Version 0.0

ECF-STScI Coordination and FOS Post-Operational Calibration Cleanup

Michael Rosa (ECF) and Stefi Baum (STScI)
July 6, 1998

1. Summary

The present memo describes the work considered necessary for a close-out of the post-operational calibration of the FOS, and determines the terms of reference for the joint effort between STScI and the ST-ECF for this particular instrument and similar efforts on other heritage instruments and/or operational instrument related activities.

2.) Background

The Faint Object Spectrograph (FOS) was one of HST's two work horse spectrographs from launch until its removal from HST during the second servicing mission in January of 1997. Over 23,000 science datasets for ~700 proposals were collected by FOS during its life, and it recorded a total of over 3000 hours of external on source integration time (~25% of the observations taken at the time FOS was removed). FOS data has a high rate of archival scientific use with 4500 FOS datasets retrieved from the HST archive in the past 4 months for science use relative to ~10,000 for WFPC2 and ~3000 for GHRS. In the Delta Cycle 7 Archival Call for Proposals 25% of the proposals utilized data from FOS, roughly 25% utilized data from the GHRS, the rest WFPC2.

Following the decommissioning of FOS from HST, ~one half STScI scientist and ~one STScI data analyst year was devoted to completing the post-operational calibration of FOS. Much was accomplished during that period of activity, which ended roughly October of 1997, at which time the bulk of those resources were devoted to STIS. Included in this close-out effort were the completion of several major FOS calibrations, in particular the updated sensitivities and flats and aperture throughputs and determinations, the complete recalibration of all the FOS spectropolarimetry data, and including the publication of the Volume II of the Data Handbook, which is dedicated to the HST Legacy Instruments, FOS included. However, despite this effort, the "final" calibration of the FOS remains incomplete in several important ways (see Appendix below).

The STScI currently provides the raw data, the initially calibrated data, an integrated system for calibration and data analysis of data from the FOS in STSDAS, and documentation and user support for FOS PI and archival users. The current level of effort devoted at STScI over the past 6 months in support to the FOS can be estimated to be 0.25 FTE instrument scientist (IS), 0.25 FTE data analyst (DA), and 0.1 FTE programmer.

In October 1997, the ST-ECF started a project focusing on a comprehensive view of raw and calibrated data from HST instruments, utilizing instrument model based calibrations and the OnTheFly (OTF) recalibration capability of the ST-ECF HST archive. The FOS was taken as the prototype. At this moment the ST-ECF has deployed an average of 0.25 FTE IS and 0.5 FTE DA to this study. This activity is to be coordinated with the STScI. The goals of this effort are:

1. to improve the post-operational calibration and documentation for the decommissioned HST "legacy" instruments,
2. to provide an improved and coherent resource to facilitate archival scientific use of the data from the HST legacy instruments,
3. to alleviate workload at the STScI.

Yet another important goal is the inclusion of this effort in support of Post-Operational Archives under a renewed MOU. The latter will transform the current study type project at the ST-ECF into an HST project with proper resources, and thereby set free resources at the STScI, which are needed, among other things, to cover the calibration requirements for operational and upcoming instruments.

3. General Terms for Cooperative Efforts

This memo applies to the coordination of work at the STScI and at the ST-ECF related to the refinement and clean-up of liens on the calibration of the FOS and subsequently on other decommissioned HST instruments, as deemed appropriate. Many of the principals outlined in this document can be applied to other cross-Institutional instrument related efforts.

This coordination memo recognizes the fact that the STScI currently assumes responsibility for the integrity of the HST Data Archives for both operational and legacy instruments, FOS inclusive, the maintenance of the Calibration Data Base System (CDBS) of calibration files, the calibration of HST data, documentation for the operational and legacy instruments, and provides user support for and data analysis software in STSDAS for GO and archival science users of HST data. An On-The-Fly calibration system for the operational instruments is under development at the STScI. Similarly, the ST-ECF is maintaining a copy of the raw HST data archive and the CDBS, offering the calibrated data for

some instruments through the On-The-Fly recalibration service, and is providing user support for GO and archival researchers aimed at the European astronomical community. All the ECF services are also available to the astronomical community at large.

The present coordination memo also recognizes that there shall be a substantial reduction in resources required at STScI in support of first FOS and then other HST Legacy instruments when resources become available to the ST-ECF through the new MOU, as well as a considerable improvement in the calibration product provided to the users of data from the FOS (and subsequently other legacy HST instrument).

This requires the transition of the study type project at ST-ECF onto proper HST project level. Until the MOU agreement on NASA/ESA level is achieved, which will transfer some of the responsibilities formally to the ST-ECF, as outlined below, the ST-ECF offers to make available results from the Post-Operational Archive Study to the STScI in a form in line with the present document but at a level of effort basis.

4. Joint Efforts

Any work undertaken must satisfy the following important constraints:

1. there must be substantive benefits to the astronomical community resulting from the efforts
2. the FTE expenditure in support of the effort must not grow disproportionately large relative to the science benefits
3. there must be relief from the work effort at STScI (i.e. overall work must be transferred from the STScI to ST-ECF).
4. the end product of the work must be realized within the adopted philosophy of support provided to HST/NGST users and within the infrastructure which is utilized for all the other HST instruments (e.g. documentation in ISRs and Volume II of the Data Handbook, software in the system supported by the STScI for HST/NGST users (currently STSDAS/IRAF), recalibrated data archived within the MAST and ECF archives as appropriate, reference files cataloged and contained within the STScI CDBS, and updated software and reference files incorporated into the On-The-Fly Recalibration services at ST-ECF and STScI, if and as appropriate).

The STScI will continue to provide direct user support and remain the primary archive for the data from the Legacy instruments.

The efforts will be entered into cooperatively between the STScI and the ST-ECF, and the implementation employed must be the one which

a) minimizes the work effort overall across the two institutions

b) assures that the bulk of the FTE effort involved with deriving and implementing the updated calibrations and documentations occurs at the ST-ECF.

Work at the ST-ECF should be done in such a way that it can be easily handed over to STScI at the appropriate point without requiring a complete rework at the STScI to implement for the user community according to the precepts outlined in 1-4 above. Conversely, work should be handed over to the STScI at a stage where the remaining work is more efficiently completed at the STScI, assuming that the STScI has the resources available to complete that work.

The way to achieve these goals will differ from item to item and therefore must be considered independently for different efforts. In cases where the 90% of the work is the development of the calibration reference file, writing of the ISR, and specification of the algorithm to be simply employed in code, there is no need for the ST-ECF to deliver STSDAS code directly. In cases where a significant fraction of the effort is itself the development of code (e.g., GRISM spectroscopic reduction packages), then either the ST-ECF may directly deliver STSDAS portable C code, or specific guidelines must be followed with regard to the implementation of the software in alternative software systems (e.g., IDL) which are not directly supported for the community by the STScI. Specifically, coding must seek for a clear separation of algorithmic and functional entities from I/O and environment. It is clear that close cooperation between the ST-ECF and the STScI in the specifications for and tracking of such larger scale software efforts will be crucial to their successful outcome, involving instrument scientists and programmers from both sides in planning for and reviewing the efforts.

Ideally, from the point of view of the STScI, and if the appropriate staff could be hired at the ST-ECF, all software deliveries from the ST-ECF to the STScI would be directly in the form suitable for export to the GO community (i.e., within the appropriate/agreed upon STSDAS framework and fully tested).

5. Management

The selection of instruments and work items, the prioritization, as well as the monitoring of progress, according to appropriate attachments to this central document, (see below) are made jointly between STScI and ST-ECF. Communications will regularly use phone and email. Video conferencing and direct joint meetings (approx. quarterly) as well as extended visits at the STScI, ST-ECF resp. (deliveries, work package selections, software transfers) will be utilized.

6. Central Document for FOS Work

The central document for FOS work is a mutually agreed upon list of calibration items to complete the close-out of the work on the FOS as currently understood. For each item the work required is described in sufficient detail (including dependencies between items). Each item is assigned a priority level, a man power estimate and responsibility (STScI, ST-

ECF), a description of the acceptance rules for closure, as well as an estimated closure date. This central document shall be updated as required.

At the completion of this effort, the ECF and the STScI should jointly consider whether a "final" recalibration and rearchiving of all FOS science data is appropriate. That would be the optimum outcome.

6.1) Description of Work

Shall be self contained, allow planning and projection, mention applicable documents, indicate unfinished work that can be incorporated, indicate required and optional stages of completion.

6.2) Prioritization

Priorities are assigned taking into account in hierarchical order

- importance to end product (benefit at user end) - dependencies among calibration items
- availability of special resources

They may be reassigned as for example items get closed, new information is obtained regarding the importance/difficulty of work.

6.3) Resource requirement estimates

For planning purposes.

6.4) Responsibilities

Work packages may be given the sole responsibility of either of the two parties (STScI or ST-ECF) or have a composite resource allocation. In the latter case one of the two parties is assigned the prime responsibility.

6.5) Time lines

These are for planning purposes. (At ST-ECF currently only level of effort possible).

6.6) Closure requirements

Closure requirements may differ from item to item. Usually they include a subset of the following:

- Types of end product
- STAN
- CDBS file delivery

- calfos modification
- post pipeline processing tool in STSDAS - inclusion in On-The-Fly recalibration
- Documentation
- ISR
- Update to Data Handbook Volume II
- Web (STAN,...)
- help files, etc.
- Availability at closure (Delivery)
- option under ST-ECF OnTheFLy Recalibration - in STScI environment
- CDBS / IRAF / STSDAS
- in STScI recognized form
- FITS, Ascii
- software prototype if agreed upon as IDL
- recalibration and rearchiving of data in the MAST and ECF archives

7. Appendix:

FOS Post-Operational Close-Out Items

Version 1.0 Monday 6 July, 1998

The ultimate end product of this effort will be a complete recalibrated FOS dataset resident in the STScI MAST archive and the updating of Volume II of the HST Data Handbook FOS section. Upon completion of the very high, high, and medium priority items listed below, the system should be ready to provide a recalibrated product with accompanying complete STSDAS software and CDBS reference files.

Interim products will be ISRs, updated calfos and other software, STAN articles, and improved calibration provided to users through STSDAS/MAST/CDBS and the ST-ECF Calibration-On-the-Fly system.

Target date for close-out is June 1999.

Work loads are in FTEs, not including additional overhead from system maintenance, training and managerial efforts. The construction of a schedule can only be completed when the available resources are understood.

Item	Description	Priority	Resources	Responsib.
1. Wavelengths			**ECF**	
	Total 5w DA, 2.5w IS (ECF); 1.5w DA, 2.5w IS (SCI)			
1.1	Internal wavelength calibration			
.1	Assess limits of variation in fit shape and	low	1 w DA	ECF
	quality for all WAVECAL observations		3 d IS	ECF
.2	Wavecal zero points			
.2.2	FOS/RD zero point correction analysis, ISR	v high	2 w DA	ECF
	i		2 w IS	ECF
.2.3	FOS/RD and BL IRAF scripts, WWW	v high	2 d DA	SCI
.2.4	Modification to CALFOS	high	3 d DA	SCI
.2.4	Deliver dispersion coeff reference table	high	1 d DA	SCI
.3	DataHandbook revision (update	high	2 d IS	SCI
	wavecal section)			
1.2	Finish internal/external ISR	low	2 w IS	ECF
	(need to compare qualities of fits with routine internal WAVECALs taken over long baseline)			
2. Flats				**ECF**
	Total 2w DA, 2.5w IS (ECF); 3d DA, 3w IS (SCI)			
2.1	Finish delivery of postCOSTAR flats (paired)	med	3 d DA	SCI
			2 d IS	SCI
2.2	Produce preCOSTAR superflatderived flats	med	1 w IS	ECF
	most beneficial for paired apertures			
2.3	Drift scans, characterize granularity	med	2 w DA	ECF

	perpendicular to dispersion		1 w IS	ECF
2.4	Incorporate results into WWW FAQ on flats	med	2 d IS	ECF
2.5	Publish ISRs on Flats/Driftscans	low	1 w IS	ECF
		low	3 d IS	SCI
3. AIS Sensitivity				**ECF**
	Total 1.5w DA, 1w IS (ECF); 3d DA, 1w IS (SCI)			
3.1	Post COSTAR			
.1	Using zeroed wavelengths to generate new	high	3 d DA	ECF
	sensitivities and aperture throughputs		2 d DA	SCI
.2	Ybase effects in several gratings (G130H)	med	3 d DA	ECF
.3	Drift scans (lightloss vs mispointing)	med	1 w DA	ECF
.4	Modify CALFOS to track ybase temporal	low	1 w DA	SCI
	effects			
3.2	PreCOSTAR			
.1	Using superflats and zeroed wavelengths for	high	3 d DA	ECF
	new sensitivities and aperture throughputs			
3.3	ISRs on sensitivity	med	1 w IS	ECF
			1 w IS	SCI
4. Aperture Throughputs				**ECF**
	Total 1.5w DA, 1w IS (ECF); 0d DA, 1d IS (SCI)			
4.1	Port S/W, analyze	med	2 w DA	ECF
4.2	Re-Do 4.1 if paired aperture flats are updatedv	low	3 d DA	ECF
4.3	If changes occur, document in ISR and	low	1 w IS	ECF
	update DH.		1 d IS	SCI

Item	Description	Priority	Resources	Responsib.

5. LSFs				**SCI**
	Total 0w DA, 0w IS (ECF); 3w DA, 1.5w IS (SCI)			
5.1	Measure preCOSTAR LSFs as in post COSTAR	high	3 d DA	SCI
5.2	ISR containing (1.5 weeks DA and 1 week IS)	low	2 w DA	SCI
			1 w IS	SCI
5.3	WWW (Info + digitized LSFs)	high	1 d DA	SCI
			1 d IS	SCI
6. PSFs				**SCI**
	Total 0w DA, 0w IS (ECF); 2w DA, 0.5w IS			**SCI**
6.1	Revise extraction (previous in error)	med	1 w DA	SCI
6.2	Revise published (and withdrawn) ISR	med	2 d DA	SCI
			2 d IS	SCI
6.3	WWW PSF info (postCOSTAR)	med	1 d DA	SCI
7. Dark (Background)			**ECF**	
	Total 1w DA, 2w IS (ECF); 3d DA, 2d IS (SCI)			
7.1	Test geomagnetic model vs magneto readings	high	1 w DA	ECF
			1 w IS	ECF
7.2	Modify CALFOS (new ref tables defined)	high	1 d DA	SCI
			2 d IS	SCI
7.3	ISR	med	1 w IS	ECF
7.4	WWW	high	1 d DA	ECF
8. Documentation Updates				
	Total 3w IS (ECF); 1w IS (SCI)			**ECF**
8.1	Final Data Handbook Revision for FOS	med	3 w IS	ECF
			1 w IS	SCI

Item	Description	Priority	Resources	Responsib.
9. Software Updates				**SCI (or ECF)**
9.1	Revise unwrap task (fos_overflow.pro)	med		
9.2	Polarimetry paper products	med		SCI
9.3	CALFOS modification for DARK	v high		
9.4	CALFOS modification for WAVELENGTHS	v high		