Briefing to WFC3 SOC

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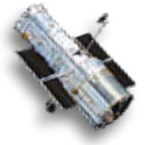
HST Senior Project Scientist

May 8, 2008

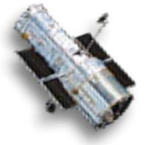


Cycle 17 Instrument Configuration/Modes

Instrument	Configuration	Mode	Orbits	Usage	
ACS	HRC	Imaging	937	**3.01%**	
		Rampfilter	21	**0.07%**	**3.5%**
		Spectroscopy	131	**0.42%**	
	SBC	Imaging	389	**1.25%**	**1.3%**
		Spectroscopy	7	**0.02%**	
	WFC	Imaging	7914	**25.41%**	
		Rampfilter	134	**0.43%**	**26.7%**
		Spectroscopy	280	**0.90%**	
COS	FUV	Spectroscopy	2486	**7.98%**	**8.0%**
	NUV	Imaging	89	**0.29%**	**1.4%**
		Spectroscopy	351	**1.13%**	
FGS		POS	460	**1.48%**	**1.5%**
		TRANS	13	**0.04%**	**0.0%**
NICMOS	NIC1	Imaging	221	**0.71%**	**0.7%**
	NIC2	Imaging	995	**3.19%**	**3.2%**
	NIC3	Imaging	2672	**8.58%**	**8.9%**
		Spectroscopy	91	**0.29%**	
STIS	CCD	Imaging	100	**0.32%**	**2.2%**
		Spectroscopy	586	**1.88%**	
	FUV	Imaging	3	**0.01%**	**3.3%**
		Spectroscopy	1011	**3.25%**	
	NUV	Imaging	5	**0.02%**	**1.9%**
		Spectroscopy	573	**1.84%**	
WFC3	IR	Imaging	5707	**18.32%**	**20.0%**
		Spectroscopy	535	**1.72%**	
	UVIS	Imaging	5389	**17.30%**	**17.5%**
		Spectroscopy	46	**0.15%**	

Imaging	**Spectroscopy**	**FGS**
78.91%	19.58%	1.5%

HST Program Status



- **HST Program presently working to October 8, 2008 LRD**
- **Completed reassessment of mission priorities**
  - Developed presentation on System Reliability and Redundancy Implications for SM4 Contingency Planning; submitted to HQ/SMD
  - Recommended re-classifying FGS2R change out as “non-core”
- **Completed on-orbit testing of One-Gyro Science Mode and Kalman Filter Sunpoint Mode**
- **Resolved COS alignment measurement anomaly**
  - Stratification of laminar flow in nitrogen purge evidently produced differential refraction, distorting spectral line shapes and orientations
- **Completed Joint Integrated Simulation #1 (JIS 1) April 1**
  - EVA3: COS insertion, ACS repair
- **JIS 2 scheduled for May 15**
  - EVA4: STIS repair, NOBL 8 insertion
- **NBL 8.4 taking place May 8-14**

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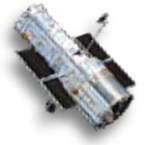
Hubble Space Telescope Program

HST Servicing Mission 4
Planned Mission Manifest and Priorities



Manifest in Priority Order

1. RSUs (Gyros)
2. WFC3
3. COS
4. Battery Modules

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5. FGS2RR

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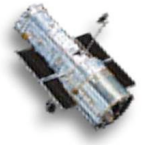
6. STIS Repair
7. ACS Repair
8. NOBL 8
9. NOBL 5
10. NOBL 7

Note: SCM and Reboost are parallel activities that do not contend with other EVA tasks and, therefore, do not affect priorities



HST Program Status
Significant Challenges

- **Minimize impact of any launch schedule delays**
- **Manage SM4 development activity within remaining contingency allocation**
- **Complete design, development, and verification of Crew Aids and Tools**
- **Complete ACS-R development**
- **HST Operations budget reduced $83.6M from FY10 thru FY13**
  - $40.6M reduction reflects “Compromise Budget” in FY10 thru FY13 agreed to in Fall 2007
  - Additional $43M removed from FY12 and FY13, results in “Broken Operation” (Unacceptable Risk)

Flight Assignment Working Group (FAWG) Planning Manifest

For detailed flow operations refer to Preliminary Manifest Option 08A-10

NASA Official: John Coggeshall
Prepared by: USA7000/Barton K. Gibson
Chart updated: 28-April-2008

CY2007 | CY2008 | CY2009 | CY2010
FY2008 | FY2009 | FY2010

103 Discovery

- **124 (1J)** 5/31 — (13+2) — 3 EVAs — (35) — JEM PM (4 JEM Sys racks, JEM RMS) — SPDU — ECSH — ET-128 — 183 nmi
- **119 (15A)** 12/4 — (13+1) — 4 EVAs — (36) — S6 — ET-130 — 195 nmi
- **129 (ULF3)** 9/3 — 3-4 EVAs — SPDU / MISSE 7A, SAMA / MISSE 7B — ELC1 — RODU 755 (2) — ELC2 — 37,016 lbs — 1500 lbs — 195 nmi — ET-133
- **132 (ULF4)** 3/18 — 3-4 EVAs — ICC-VLD — RODU 755 — MRM1 — 56,604 lbs — 1881 lbs — 205 nmi — ET-135

104 Atlantis

- **125 (HST-SM4)** 8/28 — (11) — (30) — 9/12 — SLIC — ORUC (HSC-3D) — PFR&WR — FSS — MULE — ET-127 — 304 nmi
- **Ares I-X** 4/15
- **128 (17A)** 7/16 — Last Shuttle Crew Rotation — 3 EVAs — RODU 751 — MPLM(P) — LMC — 38,141 lbs — 1200 lbs — 186 nmi — ET-132
- **131 (19A)** 1/21 — 3 EVAs — RODU 751 — MPLM(P) — LMC — 38,400 lbs — 1500 lbs — 200 nmi — ET-136

105 Endeavour

- **126 (ULF2)** 10/16 — (15+1) — 4 EVAs — (22) — RODU 751 — MPLM(P) — LMC — ET-129 — 190 nmi
  - 400 — 9/4
  - 326 — 8/29
- **127 (2J/A)** 4/23 — (15+1) — 5 EVAs — (23) — SPDU / DragonSat — JEM EF — ECSH / PPSU (2) — ELM-ES — RODU 755 — ICC-VLD — ECSH / Ande-2 — ET-131 — 200 nmi
  - 327 — 2/19
- **130 (20A)** 10/22 — 3 EVAs — Cupola — Node3 — 38,831 lbs — 804 lbs — 186 nmi — ET-134
- **133 (ULF5)** 4/29 — 3-4 EVAs — ELC3 — RODU 755 (2) — ELC4 — 56,267 lbs — 1630 lbs — 210 nmi — ET-137

This chart represents cargo bay configurations approved by the JCAWG

Hardware available to support 6-person crew on ISS

6-person crew presence on ISS following Soyuz 19S (May 2009)

Flight Rate: FY-5 / CY-6 (Dec Jan Feb Mar Apr) | FY-5 / CY-4 (May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May) | FY-4 / CY-3 (Jun Jul Aug Sep Oct)

Launch Beta Angle Cutouts*

7 β 24 — 4 β 21 — 29 β 16 — Beta Exceedance

*being above +/- 60 degrees (for 185nmi Orbit) during Orbiter/ISS combined mated ops (8 days)

*Under Review
Green APM#: Flight specific vehicle & launch month
Black APM#: Generic specific vehicle & launch month

Soyuz (S)
Progress (P)
Automated Transfer Vehicle (ATV)
H-II Transfer Vehicle (HTV)

- 29P 5/14
- 30P 8/12
- 31P 9/10
- 17S 10/12
- 32P 11/26
- 33P 2/10
- 18S 3/25
- 34P 4/22
- 19S 5/25
- 35P 6/24
- HTV1 9/1 — MRM2
- 5R 8/15
- 20S 10/1
- 36P 10/30

STS# (ISS#)
FDRD Launch Date / Launch Date
Crew Rotation
Mission duration
Number of EVAs
# of times this OV has flown
Accessed launch date
Launch Pad
External Tank
Not baselined in the FDRD
Contingency Logistic Flights
Contingency Shuttle Crew Support (CSCS) (Empty Cargo Bay)

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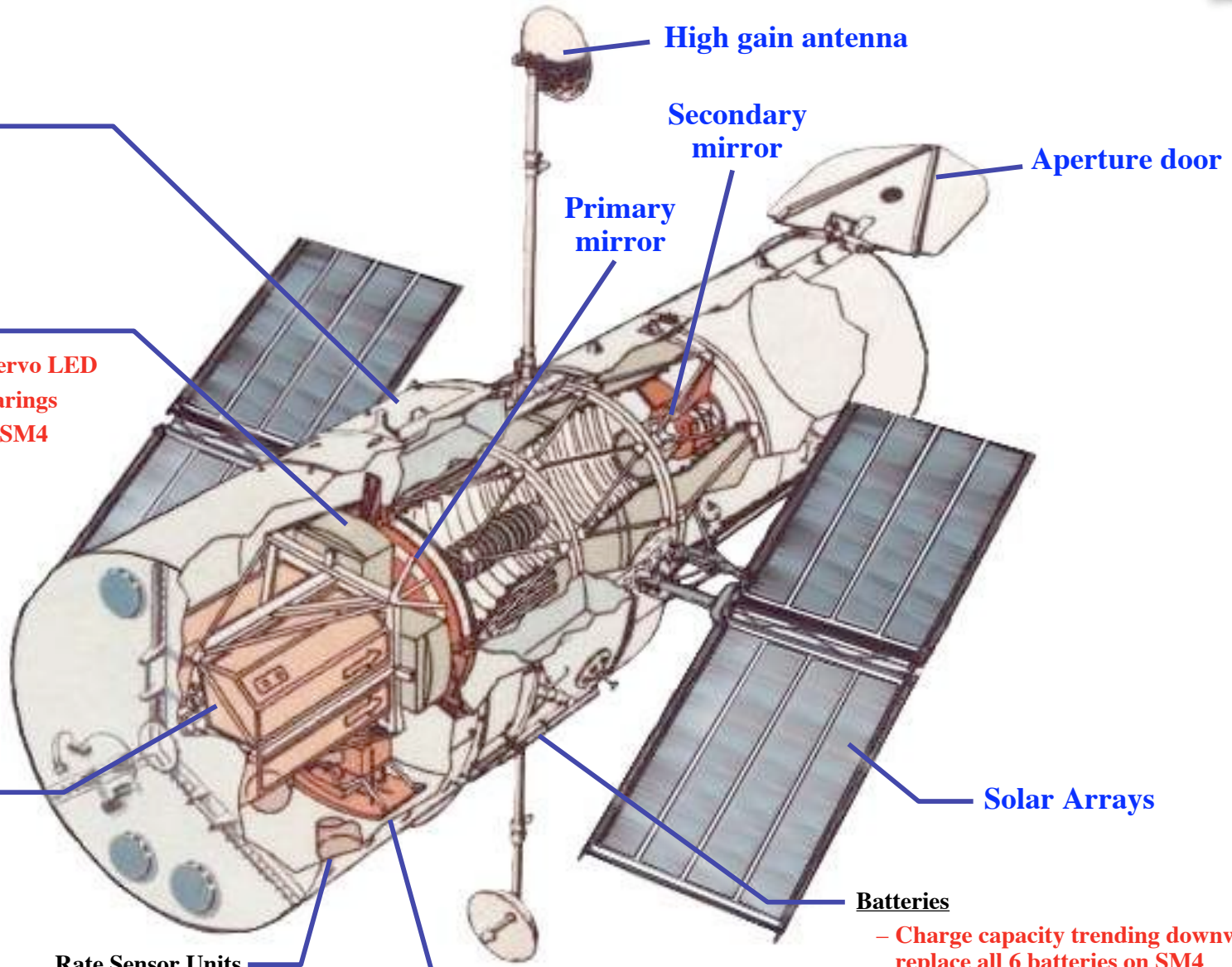
Hubble Space Telescope Program

HST Spacecraft Health



Equipment Section
- Degraded MLI: Install NOBLs on Bays 5, 7, 8 in SM4

Fine Guidance Sensors
- FGS2R: degrading servo LED
- FGS3: degrading bearings
- Replace one FGS on SM4

Axial Scientific Instruments
- STIS, failed 8/04
- STIS Repair on SM4
- ACS CCD Imaging failed 1/07
- ACS Repair on SM4
- Install COS on SM4

Rate Sensor Units
- Gyros 2, 3, and 5 failed: replace all 6 gyros on SM4

Radial Scientific Instrument
- Replace WFPC2 w/ WFC3 on SM4

Batteries
- Charge capacity trending downward; replace all 6 batteries on SM4

High gain antenna

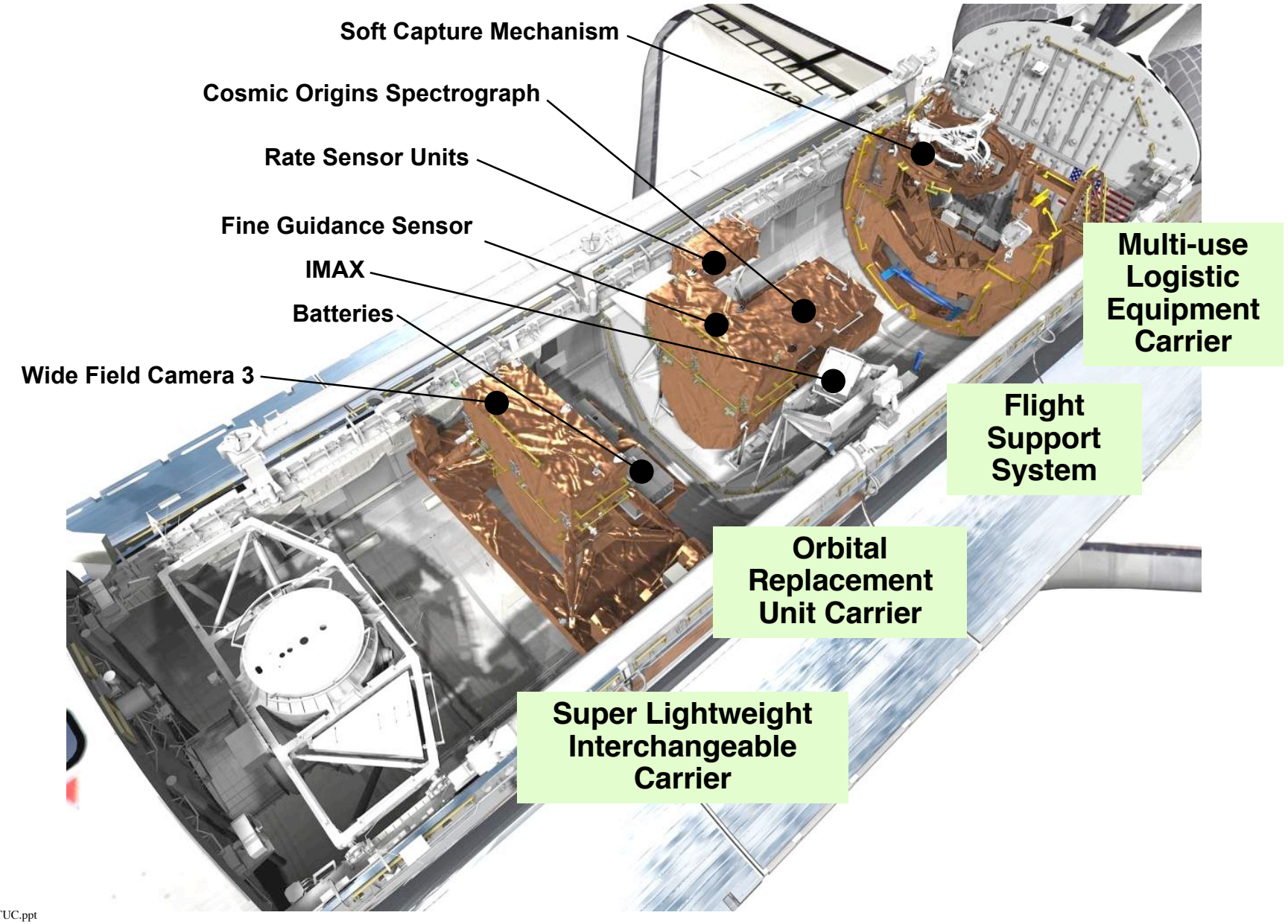
Secondary mirror

Aperture door

Primary mirror

Solar Arrays

HST Servicing Mission 4 (SM4) Configuration



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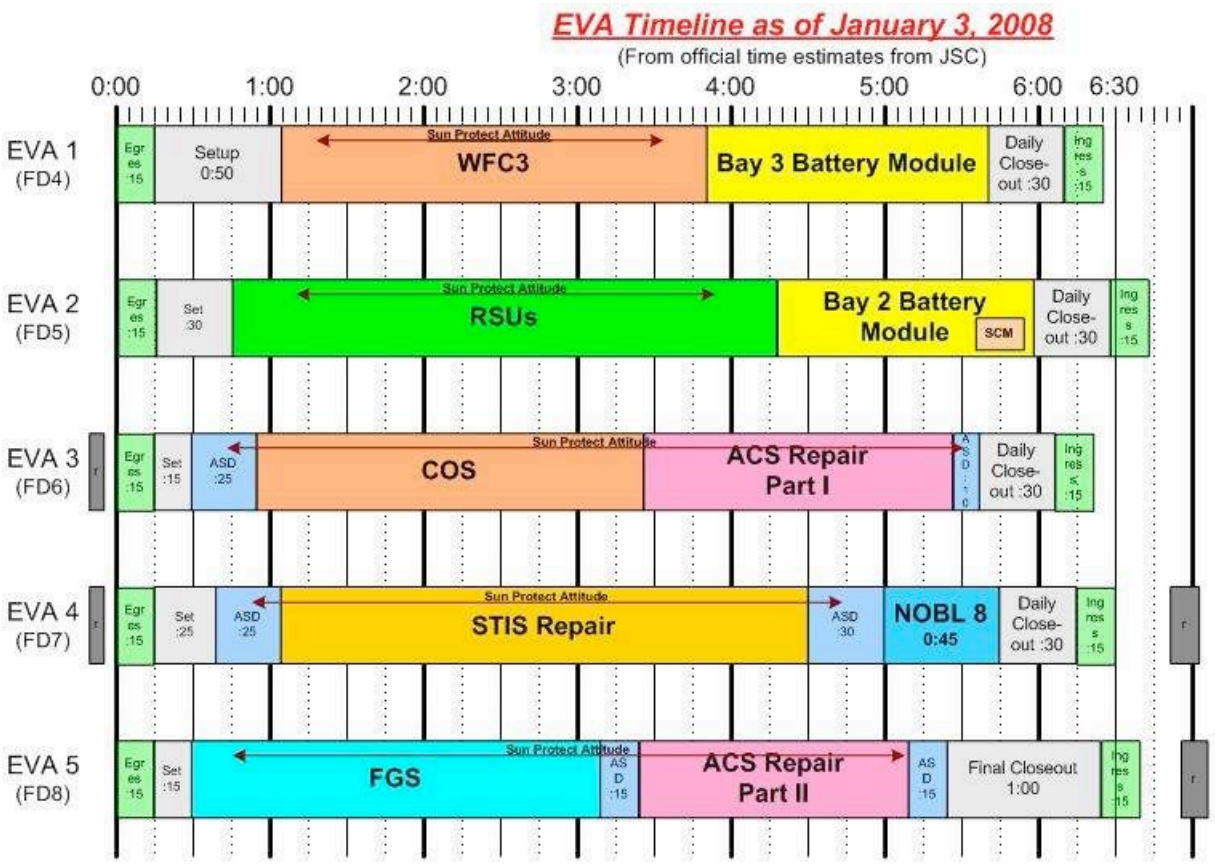
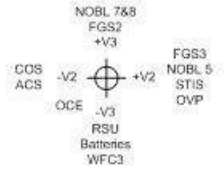
Current HST SM4 EVA Timeline



Priority	Task Times
1. RSUs (3)	3:30
2. WFC3	2:45
3. COS	2:30
4. Bay 3 Battery Mod.	1:50
Bay 2 Battery Mod.	1:40
5. FGS 2	2:40
6. STIS Repair	3:25
7. ACS - part I	2:00
- part II	1:45
8. NOBL 8	0:45
9. NOBL 5	
10. NOBL 7	
11. SCM	0:15
12. Reboost	

Note: Total ACS task time is 3 hours. If placed on one day with COS, EVA duration is 7:25. By splitting into two days, setup and cleanup need to be performed twice. At the end of ACS Part I, two cards have been removed.

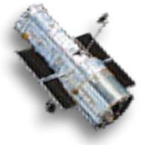


Note:

Sun Protect Attitude

indicates a sun protect attitude is required from start of opening aft shroud door to closing of aft shroud door. The length of the arrow is not to scale of task time between door opening and closing

1/7/2008; 1:19 PM -- BGK/442



SM4 Flight Hardware Status

- **WFC3**
  - **TV#3 successfully completed**
  - **Verified that all major instrument performance issues had been resolved**
  - **Obtained complete calibration data set**
  - **Minor anomalies difficult to "tweak" because instrument was fully "buttoned up" due to old launch schedule; no significant impact on scientific performance identified so far**
  - **Instrument supported Crew Fam #4, April 27-30**
- **COS**
  - **HOMS/CAOS Pre-acoustics alignment anomaly (degradation in image quality on NUV detector and slanted lines on FUV detector) attributed to optical effects of GN2 purge**
  - **Completed acoustics test with ORUC**
  - **Instrument supported Crew Fam #4**

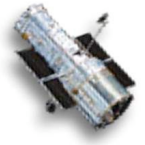
SM4 Flight Hardware Status (cont'd)

- **ACS-R**
  - **Flight-like system has been run with HST/ACS simulators; worked as expected**
  - **Also verified that flight software and operations of new hardware is near flight readiness**
  - **Two CEB-R engineering models completed; generally meet performance expectations with a flight-like CCD; noise improvements still in work**
  - **Flight Model 1 CEB-R currently in testing at the DCL; starts environmental testing at the end of May**
  - **Flight Model 2 CEB-R nearing completion; available in June**
  - **Two Flight Model LVPS-R's delivered and in storage**
- **STIS-R**
  - **Primary and spare LVPS boards ready for flight**
  - **Completed MEB Replacement Cover latch rework activity**
  - **Hardware supported Crew Fam #4**

SM4 Flight Hardware Status (cont'd)

- **Gyros (RSUs)**
  - RSUs 1004, 1005, 1006, and 1007 ready for flight
- **FGS**
  - Ready for flight
- **Batteries**
  - Recent testing of new batteries shows excellent charge capacity; no signs of degradation after long cold storage period
- **Soft Capture Mechanism (SCM)**
  - Final assembly and alignment under way
  - Hardware supported Crew Fam #4
- **New Outer Blanket Layers (NOBLs)**
  - Completed assembly of engineering model NOBL 8
  - Hardware supported Crew Fam #4

SM4 Flight Hardware Status (cont'd)



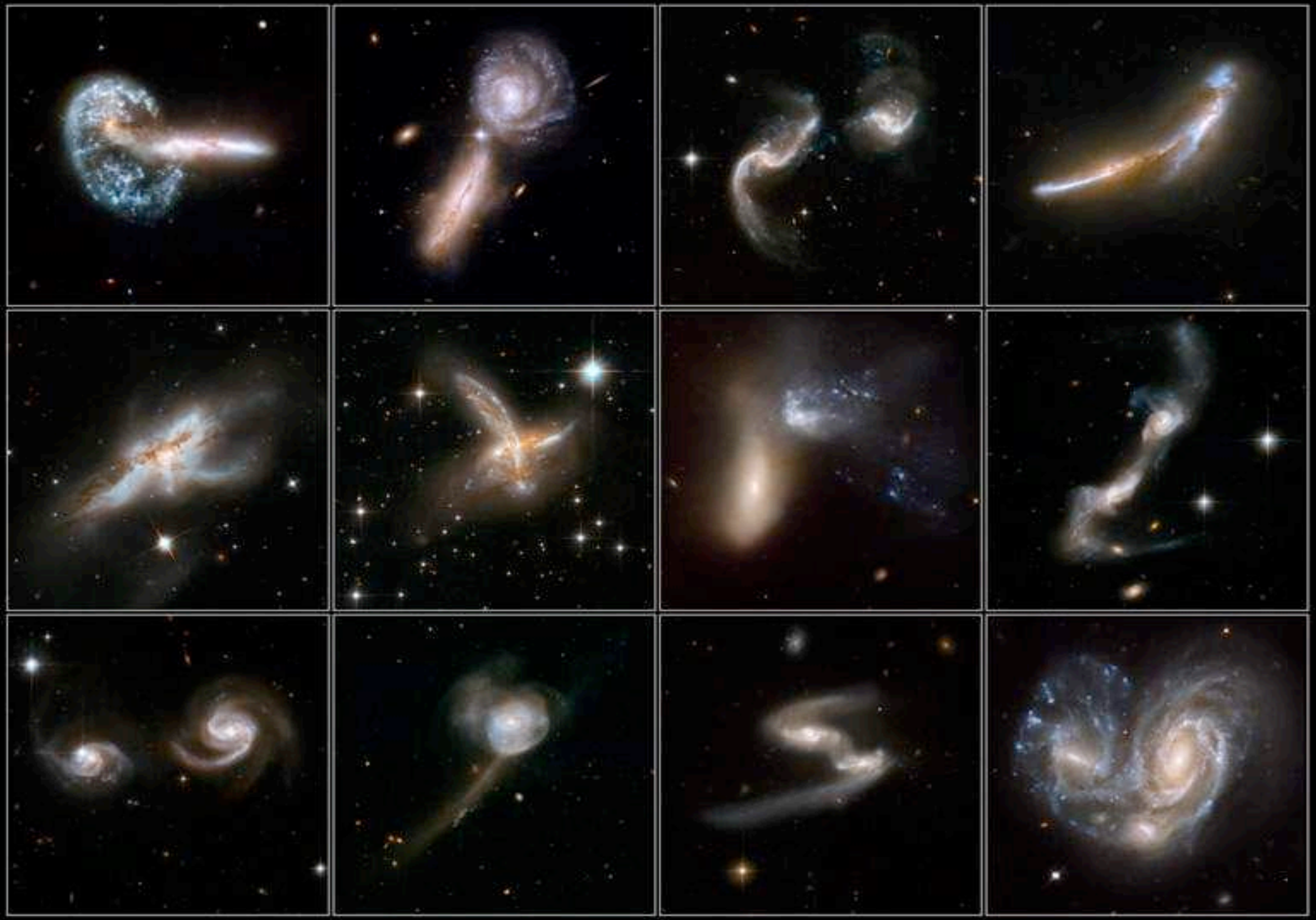
- **Space Support Equipment**
  - **FSS**
    - Completed installation of thermal blankets
    - Carrier level EMI testing completed
    - Completed thermal testing of attached Soft Capture Mechanism
  - **SLIC**
    - Completed installation of battery plate assemblies
    - Battery testing successfully completed
    - Carrier preparing for EMI testing
  - **MULE**
    - RNS hardware installed
    - Electrical testing in progress
    - Preparation for TV testing underway
  - **ORUC**
    - Supported COS acoustics test
    - Completing loads testing of IMAX support structure
    - Carrier completing electrical integration

SM4 Flight Hardware Status (cont'd)

- **Crew Aids and Tools (CATS)**
  - Conducted reviews with JSC Mission Director, HQ, Directorate, and Program to review tool development planning and to ensure appropriate oversight
  - Also conducting multiple reviews with CATS Team and ATK Management
  - Completed update of tool development schedule to support Oct. 8 LRD
  - Minimal design change requests coming from NBL
  - All engineering drawing packages released to manufacturing
  - Tool fabrication making good progress

Interacting Galaxies

Hubble Space Telescope • ACS/WFC • WFPC2



NASA, ESA, the Hubble Heritage (AURA/STScI)-ESA/Hubble Collaboration, and
A. Evans (University of Virginia, Charlottesville/NRAO/Stony Brook University)

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