### Automated Transfer Vehicle (ATV)

**European servicing and logistics vehicle**

The Automated Transfer Vehicle is an unmanned automatic vehicle which is put in orbit by the European Ariane 5 launcher. It provides the International Space Station with: pressurized cargo, water, air, nitrogen, oxygen and attitude control propellant. It also removes waste from the station and re-boosts it to a higher altitude to compensate for the atmospheric drag.

**Launch Configuration**
- Payload envelope: 8 racks with 2 x 0.314 m³ and 2 x 0.414 m³
- Cargo mass: Dry cargo: 1,500 - 5,500 kg
- Water: 0 - 840 kg
- Gas (Nitrogen, Oxygen, air, 2 gases/flight): 0 - 100 kg
- ISS Refueling propellant: 0 - 860 kg (306 kg of fuel, 554 kg of oxidizer)
- ISS re-boost and attitude control propellant: 0 - 4,700 kg
- Total cargo upload capacity: 7,667 kg

**Flight Hardware**
- Propulsion and re-boost system
- Avionics equipment
- Guidance, navigation and control system
- Communications system
- Power generation and storage system
- Thermal control system
- Russian docking and refueling system

**Launch Configuration**
- Launch site: Kourou, French Guiana.
- First flight: Spring 2008
- Flight rate: Mean: 1 ATV/18 months

**On Orbit Configuration**
- Deployed solar arrays, with a total span of 22.3 m, that provide electrical power to rechargeable batteries for eclipse periods.
- Automated flight towards the International Space Station.

**Flight Hardware**
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**Launch Vehicle**
- Ariane 5
- 300 x 300 km, 51.6° transfer orbit

**Payload**
- 8 racks with 2 x 0.314 m³ and 2 x 0.414 m³

**Propulsion Module (PM)**
- Water and gas tank
- Stand-off
- Primary structure

**Integrated Cargo Carrier (ICC)**
- Micrometeoroid and orbital debris protection system

**Spacecraft subassembly**
- Multi-Layer Insulation blanket

**Radio frequency link with Space Station for proximity operations**
- 4 x optical rendez-vous sensors

**Multi-Layer Insulation blanket**
- 4 x solar arrays for generation of electricity

**Main engine**
- (4 x 490 N)

**Ranging cues**
- 2 x visual targets for crew monitoring
- 2 x star trackers

**Communications system**
- TDRS antennas for communication

**Power generation and storage system**
- 4 x solar arrays for generation of electricity

**Thermal control system**
- Russian docking and refueling system

**Guidance, navigation and control system**
- 2 x visual targets for crew monitoring
- 2 x star trackers

**Radio frequency link with Space Station for proximity operations**
- 4 x optical rendez-vous sensors

**Avionics equipment**
- 2 x visual targets for crew monitoring
- 2 x star trackers

**Propulsion system**
- Attitude control and braking thrusters (28 x 220 N)

**Main engine**
- (4 x 490 N)

**TDRS antennas for communication**
- 4 x optical rendez-vous sensors
- Radio frequency link with Space Station for proximity operations

**Multi-Layer Insulation blanket**
- 4 x solar arrays for generation of electricity

**Spacecraft subassembly**
- Multi-Layer Insulation blanket
- Micrometeoroid and orbital debris protection system
### Specifications

#### Dimensions
- **Length:** 9,794 mm (probe retracted)
- **Largest diameter:** 4,480 mm
- **Solar arrays span:** 22,281 mm

#### Mass Budget
- **Vehicle dry mass:** 10,470 kg
- **Vehicle consumables:** 2,613 kg
- **Total vehicle mass:** 13,083 kg
- **Total cargo upload capacity:** 7,500 kg
- **Mass at launch (max):** 20,750 kg

#### Waste download capacity:
- 6,300 kg (420 km altitude, 51.6° inclination)

#### Propulsion
- **Main propulsion system:** 4 x 490 N thrusters (Pressurized liquid bi-propellant system)
- **Attitude control system:** 28 x 220 N thrusters (Pressurized liquid bi-propellant system)
- **Propellant:** Monomethyl hydrazine fuel and Nitrogen tetroxide oxidizer
- **Pressurization:** Helium pressurant at 31 MPa

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

#### Navigation:
- **GPS**

#### 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 de-orbit:** 4 Solar panel wings of 4 panels each and 40 Ah rechargeable batteries
  - **Number of arrays:** 4
  - **Number of panels/array:** 4
  - **Generated power:** 3,800 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
- **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:** Silicium Solar Cells on 4 Carbon Fibre Reinforced Plastic Sandwich panels

#### Main Contractor
- EADS-Space Transportation, Leading a consortium of many sub-contractors