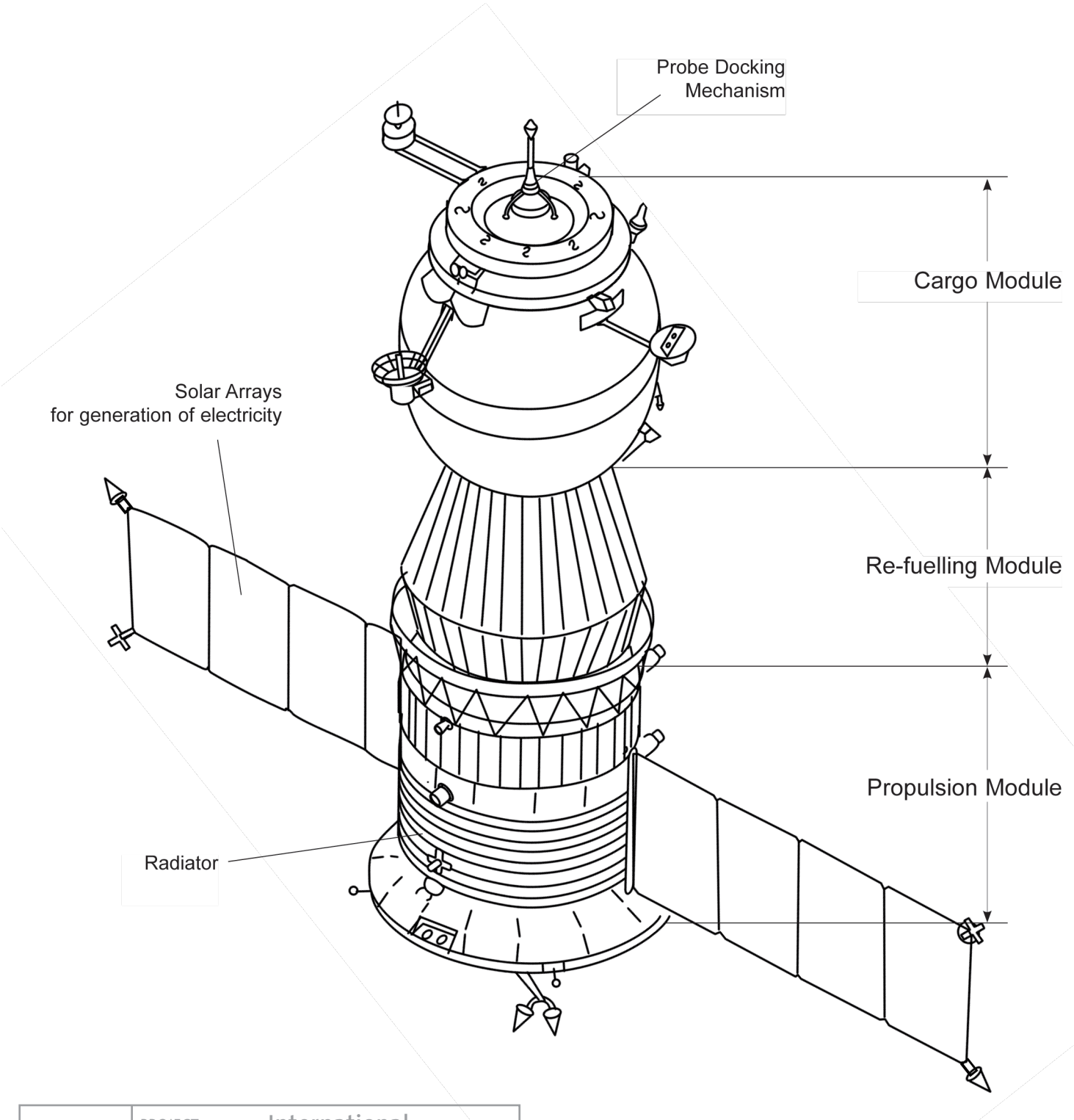
→ PROGRESS

Russian un-manned cargo spacecraft

Progress is an expendable unmanned cargo spacecraft, developed to regularly re-supply the International Space Station. The Progress vehicle is derived from the Soyuz spaceship design.

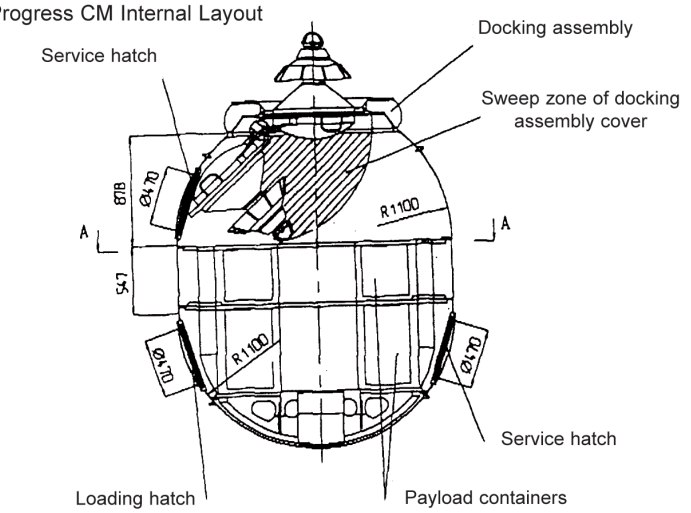


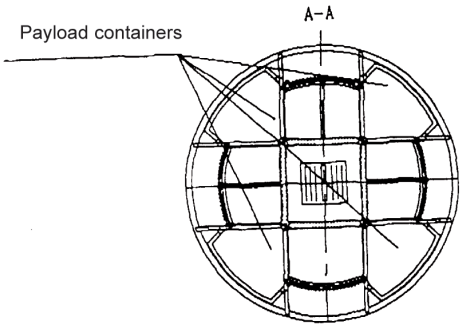
esa	PROJECT: International Space Station		
TITLE: Progress		DOCUMENT N°: ESA-HSO-COU-034	REV. 2.0

The Progress Spacecraft

The Progress space craft is composed by three major modules:
- the **Cargo Module** (CM), - the **Re-fuelling Module** (RM), and
- the **Propulsion Module** (PM).

Progress CM Internal Layout





THE CARGO MODULE (CM)

The CM is a pressurized spherical structure which is filled with cargo supplies to the ISS. Once docked and the crew has equalized the pressure, the cargo is removed and transferred. The volume that has been left empty is filled with all the rubbish and the equipment that needs to be disposed.
This module is burned during its destructive re-entry into the Earth's atmosphere.

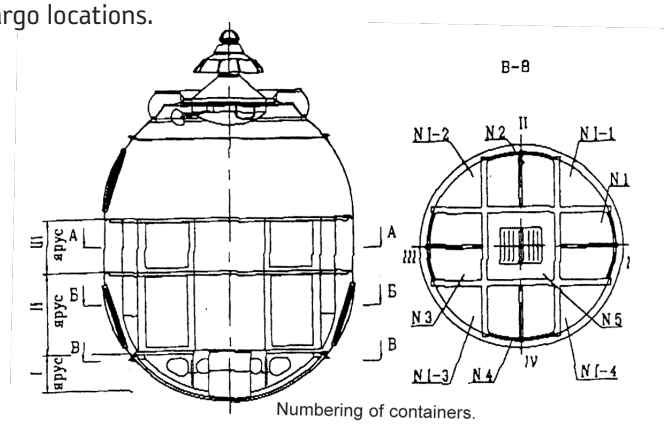
THE RE-FUELLING MODULE (RM)

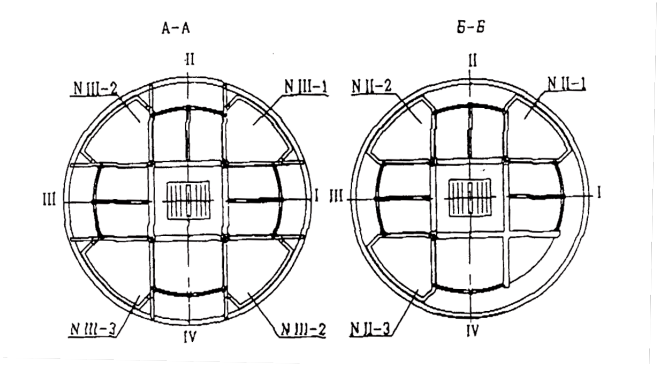
The RM is located in the middle of the Progress and it replaces the Soyuz's DM. This is an un-pressurized propellant and refuelling compartment for safety reasons insulated from the CM (in order to avoid poisonous gases to get in contact with the ISS' internal environment).
As the CM, also the RM is burned during its destructive re-entry into the Earth's atmosphere.

THE PROPULSION MODULE (PM)

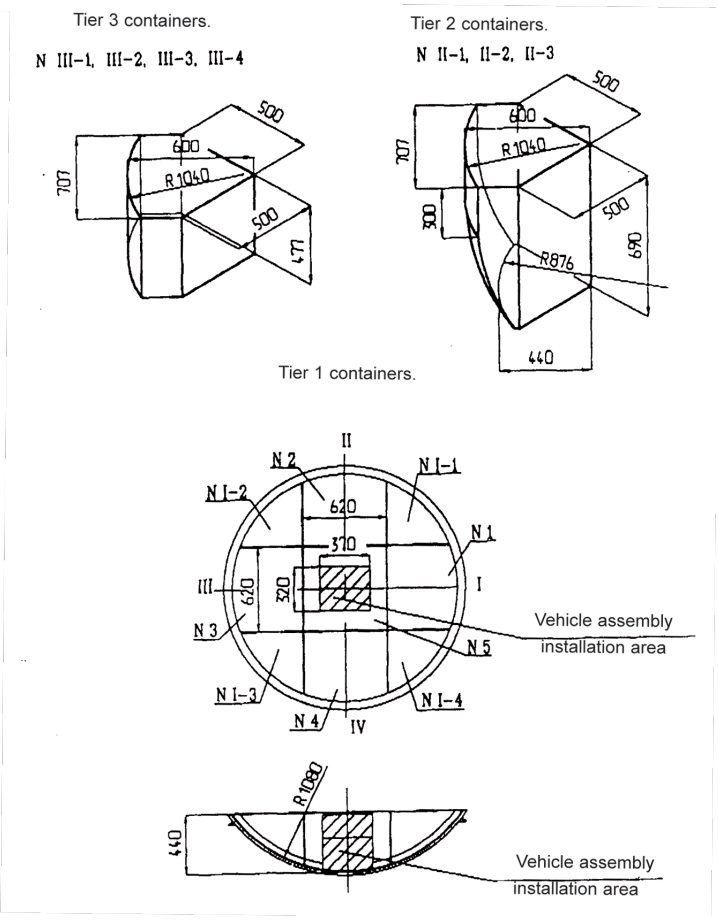
The PM is located at the rear of the spacecraft and it contains the avionics and the engines for the automatic docking.
It can also be used for the ISS' re-boosting operations.
Like the previous two modules, also the PM is burned during its destructive re-entry into the Earth's atmosphere.

Progress CM
cargo locations.





Progress CM cargo locations dimensions.



Specifications

PROGRESS SYSTEM MAJOR SPECIFICATIONS AND PERFORMANCES

Launch Mass:	7,150 kg
Length:	7.23 m
CM Diameter	2.2 m
Maximum Diameter	2.72 m
Cargo Compartment Volume	7.6 m^3
Maximum Cargo Mass	2,230 kg
Maximum Dry Cargo Mass	1,800 kg
Maximum Propellant Mass	1,950 kg
Electrical System Solar Panels Span:	10.60 m

Progress M-52 (ISS-P17) short after un-docking the International Space Station in June 2005. Photo: NASA

Utilisation Relevant Data

LAUNCH CONFIGURATION

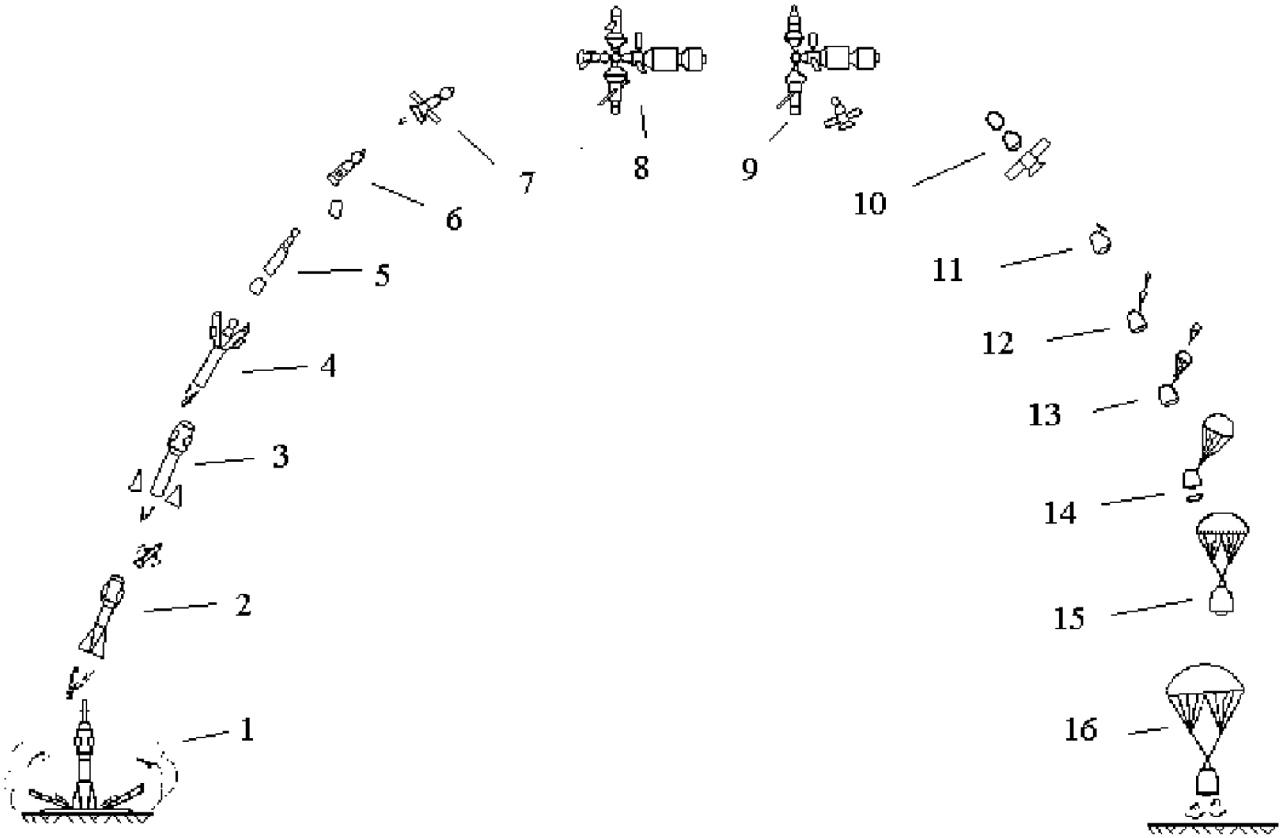
Launch vehicle: Soyuz rocket
Launch site: Baikonur, Kazakhstan
First flight to ISS: August 2000
Flight rate: Mean: 4-8/year

ON ORBIT CONFIGURATION

Deployed solar arrays, with a total span of 10.6 m that provide electrical power.

MISSION PHASES

- Spacecraft (and cargo) integration,
- Launch,
- Transfer flight to the ISS,
- Docking to the ISS,
- Docked operations,
- Cargo transfer to the ISS,
- Undocking from the ISS,
- Free flight after undocking,
- De-orbiting,
- Destructive re-entry into Earth's atmosphere.



1. Lift-off contact (КП) (h=0 km; t=0 s).
2. Jettison the launch escape system propulsion system (h=46 km; t=115 s).
3. Separation of LV 1st stage (h=49 km; t=118 s).
4. Jettison the nose fairing (h=84 km; t=165 s).
5. Separation of LV 2nd stage (h=167 km; t=288 s).
6. LV 3rd stage shut-off command, microgravity (h=202 km; t=526 s). 3rd stage separation contact (КО) (t=530 s).
7. Autonomous orbital flight (prior to docking with the orbital complex) up to 1.9 days.
8. Mated orbital flight (as part of the orbital complex) up to 210 days.
9. Undocking from the orbital complex, autonomous pre-descent flight, up to 1.3 days.
10. Vehicle compartment separation.
11. Jettison primary parachute (ОСП) cover.
12. Deploy the pilot parachute and the drogue parachute, in turn, to reduce the rate of descent.
13. Deploy the main canopy and jettison the drogue parachute.
14. Jettison the heat shield, jettison external window panes, open the automatic pressure control unit (БАРД) (h=5.5 km)
15. Re-hook the main canopy for symmetrical suspension, HF (КВ) beacon, pressurize the ОСП container ullage, release air from the ullage cylinder of the backup parachute (ЗСП) in the CA.
16. Firing of soft-landing engines, opening of the ambient air ventilation system (СДВ) valves, landing, damping the landing velocity by deformation of the bottom and the shock-absorbing seats.