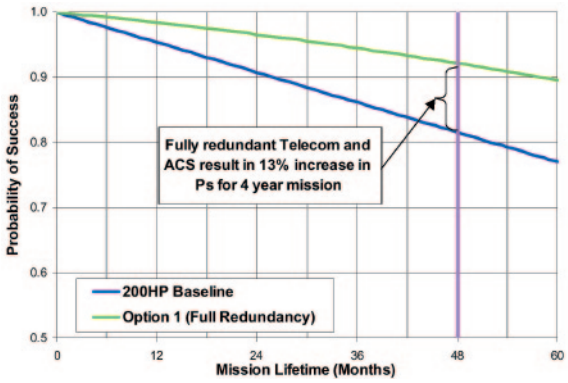
SPECTRUMASTRO

SA-200HP Spacecraft Options

Option 1: Full Redundancy - This SA-200HP option significantly increases the probability of mission success incorporating full redundancy for the ACS and Telecom subsystems. The SA-200HP baseline already has fully redundant avionics and power subsystems; the purpose of this option is to accommodate missions with required lifetimes of over four years (typically Class A or operational missions requiring very high reliability). As shown at left, the probability of success is increased to 0.922 at four years compared with 0.816 for the baseline, a 13% increase. The bus dry mass is increased by 13 kg and the power requirement is increased by 4 W.



Option 2: Deep Space Configuration - The Deep Space Option provides a NASA DSN compatible deep space exploration and interplanetary configuration compatible with most Discovery-class mission objectives. The primary change includes a swap out of the core Telecom system, elimination of ACS hardware that is not applicable to Deep Space missions, downsizing of the battery (since there are few eclipses), and downsizing of the solid state recorder. The Telecom Subsystem capabilities are shown at right. In the configuration, the bus dry mass is 301 kg and typical payload mass capability is 319 kg (Delta 7425, C3 = 0 km^2/s^2).

	34m Antenna		70m Antenna	
Distance	Uplink Rate*	Downlink Rate**	Uplink Rate*	Downlink Rate**
0.01 AU	2000 bps	2 Mbps	2000 bps	2 Mbps
0.05 AU	2000 bps	512 kbps	2000 bps	2 Mbps
0.2 AU	400 bps	32 kbps	1700 bps	136 kbps
0.4 AU	100 bps	8 kbps	425 bps	34 kbps
0.7 AU	30 bps	2.6 kbps	140 bps	11 kbps
1.5 AU	7 bps	0.6 kbps	30 bps	2.4 kbps

* Uplink via X-band LGA
** Downlink via X-band HGA

Option 3: Electric Ion Propulsion - Option 3 is the addition of the Xenon Ion Propulsion System (IPS). The purpose of this option is to provide a highly efficient (up to 3280 sec Isp), low thrust propulsion capability that is enabling for high altitude or translunar MIDEX-class missions. The addition of the IPS to the SA-200HP core configuration dramatically increases propellant efficiency, enabling high DV missions on smaller launch vehicles that are otherwise unachievable using chemical propulsion. The resulting configuration is very similar to Deep Space 1 configured for a LEO/ MEO mission. The IPS greatly increases S/C capabilities for orbit transfer, orbit maintenance, or trajectory changes as indicated (above right). The total impulse capability is more than an order of magnitude increase over the 138,000 Ns capability of the core bus hydrazine configuration. There is no change required to the 36-month development schedule due to the addition of this hardware as the baseline schedule includes six months of schedule slack.

Parameter	SA-200HP Core (Hydrazine Only)	Option 3 IPS (plus Hydrazine)
Propellant Capacity	67 kg N_2H_4	78 kg Xe 23 kg N_2H_4
Thrust Level	5N and 1N	92 mN at 2300 W 20 mN at 500 1 N for N_2H_4
Specific Impulse	200 to 225 sec	3280 sec at 2300W 1950 sec at 500 W 200 to 225 sec for N_2H_4
Total Impulse	138,000 Ns	2,620,000 Ns at 2300 W 1,560,000 Ns at 500 W 47,000 Ns for N_2H_4
Payload Mass at 5000 km circular	Not achievable	300 kg (offload of excess Xe)
Max circular altitude achievable*	2200 km*	17,500 km** (IPS firing for 11 mos)

* Assuming 285 kg P/L and Taurus XL launch into max circular altitude orbitwhile maintaining 15% launch margin (I.e., park orbit of 1700 km circular)
** Assuming 285 kg P/L and Option 3 reference scenario

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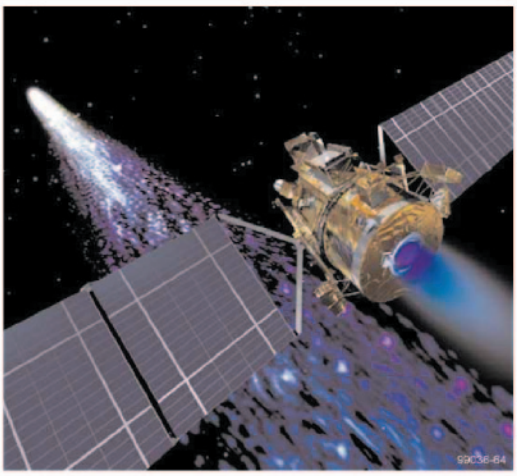
SA-200HP Spacecraft Options

Option 4: Deep Space+ Ion Engine - This option, which combines Options 3 and 4, converts the SA-200HP core to the flight-proven DS1 configuration providing a high DV interplanetary capability suitable for deep space and interplanetary Discovery-class missions. The resulting S/C bus dry mass is 387 kg and the payload mass capability is 198 kg yielding a total launch mass of 687 kg. This provides a standard launch margin of 15% for a Delta 7425 and C3 = 0 km2/s2 trajectory.



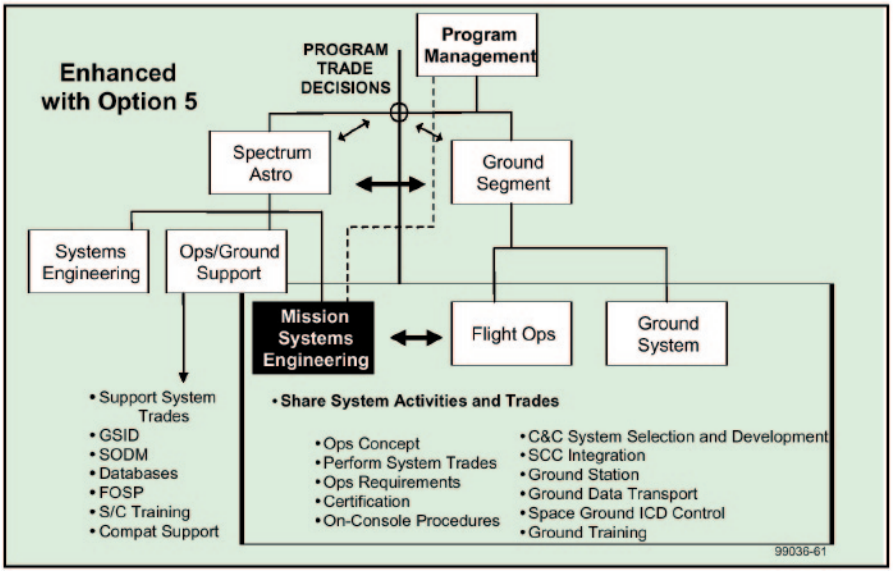
	34m DSN Antenna	
Distance	UplinkRate*	Downlink Rate*
0.01 AU	2000 bps	2 Mbps
0.05 AU	2000 bps	512 kbps
0.2 AU	400 bps	32 kbps
0.4 AU	100 bps	8 kbps
0.7 AU	30 bps	2.6 kbps
1.5 AU	7 bps	0.6 kbps

* Uplink via X-band LGA
** Downlink via X-band HGA

Parameter	Option 4 IPS
Propellant Capacity	78 kg Xe
Thrust Level	92 mN at 2300 W 20 mN at 500 W
Specific Impulse	3280 sec at 2300 W 1950 sec at 500 W
Total Impulse	2,620,000 Ns at 2300 W 1,560,000 Ns at 500 W
ΔV Capability	3800 to 4200 m/s (depending on P/L mass)

Option 5: Ground Support - Spectrum Astro offers ground segment integration support services allowing the customer ground segment team to work more closely with the spacecraft development team to further reduce risk and program costs. This service provides for engineering support in the form of a Mission Systems Engineer to define operational features affecting overall ground costs, resulting in reduced costs for ground development. Deliverables under this option include (Contractor specified format):

- Mission operations concept documentation
- Mission operations requirements documentation
- Ground Interface Control Document Inputs
- Specification for Ground Station Selection
- Specification for Ground Data Transmission Service (T-1, ISDN, etc.)



Option 6: GPS and Magnetics - Option 6 to the SA-200HP offers improved mission lifetime and performance. The addition of the magnetics (a three-axis magnetometer and three orthogonal torque rods) provides wheel momentum management without the use of propellant (a life-limiting item). The GPS navigation system improves onboard ephemeris accuracy to 90m, a feature that is critical to earth-referenced observations and measurements. The addition of these components increases the spacecraft bus dry mass by 7 kg and the bus power consumption by 8 W. Thus the available payload mass is reduced to 659 kg (from 666 kg for the baseline). Available payload power is reduced to 642 W continuous (from 650 W).

For more information contact:
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01150-PR-U18398 (Revised 01/00)