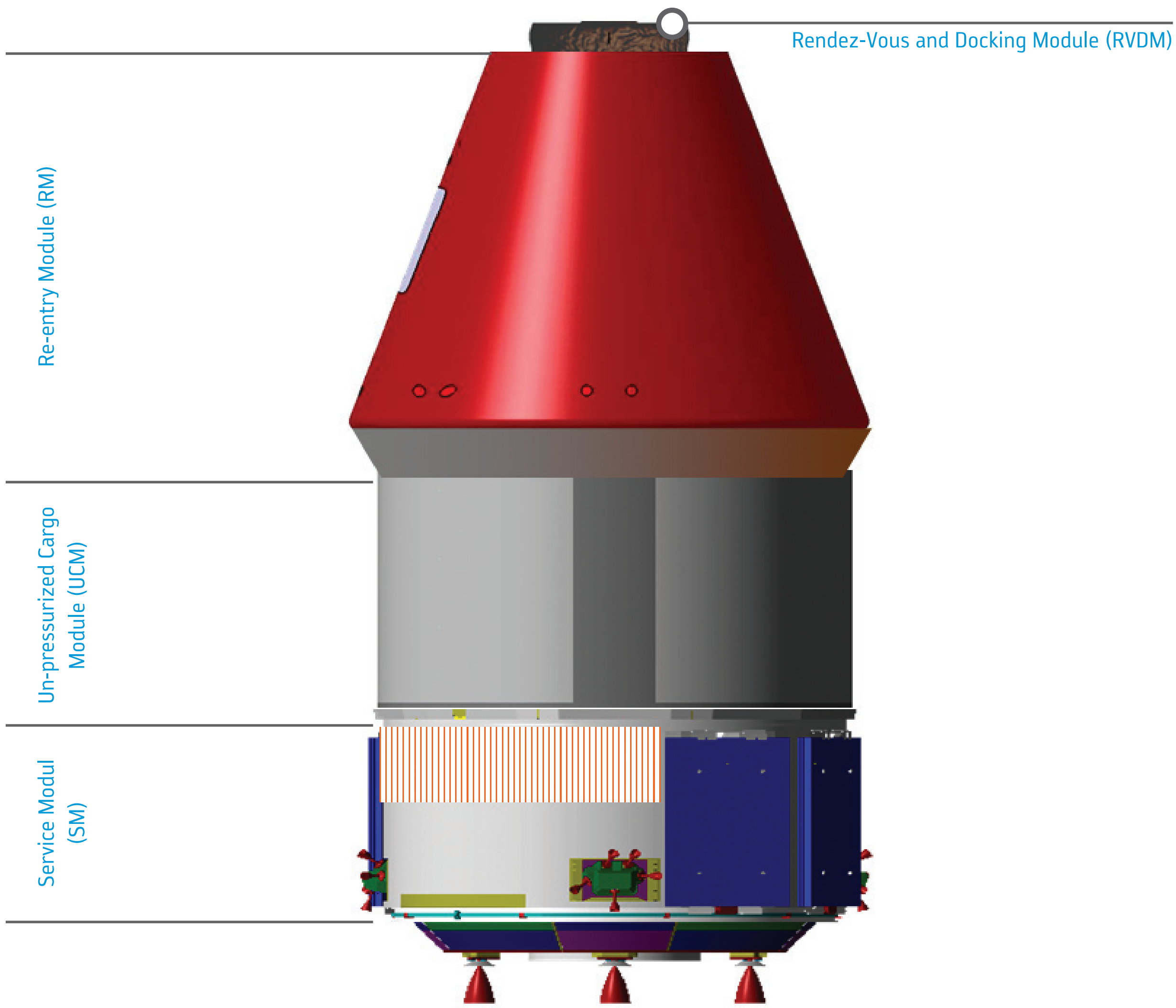
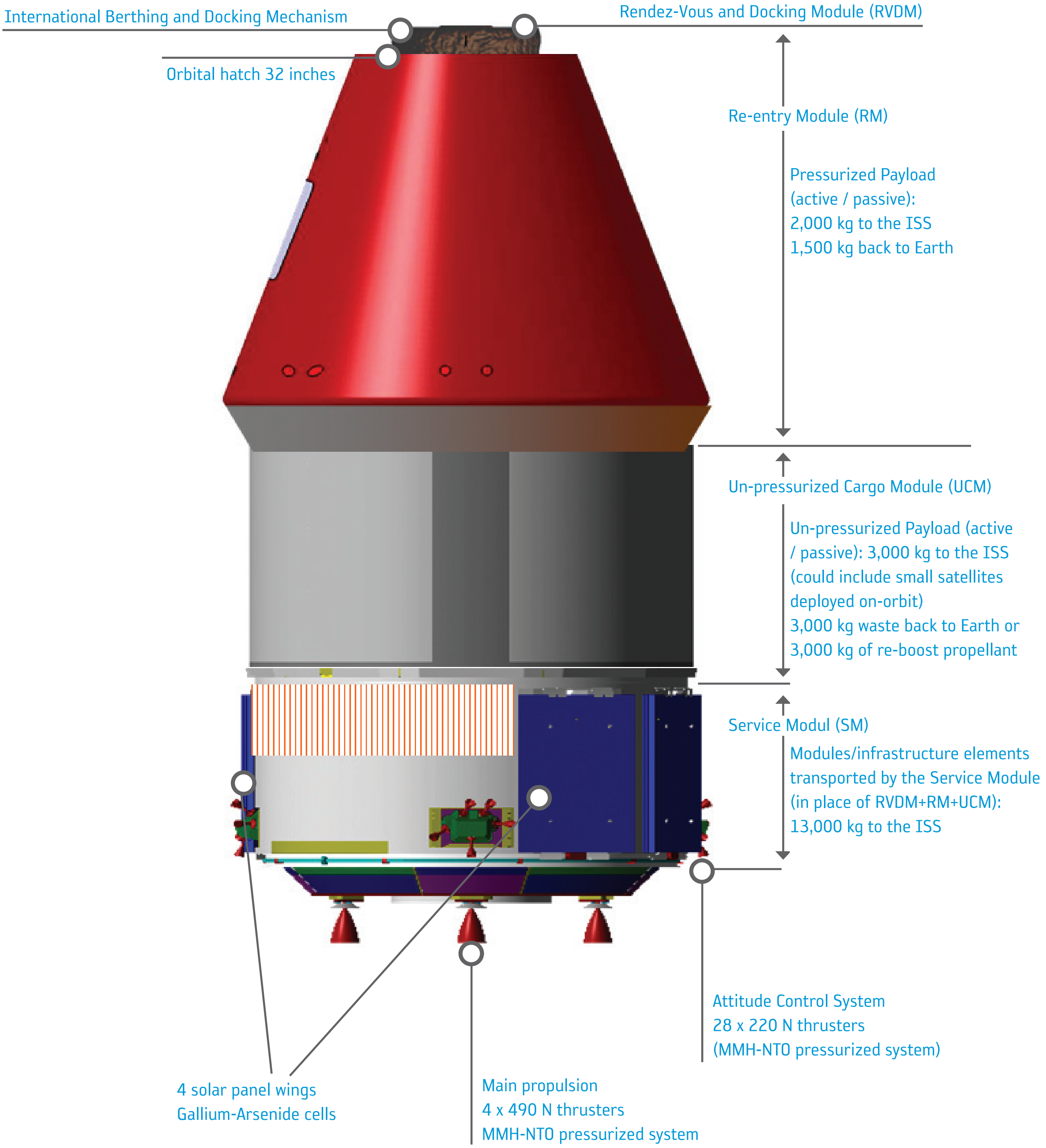
→ ADVANCED RE-ENTRY VEHICLE (ARV)

European Servicing and Logistic Vehicle

The Advanced Re-entry Vehicle is an unmanned automatic vehicle which will be put in orbit by the European Ariane 5 launcher. It will transport to the International Space Station (ISS) and back to Earth pressurized cargo (active and passive, including temperature conditioned samples and water containers). In addition it will transport un-pressurized cargo to the ISS and it will allow the release of small satellites (optional capability) on the way ahead to the ISS. When needed, it will be configured to perform the re-boosts of the ISS to a higher altitude to compensate for the atmospheric drag.
The Re-entry Module most critical re-entry elements (thermo-mechanical architecture, guidance, navigation and control, descent and landing system) are designed taking into account the future evolution of the system for crew transportation.
The Service Module proposed concept shall have a propulsion system and a GNC robust enough to allow its future use for different launch stacks and different LEO missions (alternative cargo module solutions, transportation of orbital infrastructure modules/satellites, debris removal, support to assembly/servicing/re-fuelling activities).



esa	PROJECT:	International Space Station	
TITLE: ARV		DOCUMENT N°: ESA-HSO-COU-026	REV. 2.0


International Berthing and Docking Mechanism
Rendez-Vous and Docking Module (RVDM)
Orbital hatch 32 inches
Re-entry Module (RM)
Pressurized Payload
(active / passive):
2,000 kg to the ISS
1,500 kg back to Earth
Un-pressurized Cargo Module (UCM)
Un-pressurized Payload (active
/ passive): 3,000 kg to the ISS
(could include small satellites
deployed on-orbit)
3,000 kg waste back to Earth or
3,000 kg of re-boost propellant
Service Modul (SM)
Modules/infrastructure elements
transported by the Service Module
(in place of RVDM+RM+UCM):
13,000 kg to the ISS
Attitude Control System
28 x 220 N thrusters
(MMH-NTO pressurized system)
4 solar panel wings
Gallium-Arsenide cells
Main propulsion
4 x 490 N thrusters
MMH-NTO pressurized system

Specifications

DIMENSIONS
Length: 9,700 mm
Largest diameter: 4,400 mm

MASS BUDGET
Total cargo upload capacity: 5,000 kg
Mass at launch (max): 20,000 kg
Total cargo download capacity: 1,500 kg

PRESSURIZED CARGO (ACTIVE/PASSIVE)
Mass: 2,000 kg of pressurized cargo to the ISS, 1,500 kg of pressurized cargo down to Earth.

Volume/Typology: 8 m³ to the the ISS and 6 m³ down to Earth in typical cargo containers:

- Single and double middeck lockers;
- International Subrack Interface Standards;
- Cargo Transfer Bags (CTBs).

Power: Power supply to active cargo of 500 W (total average) all along the mission (from pre-launch to post-landing, docked dormant phase at the International Space Station excluded).

UN-PRESSURIZED CARGO (ACTIVE/PASSIVE)
Mass: 3,000 kg of un-pressurized cargo to the ISS;
3,000 kg of waste un-pressurized cargo down to Earth.

Volume / Typology:
- ISS ORUs and payloads and/or small satellites deployed on-orbit (max. volume per cargo element ~ 2.9 m³).
- Re-boost propellant.

Power: Power supply to un-pressurized active cargo of 200 W (total average) from pre-launch to ISS docking.

SM TRANSPORTABLE MODULE ELEMENTS
The SM, in its space tug configuration (not in the ARV launch stack), may ensure the transport to the ISS of modules/elements with the following characteristics:

- Mass below 13,000 kg;
- Diameter below 4.4 m and length below 7 m;
- Power need below 2 kW average.

Main Contractor
Astrium-Space Transportation,
leading a consortium of many sub-contractors.

Utilisation Relevant Data

LAUNCH

Launch Stack:

The ARV will be composed by the:

- Service Module (SM), ensuring propulsion of the composite, re-boost function (optional) and services to the cargo modules in orbit.
- Un-pressurized Cargo Module (UCM), transporting un-pressurized cargo to the ISS and waste back to Earth during a destructive re-entry.
- Re-entry Module (RM), the pressurized P/L module supporting all along the mission the cargo and the related operations.
- Rendez-vous & Docking Module (RVDM), accommodating the rendez-vous sensors and the docking system (the International Berthing & Docking Mechanism - IBDM).
- A Launcher Adapter (LA), ensuring a proper interface with the launcher.

ARV will be launched with the solar panels folded. Both the orbital power generation system and heat rejection system will not be active up to the insertion in orbit. Power supply and thermal control during launch will be provided respectively by batteries and a water evaporation system.

Launch Vehicle: Ariane 5
Launch under fairing.
The launcher will inject the ARV in a 260 x 260 km orbit, 51.6° inclination.

Launch site: Kourou, French Guiana

First Flight: 2017

Flight rate: Mean: 1/18 months

ON-ORBIT

The Launcher Adapter will be left attached to the last stage of the launcher.

The solar arrays will be deployed to ensure power supply and the heat rejection will be performed via space radiators.

UCM stored satellites, if any, will be deployed during the up leg of the mission.

The system will perform orbital manoeuvres and automatic rendez-vous & docking at the International Space Station (ISS) under the supervision of the Ground Control Centre and of the ISS.

After the completion of the cargo operations at the ISS (download/upload) and of the re-boost, the ARV will separate from the Station and will perform the de-orbiting.

RE-ENTRY

After de-orbiting the RM will separate from the SM-UCM and RVDM and will perform a controlled re-entry into the Earth's atmosphere (SM-UCM and RVDM will perform a destructive re-entry).

Thermal protections will ensure a proper thermal environment in the RM in spite of the high aerothermal loads induced by the drag.

In the last part of re-entry a parachute system will be deployed to further reduce the landing speed before splash-down.

Landing site: Atlantic Ocean

ARV mission profile.