the ISS, and then as a full up-and-down crew transport vehicle launched by Ariane 5. Such ATV evolution would give Europe the capabilities of human transportation into low Earth orbit.

Unpressurised Logistics Carrier

A third ATV evolution scenario is the Unpressurised Logistics Carrier, which could bring up to the Station several tonnes of unpressurised equipment. These payloads will be transported on a dedicated carrier which could replace the Integrated Cargo Carrier on the current ATV. This unpressurised equipment would be transferred to their final location by robotic arm or by spacewalk.

Additional Scenarios

Other evolutions and modifications are also under general consideration include:

Small Payload Return

By taking advantage of available internal volume, the core of the ATV could be equipped with a small ejectable capsule able to return a cargo payload of about 150 kg to Earth at the end of its mission. This concept would be useful to bring back valuable scientific and technological experiment samples.



Artist's impression of the Small Payload Return scenario.
(Image: ESA/D. Ducros)

The Safe-Haven/Free-Flying Lab

The ATV could easily evolve towards an unmanned free-flying laboratory providing a better

microgravity level than the ISS. It could periodically dock to the ISS for major servicing support. Such a free flying pressurised spacecraft could also be used as a safe haven for an entire ISS crew in case of a major emergency on-board the Station. That would give time for a crew to survive until they are rescued by a Soyuz or other vehicle.

Mini Space Station

To build-up a mini space station, the ATV spaceships could be equipped with two docking mechanisms, one in front and one at the back, in such manner as they could mate like the carriages of a train.



Artist's impression of the Mini Space Station scenario.
(Image: ESA/D. Ducros)

Exploration Transport Vehicle

Although the concept of a space tug or transfer vehicle for moving astronauts and equipment to different Earth orbits has been envisioned for decades by different space agencies, the European-built ATV will be the most powerful space tug ever built. If required in future programmes, the ATV could also evolve to be used as a transfer vehicle carrying tonnes of supplies to Moon and Mars orbits including space telescopes and planetary spacecraft.