



Space-in-Bytes

ATV: A VERY SPECIAL DELIVERY

This is the International Space Station, the ISS. It is orbiting the Earth 400 km above our heads, flying at 28,000 km per hour. It is currently home to three astronauts - it can be a very isolated place.

Early in 2008, an Ariane 5 rocket blasted off from Europe's spaceport in French Guiana. The rocket carried the most sophisticated lorry ever built – the European Space Agency's Automated Transfer Vehicle, the ATV.

The unmanned space-juggernaut is the size of a double-decker bus and can carry up to 6 tons of scientific equipment, spare parts, fuel, oxygen and food. After a 15 day flight, the ATV automatically docked with the Space Station with the precision equivalent to the size of a 1 Euro coin.

Named after one of the first writers to predict space travel 150 years ago, the Jules Verne is the first of at least 5 ATVs that will be built to deliver scientific, and other vital supplies, to the ISS during its lifetime.

The ATV is not just a supply lorry – it is also a space tug. The Space Station gradually loses almost 100 meters of altitude a day caused by residual drag from the Earth's outer atmosphere.

After docking, the ATV can control the Space Station's altitude, using its main engines to boost it back into a higher orbit.

Built and managed by an international team the ATV is much more than a spaceship, emphasises Project Manager John Ellwood. 'It is a cargo ship, a laboratory, a rocket all in one'.

To map its position in relation to star constellations the ATV uses a star tracker – a modern day version of the sextant, used by ships for hundreds of years to navigate the world's oceans. The Jules Verne also uses the GPS satellite-navigation system to find its way to the ISS - the same technology we use here on Earth.

When it is within 300 metres of the ISS the ATV switches to a high precision rendezvous sensor, called the video-meter, to control it for the final stages of docking. The video-meter recognizes the image formed by patterns of light reflected off the ISS.

Laser pulses are bounced off mirrors on the Space Station. The video-meter measures the laser travel time and pattern of the return pulses. This gives centimetre accurate distance and position information, to automatically control the 28 manoeuvring thrusters of the ATV.

Moving at a speed of a few centimeters a second, relative to the Space Station, the 20-ton spacecraft is automatically maneuvered very slowly in stages towards it. At ESA's ATV Control Centre in Toulouse, France, a multinational team of flight controllers monitors the automated approach.

Astronauts on the ISS also monitor the automated docking. If all is going smoothly they don't have to do anything, but in an emergency the crew can either stop the ATV in its tracks, or propel it away from the Space Station for safety.

Once the Jules Verne is safely docked, the astronauts gradually transfer its cargo to the ISS over the course of 6 months. As the new supplies are used up, the empty area is used to store waste. The space-lorry turned refuse-

truck will then undock and begin a controlled re-entry into the Earth's atmosphere.

The ATV has been programmed to enter the Earth's atmosphere at a very steep angle causing it to completely burn up over the Pacific Ocean. This will destroy the waste, and the ATV, making it the most sophisticated refuse-truck ever built.

Jules Verne wrote about fantastic voyages into space. Over the coming decades ESA and its international partners are planning missions to the Moon and Mars. After the ATV's crucial role as a cargo tug for the International Space Station, perhaps its successors will become essential automated spacecraft supporting the exploration of our solar system.