Goddard Space Flight Center

HST/GSFC Project Report

Star-Forming Region NGC 2174

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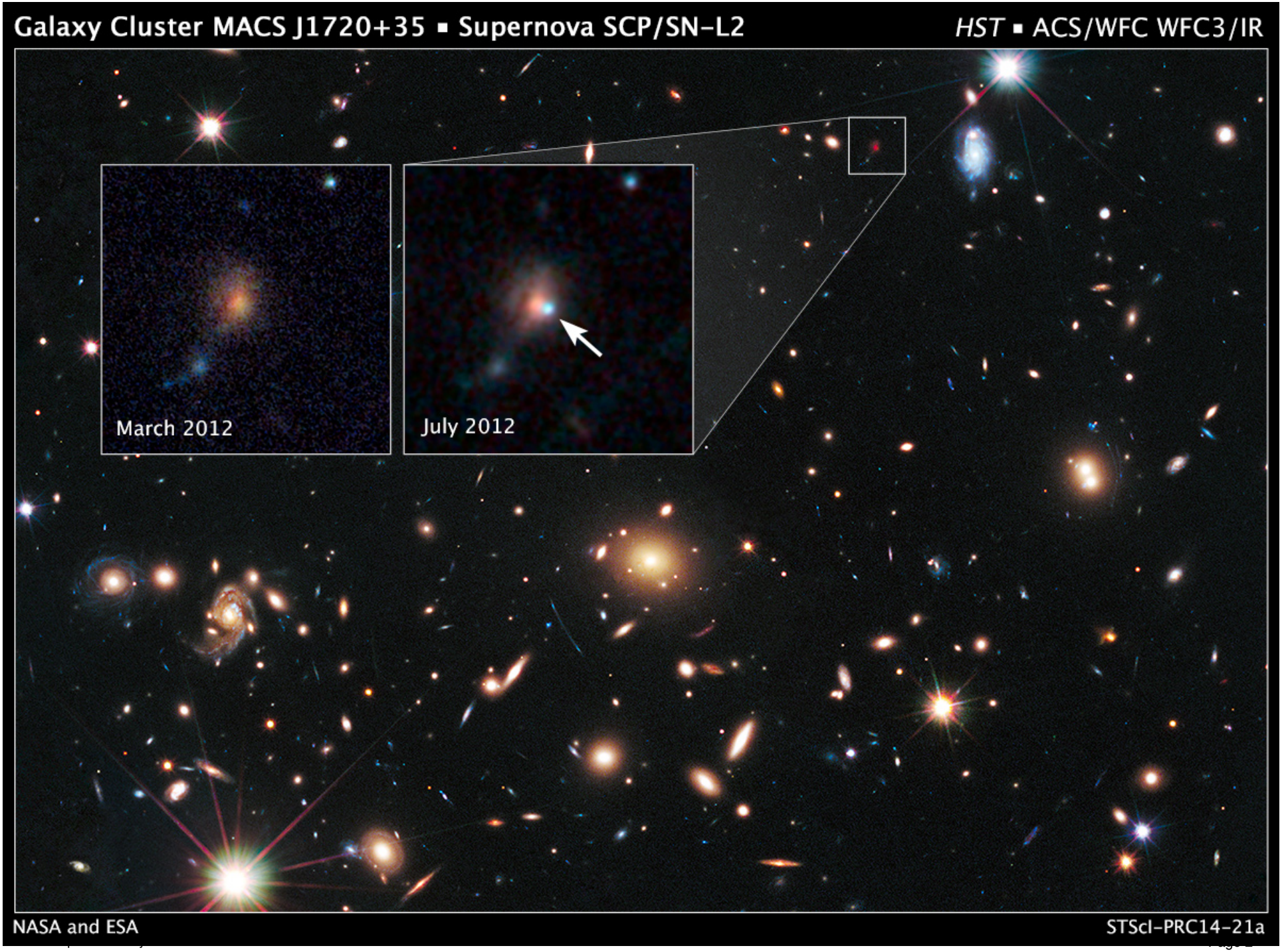
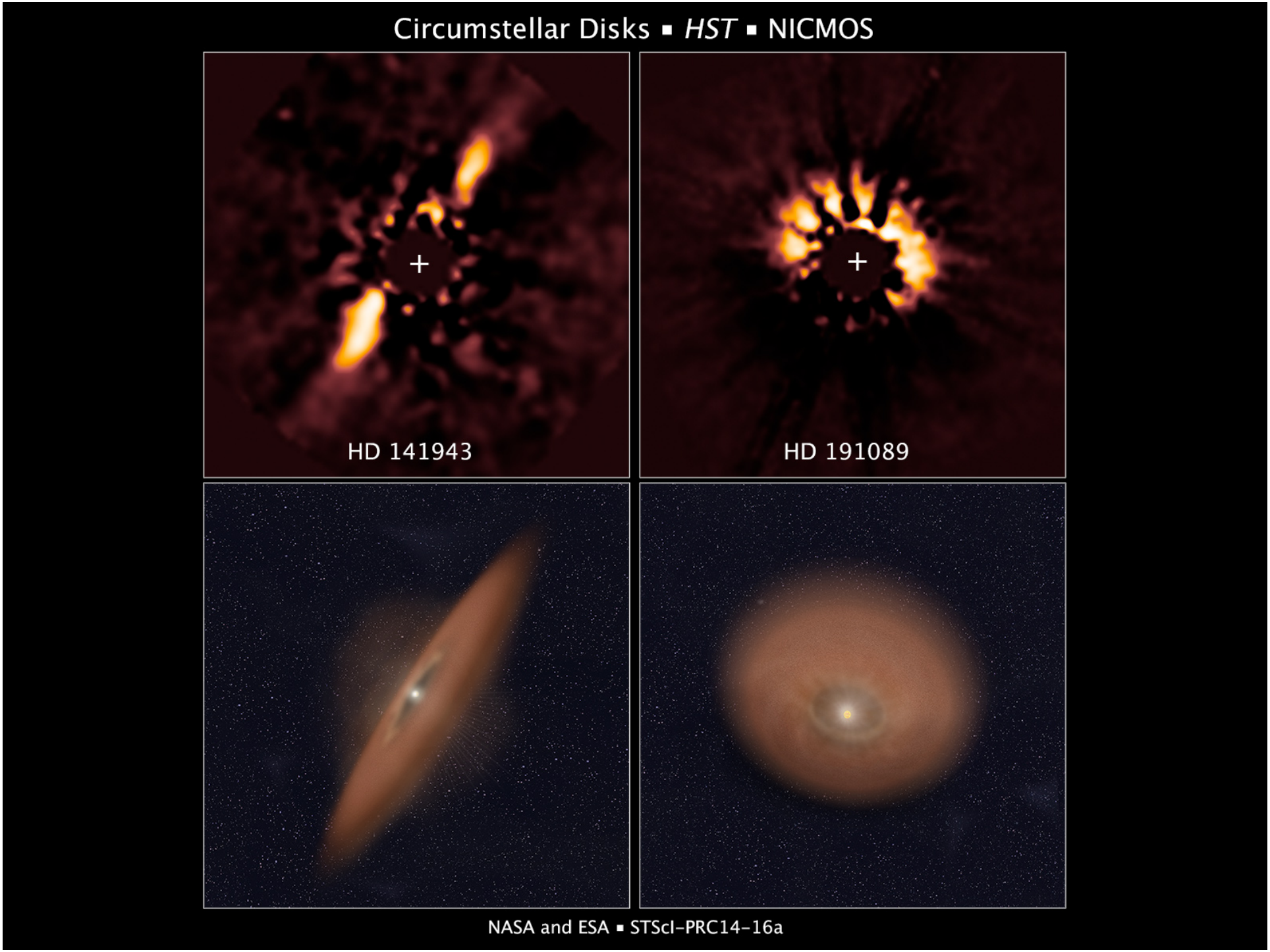
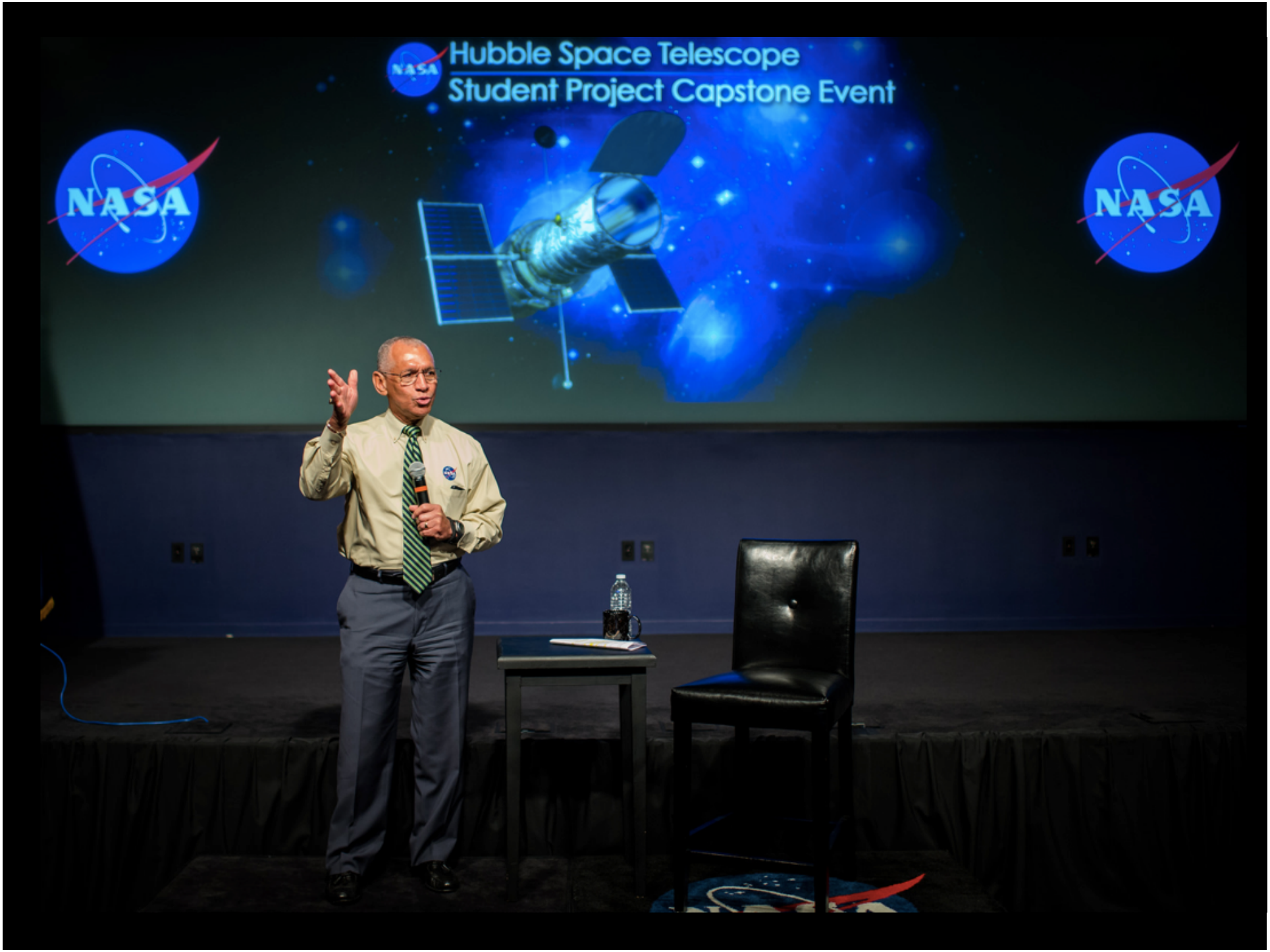
Space Telescope Users Committee Meeting
May 8, 2014


Galaxy Cluster MACS J1720+35 ▪ Supernova SCP/SN-L2
HST ▪ ACS/WFC WFC3/IR
March 2012
July 2012
NASA and ESA
STScI-PRC14-21a


Circumstellar Disks ▪ *HST* ▪ NICMOS
HD 141943
HD 191089
NASA and ESA ▪ STScI-PRC14-16a


NASA


Hubble Space Telescope
Student Project Capstone Event
NASA
NASA
NASA

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

Subsystem		Summary
Science Instruments (SI)	G	• 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 2nd lifetime position; expect to move to 3rd 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	G	• 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	G	• 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	G	• 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	G	• 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	G	• 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 turn off on March 13

Current Gyro Runtimes

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

Previous Flex Lead Failure Runtimes

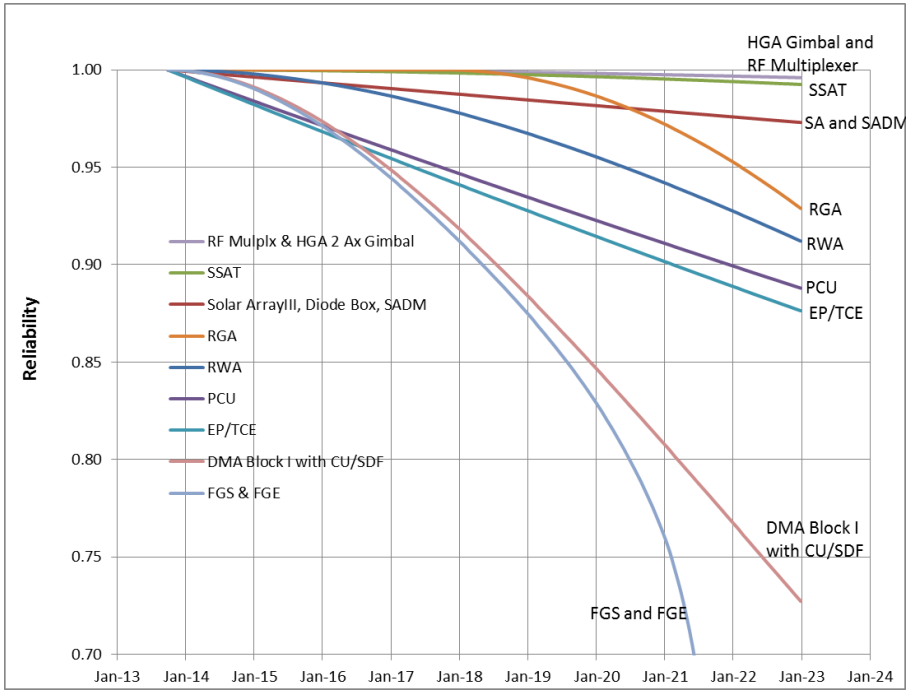
Date of Failure	Gyro	Flex Lead	Run hours at failure
1992.281	G6	Standard	21504
1997.099	G4	Standard	29304
1998.295	G6	Standard	42768
1999.317	G1	Standard	39600
1999.110	G3	Standard	47088
2007.243	G2	Standard	55584

Critical System Reliability

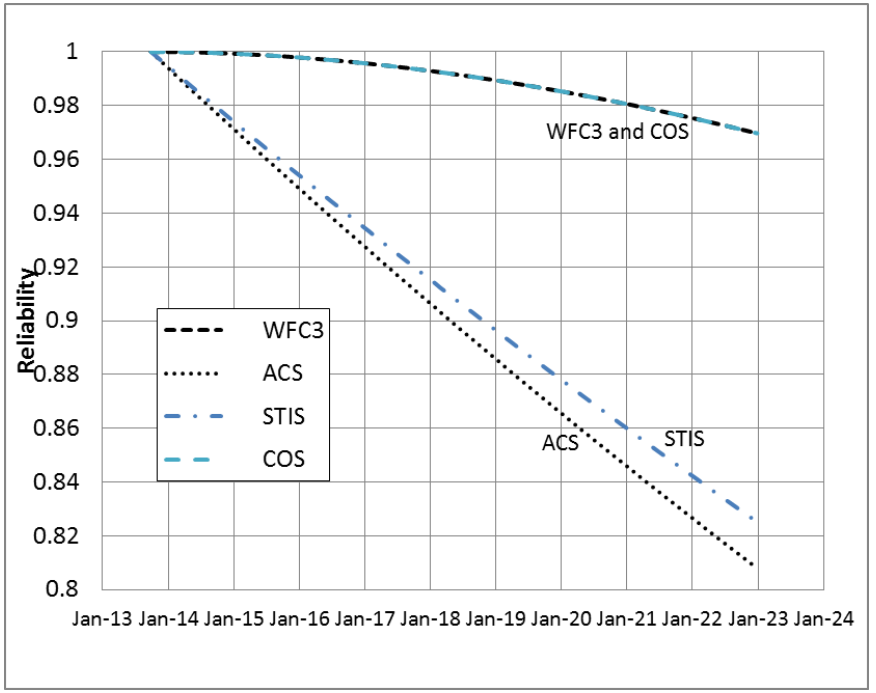
NASA Engineering and Safety Center (NESC) Technical Assessment Report

- 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

Observatory Systems



Science Instruments



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 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

Contract/Budget Status

- **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?**