SPACE TELESCOPE SCIENCE INSTITUTE
Operated for NASA by AURA

Instrument Science Report WFPC2 2001-11

Summary of WFPC2 SM3B Plans

Anton M. Koekemoer, Shireen Gonzaga, Inge Heyer, Lori M. Lubin,
Stefano Casertano, and Vera Kozhurina-Platais
November 30, 2001

ABSTRACT

We summarize WFPC2 activities and calibrations planned for Servicing Mission SM3B, currently scheduled for launch in February 2002.

1: Introduction

HST Servicing Mission 3B (SM3B) is currently planned for February 2002. During this mission several new hardware items will be installed, including the Advanced Camera for Surveys (ACS) and the NICMOS Cryocooler System (NCS). In addition, the Faint Object Camera (FOC) will be removed, two gyroscopes will be replaced, and a Power Control Unit (PCU) changeout will take place.

While no astronaut activities are planned for WFPC2, it is nonetheless of critical importance to ensure that neither astronaut activities, nor contaminations from new hardware, damage or otherwise alter the performance of WFPC2. During the previous two servicing missions (SM2 and SM3A), this goal was successfully achieved by virtue of an aggressive plan of contamination verification and control, as well as timely testing of key instrument health and performance indicators. Our plans for SM3B and the subsequent Servicing Mission Observatory Verification phase (SMOV3B) follow closely those for the previous two servicing missions (Biretta et al. 1997; Casertano et al. 1999). Herein we outline the goals of the WFPC2 activities for SMOV3B and describe specific proposals that implement these activities, together with the anticipated data analyses.

In an effort to minimize the possibility of photo-polymerization of contaminants that are deposited on optical surfaces within the telescope, HST will be maintained in a Bright Earth Avoidance (BEA) orientation during the first 12 days after the release of HST from

the space shuttle, with the intention of preventing bright UV radiation from reaching the HST focal plane area and other exposed surfaces, such as the WFPC2 Pick-Off Mirror (POM). During this time WFPC2 will be maintained in a PROTECT DECON state; STIS observations will be used to test for the presence of contamination on the optical surfaces within the Optical Telescope Assembly (OTA) and verify the end of the BEA period if the contamination is sufficiently low. Moreover, the NCS cooldown will commence during BEA, and many activities, including gyroscope calibration and WFPC2 cooldown, will be delayed until after this process is completed.

2: Goals of the WFPC2 SM3B Plan

The principal goals of the WFPC2 SM3B plan are firstly, protecting the health and safety of WFPC2 during and immediately after the servicing mission, and secondly, evaluating and calibrating any significant changes in the instrument performance.

Instrument Health and Safety

The first area of health and safety concern is contamination of the WFPC2 POM by substances that could reduce the WFPC2 UV throughput. The POM is fully exposed to the focal plane / hub area of HST, and no direct mechanical protection from contaminants is possible. Previous experience with WF/PC-1 upon return to the ground revealed a very high level of contamination on the POM, especially at Lyman α wavelengths where the reflectivity of the POM was found to be effectively zero. However, after eight years in orbit and two subsequent servicing missions, WFPC2 has so far experienced no measurable permanent decrease in the Far UV throughput. This indicates that the precautions taken during each new servicing mission, which include minimization of contaminants in the construction of new components as well as extensive outgassing prior to launch, have been successful in preventing significant contamination.

The new hardware to be installed during SM3B, in particular ACS and NCS, have been subjected to rigorous minimization of possible contaminants. Nevertheless, the possibility exists in SM3B for a higher rate of contamination than during the last servicing mission. The primary source of concern is the possibility of photo-polymerization by UV light of molecular contaminants deposited on the optical surfaces. Hence, the strategy to prevent this is to minimize bright UV Earth light from entering the telescope, by maintaining the telescope OTA axis at an orientation of 2 degrees or more from the bright Earth (the Bright Earth Avoidance, or BEA attitude) during the servicing mission, and for at least 12 days after HST release. At the end of this period, STIS Far UV observations will be used to determine whether the level of contamination on optical surfaces in the OTA path is sufficiently small that the BEA restriction can be lifted.

Unlike previous servicing missions, WFPC2 will be maintained in its warm PROTECT DECON state throughout the BEA period, as well as a period of time afterwards until the NCS has stabilized and the gyroscopes have been calibrated. The current plan is that the WFPC2 cooldown to -88° C will occur about 18 - 19 days after release of HST from the space shuttle. After cooldown, the contamination on the POM will be evaluated by means of measuring the Lyman α throughput. If the decrease is less than 20%, no action will be

taken since two better Lyman α imagers would exist on board (STIS/FUV-MAMA and the ACS/SBC). If the contamination is much higher, the implications would be evaluated at that time, and appropriate actions would be considered. However, it is exceedingly unlikely that any significant contamination would still be present on the POM, if the end-of-BEA observations by STIS reveal no contamination on the telescope primary and secondary mirrors.

Another area of health and safety concern is contamination of the cold (-88° C) CCD field-flattener windows, after WFPC2 cooldown has taken place. Some contamination of these optics is always present during normal operation of WFPC2. Typically, contaminants build up slowly on the CCD windows at a rate corresponding to a decline of 30% per month (i.e., 1% per day) in the F170W throughput. Such contaminants are removed on a regular basis by a "decontamination" procedure, executed approximately once per month, during which the CCD windows are warmed up to +22° C for a period of 6 hours. Direct experience with this procedure has demonstrated that a 30% contamination (at F170W) can be safely and thoroughly removed without long-term buildup. Since the contamination rate can possibly be higher in SM3B (perhaps as much as 2.5% per day, or more), the primary concern is to avoid deposition of contaminants that cannot be removed by the standard decontamination procedures, namely to ensure that the total contamination always remains within the safe level of a 30% or less reduction in F170W throughput. Therefore, during SM3B the following precautions will be taken to minimize contamination of the cold optics:

1. WFPC2 will be placed in a PROTECT SAFE mode during the servicing mission. In this mode the shutter is closed, and the seldom-used F785LP filter is placed in the beam, to minimize the influx of contaminants from the HST hub area. In addition, the thermo-electric coolers (TECs) are turned off.

2. After SM3B activities have been completed and the telescope has been released from the shuttle, WFPC2 will be recovered from its SAFE mode, transitioned to HOLD mode and then to a PROTECT DECON state. In this state the heatpipe heaters are turned on, thereby increasing the temperature of the camera heads and further minimizing contamination. This is a modified DECON state, with the shutter closed and the F785LP filter in place, and is designed to further minimize the influx of contaminants into the instrument (the STANDARD DECON procedure, that is normally used, encourages contaminants to leave WFPC2 by placing the shutter open and clearing the filter wheel).

3. WFPC2 will be maintained in the PROTECT DECON state throughout BEA, and extending beyond BEA up to the point when the NCS has stabilized and the gyroscopes have been calibrated. This length of time should help further minimize the influx of contaminants into WFPC2. At this point the instrument will be transitioned to its normal operational state via a one-step cooldown to -88° C, with subsequent frequent monitoring of the throughput in F170W to measure the rate of contamination buildup and to ensure that the projected contamination will not exceed the nominal 30% reduction in the F170W throughput before the following decontamination activity (see proposal 8950).

4. The shutter-open time will be minimized during the first month after WFPC2 cooldown by prohibiting external WFPC2 pure parallel observations, except as required to test its parallel capabilities.

Finally, the basic health and safety of the instrument is monitored by obtaining standard sets of bias frames, dark frames, internal flats, and K-SPOT images during orbital verification (see proposal 8950). These are similar to the internal monitors executed throughput each Cycle. The goal of these observations is primarily to look for unexpected changes in the instrument which may have resulted from the servicing mission.

Calibration Verification

The second major objective of the WFPC2 SM3B plan is to identify, and correct for, any significant changes which occur in WFPC2 calibration as a result of the servicing mission. To this end, there are proposals that test the status of the WFPC2 focus and PSF, the flat field calibration, and the photometric calibration (see the relevant proposals in Section 3).

The goal of SMOV calibration is not necessarily to return to the same calibration accuracy that was present before SMOV, but rather to calibrate out major changes so that most science can proceed. The scope of SMOV is limited, due largely to a desire for an early return to normal science operations. Hence, it may not be possible to generate corrections for all possible changes based purely on the SMOV data. For example, a satisfactory new dark calibration requires in excess of 100 dark frames, but the SMOV calibrations include only 25 darks. In the event of a significant change in dark calibration, which can easily be detected from the SMOV data, the dark frame from these 25 SMOV darks would provide sufficient calibration for most science images until a better calibration could be derived from Cycle 10/11 calibration data.

Formal Requirements

Formal requirements for WFPC2 SMOV activities are set forth in Appendix J, Section 10.4 of the Level III Mission Operations Functional Requirements Document (SMO-1000, Revision C). These establish a set of minimum requirements and activities that must be accomplished during SMOV to verify the performance of WFPC2 to support normal science operations:

J.10.4.1 WFPC II Verification Requirements

The following two assumptions apply to WFPC II at the point of HST release:

1. WFPC II is in PROTECT SAFE mode.

2. The WFPC II shutter is closed with the F785LP filter in place.

J.10.4.1.1 Engineering Activation and Check–Out Requirements

J.10.4.1.1.1 After release, the instrument shall undergo an active decontamination procedure (PROTECT DECON) of at least 12 hours. In the interval between release and the start of the decontamination procedure, the shutter shall remain closed and the Thermal Electric Coolers (TECs) shall remain off.

J.10.4.1.1.2 Upon completion of the decontamination procedure, the instrument shall undergo a contamination verification phase of at least 48 hours which shall be monitored by the STScI.[1] Upon the approval of STScI, the instrument shall be cooled to its nominal operating temperature and the AFMs[2] shall be reset.

J.10.4.1.1.3 Following TEC turn on, a standard UV stellar monitor shall be scheduled at least trice during the first week and, starting with the second week, at a declining frequency for the duration of SMOV. A decontamination procedure shall be executed no later than 1 week after TEC turn-on, and at declining frequency thereafter. (The STScI will use the UV monitor to determine whether the planned decontamination cycle is executed or additional decontaminations are necessary).

J.10.4.1.2 Science Verification Requirements

J.10.4.1.2.1 An initial set of PSF measurements shall be performed.

J.10.4.1.2.2 A photometric calibration shall be performed.

J.10.4.1.2.3 Internal calibrations, including dark frames, bias frames, K-spot images, and internal flat fields, shall be performed.

J.10.4.1.2.4 If the operational state of the NCS changes with respect to the first PSF measurement (J.10.4.1.2.1), a second PSF measurement shall be performed to reflect nominal HST operations.

J.10.4.1.2.5 During the first 30 days after TEC turn-on, no external WFPC2 pure parallels shall be scheduled, except as required to test its parallel capabilities as provided in J.10.4.16.3

1. Note that WFPC2 will be cooled down directly to -88˚ C. The requirement for a two-step transition cooldown involving an intermediate temperature of -55˚ C, which was the case in previous servicing missions, has been waived for SM3B by the HST Project Office, since the WFPC2 cooldown in this case will not occur until well after BEA. STIS observations will be used instead to determine the end of BEA during this servicing mission.
2. AFMs: Actuated Folding Mirrors

3: Calibration Proposals

The WFPC2 SMOV activities and calibrations are carried out via seven proposals, summarized in Table 1 and described individually below. One of them (8943) is a pre-SMOV proposal that obtains baseline data on a special calibrator (UV bright star) needed in order to carry out the Lyman α contamination monitor observations during SMOV3B. The other proposals will be executed during the SMOV period to collect information on the behavior of WFPC2 and to maintain its health. As usual, complete up-to-date copies of each proposal are available through the HST Program Information page at:

`http://www.stsci.edu/public/propinfo.html`

Table 1: WFPC2 SMOV3B Proposals (approximate order of execution)

ID	Proposal Title	Formal Requirements	Dependencies	Time (hours)	Pointed Orbits
8943	Pre-SM3B Lyman α Baseline	-	None		3
8949	Transition from PROTECT SAFE to HOLD, and to PROTECT DECON Mode	J.10.4.1.1.1	Completion of SM3B activities	20	
8950 Part 1	Cool Down, Contamination Monitor, Focus Check	J.10.4.1.1.2, J.10.4.1.1.3	8949, end of BEA	26	17
8950 Part 2	PROTECT DECONs, Internal and Photometric Monitors	J.10.4.1.1.3,	8949, end of BEA	24	4
8951	Lyman α Throughput Check	J.10.4.1.1.3	WFPC2 cooled down to -88˚ C		1
8952	Flat Field Calibration	J.10.4.1.2.3	WFPC2 science enabled	10	
8953	Relative Photometry Check	J.10.4.1.2.2	WFPC2 science enabled		4
8954	Point Spread Function Verification	J.10.4.1.2.1, J.10.4.1.2.4	WFPC2 science enabled		3
Totals				80	29

Proposal ID 8943: WFPC2 SM3B Lyman Alpha Check: Pre-SM3B Baseline

Purpose: Obtain pre-SM3B observations to serve as a baseline for the Lyman α contamination check on the pick-off mirror that will be carried out in Proposal 8951.

Description: This proposal will obtain observations of the WFPC2 primary standard GRW+70d5824 in the Far UV with filters F160BW and F122M, by themselves, and crossed with F130LP, to provide baseline measurements for the companion proposal in SMOV3B (Proposal 8951) that will determine whether any Lyman α contamination is present on the pick-off mirror. This proposal will also carry out a test of the REAL-TIME capability that will be extensively required during the first few days after cooldown in order to provide a timely response if an anomalously high contamination on the CCD windows is detected.

Dependencies: None

Contingency: None

Telescope Resources: 3 external orbits

Data Requirements: 21 images

Special Requirements: Schedule within 7 days after a DECON. The first 4 exposures are requested via REAL-TIME TDRSS downlink, and expedited delivery from OPUS via FTP.

Analysis and Results: Aperture photometry will be carried out on the UV data to provide pre-SMOV baseline measurements, against which the data that will be obtained during SMOV (Proposal 8951) can be compared. In addition, the data from the REAL-TIME test will be analyzed and compared with the same datasets processed through the archive, in order to verify that accurate photometry is achievable with the REAL-TIME data.

Proposal ID 8949: WFPC2 Transition from PROTECT SAFE Mode to HOLD Mode and to PROTECT DECONTAMINATION Mode

Applicable SMOV Requirement: J.10.4.1.1.1

Purpose: Recover WFPC2 from PROTECT SAFE mode, transition the instrument to an operational state, and perform initial decontamination.

Description: Recover WFPC2 from PROTECT SAFE to HOLD. Configure power relays, clear and reset safing status bits, enable and execute application processor limit checking, turn on Low-Voltage Power Supply (LVPS), initialize microprocessor, select Science Data Formatter Interface (SDF I/F), enable microprocessor idle checking and bay 1 temperature control. After transitioning to HOLD, begin real-time microprocessor memory collection for Programmable Read-Only Memory (PROM) and Random Access Memory (RAM). SMS has an appropriate wait time for RAM dump and verification. After RAM validation and while WFPC2 is in HOLD mode, initiate PROTECT DECON transition. Enable CCD heaters on, position filter F785LP in optical path, close shutter blade A, enable radiator heat pipe heaters on.

Dependencies: Completion of SM3B activities.

Contingency: None

Telescope Resources: no pointed time; approximately 20 hours non-pointed time.

Data Requirements: Availability of serial telemetry data, and RAM and PROM memory dumps.

Special Requirements: Special commanding required.

Analysis: This will be carried out by the relevant technical personnel, as follows:

- Perform engineering matrix verification (commanding, application processors, microprocessor, mechanism, and error messages).
- Perform dump and miscompares on RAM and PROM data.
- Monitor thermal and power performances.
- Monitor camera decontamination thermal profile.

Results:

- Verify nominal operation of WFPC2.
- Place WFPC2 in protective decontamination state with CCD camera temperatures at +22° C.

Proposal ID 8950: WFPC2 SM3B Cool Down, Contamination Monitor, and Focus Check

Applicable SMOV Requirement: J.10.4.1.1.2, J.10.4.1.1.3

Purpose: This proposal performs the cooldown of WFPC2 to its normal operating temperature (-88° C), as well as obtaining frequent UV throughput monitoring observations to check the rate of contamination on the CCD windows. It also includes checks of photometric throughput, focus performance, and internal calibrations, as well as three additional decontaminations scheduled within the first month after cooldown.

Description: After a period in PROTECT DECON mode (Proposal 8949), extending throughout BEA and until after the NCS has stabilized, WFPC2 is cooled down to the standard operating temperature of -88° C. Immediately following the cooldown, the expected growth of UV contamination is monitored with observations of a standard star, initially very frequent, then progressively less frequent as better information is obtained on the rate of contamination. UV monitoring observations of the WFPC2 standard star GRW+70d5824 will be obtained in the F170W filter at 0, 3, 6, 12, 18, 24, 36, and 48 hours, and 3, 4, 5, and 6 days from the end of cooldown. The focus check consists of three separate sets of F555W observations of the standard star, starting shortly after cooldown and spaced by about 24 hours.

The camera will also undergo planned decontamination procedures (PROTECT DECONs) at 7, 14 and 28 days after cooldown. Observations include a set of internals (darks, biases, INTFLATs, K-SPOTs) after the initial cooldown and after each decontamination. Photometric monitor observations will also be obtained before and after each decontamination, by observing the WFPC2 standard star GRW+70d5824 in a broad range of filters: F170W, F218W, F255W, F336W, F439W, F555W, and F814W. In each case four F170W observations will be obtained (one on each of the four CCDs of WFPC2); the observations in the other filters will be obtained on the PC1 chip.

WFPC2 is enabled for science observations after the first 24 hours of UV monitoring.

Dependencies: Proposal 8949; end of BEA

Contingency: If contamination is detected that would result in loss of 30% or more of the UV throughput at F170W, the camera will be safed via real-time commands, which are already implemented in the WFPC2 UV contamination contingency plan.

Telescope Resources: 21 external orbits, 50 hours of internals, as follows:

Total of 21 external orbits:

- 12 orbits for UV contamination monitoring and checking
- 3 orbits for focus check
- 6 orbits for pre- and post-decon photometry verification

Total of 50 hours of internals:

- 36 hours for the three decons
- 10 hours for darks (4 sets of 5 darks each)
- 4 hours for other internals (4 sets)

Data Requirements: Estimated total of 260 images

Special Requirements:

- UV monitoring data within the first 24 hours after cooldown are exceedingly time-critical and are to be transmitted via REAL-TIME ANALYSIS: must be made available to instrument scientist within 6 hours of observation, and analyzed within an additional 6 hours.
- UV monitoring within the first week, and focus data, must be delivered via QUICK-LOOK FTP within 12 hours.
- Special commanding is required for the cooldown.

Analysis and Results:

- Trend UV throughput (expected accuracy better than 1-2% per epoch).
- Verify photometry before and after each decon.
- Determine contamination rates.
- Measure focus using phase retrieval.

Proposal ID 8951: WFPC2 SM3B Lyman Alpha Check

Applicable SMOV Requirement: J.10.4.1.2.2

Purpose: Measure Far UV contamination of the WFPC2 pick-off mirror.

Description: The WFPC2 primary standard GRW+70d5824 is observed in the Far UV with filters F160BW and F122M, by themselves, and crossed with F130LP, to assess Lyman α contamination. The crossed filters are used to estimate the contribution of the red leak (particularly strong in F122M) to the total signal. Because of the small impact of Lyman α observations on WFPC2 science, we do not plan a return to BEA if low-level contamination (<20%) is detected.

Dependencies: WFPC2 cooled down to -88° C (8950)

Contingency: None

Telescope Resources: 1 external orbit

Data Requirements: 17 images

Special Requirements: Data is requested within 12 - 18 hours via expedited QUICKLOOK FTP delivery.

Analysis and Results: Aperture photometry will be carried out on the UV data and compared with pre-SMOV baseline measurements (from Proposal 8943), both for the UV filters and for the UV filters crossed with F130LP. A flux decrease in the single-filter UV observations, but not in the UV crossed with F130LP, would be indicative of Lyman α contamination.The expected measurement error is ~5%.

Proposal ID 8952: WFPC2 SM3B Flat Field Calibration

Applicable SMOV Requirement: J.10.4.1.2.3

Purpose: Verify that the WFPC2 flat field is unchanged at ~1% level.

Description: External (Earth) flat fields will be obtained for the four narrow-band filters F357N, F502N, F656N, and F953N (20 images each) after the end of the BEA phase.

Dependencies: WFPC2 enabled for science observations (8950)

Contingency: None

Telescope Resources: 10 hours, non-pointed, spread throughout SMOV

Data Requirements: 80 images

Special Requirements: None

Analysis and Results: Flat fields in each filter will be combined to remove cosmic rays and streaks. Images will be compared with pre-SM3 images to quantify stability and measure any changes that may have occurred. Check for changes in flat field. Update pipeline flat field calibration if large changes are present (not a prerequisite for further SMOV activities).

Proposal ID 8953: WFPC2 SM3B Relative Photometry Check

Applicable SMOV Requirement: J.10.4.1.2.2

Purpose: Verify that WFPC2 photometry is unchanged at the 1-2% level.

Description: The WFPC2 primary standard GRW+70d5824 is observed through a wide range of filters: F160BW, F170W, F185W, F218W, F255W, F300W, F336W, F439W. F555W, F675W, and F814W, in all four cameras.

Dependencies: WFPC2 enabled for science observations (8950)

Contingency: None

Telescope Resources: 4 external orbits

Data Requirements: 44 images

Special Requirements: Must execute shortly (1 - 2 days) after a decontamination.

Analysis and Results: Aperture photometry will be performed on each image to measure instrument response and throughput. Results will be compared with historic pre-SMOV photometry results, aimed at measuring any changes in photometry to an accuracy of 1-2%. Update pipeline and database photometric tables if required; this is not a prerequisite for further SMOV activities.

Proposal ID 8954: WFPC2 SM3B Point Spread Function Verification

Applicable SMOV Requirement: J.10.4.1.2.1, J.10.4.1.2.4

Purpose: Verify that the PSF is unchanged across the field-of-view, and verify OTA focus.

Description: Exposures over a wide dynamic range of a bright star (GRW+70d5824) through a wide-band filter (F555W) will be obtained, with a range of exposure times, in order to characterize both the core and the extended wings of the PSF. Exposures will also be made of a crowded stellar field in ω Cen (alternate target NGC 2419) on a 4x4 grid with sub-pixel stepping (0.025 arcsec) to provide a critically sampled PSF.

Dependencies: WFPC2 enabled for science observations (8950)

Contingency: If ω Cen is unavailable at the required time, use alternate target NGC 2419.

Telescope Resources: 3 external orbits

Data Requirements: 33 images

Special Requirements: Proposal must be repeated if executed before NCS turn-on (SMOV Requirement J.10.4.1.2.4).

Analysis and Results: The PSF will be reconstructed by DRIZZLE and checked against both theoretical models (TinyTim) and pre-SMOV observations. Linearity will be checked by comparing PSFs taken at different count levels. Any changes in the PSF should be measured to 5 - 10% accuracy.

4: Time Line for WFPC2 SMOV Activities

In Table 2 we present the relative timing of the WFPC2 SMOV3B activities. Dates are given initially as R+x, where x is the number of days since “R”, which denotes release of HST after the servicing mission. Additionally, since the exact date of WFPC2 cooldown is currently unknown due to uncertainties in the NCS and gyroscope calibration schedules, all WFPC2-related activities after WFPC2 cooldown (“C”) are given as C+x, where x is the number of hours or days after WFPC2 has achieved cooldown to -88˚ C. Observations of the first UV monitor and internals are to be obtained as soon as cooldown has taken place. The time line of key events can be summarized as follows:

- First WFPC2 activation (R+1); transition to HOLD; then to PROTECT DECON mode.
- After BEA end, NCS stabilization, and gyro calibration, cooldown to -88˚ C (R+19).
- Immediately after cooldown, obtain internal monitors (bias, darks, INTFLATs, K-SPOTs), and begin UV contamination monitoring, obtaining 6 sets of observations within the first 24 hours, and a further 6 within the next 6 days.
- Lyman α check at 12 hours after cooldown.
- Focus check observations at 12 hours, 36 hours and 48 hours after cooldown.
- Enable WFPC2 science 1 day after cooldown to -88˚ C.
- Photometry check in a variety of filters, and PSF verification,within the first week after cooldown.
- Additional DECONs at 1, 2 and 4 week intervals after cooldown, with associated internal monitors (biases, darks, INTFLATS, K-SPOTs), and relative photometry checks in a variety of filters, before and after each DECON.
- Obtain Earth-flats, VISFLATS, and UV FLATS within 1 - 4 weeks after cooldown.
- WFPC2 SMOV activities end, and parallels are enabled, 30 days after cooldown.

Table 2: WFPC2 SM3B Activity Time Line. Dates assume launch for the Servicing Mission on 02/14/2001 and HST Release (R) on 02/22/2002.

Day	Activity	Proposal ID; Visit #	Comments	Contingency
(R)	HST RELEASE		(WFPC2 IN PROTECT SAFE MODE)	
R+1day	WFPC2 TO HOLD; WFPC2 TO OPERATE	8949		
	WFPC2 TO PROTECT DECON MODE	8949	SHUTTER CLOSED; F785LP IN PLACE; TEC OFF	
R+19days	COOL DOWN: -88˚ C	8950; #12		
(C)	UV MONITOR: 0H	8950; #13	(REAL-TIME ANALYSIS) ANALYZE WITHIN 12H	
	INTERNAL MONITOR	8950; #14	(QUICKLOOK FTP) BIAS, DARK, INTFLAT, KSPOT	
C+3h	UV MONITOR: +3H	8950; #15	(REAL-TIME ANALYSIS) ANALYZE WITHIN 12H	
C+6h	UV MONITOR: +6H	8950; #16	(REAL-TIME ANALYSIS) ANALYZE WITHIN 12H	
C+12h	UV MONITOR: +12H	8950; #17	(REAL-TIME ANALYSIS) CONTAMINATION RATE <30% LOSS / 1 WEEK?	NO: ADD DECON
	LYMAN α CHECK	8951; #11	(QUICKLOOK FTP) GRW+70D5824, F122M, F160BW, F130LP. LYMAN α THROUGHPUT NORMAL?	TBD BASED ON RESULTS
	FOCUS CHECK #1	8950; #21	(QUICKLOOK FTP) GRW+70D5824, F555W	
C+18h	UV MONITOR: +18H	8950; #18	(REAL-TIME ANALYSIS) CONTAMINATION RATE <30% LOSS / 1 WEEK?	NO: ADD DECON
C+2h-48h	PHOTOMETRY CHECK	8950; #19	(QUICKLOOK FTP) GRW+70D5824: F170W, + 6 ADDITIONAL FILTERS	
C+24h	**** SCIENCE ENABLED ****		NO PURE PARALLELS	
C+24h	UV MONITOR: +24H	8950; #20	(QUICKLOOK FTP) CONTAMINATION RATE <30% LOSS / 1 WEEK?	NO: ADD DECON

Day	Activity	Proposal ID; Visit #	Comments	Contingency
C+36h	UV MONITOR: +36H	8950; #23	(QUICKLOOK FTP) CONTAMINATION RATE <30% LOSS / 1 WEEK?	NO: ADD DECON
C+36h	FOCUS CHECK #2	8950; #25	(QUICKLOOK FTP) GRW+70D5824, F555W	
C+1-7days	PSF VERIFICATIONS	8954; all visits	GRW+70D5824; OMEGA CEN F555W	
C+48h	UV MONITOR: +48H	8950; #24	(QUICKLOOK FTP) CONTAMINATION RATE <30% LOSS / 1 WEEK?	NO: ADD DECON
C+48h	FOCUS CHECK #3	8950; #27	(QUICKLOOK FTP) GRW+70D5824, F555W	
C+3days	UV MONITOR: +3D	8950; #26	(QUICKLOOK FTP) CONTAMINATION RATE <30% LOSS / 1 WEEK?	NO: ADD DECON
C+4days	UV MONITOR: +4D	8950; #28	(QUICKLOOK FTP) CONTAMINATION RATE <30% LOSS / 1 WEEK?	NO: ADD DECON
C+5days	UV MONITOR: +5D	8950; #29	(QUICKLOOK FTP) CONTAMINATION RATE <30% LOSS / 1 WEEK?	NO: ADD DECON
C+6days	UV MONITOR: +6D	8950; #30	(QUICKLOOK FTP)	
C+7days	PRE-DECON INTERNALS	8950; #40	BIAS, DARK, INTFLAT, KSPOT	
	PRE-DECON PHOTOMET-RIC MONITOR	8950; #41	GRW+70D5824: F170W, + 6 ADDITIONAL FILTERS	
	DECONTAMINATION: +1 WEEK	8950; #42		
C+8days	POST-DECON INTERNALS	8950; #47	BIAS, DARK, INTFLAT, KSPOT	
	POST-DECON PHOTOMET-RIC MONITOR	8950; #48	GRW+70D5824: F170W, + 6 ADDITIONAL FILTERS	
	VISFLATS	8950; #49	VISFLATS IN 7 FILTERS	
C+8-28days	EARTHFLATS: FLAT FIELD CALIBRATION	8952; 5 VISITS	F375N, F502N, F656N, F953N; 5 VISITS EACH, 4 EXP/VISIT	

Day	Activity	Proposal ID; Visit #	Comments	Contingency
	RELATIVE PHOTOMETRY CHECK	8953; 4 VISITS	GRW+70D5824, 11 FILTERS, ALL 4 CCDs	
C+14days	PRE-DECON INTERNALS	8950; #50	BIAS, DARK, INTFLAT, KSPOT	
	PRE-DECON PHOTOMET-RIC MONITOR	8950; #51	GRW+70D5824: F170W, + 6 ADDITIONAL FILTERS	
	DECONTAMINATION: +2 WEEKS	8950; #52		
C+15days	POST-DECON INTERNALS	8950; #53	BIAS, DARK, INTFLAT, KSPOT	
	POST-DECON PHOTOMET-RIC MONITOR	8950; #54	GRW+70D5824: F170W, + 6 ADDITIONAL FILTERS	
C+21days	INTERNALS	8950; #60	BIAS, DARK, INTFLAT, KSPOT	
C+28days	PRE-DECON INTERNALS	8950; #70	BIAS, DARK, INTFLAT, KSPOT	
	PRE-DECON PHOTOMET-RIC MONITOR	8950; #71	GRW+70D5824: F170W, + 6 ADDITIONAL FILTERS	
	DECONTAMINATION: +4 WEEKS	8950; #72		
	UV FLATS	8950; #43	2 INTERNAL UV FLATS	
	DARKS	8950; #44	2 DARKS	
	UV FLATS	8950; $45	2 INTERNAL UV FLATS	
	DARKS	8950; #46	2 DARKS	
C+29days	POST-DECON INTERNALS	8950; #73	BIAS, DARK, INTFLAT, KSPOT	
	POST-DECON PHOTOMET-RIC MONITOR	8950; #74	GRW+70D5824: F170W, + 6 ADDITIONAL FILTERS	
C+30days	**** END WFPC2 SMOV ****		START PARALLEL SCIENCE	

5: Data Analysis Plans

In Table 3 we identify teams for the data analysis, including backups where needed, and also specifying turn-around timescales for analysis of the results. A number of the WFPC2 proposals for SMOV3B are time-critical, since their results might indicate health and safety concerns for the camera (especially excessive contamination). Such time-critical proposals require a firm, relatively short turn-around time for analysis of the results. Time-critical proposals with a turnaround time of less than 3 days also require special data handling, including dedicated REAL-TIME data downlinks from HST and special expedited processing at STScI. Specifically, the results from the UV contamination monitoring observations in proposal 8950 must be available no later than 12 hours after the observations are taken. A combination of REAL-TIME data transfer directly from HST via dedicated TDRSS downlinks, together with expedited processing and FTP transfer by OPUS staff, will make the data available within 6 hours, leaving an additional 6 hour window for the analysis.

Table 3: Data analysis teams and time requirements

Activity	Proposal	Primary responsibility	Backup	Turn-around Time (after data acquired)
Lyman α Baseline - Pre-SM	8943	Koekemoer, Gonzaga, Lubin		1 week quick check; 2 weeks analysis
Transition to HOLD, PROTECT DECON, and Cool Down to -88˚ C	8950	Koekemoer, Gonzaga	Whitmore	On-call availability in case of trouble
Focus	8950	Krist, Makidon, Lallo		3 days
UV Contamination Monitor	8950	Koekemoer (coord.)	TBD	6 - 12 hours in the first week
Protect Decontaminations	8950	Koekemoer, Gonzaga		1 week
Lyman α Throughput Check	8951	Lubin, Heyer	Koekemoer	3 days quick check; 1 week analysis
Flat Field Check	8952	Koekemoer, Heyer	McMaster	4 weeks
Relative Photometry Check	8953	Lubin, Heyer	McMaster	4 weeks
PSF Check	8954	Lubin, Platais	Koekemoer	4 weeks
Internal Monitors	8950	Koekemoer, Gonzaga, Platais	Heyer	4 weeks

References

Biretta, J., McMaster, M., Baggett, S., and Gonzaga, S. 1997, “Summary of WFPC2 SM97 Plans”, WFPC2 ISR 97-03

Casertano, S., Gonzaga, S., Biretta, J., and Balleza, J. 1999, “Summary of WFPC2 SM3A Plans”, WFPC2 ISR 99-03