**European servicing and logistics vehicle**

The Automated Transfer Vehicle (ATV) is an unmanned automatic vehicle sent into orbit by the European Ariane 5 launcher. It provides the International Space Station with: cargo, water, air, nitrogen, oxygen and attitude control propellant. It also removes waste from the Station and reboosts it to a higher altitude to compensate for atmospheric drag.
Integrated Cargo Carrier

ATV-3 containers being offloaded in Kourou harbour from the French cargo ship MN Toucan on 25 August 2011
## Specifications

### Dimensions
- **Length:** 9794 mm (probe retracted)
- **Largest diameter:** 4480 mm
- **Solar array span:** 22 281 mm

### Mass Budget
- **Vehicle dry mass:** 9778 kg
- **Vehicle consumables:** 2261 kg
- **Total vehicle mass:** 12 039 kg
- **Total cargo upload capacity:** 7384 kg
- **Mass at launch (max):** 20 100 kg
- **Waste download capacity:** 6495 kg (420 km altitude, 51.6° inclination)

### Propulsion
- **Main propulsion system:** 4 x 490 N thrusters (pressurised liquid bipropellant system)
- **Attitude control system:** 28 x 220 N thrusters (pressurised liquid bipropellant system)
- **Propellant:** Monomethyl hydrazine fuel and Nitrogen tetroxide oxidiser
- **Pressurisation:** Helium at 31 MPa

### Avionics
- 2-failure-tolerant architecture
- Equipment interconnection via multiple redundant MIL-STD-1553B buses
- 2-fault-tolerant computer via voting mechanisms
- Flight Application Software: 450 000 lines of code

### Communications Infrastructure
- **To ground:** S-band via TDRS satellite
- **ATV to ISS:** S-band antenna via proximity link

### Relative Navigation
- Relative GPS
- Optical rendezvous sensors

### Thermal/Environmental Control
- **Thermal Control:** Multi-Layer Insulation material, active thermal control using variable & constant conductive heat pipes and paints
- **ECLSS:** Fire detection, air circulation, air temperature monitoring

### Electrical Power
- **Ascent to ISS and deorbit:** 4 solar wings of 4 panels each and 40 Ah rechargeable batteries
- **Number of arrays:** 4
- **Generated power:** 3800 W after 6 months in orbit
- **Required power:** < 400 W dormant mode
- **Supplied by ISS:** < 900 W active mode

### Main Construction Material
- **Pressure shell:** Al-2219
- **Micrometeoroid and Debris Protection System:** Primary bumper: Al-6061-T6, Secondary bumper: Nextel/Kevlar blankets, Internal structure (racks): Al-6061-T6
- **Thermal insulation:** Goldised Kapton Multi-Layer Insulation blanket & aluminised beta cloth
- **Solar arrays:** Silicon solar cells on 4 carbon fibre reinforced plastic sandwich panels

### Main Contractor
- Astrium-Space Transportation, leading a consortium of many subcontractors

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**ATV Johannes Kepler** approach photographed by ESA astronaut Paolo Nespoli on the International Space Station
### Utilisation Data

#### LAUNCH CONFIGURATION

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Payload:</strong></td>
<td>8 racks with 1.25 m³ each</td>
</tr>
<tr>
<td><strong>Envelope:</strong></td>
<td>1.005 m³ in front of 2 racks</td>
</tr>
<tr>
<td><strong>Cargo mass:</strong></td>
<td></td>
</tr>
<tr>
<td>- Dry cargo:</td>
<td>2200 kg</td>
</tr>
<tr>
<td>- Water:</td>
<td>285 kg</td>
</tr>
<tr>
<td>- Gas (oxygen and air):</td>
<td>100 kg</td>
</tr>
<tr>
<td>- ISS refuelling propellant:</td>
<td>860 kg</td>
</tr>
<tr>
<td>- ISS reboost and attitude control propellant:</td>
<td>3150 kg</td>
</tr>
<tr>
<td>- Total cargo upload capacity:</td>
<td>6595 kg</td>
</tr>
</tbody>
</table>

| **Launch vehicle:**   | Ariane 5 (300 x 300 km, 51.6° transfer orbit) |
| **Launch site:**      | Kourou, French Guiana |
| **Launch date:**      | 9 March 2012 (as of 4 February 2012) |

#### IN-ORBIT CONFIGURATION

Deployed solar array, with a total span of 22.3 m, provide electrical power to rechargeable batteries for eclipse periods. Automated flight towards the International Space Station.

#### FLIGHT HARDWARE

- Propulsion and reboost system
- Avionics equipment
- Guidance navigation and control system
- Communications system
- Power generation and storage system
- Thermal control system
- Russian docking and refuelling system

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**Diagram:**
- Payload racks
- Refuelling System
- Propulsion Module (PM)
- Avionics Module (AM)
- Multi-Layer Insulation blanket
- Micrometeoroid and orbital debris protection system
- Stand-off
- Primary structure
- Spacecraft subassembly
- Integrated Cargo Carrier (ICC)