HSTAR 11935

ACE Primary Bus Voltage out of limits low
Background

• A Secondary Mirror move took place on day 201 (July 20) starting at 09:00 GMT.
• After the ACE was powered up (it is normally off) it took ~ 20 minutes for the ACE primary bus voltage to stabilize at 23.4 volts.
• Actuator commanding was delayed for 22 minutes until the voltage was back in limits (23 volts). The ACE operational range is spec’ed at 23v – 32v.
• All indications are that the move was nominal although there is no direct confirmation of actuator movement in telemetry. Confirmation is provided by assessment of focus at the SIs.
• Thanks to the following for analysis and charts:
  – Dennis Crain (OTA)
  – Dave Parker (FS&S)
  – Morgan van Arsdall (OTA/SI hybrid)
  – Greg Waldo (EPS)
Chronology

- 09:01:56 FN format (ROP DF-09A).
- 09:03:17 ACEINIT 1. There are no verifiers for this proc.
- 09:03:55 ACEON 1 1 CCL completed. All verifiers, except EACEPBUS (23 to 32 V limits) confirmed.
- ~ 09:05 OTA SE review of EACEPBUS behavior suggested the value to be rising. With ~ 40 minutes until the end of opportunity# 1 command window, we elected to give it some time to rise before shutting down the ACE.
- 09:22:37 EACEPBUS first toggles in bounds (>= 23 V).
- 09:24:17 EACEPBUS returns in bounds after dropping OOL low 4 times and looks to be stable (above low limit).
- 09:25:39 CCL issued to command ACTUATOR# 25 (first of 6) for secondary mirror move.
Chronology

- 09:26:11 ACTUATOR# 25 CCL (FWD 5 steps) completed.
- 09:26:55 ACERESET completed.
- 09:27:50 ACTUATOR# 27 CCL (FWD 5 steps) completed.
- 09:28:26 ACERESET completed.
- 09:28:47 ACTUATOR# 29 CCL (FWD 5 steps) started.
- 09:29:13 EACEPBUS drops OOL low for 6th (and final) time at 22.8731 V.
- 09:29:18 ACTUATOR# 29 CCL (FWD 5 steps) completed.
- 09:29:25 EACEPBUS back in bounds.
- 09:29:47 ACERESET completed.
- 09:30:38 ACTUATOR# 26 CCL (REV 5 steps) completed.
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Chronology

- 09:31:02 ACERESET completed.
- 09:31:47 ACTUATOR# 28 CCL (REV 5 steps) completed.
- 09:32:10 ACERESET completed.
- 09:32:57 ACTUATOR# 30 CCL (REV 5 steps) completed.
- 09:33:19 ACERESET completed.
- 09:33:56 ACEOFF completed.
- 09:34:57 HN format confirmation after ROP DF-09A completed. OR 18625-1 completed.
- SAC FRS ID 13 submitted to perform ACTUATOR MONITOR assessment of mirror move.
- Results of SAC monitor report reviewed. All results are as nominal showing expected direction and number of steps for each of actuator 25 through 30.
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ACE Block Diagram

Diagram details:

1. PRIMARY POWER
2. SECONDARY POWER
3. Weld Commands
4. ALE Commands
5. Telemetry Outputs (NED)
6. Mirror Frame Sync Signal
7. Potentiometer Telemetry Outputs (Analog)
8. Analog Telemetry Outputs
9. Temperature Monitor Outputs

W. G. Crabb 7/22/09
ACE Relay Section Diagram
## Historical Data Comparison

<table>
<thead>
<tr>
<th>Date</th>
<th>ACE Primary Voltage</th>
<th>Bus Voltage</th>
<th>Load Current</th>
<th>Difference (Max - Min)</th>
<th>Comment</th>
</tr>
</thead>
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<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
<td>Avg.</td>
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</tbody>
</table>
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ACE Pri. Voltage

Orbit Night at Power On

Hubble Space Telescope

Start time: 2009.201 08:45:00.000
Stop time: 2009.201 10:00:00.000

Vision 2000 Control Center System

Analysis & Trending

Data Source: Best; Good Only
Filtering: All Data
Constraint Label: None

Electrical Data

Trace 1: E46_EACEPRUS volt
- TLM: ACE Pri Bus Volt
  - Fts: 111/6
  - Min: 0.0056
  - Max: 23.3709
  - Mean: 5.7898E+08
  - StdDev: 9.6938E+08
  - Axis: 1

Trace 2: C811_C81000000 amp
- TLM: Load Bus Current
  - Fts: 2919/9
  - Min: 85.8000
  - Max: 99.8000
  - Mean: 1.00536E+01
  - StdDev: 2.65531E+00
  - Axis: 2

Trace 3: C874001000 amp
- TLM: Structure Curr
  - Fts: 2919/9
  - Min: -0.200000
  - Max: 4.999990
  - Mean: 2.52442E+00
  - StdDev: 1.82381E+00
  - Axis: 1

Trace 4: C811_C81000000 volt
- TLM: Main Bus A Volt
  - Fts: 111/6
  - Min: 28.0290
  - Max: 31.8280
  - Mean: 3.07482E+01
  - StdDev: 1.14859E+00
  - Axis: 1
**Summary**

- Actuator Control System appears to be functioning nominally.
- All indications are that the mirror move was successful. SI focus assessment required to confirm.
- Slow rise in ACE Primary Bus Voltage appears to be tied to the lower main bus voltage at orbit night. It rose to its nominal range once HST entered orbit day.
- Circuit analysis is continuing.
- For future mirror moves we may want to restrict operations to orbit day.
Backup
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ACE CONTROL RELAY SECTION – ACEOFF 1

Diagram showing the connections and components of the ACE Control Relay Section. The diagram includes labels for EMI Filters 1 to 4, EAPRIBUS, EADSABL1, EADSABL2, EAENABL1, EAENABL2, EAENBLM1, EAENBLM2, EAREDBUS, EADSBLM1, EADSBLM2, EAENELM1, EAENELM2, EAECONV1, EAECONV2, and a section for motor drives. Connections are indicated with arrows and switches labeled K1 to K6.