National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

JPL

SPACECRAFT STATUS REPORT

2001 MARS ODYSSEY

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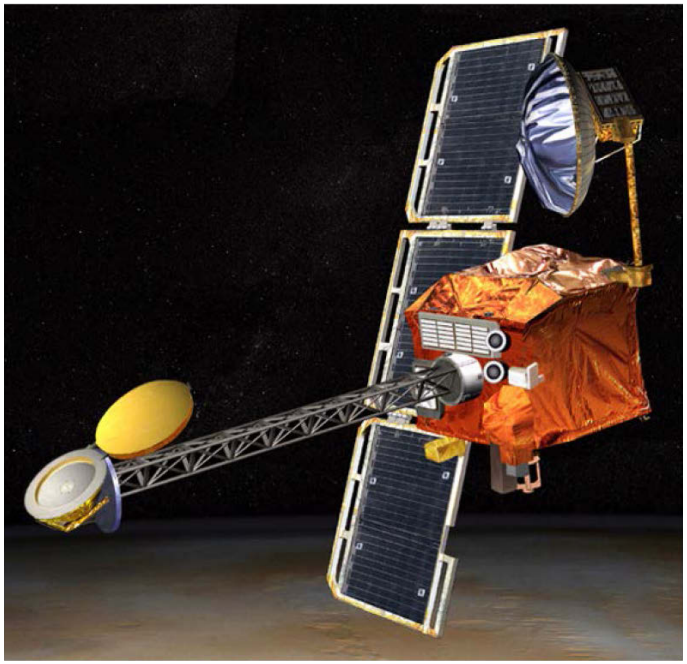
HEND Workshop 2012

LOCKHEED MARTIN

Project Overview



Salient Features:

Category: 2

Risk Class: B

- Mars Orbiter Launched: April 7, 2001
- Science Mission Began: February 19, 2002
- Payload:
  - Thermal Emissions Imaging System (THEMIS)
  - Gamma-Ray Spectrometer (GRS)
  - High Energy Neutron Detector (HEND)
  - Neutron Spectrometer (NS)
  - Martian Radiation Environment Experiment (MARIE)
- Primary Mission: 917 Days, Ended August 24, 2004
- Extended Mission: August 25, 2004 to March 31, 2013

Science

- Acquire High Spatial and Spectral Resolution Mapping of Surface Mineralogy
- Provide Information on the Morphology of the Martian Surface
- Observe inter-annual variations and secular changes
- Determine Abundance of Hydrogen in the Shallow Subsurface
- Globally Map the Elemental Composition of the Surface (completed)
- Characterize Specific Aspects of the Martian Near-Space Radiation Environment (completed)

ODY Upcoming Events

- 30 May 2012 -- Planetary Science Division FY12 Senior Review Proposal Due
  - Face to Face will be held in Washington in June…Date is TBD
- 16 July thru 21 August 2012 -- IMU Based Attitude Determination Mode
  - Current Mode is All Stellar
- 5 August 2012 -- MSL EDL
  - No change in instrument configuration
  - We do have a commanding black out period
    - No commands may be sent to the Spacecraft starting 3-7 Aug 2012
- 20 August 2012 -- Drop in High Data rates
  - From 124kbps to 110 kbps
- 28 August 2012 – Fifty-Second Project Science Group (PSG) Meeting
- January 2013 -- Eclipse Season starts

NOTE: No HGA Mitigation Rolls planned

ODY Concerns

Date Identified	Title of Problem or Concern	April 2012 Status	
		Likelihood	Consequence
Jun 2010	UHF Power Cycles have reached the conservative lifetime limit	Unlikely	Significant Reduction in Mission Return for Landed Assets
Jun 2010	Potential IMU failure	Significant	Significant Reduction in Mission Return
Jan 2012	Care for Aging S/C Battery	Very Low	Mission Failure

Note: All Risks shown are potential threats to mission success. ODY has no Significant and likely threats to mission success.

UHF Transceiver Lifetime

- Description
  - UHF power cycles near the conservative lifetime limit of 12,000 (based on accelerated life testing)
    - Lifetime numbers are considered to be ‘soft.’
    - It is possible there will be no warning of an impending failure
- Current Status
  - UHF transceiver is currently operating normally with no signs of degradation

UHF Transceiver Lifetime (cont.)

- Mitigation
  - Reliable passes have since been reduced
- Expected Resolution / Impact
  - Should UHF operation degrade, determine if UHF-A's operation is adequate to support landed assets and continue to monitor
  - When mission requirements warrant, swap to B side and utilize UHF-B

  Note: Degraded relay support can have possible impact on MER and MSL relay operations, depending upon timing and degree of failure

Potential IMU Failure

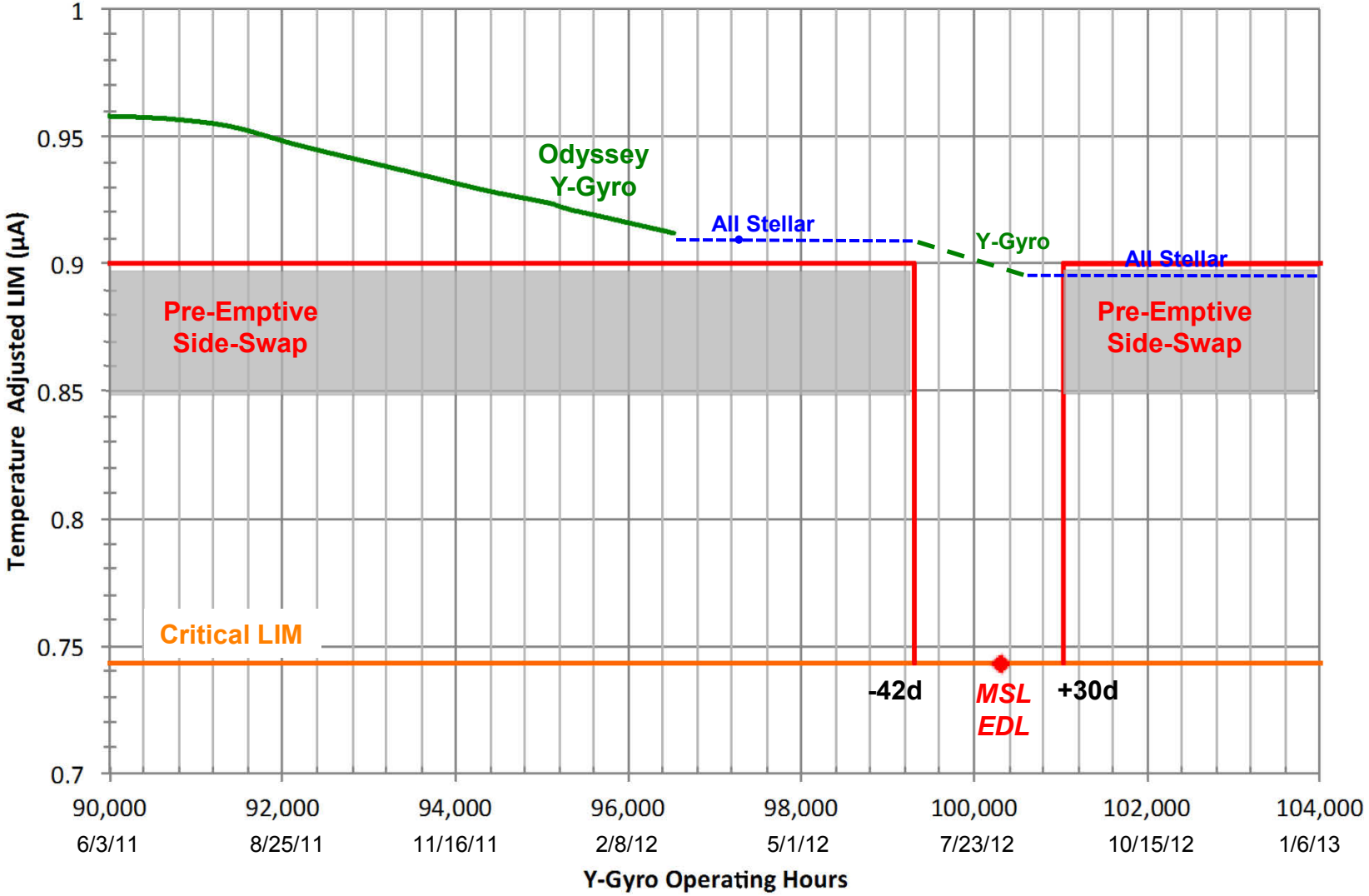
- Description
  - Odyssey has been on A-Side since launch (7 Apr 2001)
  - IMU-A has been nearly continuously powered since launch
  - Predicted operating range of 98,203 – 104,410 hours
  - IMU-A continuous operation would need to reach 100,320 hours to support MSL EDL
  - Actual remaining life is unknown
- Current Status
  - IMU-A powered off on 7 March 2012 for All Stellar Demonstration #3
  - IMU-A was operating normally
    - LASER Intensity Monitor (LIM) can provide *some* warning of impending failure
    - All IMU-A gyros show initial signs of LIM decay -- continuing to monitor and analyze when powered on
  - IMU-B (as with the S/C B side) was last operated during ATLO (6 Apr 2001)

Potential IMU Failure (cont.)

- Expected Resolution / Impact
  - Continue to operate in All Stellar mode to greatly reduce reliance on IMUs (estimating 95% IMU utilization reduction)
    - Outage protection timer halts attitude error growth if star camera outage exceeds 180 seconds
    - Switch back to gyro mode for critical events, OTMs, and safe mode entry

    -- and / or --
  - Upon an agreed-to / reviewed indication of impending failure, side swap to B to utilize IMU-B
    - Could save some IMU-A life and retain S/C redundancy
    - Provides for an orderly swap to B side

Successful All Stellar Scenario



Aging S/C Battery

- Description
  - Odyssey only has one battery
  - Expert opinion is that the ODY battery should not exceed 25% depth of discharge (DOD)
  - With a single battery, it is difficult to accurately determine its state of health and therefore conservatism is warranted
  - Eclipse season exposes the battery to deeper discharge depths
- Current Status
  - Battery has exhibited no signs of premature aging
  - Considering the age of battery and that it represents a single-point-failure, it is prudent that action be taken to comply with the 25% DOD recommendation

Aging S/C Battery (cont.)

- Expected Resolution / Impact
  - Change the spacecraft's power profile so as not to exceed the 25% DOD
  - Move the orbit to a LMST that will expose the S/C to shorter eclipse durations and therefore impact the DOD to a lesser degree
    - ODY's 'eclipse season' resumes in January 2013; there is no need to adjust the orbit prior to MSL EDL

Manager's Assessment

- Fourth extension of Odyssey mission continues, with orbital science investigations and relay services for landed assets.
- Mitigation of aging IMU and UHF transceiver
  - ODY has responded to Program Office / board recommendations
  - All Stellar mode has been certified for flight operations and is now standard for nadir point operations on the A-side
- Investigating options to mitigate aging Battery
  - Gradual transfer to a later LMST orbit node to shorten eclipse durations
  - Reduce spacecraft loads during the longer eclipses
  - Optimize battery performance
- ODY is preparing for E5 Proposal and Planetary Science Division FY12 Senior Review activities
- ODY is on track to support MSL EDL and surface operations
- ODY is managing consumables in order to remain in operations until 2020