HST Mission Report
SM4 Preparations

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STUC Presentation
April 10, 2008

Last presentation: October 2007

Outline

- SM4 New Instrument / Repair Support
- Cycle 17 Phase I survey
- Servicing Mission Observatory Verification (SMOV)
- SM4 Data Policy
- SM4 Simulations and Staff Training
- SM4 DRM Exercise
- Pure Parallels
- Backup charts
  - STUC and Science Staff Poll
  - EVA Timeline

Joint STScI / GSFC Activities

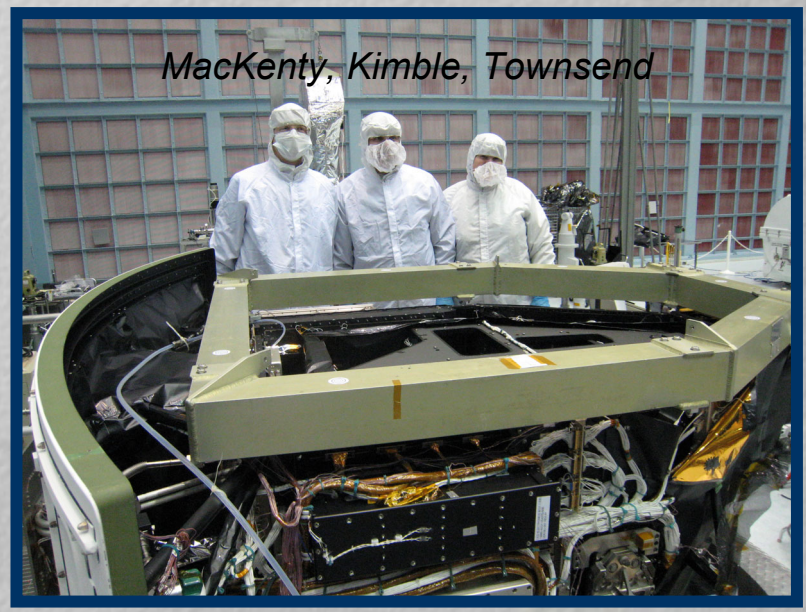
- STScI is working closely with the HST Project on many fronts
  - SM4 manifest priorities
  - SM4 Servicing Mission Observatory Verification (SMOV) preparations
  - SM4 GSFC Simulations and Joint Integrated Simulations (JIS)
  - Servicing Mission Ground Tests (SMGT)
  - Instrument development and testing (WFC3, COS)
  - Instrument repair preparations (ACS, STIS)
  - Lifetime extension initiatives (instruments, observatory subsystems)
  - Early Release Observations (EROs)
  - One-Gyro Readiness

Ongoing Instrument Activities

- Recent and upcoming presentations to astronomical community
  - January: AAS meeting in Austin, HST meeting in Bologna
  - June: AAS in St. Louis, SPIE meeting in Marseille
- Help Desk support leading up to Cycle 17 Phase I deadline
- Instrument Handbooks released with Cycle 17 CP
  - New handbooks for COS and WFC3
- ETCs
  - All teams participating in updates for ETC version 17.2 release (May 2008)
    - COS IDT very helpful in finding bugs / testing for COS ETC
  - ETC server being reconfigured to make more robust for Phase II

WFC3 Development Support

- STScI Scientists and Data Analysts support
  - EMI testing 2 shifts/day for 3 week test in Jan/Feb 2008
  - VEST/SMGT (Feb 8-12) on-site support/analysis
  - Thermal Vacuum 3 (mid Feb - mid Apr)
    - ~20 persons involved
    - 40+ days under vacuum with STScI 24/7 support for IS and Quicklook consoles
    - ~25 days for science calibration
    - Science plan was reviewed by IPT and SOC
  - UVIS3 optical alignment



WFC3 Crew Familiarization

WFC3 SMOV and Cycle 17 Preparations

- SMOV
  - Staff working 40 proposals in parallel with TV3 support
  - SOC reviewed SMOV plan at Feb 7-8 meeting
    - Addition of GRISM calibration related to SOC Early Release Science program
  - Current TV3 schedule should permit completion of planned calibrations
    - No impact on SMOV expected

- Cycle 17 Preparations
  - Instrument Handbook published
    - TV2 results from Fall 2007 included
    - Handbook based on flight detector performance (UVIS1 & IR4)
  - Additional staff in WFC3 group
    - User support
    - Astrometric analysis and multidrizzle support
    - Data analysis and reference file creation
    - TV3 support

COS Cycle 17 Preparations (1 of 2)

- Scheduling System
  - Pre-visit overhead adjustment in testing (TRANS, APT)
    - Hides several minutes of overheads in occultation period
- Coordinate systems updates
  - Makes FUV and NUV user coordinate systems consistent
    - Dispersion along +x and cross-dispersion along +y for raw data
    - Allows consistent use of POS-TARGs
- APT/BOT implementation for Phase II
  - Internal team testing ongoing
  - Early beta release to COS GTO and ERO teams
- Pipeline Verification Team
  - Joint Working Group with IDT
  - Evaluating *calcos* functionality, keywords and associations
    - Verify *calcos* products are consistent with requirements (AV-03)

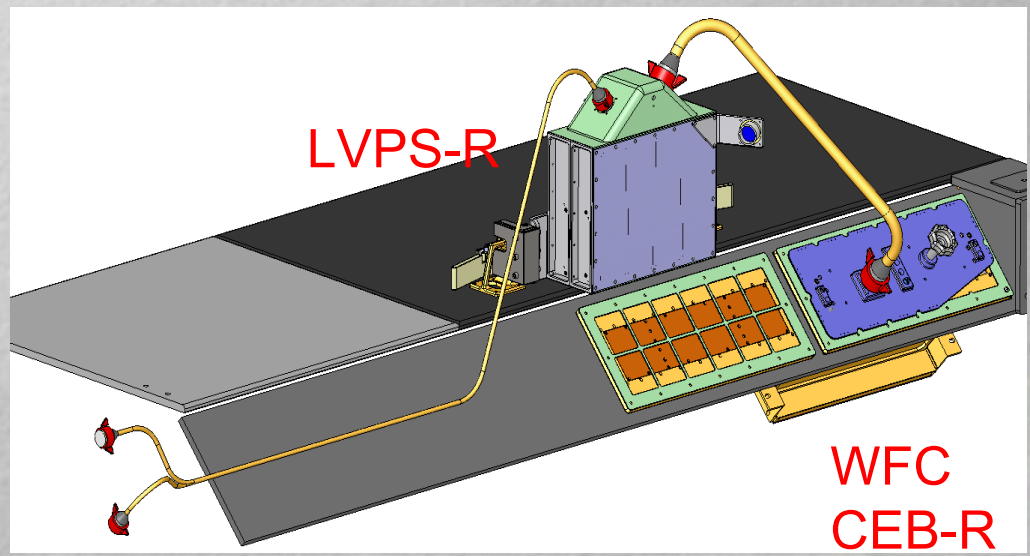
COS Cycle 17 Preparations (2 of 2)

- Archive
  - Defining science tables and required keywords
  - Using SMGT and TVac data as test cases

- COS Data Handbook
  - Initial draft in late May 2008
  - Final product planned for Oct 2008

ACS Repair

- Goals:
  - Restore WFC functionality on Side-1 (LVPS failed in June 2006) by replacing the 4 WFC CEB cards with a new module (CEB-R) powered by a new LVPS (LVPS-R)
  - Restore HRC functionality by backpowering the existing HRC CEB (success depends on the status of the existing wire harness within ACS)
  - Requirement: do no harm to SBC
- ACS-R passed CDR on Oct 3-4, 2007



ACS Repair Activities

- Support ground calibration and identify areas where science operations may need modification
  - Commanding, proposal preparation, data processing
  - Analysis of test images and characterization of ACS-R electronic performance at GSFC DCL
    - Data processed and analyzed at STScI
  - Web page for repair has been posted
    - http://www.stsci.edu/hst/acs/performance/ACSR_status
- Define and support the functional test to be executed during SM4
- SMGT planning and test definition
- SMOV planning and on-orbit re-commissioning

New ACS Tuning/Readout Modes

- Cycle 17 will contain a new CCD optimization program that may facilitate the reduction of readout noise of the WFC CCDs.
  - "Oscilloscope mode" will be executed promptly if the noise measured during the SM4 Functional Test is not satisfactory
    - Test examines signal waveform as pixels are read
    - Interleaved with internal calibrations during tuning
    - Readnoise, CTE, cross-talk, gain, and linearity will be checked
  - "Slow readout mode" (half normal speed) will be implemented if tuning does not reduce noise to satisfactory level
    - Ground tests show possibility of SQRT(2) improvement in readnoise
    - If not needed, SRM availability will be deferred until Cycle 18
- STScI is conducting a study of the science impact of increased readnoise, and the need for oscilloscope or slow readout mode
  - OM always worthwhile if improvement exceeds 10%
  - SRM improves efficiency ~7% (program average) if readnoise is as high as 10e^-, with gains/losses as high as +/-25% for some individual programs
    - Make selectable by observer

STIS Repair and Cycle 17 Preparations

- STIS Repair
  - Testing of replacement hardware proceeding satisfactorily
  - Some rework of replacement cover latches continues
  - Aliveness and functional tests to be conducted during SM4 have been developed, and pass/fail evaluation criteria defined

- STIS-R SMGT occurred January 17, 2008
  - STScI checked format of Functional Test science data
  - OPUS acknowledged receipt of data
  - STIS SMOV special commanding was not tested during the formal SMGT
    - Testing in a separate System Functional Test (SFT) using an STScI supplied SMS

- STIS Pipeline and Calibration
  - Static archive essentially complete
  - On-the-fly recalibration will be resumed for post-repair STIS data;
    - Older data will continue to be fetched from the static archive

Cycle 17 Phase I Survey

- Survey sent to all proposers
  - 150 responses, twice as many as last year
  - Most users were happy with Phase I tools and documentation/user support
- Key items in complaints (168 total: 155 “minor”, 13 “major”)
  - ETCs
    - Large number of requested enhancements for COS
    - Target acquisition
  - Documentation
    - Too many layers, difficult to navigate website (announcement page)
    - Major updates near deadline (e.g., COS GTO catalog not in duplication list)
    - “Sketchy” nature of COS and WFC3 websites
  - APT and Aladin
    - “Complicated” to use or (re)install
- We will factor these comments into the handbooks and on-line documentation

Servicing Mission Observatory Verification (1 of 3)

- Joint STScI/Project Team for SMOV Planning and Implementation
  - SI teams, Power and Electrical Systems, Temperature Control Systems, Pointing and Attitude Control Systems, and ERO team representatives
    - SMOV Working Group Leads: Biagetti (STScI), Burley (GSFC)
  - Continual integrated plan refinement and resolution of issues
- STScI SMOV Team leads the post-SM4 operations
  - SI/Subsystem STScI Leads:
    - MacKenty (WFC3), Keyes (COS,) Proffitt (STIS), L. Smith (ACS), Nelan (FGS), Wiklind (NICMOS), Lallo (Telescope), Noll (ERO), Wheeler (Engineering), Reinhart (Scheduling), Perriello (Proposal Implementation), Ellis (OPUS)
- Early Release Observations (EROs)
  - Joint STScI/Project/IDT/HQ team

Advanced Camera for Surveys ERO - SM3B

Servicing Mission Observatory Verification (2 of 3)

- STScI Internal Readiness Review at launch minus ~ 6 weeks
- 05 Sep 2008 HST release for a 28 Aug 2008 launch
- 26 Sep 2008 Bright Earth Avoidance (BEA) period ends
- SMOV4 complete ~1st week of December 2008

Instrument Availability Dates for GO Science / EROs Assuming a 28 Aug 2008 Launch Date			
STIS	CCD		26 Sep (Nov 5) (Hypothetical 6 week delay)
	MAMA		28 Sep (Nov 8)
NICMOS	Cameras		05 Oct (Nov 14)
ACS	SBC		15 Sep (Nov 6)
	HRC		05 Oct (Nov 15)
	WFC		14 Oct (Nov 24)
	Coron		29 Oct (Dec 15)
WFC3	UVIS	Outgas	20 Oct (Nov 30)
	IR	Outgas	29 Oct (Dec 9)
COS	NUV	Outgas	20 Nov (Dec 29)
	FUV	Outgas	24 Nov (Jan 2)
FGS	1R		27 Sep (Nov 7)
	2R2		20 Oct (Nov 30)

Servicing Mission Observatory Verification (3 of 3)

SMOV4 Proposal Status

10 EV points/proposal

- 3 points for prop submit
- 2 points for 1st PIT meeting
- 2 points for 2nd PIT meeting
- 3 points for proposal completion

159 SMOV4 PROPOSALS = 1590 total EV points

73 PROPOSALS PIT-APPROVED TO DATE

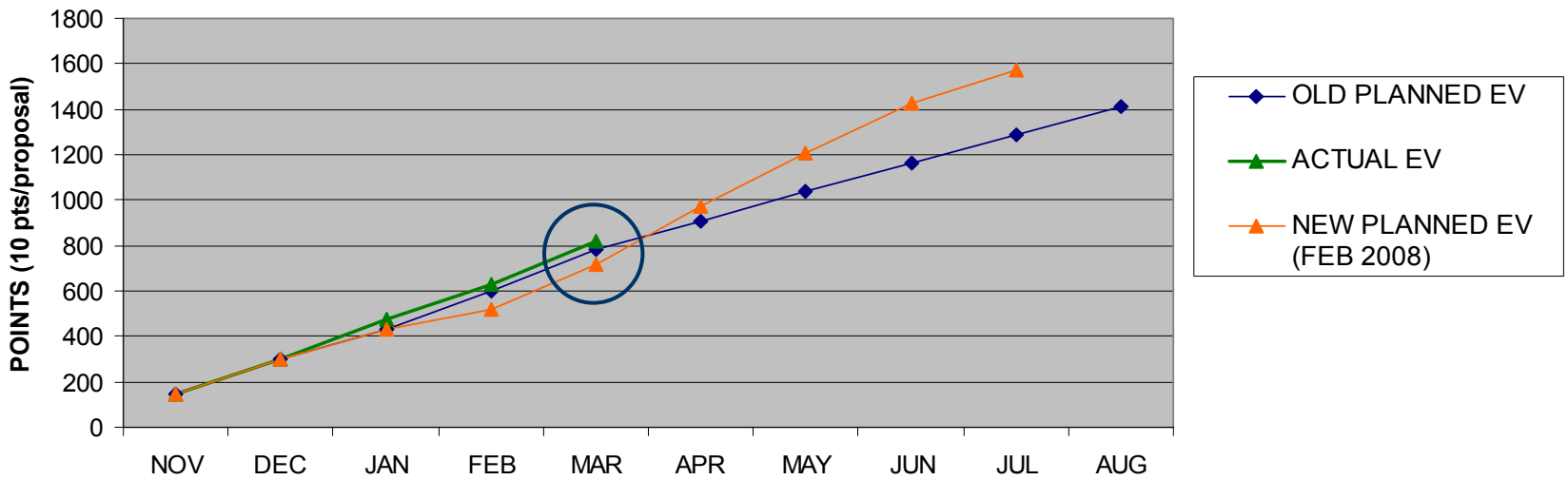
18 PROPOSALS CURRENTLY IN WORK

PIT PROCESS = 52 % COMPLETE

SMOV PIT EARNED VALUE -- NOV2007 - AUG2008
(as of 26MAR08)

Proposal Implementation Team (PIT)

13 NICMOS	26 STIS
23 ACS	34 COS
40 WFC3	08 OTA/FGS
10 ERO	05 Misc



SM4 Data Release Policy (1 of 2)

- Proprietary period managed at proposal level
  - Proposal restriction based on most restrictive SI/channel in proposal
  - Most SMOV and ERO proposals are single SI/channel

Data Type	Proprietary Period	Restrictions on Use
SMOV Data (New and Restored Channels)	Until first ERO press release for SI/channel	Available only to SMOV Team until released
SMOV Data (Non-ERO Channels)	None	None
ERO Data	Until ERO issued or until released by ERO Team	Available only to ERO Team until released
GO Science Data (New and Restored Channels)	1 year	Available to GO with confidentiality agreement
GO Science Data (Non-ERO Channels)	1 year	None
COS GTO Data	1 year	Same as for GO data
WFC3 ERS Data	Until ERO press release	Available to SOC with same restrictions as GO data

SM4 Data Release Policy (2 of 2)

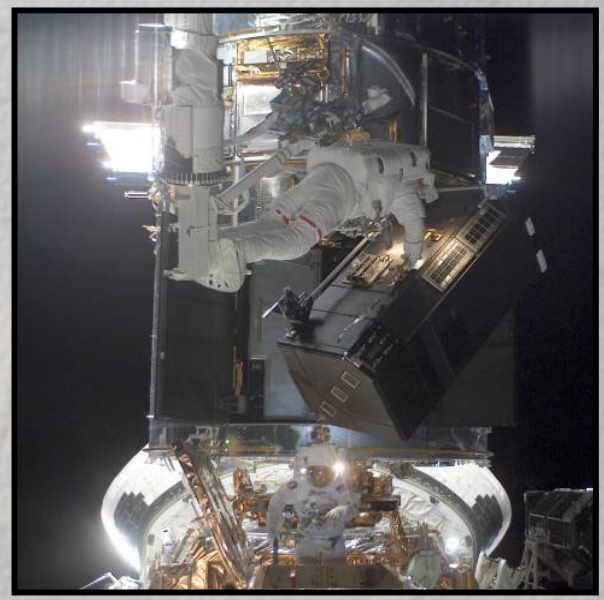
- Non-disclosure agreement needed to access GO data
  - Email sent to GOs prior to release of data
  - Email acknowledgement needed prior to release of data

> All Guest Observers accessing their Cycle 17 data (except ACS/SBC, NICMOS, and FGS astrometry data) in advance of the NASA ERO press release agree to refuse any public discussion or display of these data and/or any scientific results derived from them until after TBD DATE, which is the date of the official NASA ERO press conference. Public discussions include seminars, colloquia, press conferences, lectures, conference posters, website postings, mass media interviews, and journal publications.

  - Any remaining embargoes will be lifted after TBD DATE.

SIM/JIS (1 of 2)

- STScI is participating in SM4 training exercises
  - SIMs/JISs
    - Typically 1 day SIMs, 1-3 day JISs
    - Cover each EVA day, rendezvous and deploy sequences
    - Exercise normal mission plans
    - Exercise real-time decision making processes
  - 12 SIMs with GSFC
    - Most recent SIM: SIM10 - FGS+ACS repair
    - Each EVA covered twice (completed)
    - 2 more remain (miscellaneous)
  - 7 JISs with GSFC and JSC
    - Full-up participation, including astronauts
    - Treat as if actual SM4 activity
    - First JIS (EVA#3) occurred April 1



SIM/JIS (2 of 2)

- STScI roles:
  - Console engineers (Long & Wheeler)
    - Ensure Command Plan steps execute
    - Aliveness test and functional test command/telemetry verification
    - Provide input for anomaly investigations, re-planning
  - Instrument teams (ACS, COS, STIS, WFC3, FGS)
    - Analyze data from the instrument functional tests
    - Provide input for anomaly investigations, re-planning
  - Management
    - HSTMO participation at GSFC
    - Director's Office participation at JSC

SM4 Instrument Training at STScI

- Purpose
  - Develop and spread knowledge of the new instruments: WFC3 & COS
  - STIS refresher (last used in August 2004)
- Aim
  - Staff trained by late spring 2008 so that we can operate the SM4 instruments safely, efficiently, and in an optimal scientific manner
- Audience
  - All staff directly involved in science operations of the SM4 instruments
- Format
  - Lectures and round table discussions; recorded and accessible on the web
- Schedule
  - STIS completed
  - COS lectures completed, discussions upcoming
  - WFC3 to follow later this spring after thermal vacuum testing is completed

SM4 Instrument Training

SM4 DRM Planning & Scheduling Exercise (1 of 2)

- Demonstrate that ground system functions on a representative sample of post-SM4 proposals in 3-gyro mode
  - Proposal creation
  - Proposal implementation
  - Long Range Plan generation
  - Weekly science schedule generation
  - SMS generation
- 71 proposals for all SIs (COS, WFC3, ACS, STIS, NICMOS, FGS)
- 8 flight calendars built
  - 870 external orbit pool
  - Included science visits, parallels, SNAPs, internal cals, guide stars
  - SPSS, SMS, and PASS generation work fine, no functional issues
  - Minor issues with APT identified and addressed

SM4 DRM Planning & Scheduling Exercise (2 of 2)

SMS	LRP	real	COS	WF3	STIS	ACS	NIC	FGS	Int	SNAP	Eff
07260	93	74	38	36	18	8	4	0	172	18	50%
07267	82	78	17	44	13	17	3	0	69	3	44%
07274	73	70	8	36	4	9	6	10	81	12	45%
07281	80	77	31	24	1	4	14	6	64	8	45%
07288	79	80	27	38	0	13	0	5	65	11	44%
07295	86	82	48	12	11	35	1	5	73	5	44%
07302	77	75	33	40	6	4	0	0	50	11	45%
07309	95	83	38	41	10	10	2	0	47	3	50%

- Eight-week DRM average: 83 orbits
- Recent (Cycle 12/13) 3-gyro average: 81 orbits

Pure Parallels (1 of 3)

- Parallel observations offer a chance to increase the science productivity of HST
  - Reworking pure parallel implementation for Cycle 17
- Operate one or more instruments in conjunction with the prime science instrument
  - Pure parallels attached only to COS primes in Cycle 17
- Pure parallels may specify any of the following imagers
  - ACS/WFC
  - ACS/HRC
  - WFC3/UVIS
  - WFC3/IR
- Received 6 Cycle 17 Phase I proposals for 1361 pure parallel orbits

Pure Parallels (2 of 3)

- Process
  - GOs submit PP Phase I proposals at same time as other GO proposals
    - TAC ranked / selected
  - Non-PP GOs submit their Phase II proposals (3 Jul 2008)
  - PP opportunity list (COS primes) is developed by STScI
    - Opportuntity list loaded into APT
  - PP GOs build Phase II proposals using available opportunities (29 Aug 2008)
    - Can specify multiple matches that work to increase scheduling flexibility
  - STScI balances opportunity matches across programs in LRP and resolves conflicts
    - If necessary, TAC rankings can be used
  - Parallels are attached to primes and then executed according to schedule

Pure Parallels (3 of 3)

- Iterative development
  - Build a minimal tool for Cycle 17 and extend in future cycles based on demand and experience
- Required work in multiple areas
  - TRANS, SPIKE, DB to find parallel opportunities
  - APT to create parallel observations and matches
  - DB, POPS (was POMS), SPSS to execute parallels
- System currently in operational testing stage
  - On schedule for May 21 APT release

Backup Charts

STUC and STScI Science Staff Poll (1 of 3)

- The STUC and STScI science staff were polled to gauge the community's preference for maximizing Hubble science.
- The following hypothetical question was asked, and a binary response (A or B) requested:
  - *If you had to choose between the following two instrument complements, which would you choose from a scientific point of view?*
    - A) *COS, WFC3, ACS, and STIS available for 5 (and only 5) years*
    - B) *COS and WFC3 available for 8.5 years*
- The responders were told that they should assume that the listed instruments perform nominally during the given time period and that all normal modes of operation would be available.
  - Not expected to be true based on lifetime analyses, but the purpose of the question was to establish if there is a strong preference between a shorter more-capable mission and a longer less-capable (but still very powerful) mission.

STUC and STScI Science Staff Poll (2 of 3)

- Result:
  - Opinion is rather evenly split between the two scenarios presented
  - Some strong individual opinions, but many respondents thought this was a difficult choice

Poll Results		
	STUC	STScI Science Staff *
(A) COS, WFC3, ACS, and STIS for 5 years	8 / 13 (62%)	16 / 36 (44%)
(B) COS and WFC3 for 8.5 years	5 / 13 (38%)	20 / 36 (56%)

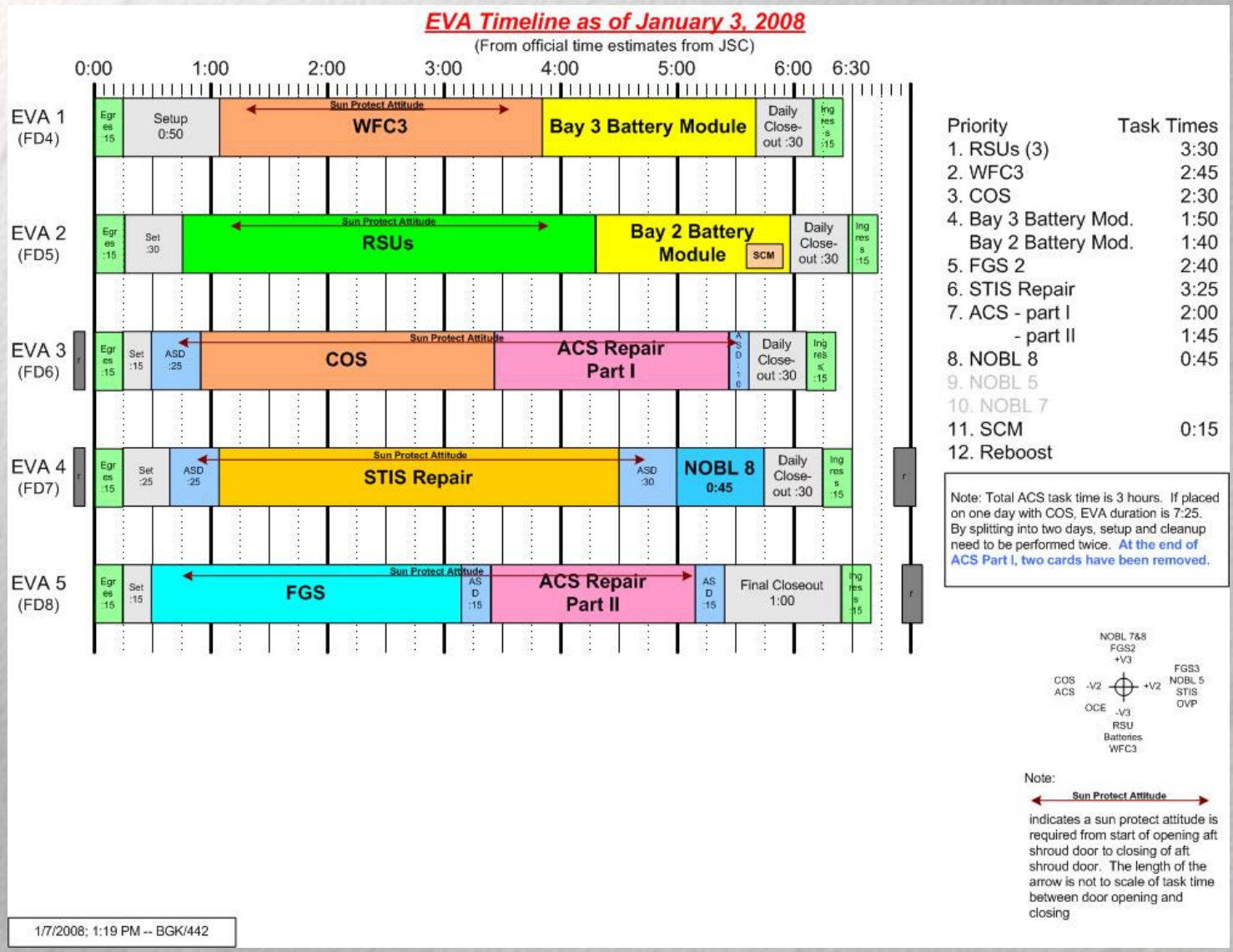
* Does not include STScI HST mission office or Director's office opinions.

STUC and STScI Science Staff Poll (3 of 3)

- Reasons given in favor of choice (A)
  - Instrument suite brings all capabilities to bear on timely topics
  - Unique capabilities of STIS and ACS expand science variety
  - Parallel opportunities with ACS
  - Archival value of ACS imaging
  - Volume of data believed to be larger
- Reasons given in favor of choice (B)
  - Potential overlap with JWST *
  - No other optical imaging or UV spectroscopy capabilities available for many years
  - Ability to respond to new science ideas
  - Narrower range of science compensated by longevity
  - Volume of data believed to be larger

*** This was the single most common reason given for preferring one choice over another.**

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