Agenda

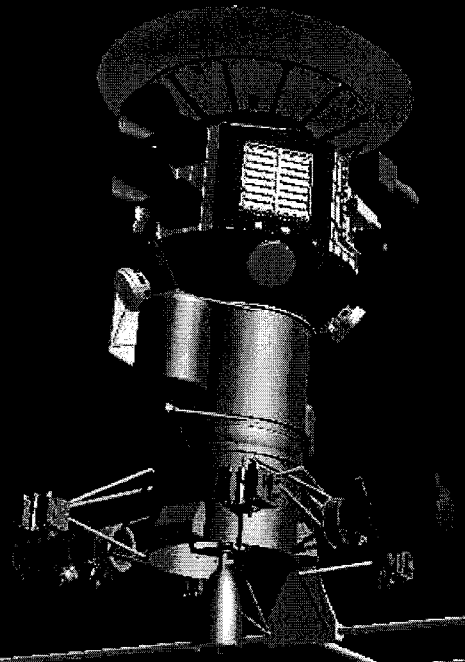
June 6, 2001

8:30	Introduction	Karla Clark
9:00	X2000/Europa Orbiter Avionics Overview	Valerie Thomas
9:30	Power Mixed Signal ASIC Library	Greg Carr
9:45	Power Converter and Assembly	Loren Jones
10:15	Power Activation and Switching Module and Slices	Ian Ruiz
10:45	System Flight Computer	Dwight Geer
11:15	System Interface Assembly	Dwight Geer
11:45	Lunch	
1:00	System I/O Slice	Genji Arakaki
1:30	Non-Volatile Memory Slice	Karl Strauss
1:45	Temperature Remote I/O and Assembly	Karl Strauss
2:00	Advanced Packaging	Charlie Kaczinski
2:30	Software	Blair Lewis
3:00	Integration & Test	Bonnie Theberge
3:30	Flight Hardware Logistics Program	Kevin Clark

Programmatic Changes

- X2000 Integrated First Delivery Project (IFDP) incorporated into management structure of Europa Orbiter
- X2000 technology development continues as before with more relaxed schedule to fit within Europa Orbiter Project schedule and budget
- X2000 technical team and objectives remain the same
- X2000 still multi-mission wherever possible – supplying flight processors to Deep Impact and ST3 and flight memory to Deep Impact

Europa Orbiter
GROUP 1 SCIENCE OBJECTIVES

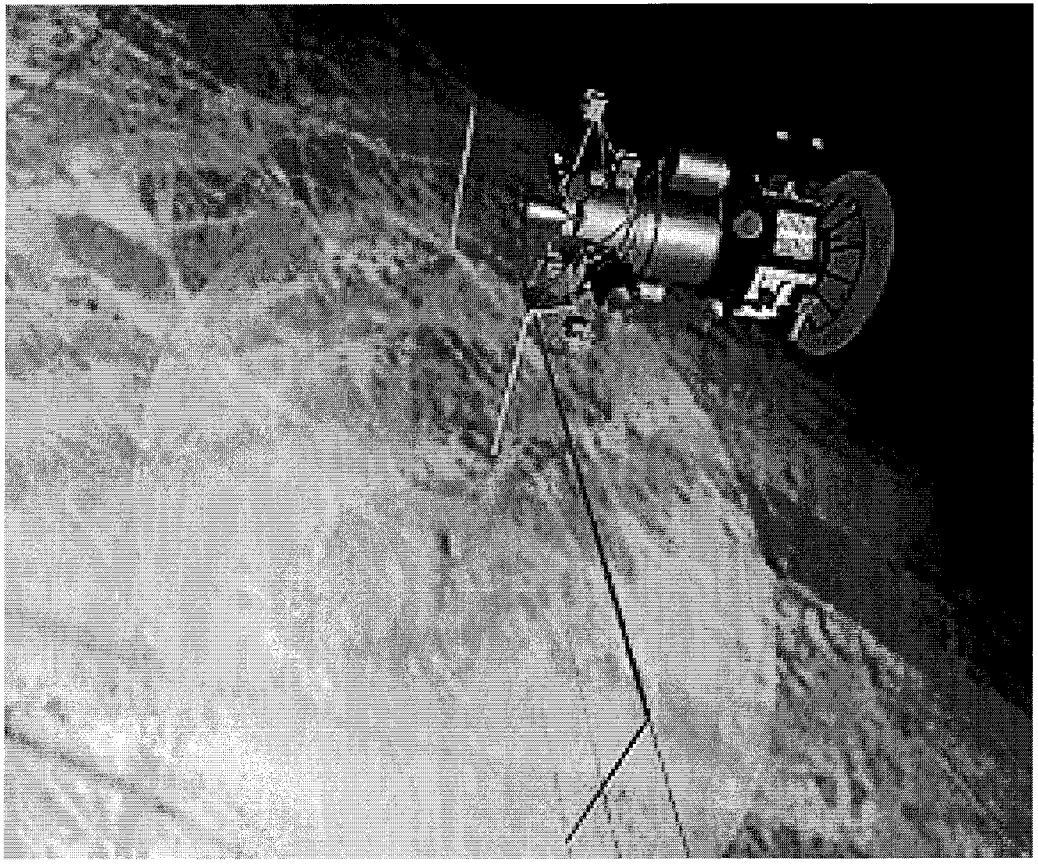


(1) Determine the presence or absence of a subsurface ocean

(2) Characterize the 3-D distribution of any subsurface liquid water and its over-lying ice layers

(3) Understand the formation of surface features including sites of recent or current activity, and identify candidate sites for future lander missions

Investigations



Strawman Science Investigations

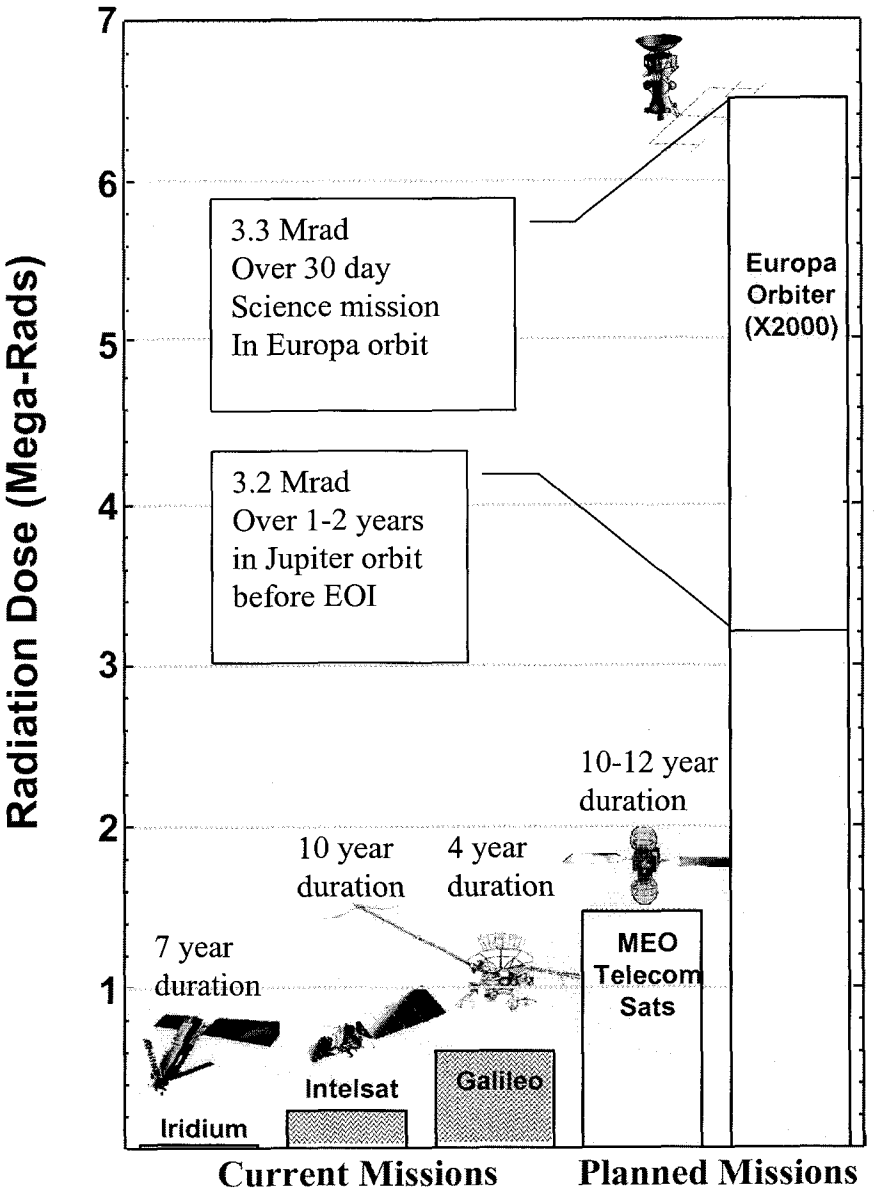
Radio Science/Doppler Tracking
Laser Altimeter
Imaging
Radar Sounder
Selection pending on AO proposals

Three Characteristics

Three characteristics drive to cost and complexity of the Europa Orbiter Mission:

- Radiation Environment
- Radioisotope Power Source
- High Launch & Trajectory Energy Requirements

EO Mission Radiation Environment



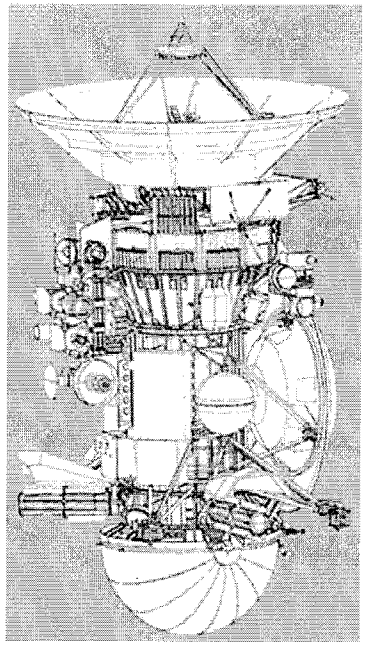
- The Europa Orbiter total dose environment is harsh compared to current experience
  - At Europa an astronaut inside an EVA suit receives a lethal dose every 12 minutes
- The Europa Orbiter must operate with high reliability during the 30 day mission
  - Science objectives
  - Achieve quarantine orbit
- Impact
  - High technology, high risk, high cost electronics development (X2000) to reduce risk
  - Total shielding = 39 kg

Mission Design

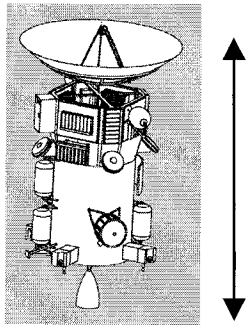
- Launch Vehicle - Delta 4050H
  - >95% confidence of launching in prime opportunity
  - Kick stage 48V/B, 63D, or 63F
- Direct trajectory
  - $C_3 \leq 80$ km^2/s^2
  - Broken Plane Maneuver
  - Minimum perihelion ~0.98 AU
- Jupiter orbit
  - Ganymede gravity assist prior to JOI ~500km
  - JOI @ 12.5 Rj, initial orbit ~200 days
  - Lowest perijove encountered ~8.5 Rj
  - >a dozen satellite encounters
  - ~60 trajectory correction maneuvers to navigate
  - TCMs +/-1 day from encounters
  - 4 critical main engine burns
- Europa orbital phase
  - Interim orbit of perhaps 200x300 km
  - 30 days @ 90% confidence, <90° Earth-Sun-Europa angle (<5 AU from Earth)
  - Quarantine burn(s) at EOM - achieve 500-1000 year orbit lifetime (roughly 400 km altitude)

X2000: Contributions and Users

Cassini S/C
22.3 ft (6.7 m)



Europa Orbiter S/C
11.4 ft (3.5 m)



X2000 Users

JPL

- Europa Orbiter - Full Flight Set
- Deep Impact - Flight Computer/ Nonvolatile Memory/ System Interface ASIC
- ST-3 - Flight Computer/ Nonvolatile Memory/ System Interface ASIC
- Mars 07 - Considering Full Flight Set
- SIM - 8 Flight Computers baselined
- Technologies - Various new concepts that utilize the X2000 ASICs

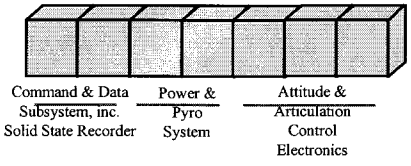
GSFC/NOAA

- NPP (NPOESS Preparatory Project)/NPOESS - Flight Computer & 1394 bus baselined (SIO)

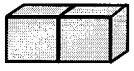
DOD

- SBIRS Low - Considering Avionics

Cassini Bays

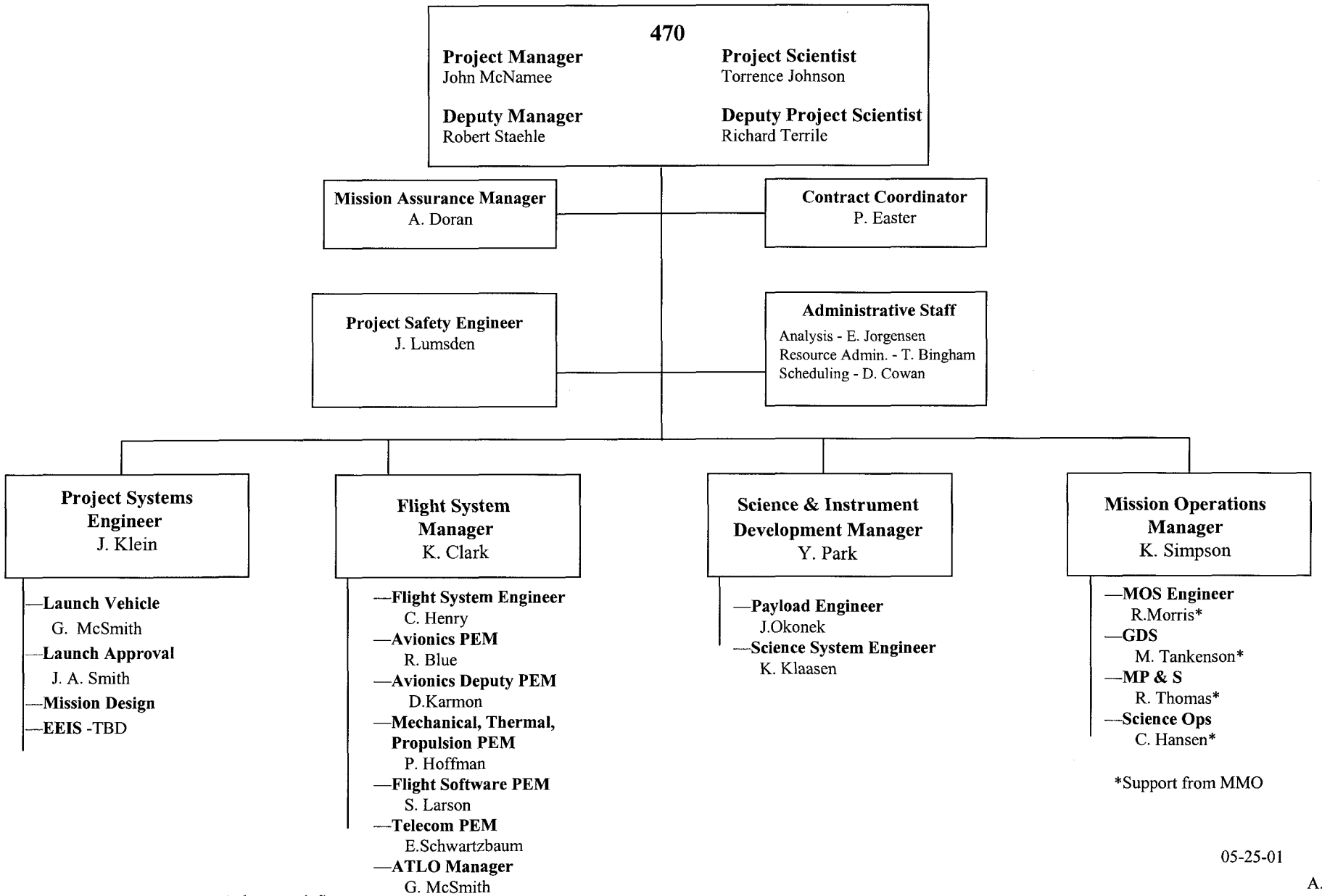


X2000 First Delivery Chassis



Mass (kg)	170	43	Plus Shielding of 13kg for X2000 electronics only
Power (W)	137	167	at Orbit Insertion
Volume (m^3)	.252	.074	
Hardness (krads)	350	5000	
Processing Speed (MIPS)	1	60-200	Effective (240 MIPS Dhrystone)

Europa Orbiter Project



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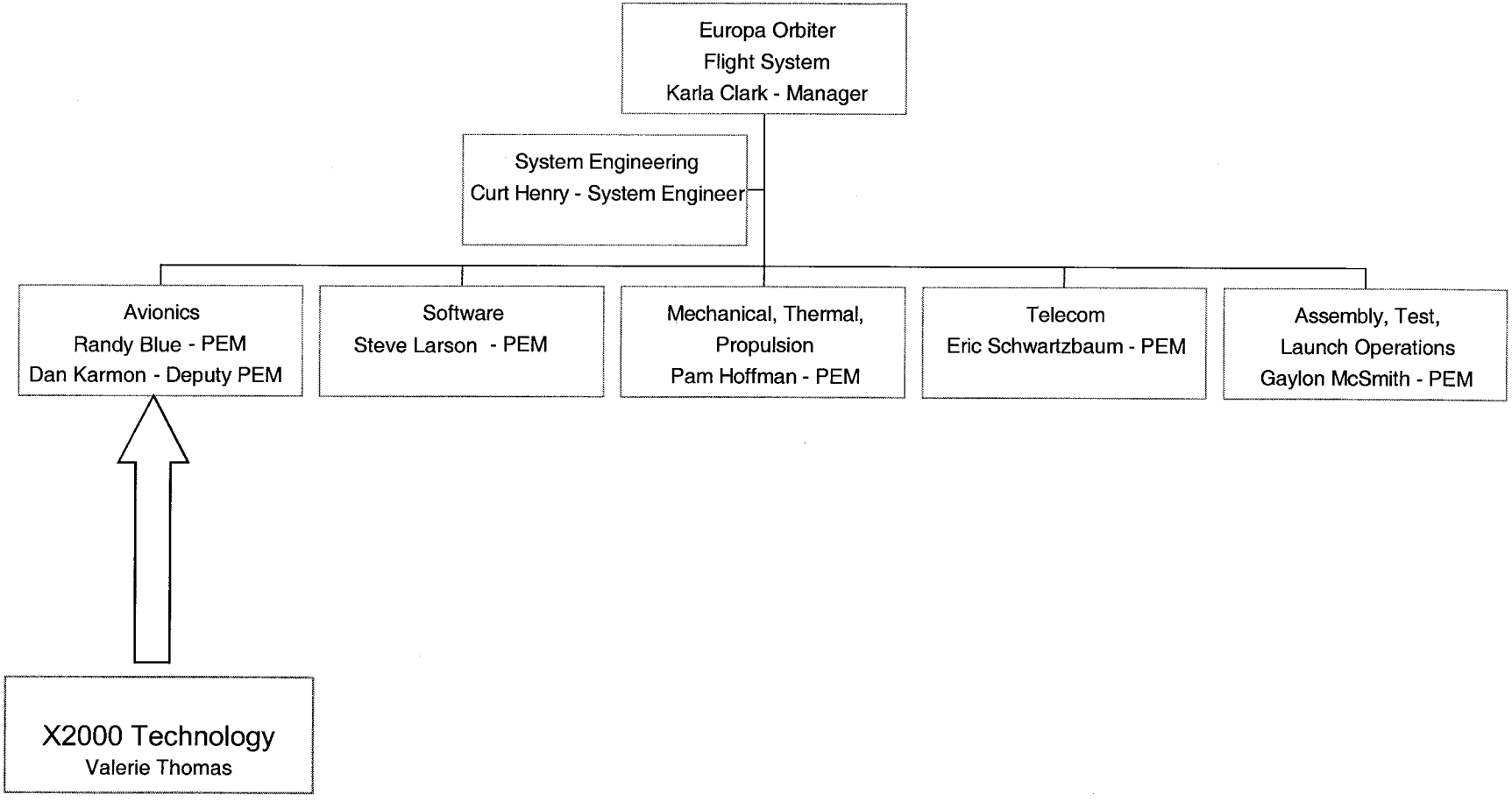
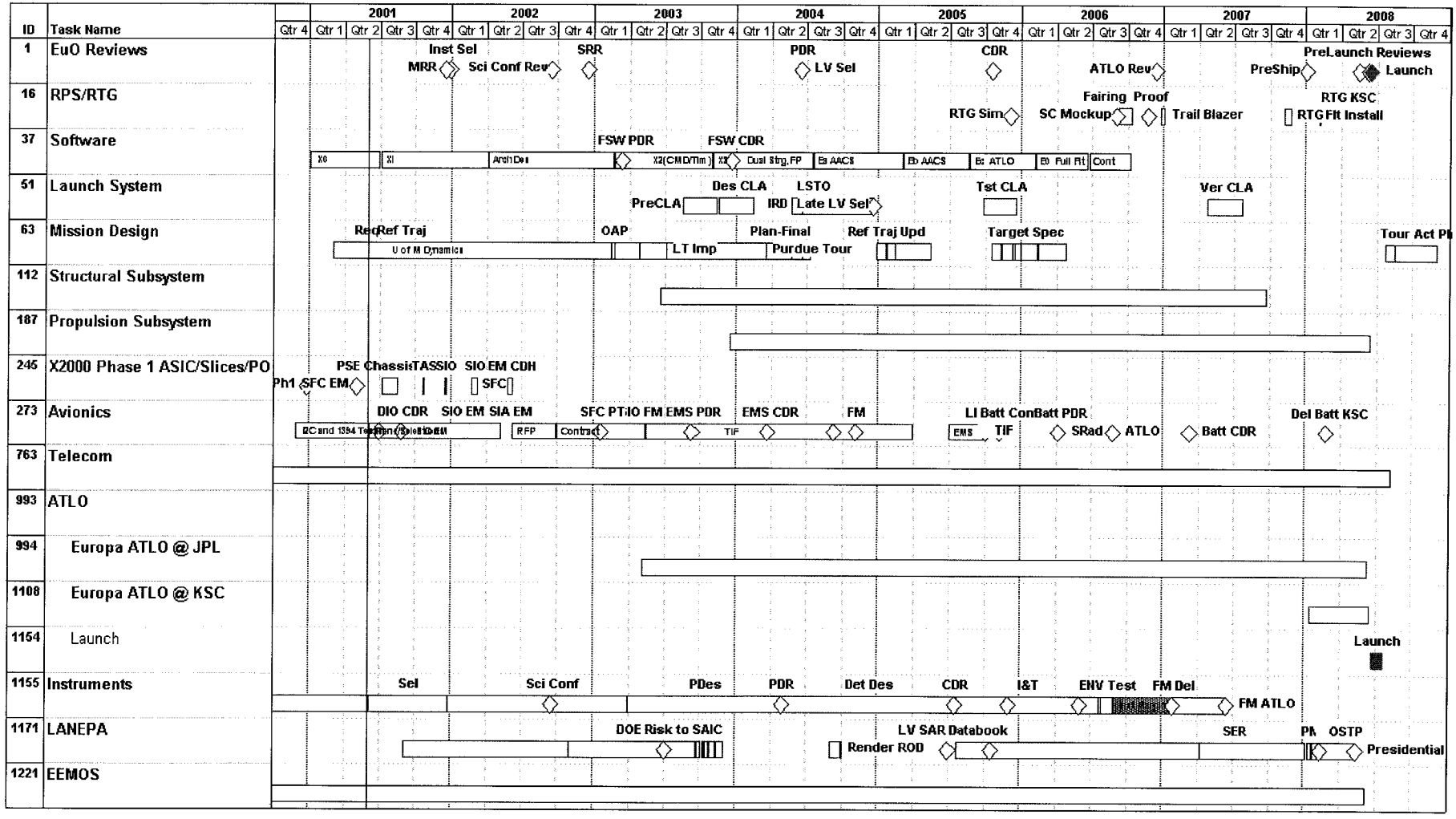
Flight System Organization Chart

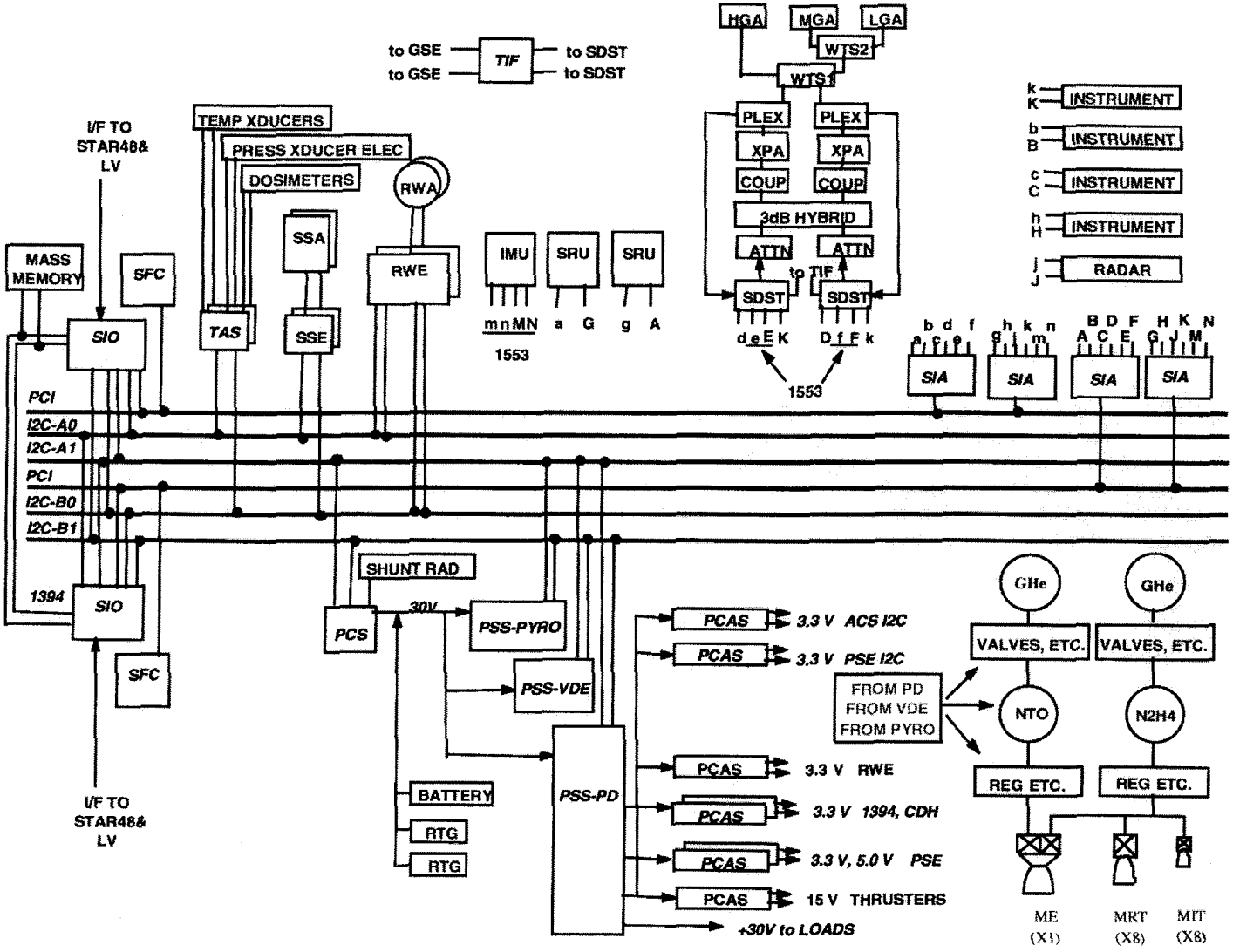


EO Top Level Schedule

All Years are FY



EO Functional Block Diagram



X2000 IN BLACK ITALICS

EUROPA ORBITER FUNCTIONAL BLOCK DIAGRAM 1/12/01

Flight System Block Diagram Acronyms & Abbreviations

ACRONYMS & ABBREVIATIONS USED IN FLIGHT SYSTEM BLOCK DIAGRAMS

1394 - DATA BUS STANDARD

1553 - DATA BUS STANDARD

ACS - ATTITUDE CONTROL SYSTEM

ATTN - ATTENUATOR

CDH - COMMAND & DATA HANDLING

COUP - COUPLER

GHe - GASEOUS HELIUM

GSE - GROUND SUPPORT EQUIPMENT

HGA - HIGH GAIN ANTENNA

IMU - INERTIAL MEASUREMENT UNIT

I2C - DATA BUS STANDARD

LGA - LOW GAIN ANTENNA

LV - LAUNCH VEHICLE

ME - MAIN ENGINE

MGA - MEDIUM GAIN ANTENNA

MIT - MINIMUM IMPULSE THRUSTER

MRT - MEDIUM RANGE THRUSTER

NTO - NITROGEN TETROXIDE

N2H4 - HYDRAZINE

PCA - POWER CONVERTER ASSEMBLY SLICE

PCI - DATA BUS STANDARD

PCS - POWER CONTROL SLICE

PD - POWER DISTRIBUTION

PLEX - DIPLEXER

PRESS - PRESSURE

PSE - POWER SYSTEM ELECTRONICS

PSS - POWER SWITCH SLICE

PYRO - PYRO SWITCHES

RAD - RADIATOR (SHUNT)

REG - REGULATOR

RTG - RADIOISOTOPE THERMOELECTRIC GENERATOR

RWA - REACTION WHEEL ASSEMBLY

RWE - REACTION WHEEL ELECTRONICS

SDST - SMALL DEEP SPACE TRANSPONDER

SFC - SYSTEM FLIGHT COMPUTER

SIA - SYSTEM INTERFACE ASSEMBLY

SIO - SYSTEM INPUT/OUTPUT INTERFACE

SRU - STELLAR REFERENCE UNIT

SSA - SUN SENSOR ASSEMBLY

SSE - SUN SENSOR ELECTRONICS

STAR48 - KICK MOTOR

TAS - TEMP REMOTE I/O ASSEMBLY SLICE

TEMP - TEMPERATURE

TIF - T-ZERO INTERFACE

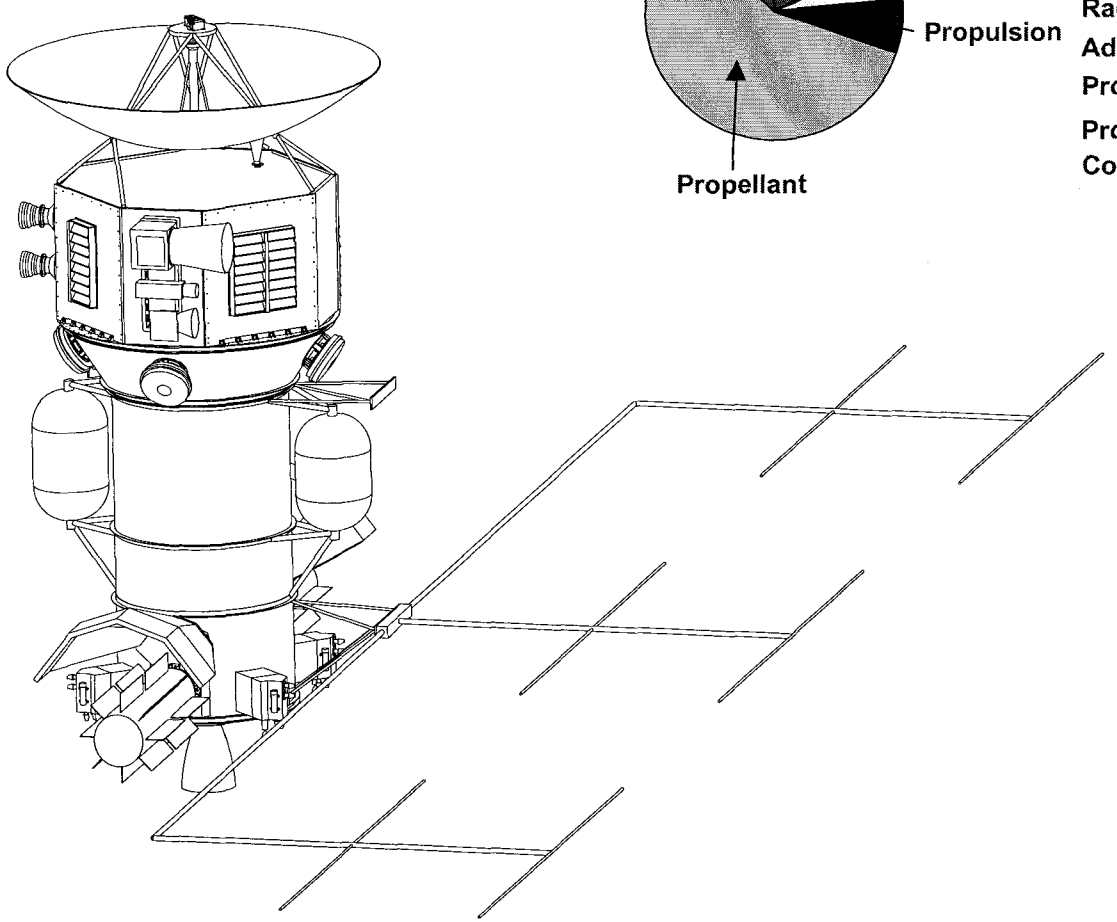
VDE - VALVE DRIVE ELECTRONICS

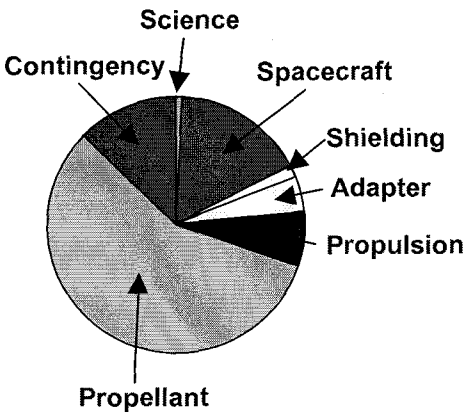
WTS - WAVEGUIDE TRANSFER SWITCH

XDUCER - TRANSDUCER

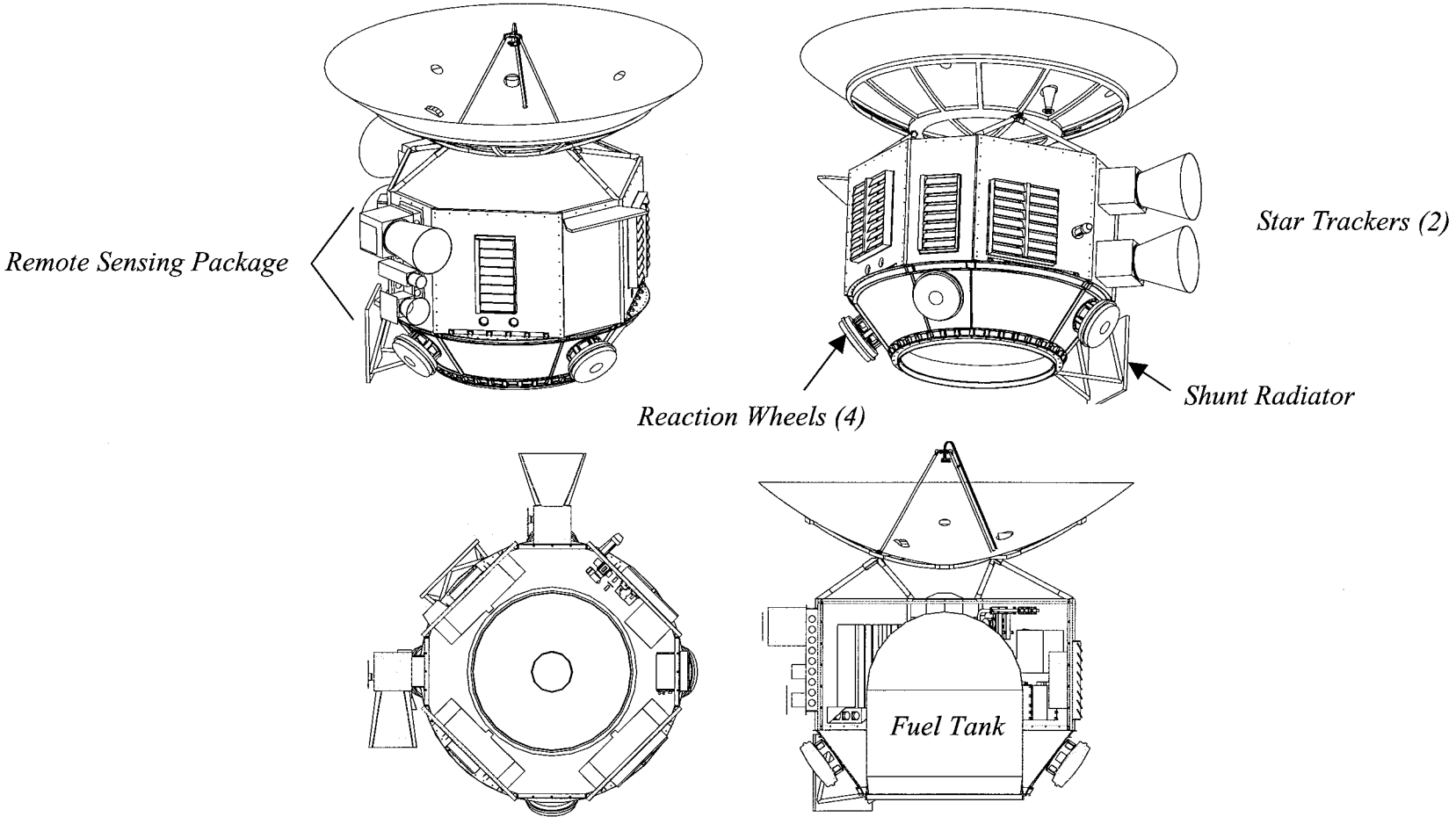
XPA - X BAND POWER AMPLIFIER

Orbital Configuration





MASS BREAKDOWN:

Science (allocation)	20 kg
Spacecraft (CBE)	354 kg
Rad shielding (CBE)	39 kg
Adapter (CBE)	90 kg
Propulsion Subsystem (CBE)	150 kg
Propellant (fully loaded)	1221 kg
Contingency (dry)	273 kg

Science & Avionics Module