Solar Probe Plus

A NASA Mission to Touch the Sun

Integrated Science Investigation of the Sun Energetic Particles



Preliminary Design Review 05 – 06 NOV 2013

Flight Operations

Eric Christian



Outline



- Initial commissioning
- Nominal operations
- Instrument command loads
- Instrument autonomy requirements
- Flight operations staffing
- Off-nominal operations

Initial Commissioning



- ISIS EPI-Lo and EPI-Hi Statistics Gathering and Threshold Scans
- After initial checkout it is important that ISIS instrument gather as much data as possible (especially raw event data)
- Allows instruments to populate composition tracks so that TOF vs E flux boxes (EPI-Lo) and De vs Eprime boxes (EPI-Hi) can be adjusted before perihelion
- Threshold scans to determine optimal threshold values
- 6 weeks need for these activities
- EPI-Lo does not need to be on continuously
- ISIS EPI-Lo and EPI-Hi Table Loads and/or Software Updates
 - Table updates expected (adjustment of flux box bins) 3 weeks into statistic gathering period
 - Software updates as needed
- Based on STEREO experience EPI-HI will require 10-20 opportunities (on separate days) to send commands in the first two months
 - Necessary to obtain/analyze at least a few hours of new data in between command opportunities to test whether the commands worked
 - Therefore, need to collect data between commanding opportunities

Nominal Operations



EPI-Hi and EPI-Lo operate the same whenever powered-on except for the volume/content of the data sent to the S/C inside/outside 0.25 AU

- Spacecraft- Sun Distance R<0.25 AU (Normal Science Mode)</p>
 - Full nominal power
 - High data collection rate
 - Burst mode (EPI-Lo)
- Spacecraft- Sun Distance: 0.25 AU < R (Low-rate Science Mode)</p>
 - Full power whenever possible
 - Reduced data collection rate (fits within ISIS telemetry allocation)
 - Commanding window should be scheduled late in the series of telemetry passes, although it may not be used every orbit
 - Minimize power cycling the HV supplies
- Expecting some tool to plan and coordinate operations

Instrument Command Loads



Commanding of EPI-Hi and EPI-Lo

"Flatsat" at UNH used to test command loads

- SwRI engineer will be responsible for using the native design products during Phase C to create a "behavioral model" of EPI-Hi and EPI-Lo
- Constraint Checking Modules
- Standard Commanding performed via GSEOS at UNH SOC
- Commissioning and Contingency response, commanding may optionally be done by EPI-Hi and EPI-Lo via GSEOS directly through MOC
- Planning for instrument operations
 - Planning software
 - Automated routines & Templates for initial planning
 - Interactions with ISIS SOC interfaces for finalization of planning
 - Develop rough plans three orbits ahead
 - Test command load
 - Develop definitive plans one orbit ahead
 - Final testing
 - Upload





- Instrument Autonomy requirements considerably more than in initial SPP proposal and more than EPI-HI has experienced in previous missions
- Main additional requirement is the ability to record the instrument state and return to that state autonomously after instrument power cycling, due to either s/c telemetry time periods or anomalous safing of instrument.
- ISIS will implement operational mode changes via instrument autonomy logic supplemented by a macro capability

Flight Operations Staffing



FLEXIBLE

- variability of telemetry and commanding requires flexible staffing
- Priorities (in order)
 - Analysis of health and safety housekeeping
 - Analysis of quicklook science data to determine interesting time periods and science optimization
 - Full analysis of science data and generation of data products



- Plan to avoid them
- If they do occur, do whatever is necessary
 - Pull in whomever is needed, when they are needed