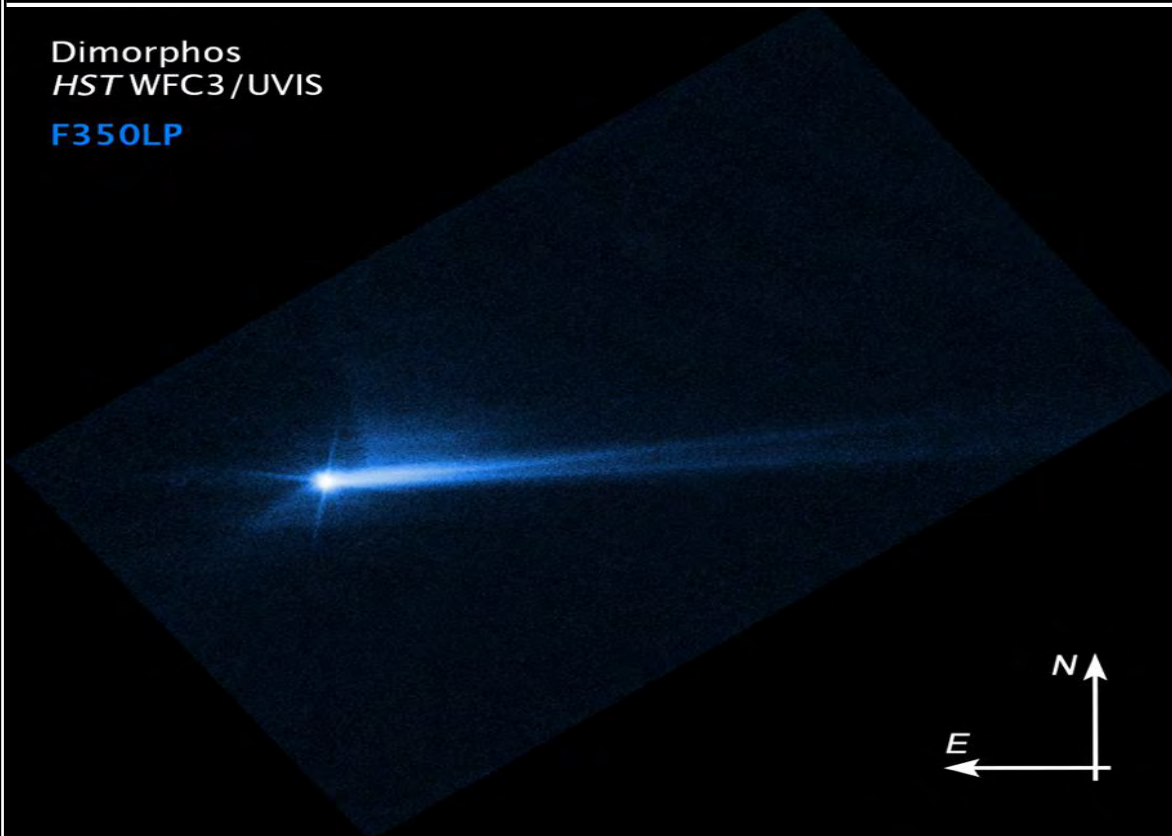




HST/GSFC Project Report



Dimorphos
HST WFC3/UVIS
F350LP



Hubble observation of the DART impact aftermath

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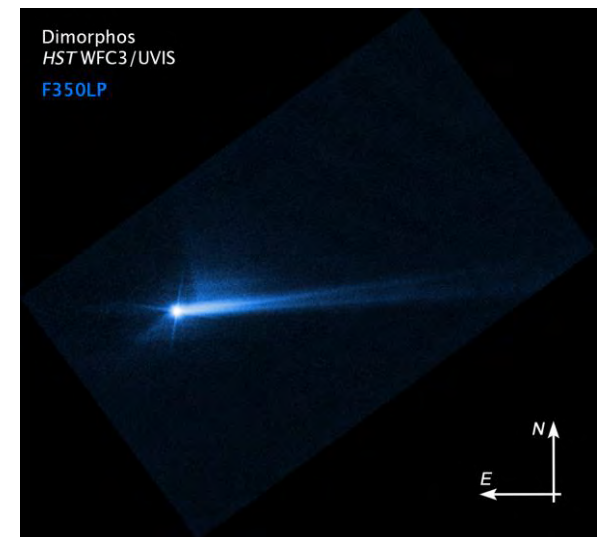
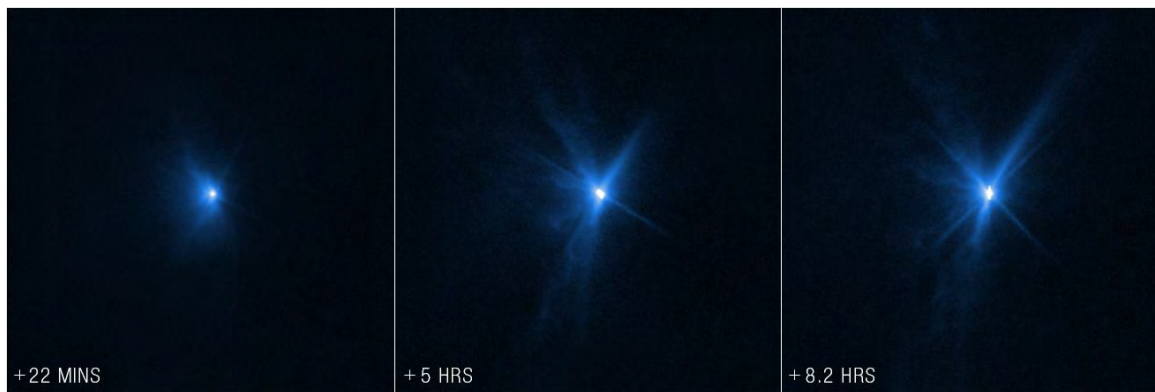
Deputy Project Manager/Resources

**Space Telescope
Users Committee
Meeting
October 20, 2022**

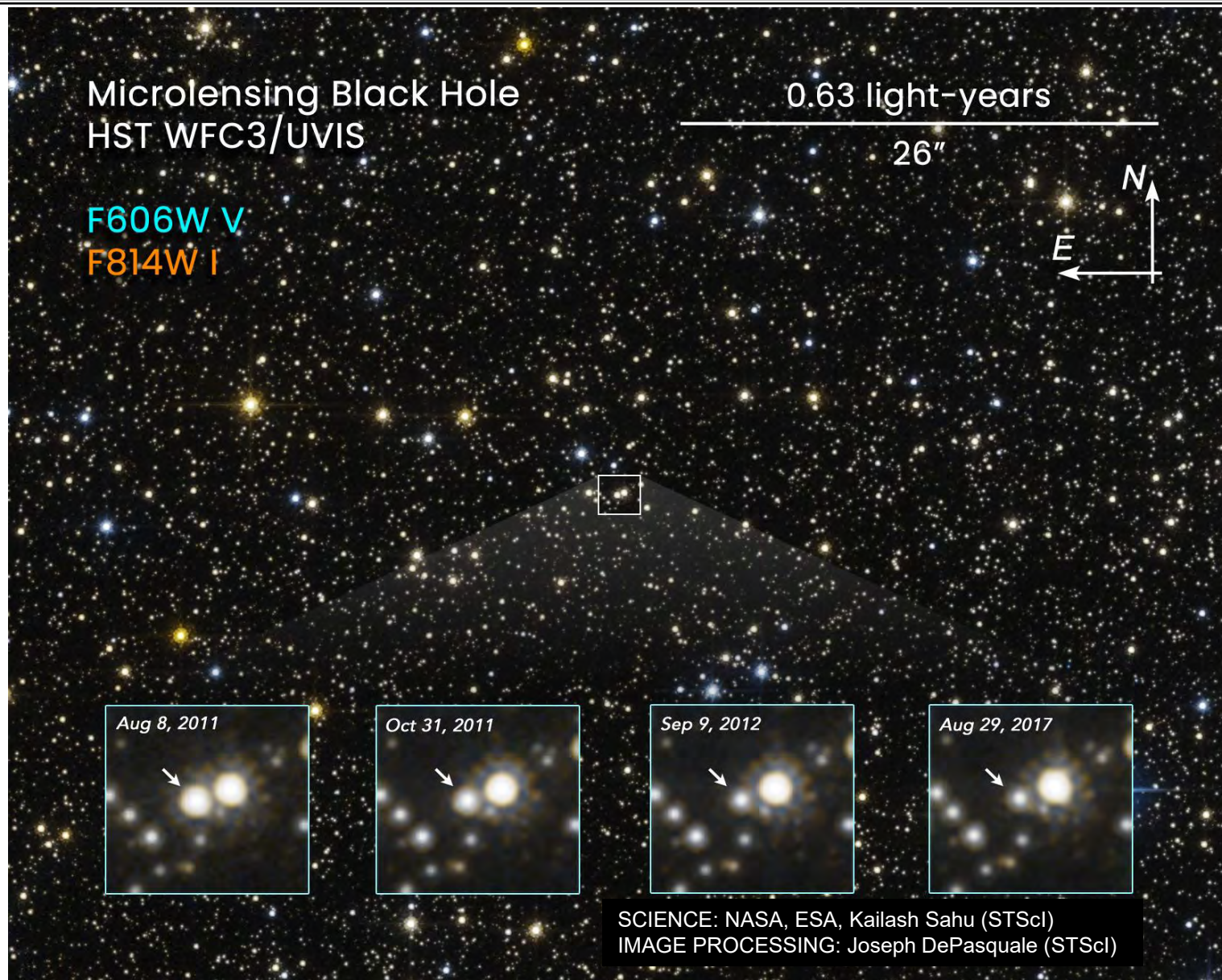
Agenda

- **Science Highlights**
- **2022 Senior Review**
- **NASA/SpaceX Study (Tom Brown covered)**
- **Observatory Status**
 - **Solar Array Drive Electronics – Safehold events**
 - **Fine Guidance Sensors**
 - **Gyros**
 - **SI C&DH**
- **Budget**

Hubble imaged the **DART** impact ejecta in the hours after impact with asteroid Dimorphos, showing ejecta that appear as rays stretching out from the body of the asteroid. Dimorphos observations mark the first time that Webb and Hubble simultaneously observed the same celestial target. Astronomers are investigating why the debris appears consistently bright in Hubble images long after the impact. A Hubble image was featured in a NASA release announcing initial success of the DART mission.



Hubble Detects and Measures the Mass of an Isolated Black Hole in the Milky Way



Senior Review 2022

"Hubble and Chandra occupy the top tier given their immense, broad impact on astronomy. These Great Observatories continue to enable a very large number of well-cited publications, with an increasing fraction of publications stemming from archival studies, indicating that their science will endure well after these missions end... Hubble, entering its third decade of science, continues to provide unique optical and UV imaging and spectroscopy, with no comparable UV facility planned beyond the next decade... Both [Hubble and Chandra] missions are operating at extremely high efficiency, and although they are increasingly showing signs of age, both are likely to continue to generate world-class science throughout the next half decade, operating in concert with JWST as it begins its flagship role."

-- June 2022 Senior Review APAC Subcommittee Report

August 2022 NASA HQ Response to Senior Review recommendations:

"The Hubble mission is directed to implement efficiencies in operational and community outreach support in order to preserve the level of General Observer (GO) funding as much as possible within the FY23 President's Budget Request. Funding for the NASA Hubble Fellowship Program will be provided external to the Hubble mission, providing budget flexibility to address this direction. The guiding principle should be to maximize the science returns for the community by preserving mission infrastructure while maximizing GO funding. The Hubble mission will be invited to the 2025 Astrophysics Senior Review."

GO HUBBLE GO !!  

Senior Review 2022

- **2022 Senior Review**
 - Panel reports were made public in June
 - HQ Letter of Guidance received in August
 - Established firm guidance for FY23-25 and notional guidance for FY26-27
 - FY23 - \$93.3M, FY24-FY27 \$98.3M
 - No longer responsible for NASA Hubble Fellowship Program funding beginning with FY24
 - Increases buying power for Hubble GO/AR program in face of inflation without escalating the Hubble overall budget
 - Project response is due in November

Agenda

- **Science Highlights**
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Observatory Status

- **Solar Array Drive Electronics (SADE) – Safehold Events**

- August 30
 - SADE-2 electronics experienced Single Event Upset while passing through the South Atlantic Anomaly during a solar array slew
 - Slew end point value became corrupted which led to a mismatch between expected and actual position during the slew, resulting in safehold
 - Solar array drives were tested, exhibited normal behavior; resumed normal science operations on September 1
- October 17
 - SADE-2 failed a torque test at the beginning of solar array slew
 - Although not in SAA, appears consistent with SEU run away slew
 - Functional test of Solar Array drives planned for October 18

Observatory Status

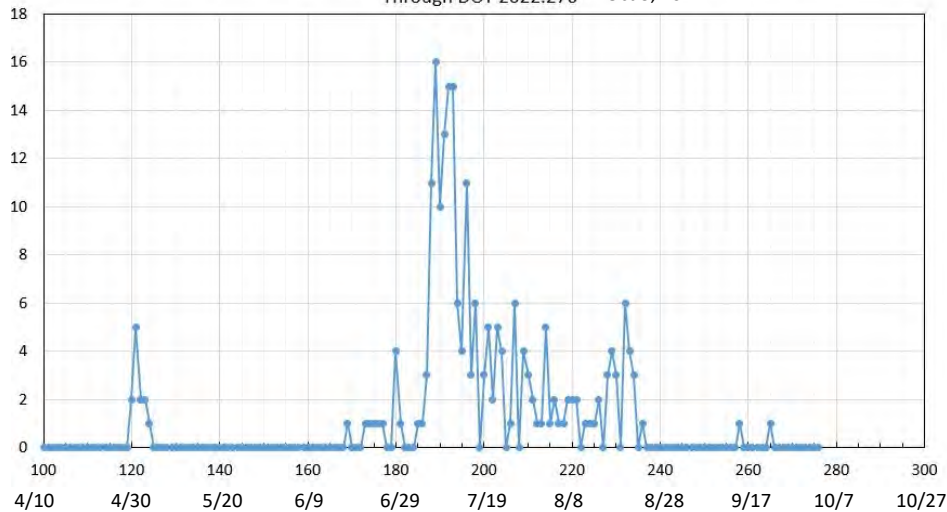
- **Fine Guidance Sensors**

- Following recovery from the 2021 SI C&DH Side-B anomaly, FGS-2 experienced B-servo compensation error voltage saturation events
 - Tiger Team concluded that the stalls were likely due to lubrication/debris on ball bearing or toroid preventing small motion slews as indicated by the compensation error saturating; normal use of the FGS resulted in improved performance
- FGS-2 period of saturation events from April 30-September 22
 - GSFC and STScI worked to actively manage the FGS selection process
 - Integrated spiral maintenance slews using the Internal Test Source to increase the servo motion per Tiger Team discussions
 - Returned to normal sensor selection processes on October 10
 - Still choosing to use FGS-3 instead of FGS-2 for moving targets and spatial scanning observations
- FGS-1 – incorporating spiral maintenance slews to address Servo-B trends

Observatory Status

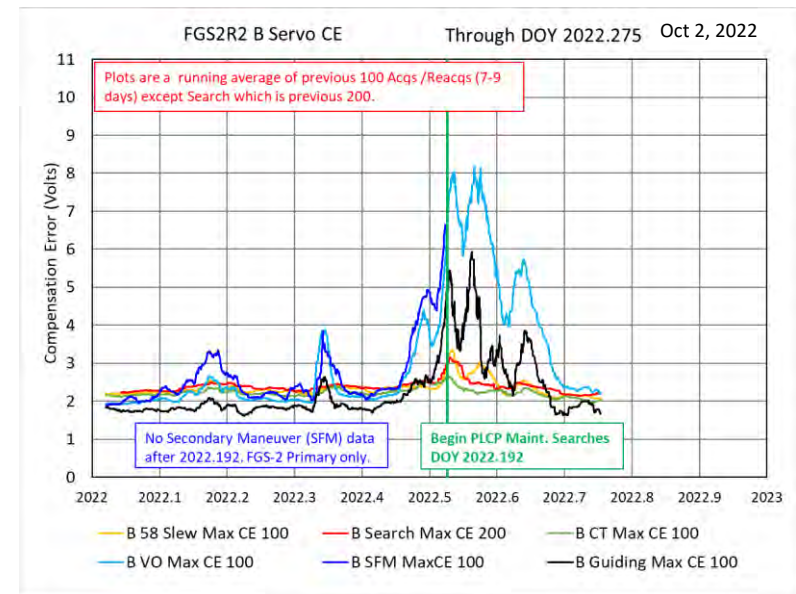
9/30/2022

Figure 1: FGS2R2 Servo-B CE Saturation Events
Number of FGS-2R2 B-Servo Saturation Events over two 40 HZ samples per DOY - 2022
Through DOY 2022.276 Oct 3, 2022



Two FGS2R2 Servo-B stalls since Aug 24

Figure 2: FGS2R2 Servo-B CE Running Average 100 Acqs/Reacqs

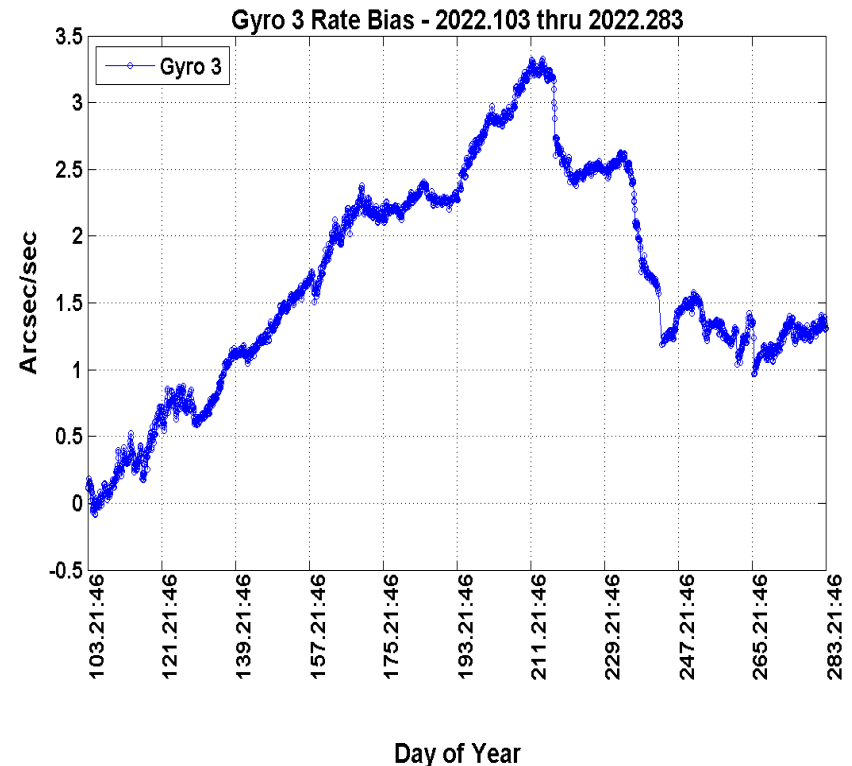
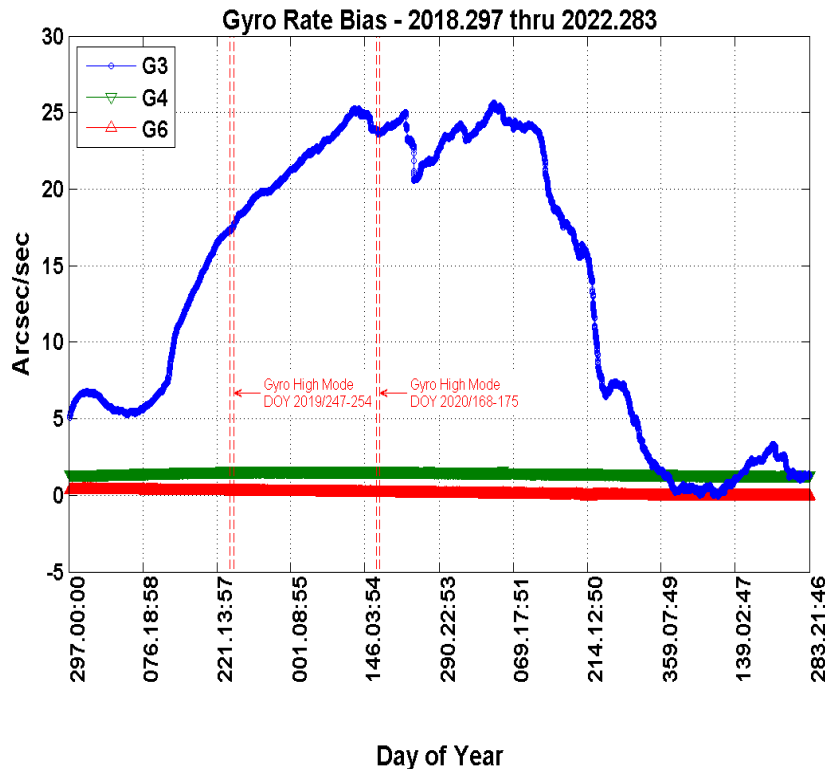


Observatory Status

9/30/2022

- **Gyro-3 Performance**

- Gyro-3 rate bias remains noisy but in family with gyros 4 and 6
- Occasionally requires ground intervention to update bias
- Next flight software release to incorporate bias update capability (Spring 2023)



Mission Operations – Gyro Run Time Performance

Current Gyro Runtimes				Previous Flex Lead Failure Runtimes			
Post SM4 RGA	Status	Flex Lead	Total Hours 2022/273 (9/30/2022)	Date of Failure	Gyro	Flex Lead	Total hours at failure
G1	Failed April 2018	Standard	43,359	1992.281	G6	Standard	34825
G2	Failed October 2018	Standard	47,550	1997.099	G4	Standard	31525
G3	On	Enhanced	57,295	1998.295	G6	Standard	46276
G4	On	Enhanced	127,793	1999.110	G3	Standard	51252
G5	Failed March 2014	Standard	51,497	1999.317	G1	Standard	38470
G6	On	Enhanced	74,907	2007.243	G2	Standard	58039
				2014.066	G5	Standard	51497
				2018.111	G1	Standard	43359

G4 (Enhanced Flex Lead) – Highest runtime hours on program 127,793

Mean runtime hours for the 3 Enhanced Flex Lead gyros 86,665

G6 (Enhanced Flex Lead) – 2nd highest hours 74,907

Third highest hours (Standard Flex Lead G1 from SM3A) 60,444

G3 (Enhanced Flex Lead) – 6th highest hours 57,295

Mean runtime hours for all 22 HST gyros 48,378

Mean runtime hours for the 8 HST Standard Flex Lead failure gyros 44,405

Observatory Status

- **Science Instrument Control and Data Handler**
 - Currently operating on Side-A following the July 2021 side switch recovery
 - Experienced loss of minor frame synchronization anomaly on October 23 and again on October 25, 2021; no recurrences observed to date
 - Developed and installed patches for all four instruments to enable uninterrupted science data collection if minor frame synchronization messages are dropped
 - Assessing feasibility/complexity of an alternative source for minor frame synchronization messages on Side A should the loss return, become more frequent and/or persistent
 - Developing approach/implementation plan for Blind Science Operations
 - Enable science capability on Side-B if necessary
 - Demonstrated in the lab the ability to command instruments to perform observations, collect data, and route data for download
 - Preliminary operations concept and requirements review planned for November

Budget Status

FY22	FY23	FY24	FY25	FY26	FY27	FY28
\$98.3	\$93.3	\$98.3	\$98.3	\$98.3	\$98.3	\$98.3

- **Cycle 29 (FY22) - \$32.5M**
- **Cycle 30 (FY23) – still finalizing Cycle Value; expect to fully award the Financial Review Committee recommendation (14-month cycle)**
- **Cycle 31 (FY24) – 10-month cycle; expect to provide full support**
- **Monitoring inflation impacts**