



***Solar Terrestrial Relations Observatory (STEREO)
Pre-Phase-A Requirements Review***



Mechanical

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Solar Terrestrial Relations Observatory (STEREO) Pre-Phase-A Requirements Review



Mechanical Design Objectives

- Spacecraft bus requirements
- Candidate launch vehicle evaluations
- Science instrument suite
- Spacecraft mass statement



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Spacecraft Bus Requirements

- Two identical Sun-pointing spacecraft
- Two-year total mission lifetime, five year expendables
- Fit within dynamic envelope of Athena II (92" fairing) launch vehicle
- Maximum payload weight of 350 kg (Athena II capability)
- Spin balanced for orbit injection by STAR 37 solid rocket motor
- Gimballed high-gain antenna capable of 115° of rotation
- 3-axis stabilized on-orbit
- Balanced to minimize separation of center of pressure and center of mass
- Provide thermal and mechanical environments for science instruments



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Candidate Launch Vehicle Evaluations

- Taurus XL (92" fairing)
- Delta II (114" fairing)
- Athena II (92" fairing)
- Space Shuttle



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Science Instrument Suite

- Chromosphere and Low Coronal Imager
- Coronagraph
- Radio Burst Tracker
- Heliosphere Imager
- Solar Wind Analyzer
- Magnetometer
- Solar Energetic Particle Detector



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Solar Coronal and Imaging Package (SCIP)

- Chromosphere and Low Corona Imager
 - Positioned for Sun pointing
 - Clear field of view of 180°
 - Optical field of view of $15^\circ \times 15^\circ$
 - 2π steradian view of space for CCD radiator (-70°C)
 - Three kinematic mounts
 - Thermally isolated from mounting structure
 - Integral electronics
- Coronagraph
 - Part of Chromosphere and Coronal Imager above



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Heliosphere Imager (HI)

- Positioned at 90° to the spacecraft-Sun line
- Optical field of view of $165^\circ \times 165^\circ$
- 2π steradian view of space for CCD radiator (-70°C)
- Integral electronics



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Solar Wind Plasma Analyzer (SWPA)

- One Faraday Cup Sun pointing, Second Faraday Cup 90° to Sun Pointing Cup and Third Faraday Cup (TBD) position to be determined
- Field of view of $\pm 60^\circ$
- Remote electronics
- Thermally coupled to mounting surface



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Magnetometer

- Sensor deployed by boom to a distance of 3-6 meters from spacecraft
- Sensor positioned along anti-Sun line
- Remote electronics
- Sensor thermally isolated from boom mounting surface



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Solar Energetic Particle Detector (EPD)

- Positioned at 45° angle to the spacecraft-Sun line
- Field of view of detector is $\pm 35^\circ$
- Rotary actuator required for repositioning detectors



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Radio Burst Tracker (RBT)

- Boom antennas (3) deployed to a length of 10 meters
- Boom antennas mutually perpendicular to one another
- Boom antennas not parallel to spacecraft-Sun line
- Boom antennas thermally coupled to mounting surface
- Remote electronics



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Spacecraft Component Weights List

	<u>MASS (kg)</u>
Power Subsystem	58.20
Ga-As Solar Array (2 wings, 36 sq.ft.)	16.40
Super Nickel-Cadmium Battery (21 amp-hr)	23.80
Power Switching Unit (PSE)	13.50
Peak Power Tracker (PPT)	4.00
Power Shunt/Fuse Box	0.50
Attitude Control Subsystem	47.00
NEAR Inertial Measurement Unit	5.50
NEAR Reaction Wheel (3 required) and Electronics	12.90
TIMED Star Tracker	6.40
TIMED Attitude Flight Computer (AFC)	2.40
TIMED Attitude Interface Unit (AIU)	6.60
Cold Gas Storage Tank and Thruster System (4 thrusters)	11.00
Adcole High Resolution Sun Sensor and Electronics	1.00
Adcole Sun Sensor (2 heads required) and Electronics	1.20



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Spacecraft Component Weights List (con't)

RF Subsystem	21.00
High Gain X-Band Dish Antenna (1.1 m dia)	6.50
Antenna Gimbal Drive and Electronics (90°)	4.50
X-Band Amplifier (TWTA w/power supply)	3.60
RF Coax Switch (3 required) Assembly and Flex Cables	3.70
RF Diplexer	0.20
Mid Gain X-Band Fan Beam Antenna (2 required)	1.00
Low Gain X-Band Patch Antenna (2 required)	1.50
Avionics Subsystem	12.80
TIMED IEM (9 card design)	12.30
MSX type Ultra Stable Oscillator	0.50
Thermal Subsystem	17.10
MLI Blankets, Heaters and Thermostats	16.00
TIMED Remote Interface Unit (RIU) (5 required)	1.10



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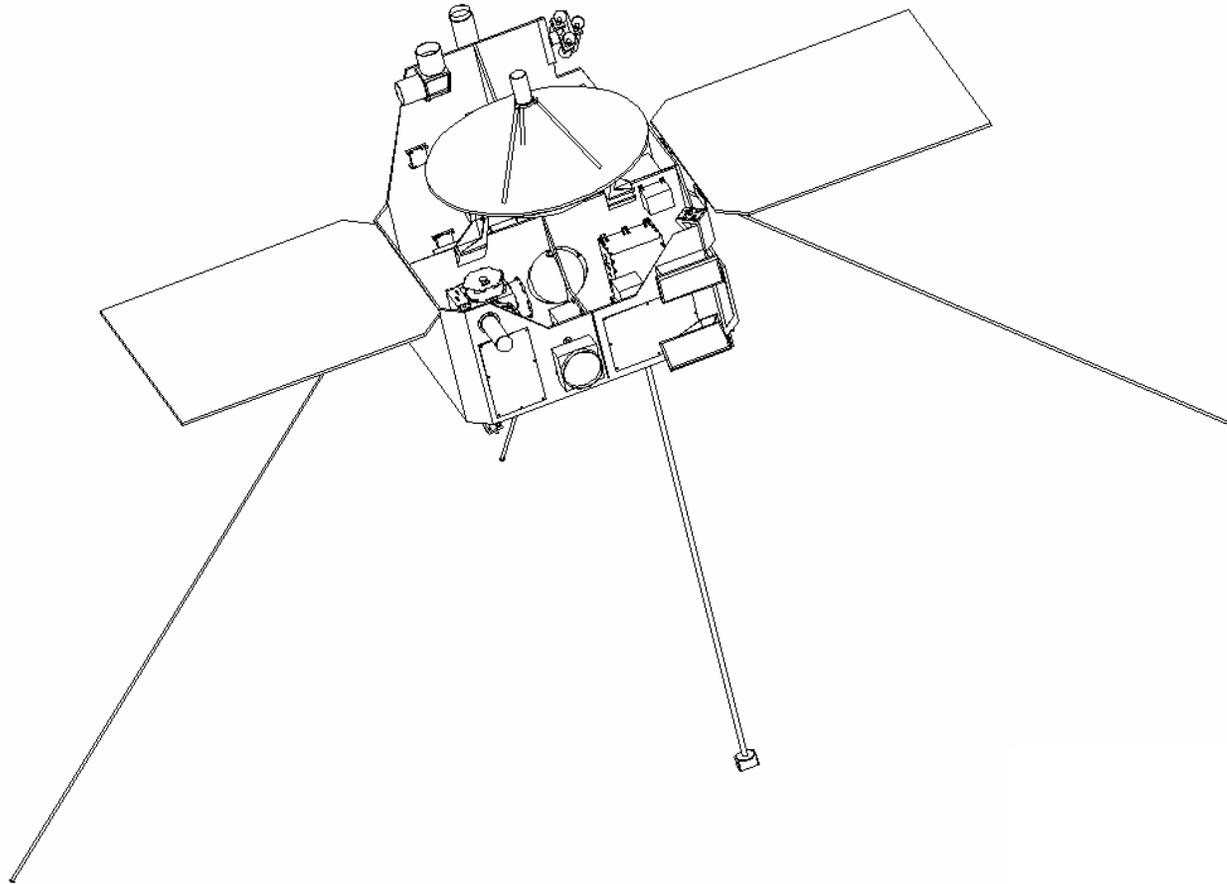


Spacecraft Component Weights List (con't)

Instrument Subsystem		66.00
Solar Coronal Imaging Package (SCIP)	30.00	
Energetic Particle Detector (EPD)	3.00	
Solar Wind Plasma Analyzer (SWPA) and Electronics	7.00	
Radio Burst Tracker (RBT) Electronics	4.00	
Hingelock 621 Deployer (10 meter) for RBT (3 required)	4.00	
CME Heliospheric Imager (HI)	6.80	
GSFC Magnetometer and Electronics	2.00	
Astro Bi-Stem Actuator (6 meter) for Magnetometer	4.00	
Instrument Bench (SCIP and IMU)	5.20	
Spacecraft Bus Subsystem		64.80
Primary and Secondary Structure		
@ 12% of 350 kg (max. launch mass)	42.00	
Wiring Harness @ 5% of 350 kg (max. launch mass)	17.50	
Spin Balance Weights @ 1.5% of 350 kg (max. launch mass)	5.30	
	TOTAL =	286.90
	Contingency Based on 350 kg (max.) =	18%

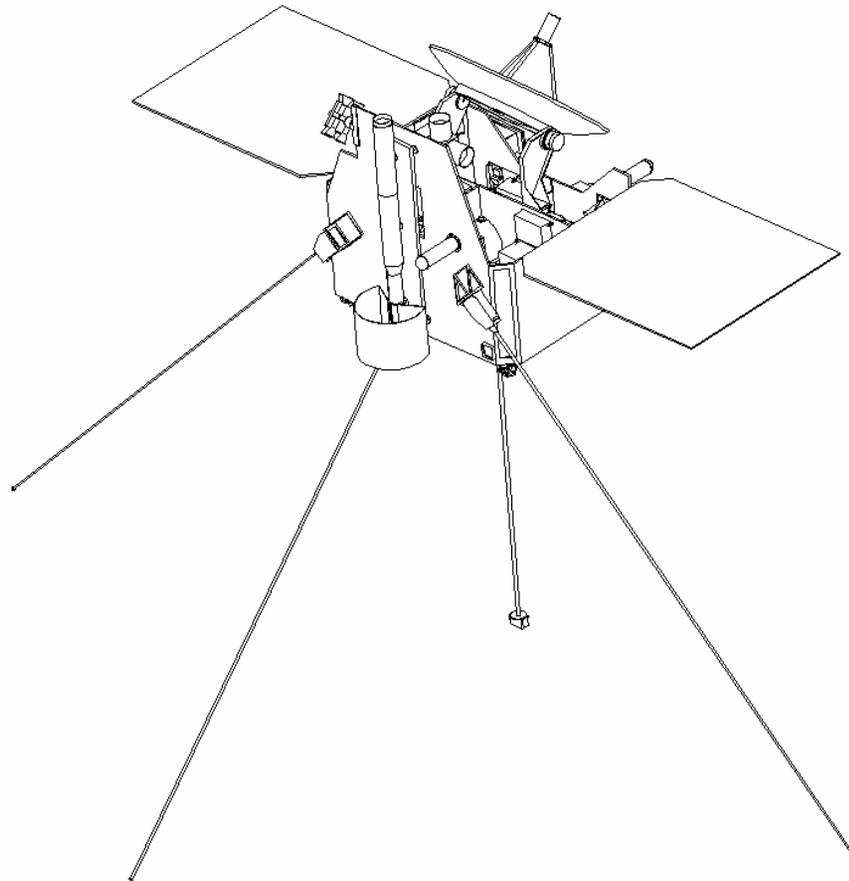


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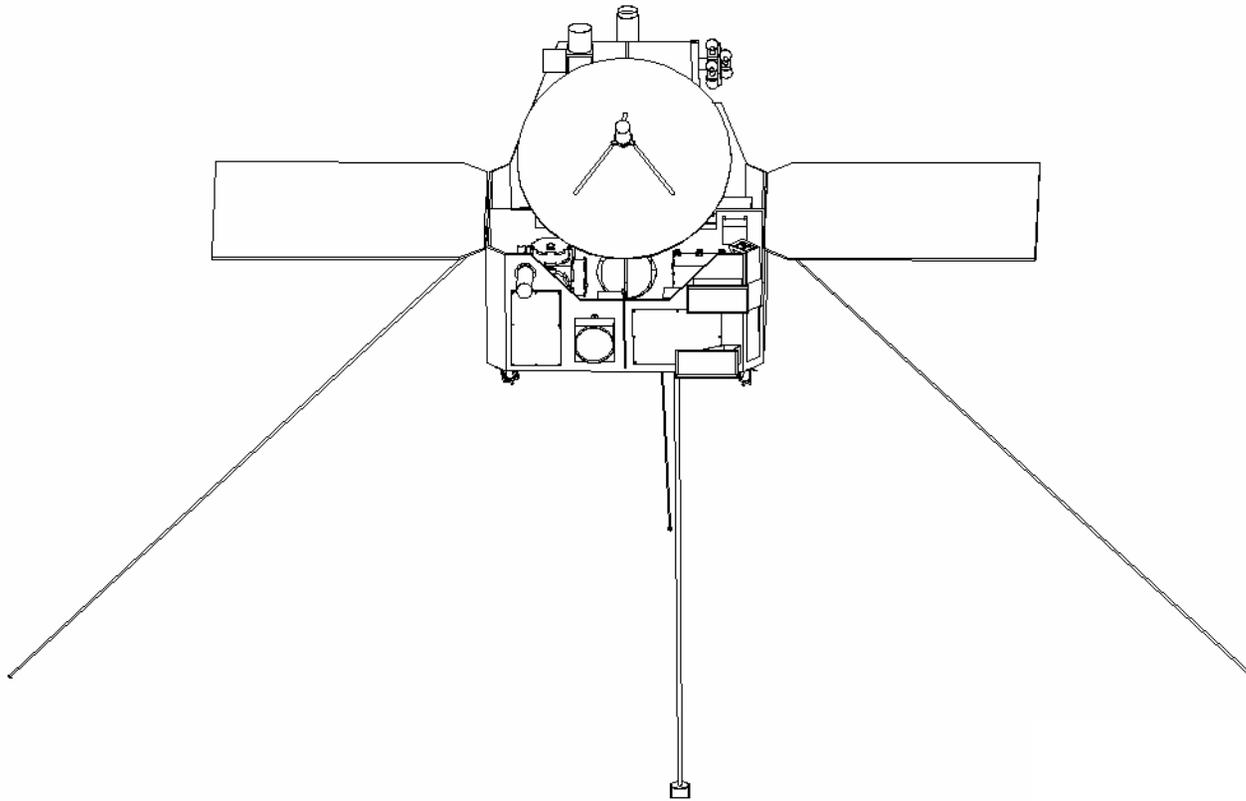


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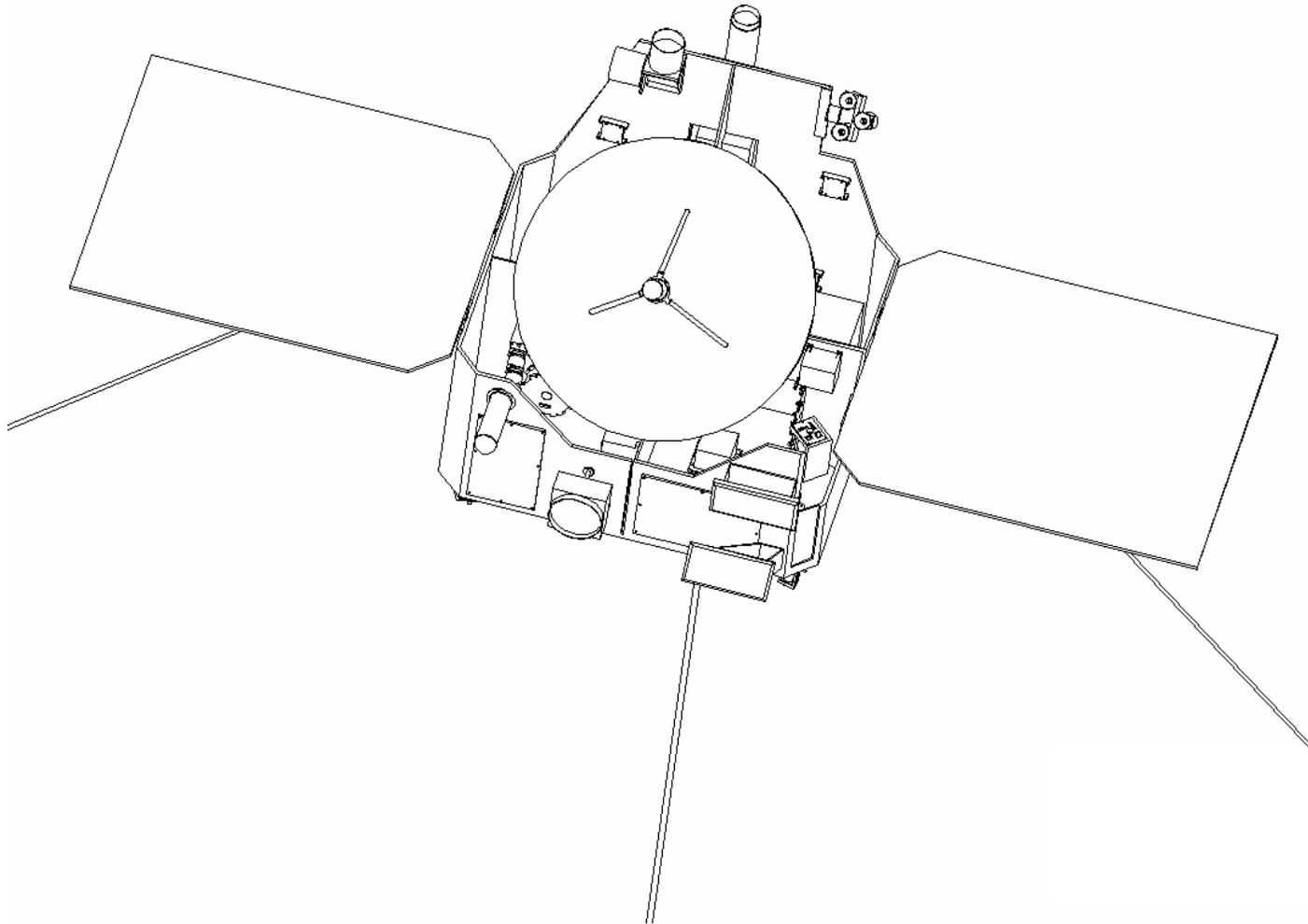


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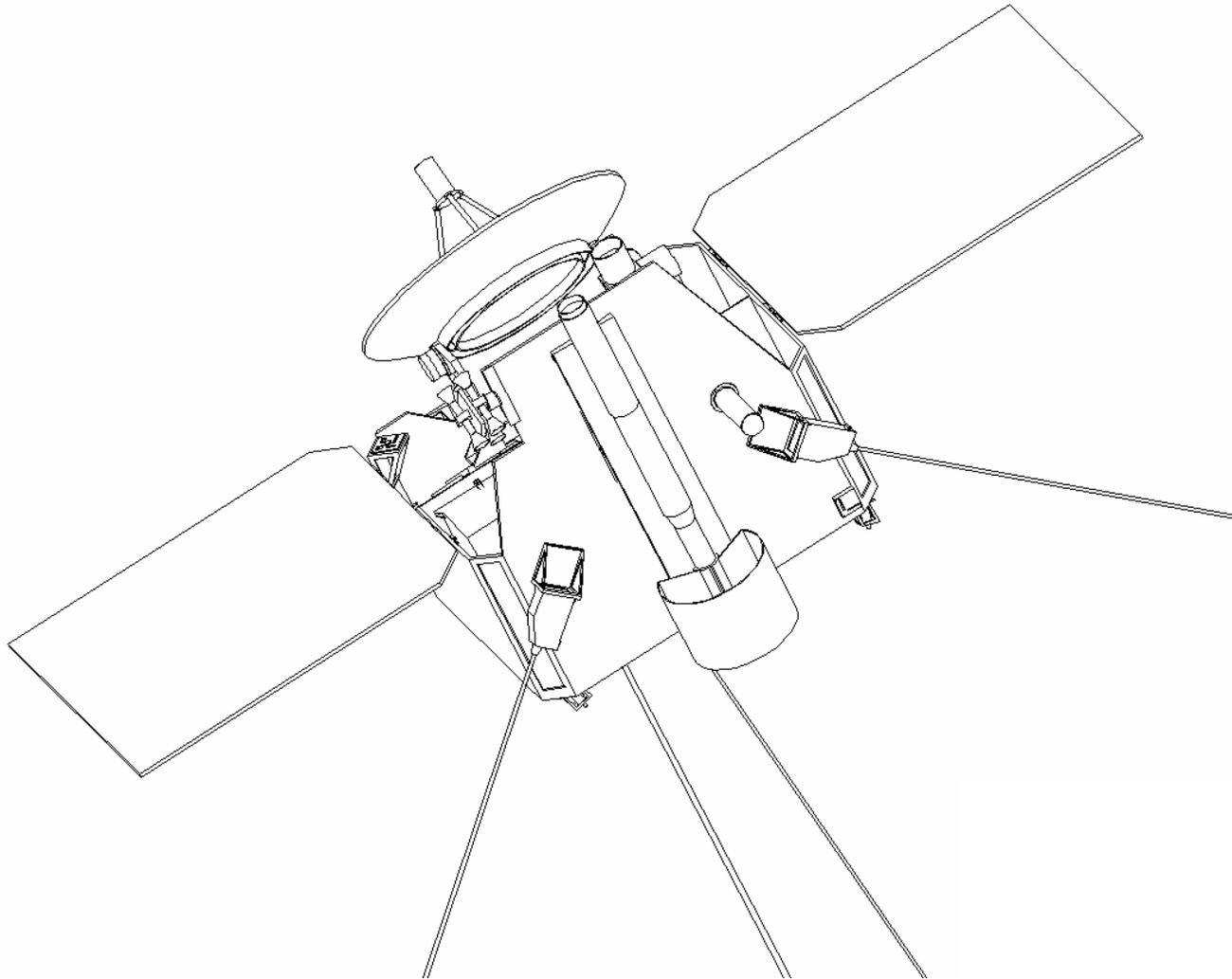


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