Space Telescope Users Committee Meeting
May 8, 2014
Circumstellar Disks • HST • NICMOS

HD 141943

HD 191089

NASA and ESA • STScI-PRC14–16a
## Project Perspective

### The HST Mission is Excellent

- **Senior Science Review**
  - Proposal and Site Visits were great and very well received
  - Very positive verbal feedback provided by HQ’s
  - Anticipate final written reports in coming weeks

- **Strong NASA HQ support**
  - Mission extended officially through 2016 (whew!)
  - Support 2020 Vision
  - 24th Anniversary event at the National Air and Space Museum
  - 25th Anniversary planning underway

- **Science programs are exciting**
  - Tremendous community interest evidenced by 1135 proposals for Cycle 22
  - Frontier Fields Initiative underway
  - Enhanced Wide Field Camera 3 (WFC3) spatial scanning in use
  - Completed observations for the Multi-Cycle Treasury Programs
Observatory Status

• Spacecraft and Instruments Update
  – Gyro 5 failure in March
  – NASA Engineering and Safety Center (NESC) Reliability study completed
  – WFC3 Channel Select Mechanism movement has been minimized
  – Cosmic Origins Spectrograph (COS) Far Ultraviolet Detector lifetime positions and High Voltage management tailored to optimize use
# HST OBSERVATORY STATUS

**Status as of: 5/1/14**

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Summary</th>
</tr>
</thead>
</table>
| **Science Instruments (SI)** | - WFC3 performance excellent; Channel Select Mechanism (CSM) movement and dust particles monitored  
                                    - COS FUV detector sensitivity degradation (ARB final report 4/11); Rate of degradation has essentially ceased  
                                      - Operating at 2\textsuperscript{nd} lifetime position; expect to move to 3\textsuperscript{rd} by early 2015  
                                      - ACS and STIS repaired instruments performing nominally  
                                    - NICMOS in standby following decision to not restart following Cycle 19 proposal evaluations |
| **Electrical Power System**  | - Performance of batteries is excellent; benchmark set to 510 Amp Hours  
                                    - Solar Array 3 performance remains excellent  
                                    - 12/22/12 Software Sun Point (SWSP) safemode entry; first unplanned entry since 2007  
                                    - Solar Array Drive Electronics (SADE) investigation following 2/15/13 SWSP completed with ESA support; no further actions identified |
| **Pointing Control System**  | - Gyro 5 failed on 3/7/14; 1-2-4 gyro configuration; Gyro 6 powered off 3/13/14; Gyro 3 removed from control loop and powered off in 2011; all gyros configured to operate on secondary heater controller  
                                    - Gyro 4 motor current increased from 120mA to 190mA in 9/11, has remained stable at ~178 mA  
                                    - Attitude Observer Anomaly (AOA) (ARB report October 2011) mitigation completed November 2012  
                                    - FGS-3 use is minimized to preserve degraded bearings |
| **Data Management System**   | - SI Command and Data Handler (C\&DH) has had 6 lockup recoveries since 6/15/09; most recent was 6/2/12  
                                    - SI FSW enhanced to protect detectors in event HV left on in SI C\&DH lock up event  
                                    - Science Data Formatter (SDF) input cycling modified to reduce thermal load  
                                    - Solid State Recorders (SSRs) 1&3 have each experienced a single lock up while in the South Atlantic Anomaly (SAA); Alert monitors detect condition to minimize data loss |
| **Communications**           | - Multiple Access Transponder 2 (MAT2) coherent mode failed (12/24/2011); Two-way tracking unavailable  
                                    - Joint Space Operations Center (JSpOC) now the source for the operational ephemeris via Conjunction Avoidance Risk Assessment (CARA) team and the Flight Dynamics Facility |
| **Thermal Protection System**| - Condition of Multilayer Insulation (MLI) observed during SM4 was as expected  
                                    - New Outer Blanket Layers (NOBLs) installed on Bays 5,7, and 8 during SM4  
                                    - Equipment bays performance tracking well with predictions, no concerns forecasted at this time |
Mission Operations

- **Gyro 5 Failure**
  - A motor flex lead failed accompanied by a large bias shift on February 22; the gyro continued to operate - in two prior instances, gyros operated for 67 and 68 days
  - A large bias shift was observed on March 1, suggesting failure was imminent
  - Spacecraft entered Kalman Filter Sunpoint safemode on March 7 at 6:45 am
  - Per the established plan, Gyros 1 and 2 were turned on, and the spacecraft was recovered to 3-gyro science mode using Gyros 1, 2, & 4 in less than 30 hours
  - Gyro 6 was turned off on March 13

### Current Gyro Runtimes

<table>
<thead>
<tr>
<th>Post SM4 RGA</th>
<th>Flex Lead</th>
<th>TOTAL HOURS PRIOR TO FLIGHT</th>
<th>OPS HRS SINCE SM4</th>
<th>TOTAL HOURS THRU 2014/091</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Standard</td>
<td>6429</td>
<td>1399</td>
<td>7828</td>
</tr>
<tr>
<td>G2</td>
<td>Standard</td>
<td>6601</td>
<td>1399</td>
<td>8000</td>
</tr>
<tr>
<td>G3</td>
<td>Enhanced</td>
<td>5855</td>
<td>18706</td>
<td>24561</td>
</tr>
<tr>
<td>G4</td>
<td>Enhanced</td>
<td>10495</td>
<td>42802</td>
<td>53297</td>
</tr>
<tr>
<td><strong>G5</strong></td>
<td>Standard</td>
<td><strong>9297</strong></td>
<td><strong>42360</strong></td>
<td><strong>51657</strong></td>
</tr>
<tr>
<td>G6</td>
<td>Enhanced</td>
<td>8711</td>
<td>27234</td>
<td>35945</td>
</tr>
</tbody>
</table>

### Previous Flex Lead Failure Runtimes

<table>
<thead>
<tr>
<th>Date of Failure</th>
<th>Gyro</th>
<th>Flex Lead</th>
<th>Run hours at failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992.281</td>
<td>G6</td>
<td>Standard</td>
<td>21504</td>
</tr>
<tr>
<td>1997.099</td>
<td>G4</td>
<td>Standard</td>
<td>29304</td>
</tr>
<tr>
<td>1998.295</td>
<td>G6</td>
<td>Standard</td>
<td>42768</td>
</tr>
<tr>
<td>1999.317</td>
<td>G1</td>
<td>Standard</td>
<td>39600</td>
</tr>
<tr>
<td>1999.110</td>
<td>G3</td>
<td>Standard</td>
<td>47088</td>
</tr>
<tr>
<td>2007.243</td>
<td>G2</td>
<td>Standard</td>
<td>55584</td>
</tr>
</tbody>
</table>
NASA Engineering and Safety Center (NESC) Technical Assessment Report

- Generated “HST Observatory System Reliability Review” dated December 12, 2013
- Assessed reliability of major subsystems – Good reliability exists through 2020
- Reliability model was updated and a spreadsheet tool provided to the Project
- Reliability predominately based on probability of random failure using observed failure rates
## Mission Operations

### Life Extension Initiatives
- Completed all the procedures and proposals for WFC3 and COS side-switches
- Completed Algorithm Description Document for Reduced Gyro Reduced Wheel (RGRW) science mode
- Fine Guidance Sensor (FGS) clear filter – FGS-2 magnitude dependent dependent commanding
- Spacecraft flight software release 3.8 (Enhanced Autonomous Command Routines and improved Attitude Observer Initialization (AOI)) was operational in December
- Release 3.9 (V2-axis attitude disturbance mitigation) to be operational in July
- Release 4.0 content will address Attitude Observer Anomaly (AOA) and V2 disturbance mitigations in One Gyro Science (OGS) mode

### Ground System Activities
- Refreshing GSFC 2002 vintage Sun-based control center systems
  - Control Center System (CCS) 9.0 is operational
  - Science Pipeline (SP) 1.0, Level 0 science data processing system, is operational
  - Archive 3.0 to be completed by mid-2015
- White Sands-1 (WS-1) ground station added as a contingency site
Science Operations Contract Status
- Completed the modification to incorporate science operations through April 30, 2016
  - Contract awarded in 2007 assumed end of HST science on April 30, 2014 following the successful launch of the James Webb Space Telescope
  - Maintains support for Education and Public Outreach
- In early stages of process to acquire the follow on contract

General Observer / Archival Research
- Cycle 21 awarded value was $28.6M
- Expect to maintain flat funding for Cycles 22 and 23 (FY15-FY16) pending budget modifications

Budget Concerns
- President’s FY15 Budget Request was reduced $5M below Project expectation
- Current budget guidance will require the scope of the operations contracts at both the STScI and GSFC to be reduced as early as their mid-2016 start dates
- Expect that overall grant cycle values will be reduced beginning in FY17 (Cycle 24)
Discussion

- Questions?