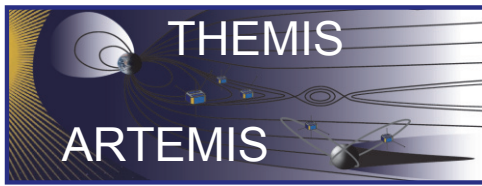


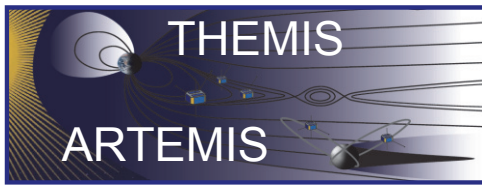
Constellation Status, Plans for Future

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Outline

- Mission Status Summary
- Mission Networks
- Flight Systems Performance
- Anomaly Status
- Science Operations Metrics
- ARTEMIS Navigation Status
- ARTEMIS P2 Long Shadows
- ARTEMIS DSN Coverage Early 2011
- P2 Low Voltage Power Supply Anomaly
- Summary



Mission Status Summary

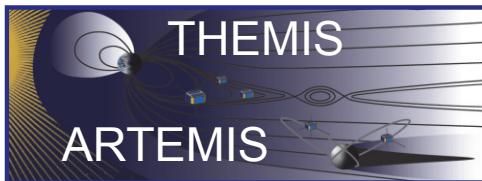


Constellation Status

- All five probes are very healthy in general and continue to collect high quality science data after 4+ years of successful on-orbit operations
- In general, none of the five probes show any sign of degradation in any of the spacecraft subsystems
- One spacecraft lost an EFI sensor sphere (Oct. 2010) and preamp on the same boom (Aug. 2011)
- Few other minor issues with no impact to mission success
- Fuel reserves on THEMIS A, D, and E, continue to allow for ambitious mission extensions

Ground Systems & Operations Status

- All ground systems are processing nominally
- Executed 536 individual thrust operations to date
- Completed more than 28,600+ passes to date (DSN: nearly 1300+)

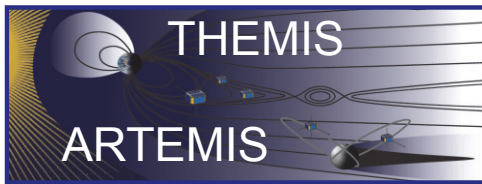


Spacecraft Bus Systems Status



Flight Systems Status Summary – Spacecraft Bus

System	Subsystem	Probe	Status	Comments
Spacecraft Bus	Bus Subsystems	A - E	Nominal	
	BAU FSW	A - E	Nominal	All probes are running BAU FSW version 0x3701; upload completed on Nov. 7, 2009
	C&DH	A - E	Nominal	Generally not many issues with resets
		D	Electronics more sensitive to charged particle events	BAU resets and PCM hang-ups seen more frequently on D than on the other 4 probes combined
	Telecom	A - E	Antennas weaker than expected	Degraded operational link budgets (B: -3 dB; A,C,D: -4 dB; E: -5 dB)
	Power	A - E	Nominal	Power systems allow operation through 4-h shadows; longest penumbra ~8 h
	Thermal	A - E	Nominal	No issues in nominal mission attitude
		E	Thermal leak near Service Valve 2	Analysis shows no risk of freezing fuel lines
	RCS	A - E	Nominal	All RCS thrusters & valves function well, no leaks
	ACS	A - E	Nominal	All ACS sensors nominal

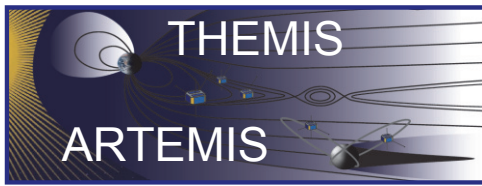


Instrument Status



Flight Systems Status Summary – Instruments

System	Subsystem	Probe	Status	Comments
Instruments	Instrument Suite	A - E	Nominal	
	IDPU FSW	A - E	Nominal	All probes are running IDPU FSW version 0x56; upload completed on Nov. 19, 2010
	LVPS	C	Over current trip anomalies	Four trips have been observed to date, starting Nov. 25, 2011. Investigation is ongoing.
	EFI	B	Lost -X sensor sphere and part of the fine wire due to melting of the fine wire, likely as a result of micrometeorite impact, possibly from the Orionids (Oct. 14, 2010) Lost -X sensor preamp (Aug. 27, 2011) after lunar insertion	Reconfigured instrument to use $\pm Y$ sensors to obtain spin-fit DC electric field measurements and to trigger bursts; $\pm X$ pair continues to provide wave measurements; no significant science loss
	ESA	A - E	Small degradation in sensitivity of electron sensor below 30 eV in certain angle sectors	Localized MCP degradation in angle sectors looking along the spin axis may be caused by emission of photo electrons from axial booms – probes A and B have least amount of degradation, had booms deployed later
	SST	A - E	Noticeable degradation of sensitivity in all ion detectors	Caused by ion implantation; Increased sensor bias once to restore nominal sensitivity
		D	Attenuator B stuck in closed position due to a failure of the actuator mechanism (Apr. 9, 2010)	While attenuator A is still functioning, both attenuators will likely be left in the closed position for the remainder of the mission; no significant science loss



Science Instrument Commanding

- Configuration changes discussed in weekly operations meetings
- All instruments command sequences typically tested on FlatSat prior to upload (FlatSat was moved from cleanroom to operations area)
- Operations team implemented 131 Instrument Configuration Change Requests (ICCRs) to date, based on input from the science team

Science Data Recovery Metrics

- Data dumps near perigee typically at 128K, 512K or 1024K
- Tohban monitors data quality and completeness
- Required data volumes: 591-751 Mbits/orbit, varying with compression
- Actual recovered data volumes (mostly with >99% completeness):

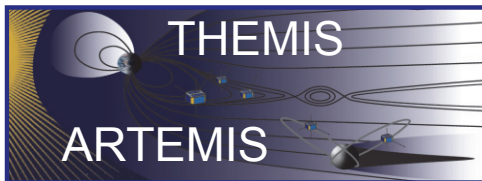
2007: 453 – 486 Mbits/orbit

2008: 664 – 924 Mbits/orbit

2009: 837 – 1050 Mbits/orbit

2010: 907 – 919 Mbits/orbit (THEMIS-Low probes)

2011: 931 – 963 Mbits/orbit (THEMIS-Low probes)



Remaining Fuel Reserves



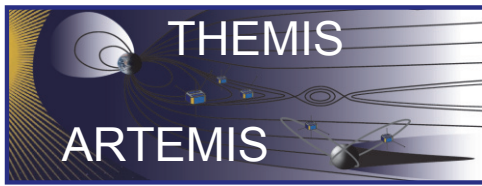
Maneuver and Fuel Budget Summary to Date

Parameter	THEMIS A P5	THEMIS B P1*	THEMIS C P2*	THEMIS D P3	THEMIS E P4
Initial Fuel Load [kg]	48.800	48.780	48.810	48.810	48.820
Remaining Fuel [kg]	12.505	5.182	3.401	25.868	22.463
Remaining Fuel [%]	25.625	10.623	6.968	52.997	46.012
Total Expended ΔV [m/s]	744.200	938.784	976.807	449.130	512.774

* ARTEMIS Probes

Total executed thrust operations by end of prime mission: 296

Total executed thrust operations to date: 536

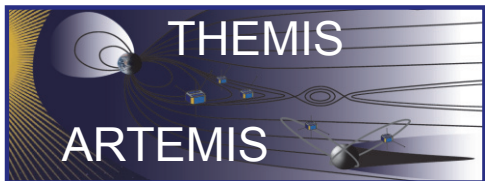


ARTEMIS Navigation Status



ARTEMIS P1 and P2 have entered lunar mission orbits

- Extended stay in Earth-Moon Lissajous orbits 3+ months
- Total cost of Lissajous station-keeping maneuvers was well below budgeted values
 - Used approximately 50% of allocated ΔV .
- Final lunar placement maneuvers have been completed
 - P1 finished Sep. 7, 2011
 - P2 finished Nov. 7, 2011
- Roughly two maneuvers per year in 2012 and 2013 will be needed for periselene altitude control
 - Next P1 maneuver is Jan. 19, 2012
 - Next P2 maneuver is expected in Apr. 2012

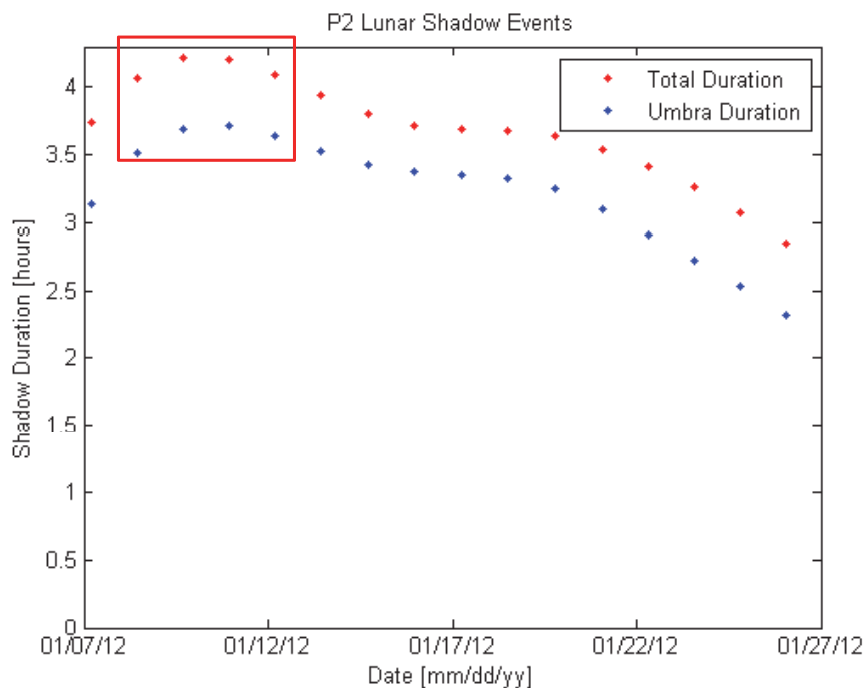


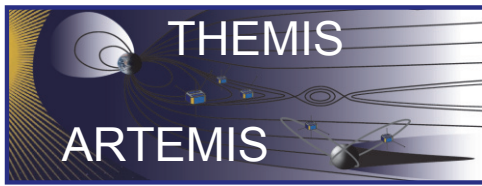
ARTEMIS P2 Long Shadows



ARTEMIS P2 will experience long shadows in Jan. 2011

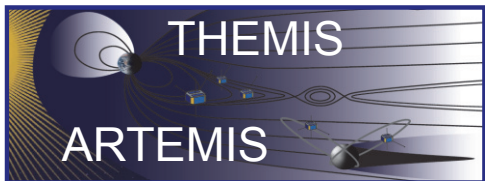
- Shadow durations of approximately 4 hours are expected on consecutive orbits
- Operations team may need to curtail instrument operations during these extended shadows to conserve power





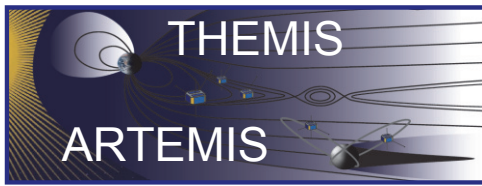
Due to GRAIL maneuver operations ARTEMIS DSN coverage will be limited in the early 2011 period

- Data retrieval will be handled through DSS-15 on a receive only basis
- No two-way Doppler or range tracking from DSS-15
- Commanding and tracking will be supported by USN
- BGS will continue to carrier track
- Return rate of science data is expected to be nominal



Tracking several suspected over current trips in P2's LVPS

- Four occurrences have been observed
 - Nov 25, 26, 30, and Dec 7, 2011
- Anomaly observed during periselene transits in full sunlight with altitudes below 700 km
- S/C currently being commanded to close the SST attenuator during these transits this weekend
 - Results on whether this mitigates the anomaly will be discussed in the Tuesday mission operations meeting (Dec 13)



Summary

- Overall Mission Status
 - Completed THEMIS prime mission on November 19, 2009
 - Encountered 64 anomalies since launch - 58 closed
 - None of the anomalies caused a serious risk to mission success
- Flight Systems
 - All bus flight subsystems continued to perform well
 - All science instruments are working very well in general
- Ground Systems
 - All ground systems continue to function well
- ARTEMIS Mission Extension
 - Initiated Earth departure on July 20, 2009
 - Lissajous science phase started on October 22, 2010
 - Lunar orbit insertions completed July, 2011
 - Final lunar orbits reached Nov, 2011