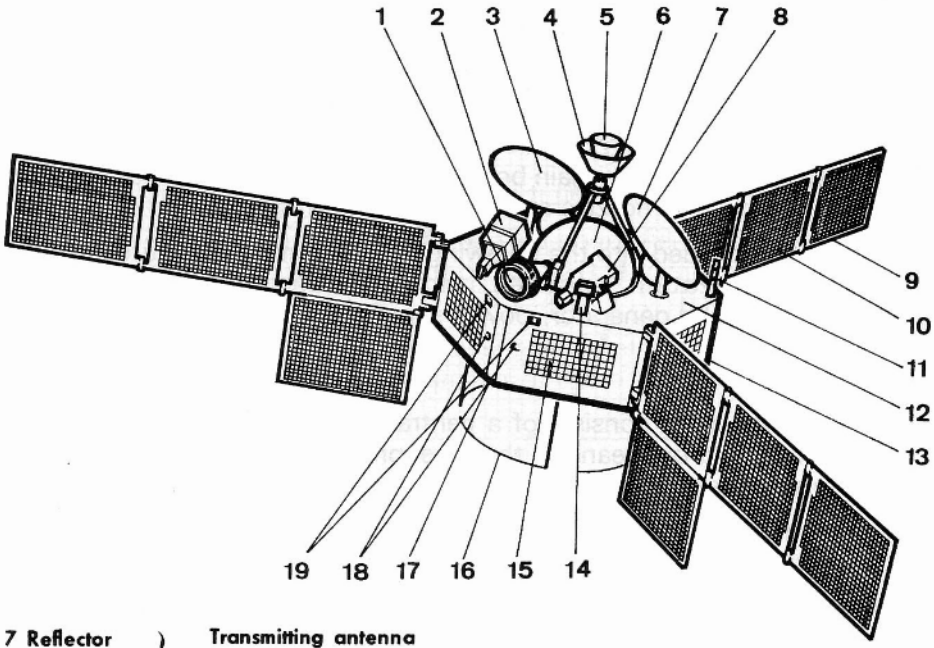
SYMPHONIE SATELLITES – FACT SHEET

Mission : French German experimental telecommunication mission in geostationary orbit using C-band broadband transponders, a global receive coverage (up-link at 6 GHz band) and two transmit coverage (down-link at 4 GHz band), over Europe-Africa and Eastern Americas zones respectively.

In-orbit service : Overall service of SYMPHONIE A and SYMPHONIE B satellites was performed in the period 1975 – 1984 under French German co-operation. Mission was specified for 5 years and achieved over 10 years; spacecraft lifetime lasted about 9 years for each flight model in specified orbital position.

SPACECRAFT FEATURES



7 Reflector } Transmitting antenna
8 RF Source } Euro-African zone
9 Solar panel, unfolded
10 Solar cells
11 Sun sensor
12 Superisolation coating
13 Side plate
14 Sun sensor
15 Optical solar reflectors
16 VHF Antenna element
17 Equipment case
18 Cold gas jet vent
19 IR Edgetracker sensor

1 Receiving antenna
2 RF Source } Transmitting antenna
3 Reflector } American zone
4 Thermal shield
5 Apogee motor nozzle
6 Apogee motor tank

Spacecraft mass : Mass at launch 402 kg, injected into synchronous orbit 242 kg, dry 215 kg

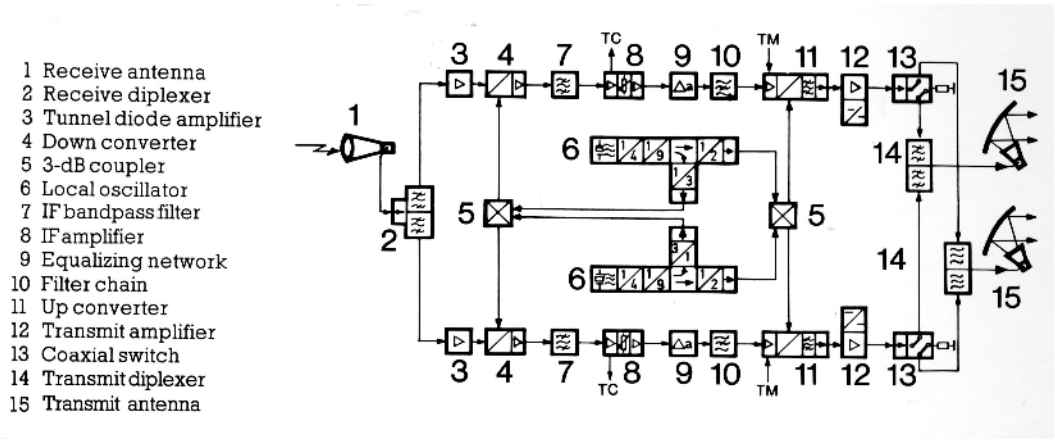
Spacecraft power : 303 W BOL (beginning of life) down to 187 W EOL (end of life) generated from unfolded solar panels
30 Ah energy available from two Ni-Cd batteries over eclipse time

Station keeping : Capacity to maintain orbit inclination over 5 years and on station longitude over 10 years

Pointing accuracy : Accuracy better than .5 degree in all body-stabilised attitude control modes

PAYLOAD FEATURES

- One global receive antenna, two transmit antennas on dedicated coverage zones
- Frequency band of 500 MHz subdivided in four sub-bands, two of them dedicated per satellite
- Two double frequency conversion transponders of 90 MHz bandwidth each
- Receive sensitivity G/T = -15 dB/°K
- Transmit radiated power EIRP of 30 dBW on edge of covered transmit zones
- Two 13 W travelling wave tube TWT power amplifiers in the 4 GHz transmit bands
- Intelligible crosstalk level better than –60 dB



BUS SUBSYSTEMS FEATURES

Structure

- Six-sided equipment case, 1.7 m diameter and .5 m in height, braced with a aluminium central tube through three suspended webs
- Webs, plates and panels made of aluminium honeycomb core sandwich type technology
- Solar array panels and antenna dishes made of aluminium honeycomb with glass epoxy sheets

Thermal control

- « insulated core » thermal control type with trimming heaters in cold locations
- super-insulation blankets combining multi-layer aluminised Mylar and Kapton cover sheet
- external radiating surfaces covered with optical solar reflectors (OSR) cells

Power supply

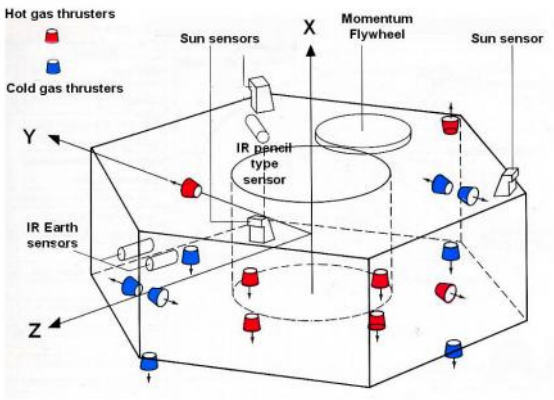
- Fixed solar generator after deployment
- 22000 2-by-2 cm silicium solar cells
- 27 Volts regulated bus voltage
- 300 W shunt dissipator capacity
- Two 14 Ni-Cd elements batteries
- 4 DC-DC power converters

Telemetry- Tracking and Command (TTC)

- Main mode in VHF frequency bands
- Auxiliary mode in C-band coupled with payload operation
- Telemetry modulation PCM/PSK/PM
- Telemetry rate of 8 bps in low mode with 198 quantities and 64 bps with 24 quantities
- Command modulation PDM/AM on TDCS standards
- 127 on-off type commands plus 8 bits memory registers

Propulsion

- Bi-propellant apogee motor, 400 Newton thrust with Isp of 305 s
- 7 bi-propellant 10 Newton thrusters for orbit control with Isp of 285 s
- 8 nitrogen 1 Newton thrusters, for attitude control and East-West station keeping back-up, with Isp of 68 s



Attitude control

- Spin stabilised mode with tilting capacity until synchronous orbit acquisition phase
- 3-axis body stabilised modes all over communication mission, thanks to momentum (20 Nms) flywheel permanent control loop and periodical thrusters control operations
- Infrared Earth sensors and sun sensors attitude measurement (no gyros set on-board)
- Attitude control electronics with memory registers and download checking capability