

Electronic Submission of HST Phase I Proposals

Brett S. Blacker^a, Glenn Miller^a, C. Megan Urry^a, Harry E. Payne^a, and Drew Asson^b

^aSpace Telescope Science Institute, 3700 San Martin Drive, Baltimore, Maryland 21218 USA

^bCommunity of Science, Inc. 1615 Thames Street, Baltimore, Maryland 21231 USA

ABSTRACT

As institutions and observatories are required to handle more tasks with fewer resources, the need to assist or automate some of the processing becomes crucial. One of the easiest tasks to automate is the front-end process of requesting to use the telescope. Proposing for Hubble Space Telescope (HST) observing time and archival research proceeds in two phases: in Phase I, the scientific merits of the proposal are considered, and only accepted proposals enter Phase II, where the observations are specified in complete detail.

The HST Phase I process includes obtaining, completing, and submitting proposal forms. The automation includes making the proposal forms available, and allowing them to be submitted electronically. By providing a standard proposal form, the necessary information contained in the proposal is extracted and processed by software. Tracking and low-level error detection can be handled with software, while more intellectually challenging tasks are handled by people.

This paper discusses the current system for Phase I proposers to use the Hubble Space Telescope, including some of the tools available for automating a proposal submission process. This paper is an update of the system described in the published paper "Computer-assisted Proposal Submission Systems"¹. This system has been in use for the past three HST Cycles and is being used for the most current call for proposals.

Keywords: Phase I, Electronic Submission, Automation, Hubble Space Telescope

1. INTRODUCTION

This paper presents an update to the system described in a previous paper¹ published after the new system was in place for one cycle. It will provide a brief description of the HST, summarize the rationale for implementing a new system as well as an overview of that current system. It will also discuss how the system has operated since its inception in 1994 as well as how the STScI has made our Electronic Phase I Submission System available to the science community. Information will be provided on which other facilities are using our submission system for their observatories, plan to use it, or are currently evaluating our system in conjunction with their own. This paper concludes with a short discussion on future directions that need to be addressed in order to continue striving to reduce costs, but not diminish services.

2. DESCRIPTION OF THE HUBBLE SPACE TELESCOPE

NASA's Hubble Space Telescope is an orbital observatory that was launched by the Space Shuttle Discovery in April of 1990. Until the end of 1993, its performance was affected by the primary mirror's spherical aberration, which was discovered shortly after launch. The first HST Servicing Mission, carried out by the Endeavour astronauts in December 1993, restored the optical performance for which the telescope was originally designed as well as correcting several other problems that had arisen after the launch. The second HST Servicing Mission, carried out by the Discovery astronauts in February of 1997, installed two new science instruments, a new Solid-State Recorder, and a refurbished Fine Guidance Sensor.

HST currently has five scientific instruments (Wide Field/Planetary Camera 2, Near Infrared Camera/Multi-Object Spectrograph, Space Telescope Imaging Spectrograph, Faint Object Camera and Fine Guidance Sensors) and provides improved resolution and sensitivity because it is above the earth's obscuring atmosphere. The Space Telescope Science Institute (STScI) is responsible for managing the scientific operations of HST.

Proposals for observation of astronomical objects are submitted to the STScI by astronomers and are processed by a series of software systems including our Phase I system. This occurs after a Call for Proposals (CP) has been issued by the STScI. This nominally occurs once a year and is also referred to as a “Cycle” or the Phase I period. “Phase I” refers to the process from proposal preparation and submission through the selection of a recommended list of accepted programs by the peer reviewers and ultimately by the STScI Director’s approval. Proposers submit a scientific justification and observation summary for review by a peer review group called the Telescope Allocation Committee (TAC). The TAC review, results in a list of projects that are recommended to the STScI Director for approval and implementation.

The accepted proposals move into Phase “II”, where proposers are required to create detailed observing programs, which include specifications of the actual HST exposures that are to be carried out by the SIs and the telescope. The results are a series of spacecraft commands which cause data to be obtained. These data are returned to the STScI for analysis and archiving.

Proposals for HST observing time may be submitted by scientists of any nationality or affiliation, and may request use of any of the Science Instruments. Proposals for funded Archival Research may be submitted only by scientists affiliated with US institutions (unfunded archival research is open to all).

3. PROCESS IMPROVEMENT

Observatories and institutions are constantly seeking ways to improve services while reducing their associated costs. For the past several years the STScI has been actively involved in many areas of Process Improvement for the HST Ground System elements that we are responsible for maintaining and operating. These have involved areas of planning and scheduling, archiving of the data, and user support, to make them simpler and more efficient to run, as well as attempting to reduce the work load for STScI staff. The Project to Re-Engineer Space Telescope Observing (PRESTO), was created from a Continuous Process Improvement (CPI) activity to streamline and improve the HST observation selection, development, planning and scheduling process. This CPI team led to a special project at the STScI and once the concept was proven, into a full, operational division. Presto is responsible for the front-end activities associated with HST observing, from science program selection to command load generation and provides technical support to users in preparing their HST observations. A byproduct of the original CPI team was a very detailed user survey that pointed out that HST’s Phase I system needed to be improved. A small team was created to review HST’s Phase I system and suggest improvements.

3.1 What the Team Found Out.

In the early days of HST, proposers had to fill out both electronic and paper Phase I submission forms. The electronic form requested redundant information in various places as well as information for implementation details that were never used during the Phase I review and selection process. The forms were submitted in many different types of formats, both electronic and paper. Submissions were reviewed by the Phase I analysis team who upon finding errors, would make corrections before being able to load the required information into a database that could be used for the peer review meetings. This process needed to be revised for the benefit of the proposer as well as the staff. More details can be found in the original paper¹.

3.2 What They Did.

Out of the effort of a small team, made up of developers and scientists, a new Phase I submission system^{1,2,3} was designed and implemented. It was created in a very short timescale of several weeks by the diverse team. They used the Kitt Peak National Observatory (KPNO) electronic submission system^{5,6,7} as a model.

The HST Electronic Phase I Submission system was designed using three software tools for the three unique processing components; LaTeX, procmail, and Perl. All of these are freeware products and that run on many different platforms. Our System was implemented on the UNIX platform as that was the most common platform in use at the STScI.

The design of the system relied entirely on the fact that virtually all of the existing HST proposers had access to electronic mail¹.

Instead of the variety of forms that used to comprise Phase I, the system was built around two forms. The first was for the actual proposal, either an observing proposal or an archival research proposal, and the other was for the budget requests. The HST Phase I Submission System was put in place to deal only with the observing and archival research proposals. The budget forms are still only accepted via regular mail due to the requirement of having an authorizing signature, but an effort is under implementation at the STScI to move towards an all electronic Budget submission as well. This should be completed in time for HST's Cycle 9.

3.2.1 The LaTeX Template

The template products were chosen to be developed using the LaTeX⁸ document preparation system, because it is widely used and accepted in the astronomical community. It handles figures, formulas, and text extremely well. It allows for very structured documents while allowing maximum flexibility to easily modify the text without worrying about how the product is going to turn out.

A LaTeX template was created with various LaTeX style files to provide one form that a proposer could fill out and submit to the STScI. This template is a heavily commented, easy to fill in form that allows our software to “strip” out certain information from the template to be stored in the proposal traveling database (e.g. PI name, Title, Instruments used, etc.). Figure 1 shows a portion of the Phase I template that has been filled out by this author. Proposers enter the desired values inside the braces.

```

% 6.  PRINCIPAL INVESTIGATOR
%
%  Identify the PRINCIPAL INVESTIGATOR (PI). If you wish to include
%  your title (Dr., Prof.,...), include it in \PIfirstname as in:
%      \PIfirstname{Dr. Bob}.

\PIfirstname      {Brett}
\PIlastname       {Blacker}
\institution      {Space Telescope Science Institute}% Please do not abbreviate.
\sundries         {} % Only if needed (office, location code, etc.)
\street          {3700 San Martin Drive} % Example: 4321 University Avenue
\town            {Baltimore} % Example: Anytown
\postalcode      {21218} % Postal (or zip) code. Example: DK 2740
\telephone       {410-338-1281}
\email           {blacker@stsci.edu}
\country         {USA} % Country of above named institution.
\USstate         {MD} % 2-letter code required for US proposers only
%\ESAMember      {yes} % Uncomment line only if you are an ESA member.

```

Figure 1. Principal Investigator Section of the LaTeX Template

3.2.2 Handling and Processing the Electronic Mail

¹ For the rare observer without access to electronic mail, a paper form would be accepted. There have been no such submissions in the last 2 years.

The Electronic mail handling task was perfectly suited to procmail, which is a UNIX utility which allows the automatic handling of incoming electronic mail. It can easily handle tasks such as sorting and reacting to mail by either the subject, the sender, or the content. Mail is handled by automatically forwarding all of the incoming mail messages to an account, which is running procmail. We have setup an account “newprop@stsci.edu” that handles the Phase I submission system. Proposers send all electronic mail to this account. The Phase I submission system software works from this account. The current LaTeX templates and associated files are stored there. Also the proposal products that are submitted, are retrieved from this account as well.

Figure 2 illustrates how incoming messages are handled by the Phase I Submission System.

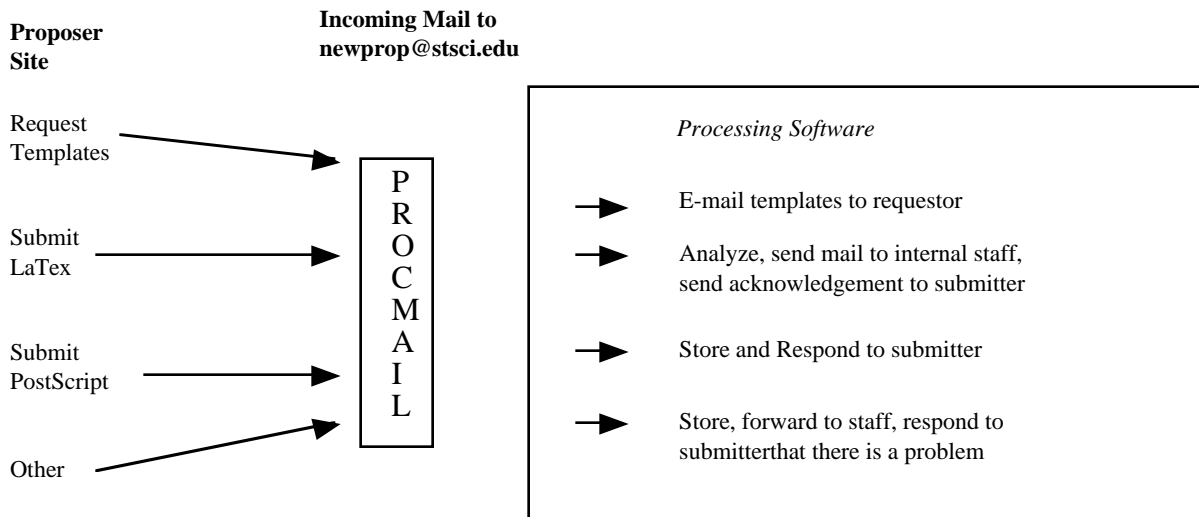


Figure 2. Data Flow

The parsing, extraction, and analysis software were written in the Perl⁹ and Tcl/Tk¹⁰ scripting languages.

4. HOW THE SUBMISSION SYSTEM WORKS

4.1 Requesting the Templates

During the preparation of the CP, the LaTeX template and processing software is updated to reflect the current changes for that particular cycle. We have set up several procmail routines to handle the different periods during the Cycle, such as: when the CP is released to the science community via an electronic mail and postcard notification process, the submission software is activated; then right after the deadline has occurred, we send a “Late” notice for several weeks for any incoming messages; finally, after the TAC review, we activate the “We are closed for the Season” message, which remains in place until the beginning of the next phase I period.

The proposers are initially instructed to send a message to the processing account with a subject of “request templates” if they wish to receive the HST Phase I LaTeX template and associated files, which includes a “Welcome” message; the observing and archival research templates; a filled out example template; the Phase I style file; and several other style files for figure and table encapsulation.

The request for templates is handled by procmail and the template products are usually sent back to the requester in a very short time, normally less than 5 minutes, but it depends on the amount of internet traffic. Another benefit of procmail utility is that it logs all of the electronic mail communication that comes into that account. This enables us to track what is happening, as well as provides a list of all electronic mail addresses that have made requests or submissions. This provides an easy mechanism in case some piece of information needs to be relayed to those who have requested the templates or have submitted a proposal, such as an update to the template files or new spacecraft or scientific information that would be beneficial to the proposers prior to the Phase I deadline.

Figure 3 shows a portion of the logfile that is created by procmail and is used by the Phase I analysis team.

```

From meg@ohio-state.edu Sat Jan 10 08:00:27 1998
Subject: request templates
Folder: $AUTOGET >>$LOGFILE 1230
From groovequid@cmay4g.net Sun Jan 11 05:27:28 1998
Subject: thank you
Folder: $HANDLER >>$LOGFILE 3893
From Mailer-Daemon@stsci.edu Sun Jan 11 05:28:06 1998
Subject: Returned mail: Host unknown (Name server: jrandal.net: host not found)
Folder: /usr/lib/sendmail -oi blacker@stsci.edu, shea@stsci.edu 2444
From miller@stsci.edu Mon Jan 12 08:25:35 1998
Subject: i'm just a random astronomer testing the phase i stuff
Folder: $HANDLER >>$LOGFILE 680
From miller@stsci.edu Mon Jan 12 08:28:55 1998
Subject: request template
Folder: $AUTOGET >>$LOGFILE 640
From cmu@stsci.edu Thu Jan 29 15:32:29 1998
Subject: request templates
Folder: $AUTOGET >>$LOGFILE 789
From cmu@stsci.edu Thu Jan 29 15:32:39 1998
Subject: Automatic reply: on sabbatical
Folder: $HANDLER >>$LOGFILE
From blacker@erols.com Thu Feb 19 21:20:44 1998
Subject: HST Cycle 7 archival proposal
Folder: $HANDLER >>$LOGFILE 12255

```

Figure 3. Display of Logfile

4.2 Completing the Template

Once the proposer has received the template products, they fill out the appropriate LaTeX template for either an observing or archival research proposal. The proposer can use any text editor or word processing system to fill out the LaTeX template, as once it has been submitted no further LaTeX processing is done on it at the STScI. We currently require two types of submissions, *the unformatted submission* and a *formatted submission*.

In the *unformatted version*, we require only a part of the template to be answered, mainly the coverpage information about the investigators and the observations summary form, which briefly describes the observations. The *formatted submission* is the complete template filled out, including the scientific justification. The easiest method to generate the *formatted submission* is to completely fill out the LaTeX template, include figures as required and then process that file, with LaTeX. The resulting output product will be in the PostScript™ format. If LaTeX is not available to the proposer, then the proposer may once again use any type of text editor or word processing system to generate a formatted version as long as they follow the Phase I proposal formatting style. Presently, our system will only handle a PostScript™ file submission, however, we are in the process of improving the system to handle the PDF™ file format as well, and hope to have that in place for Cycle

8 later this year. The submission system software can process and recognize plain ASCII, uuencoding (e.g. from Sun's mailtool), and MIME encoding.

4.3 Proposal Submission and Processing

As discussed above, the proposer is required to submit an unformatted version and a formatted version to the STScI's proposal processing account before the Phase I deadline. Currently, each product needs to be a separate submission to the processing account, so that it will be handled properly by the submission system. We are also in the process of updating the system to allow for both submissions to be included in one electronic mail submission instead of two.

We now require proposers to submit both the unformatted version and formatted version electronically, instead of the PI having the choice of submitting the formatted version electronically or mailing a paper copy to the STScI. This allows the staff to concentrate on one type of submission rather than taking resources to handle a mixture of both. We have discussed utilizing the WORLD-WIDE WEB (WWW) for our proposal submissions, but are reluctant to maintain the overhead for two separate submission systems.

After each submission is received and processed by the Phase I submission system, the proposer will receive an acknowledgment message for each submission product. The type of submission is then determined and handled accordingly. The PostScript submissions are saved, printed, and then compressed. The templates are saved, they are parsed to perform validity checks and then are stripped and stored as an archive file which can be utilized for statistical analysis of the submitted proposals as well as to load the necessary information into the peer review databases. Some of the validity checks that are performed are to look for missing and/or incorrect information, such as: checking for multiple values assigned to single-value entries; missing principal investigator information, number of orbits or targets requested, missing abstract as well as other constraints.

The error analysis output reports are electronically mailed to the proposer and/or the Phase I processing team, who handle the manual tasks associated with the process. The proposal will be corrected and resubmitted by the proposer, or the Phase I team will make the corrections, reprocess the proposal through the system, and inform the proposer. Figure 4 shows one type of error message that is sent to the Phase I analysis team. A slightly different version would be returned to the proposer explaining the errors that require the proposal to be fixed and resubmitted.

```
From: newprop@stsci.edu (Phase I Submission auto handler)
To: blacker@stsci.edu, shea@stsci.edu
Subject: Phase I proposal submission from No PI name found
Date: Wed, 18 Feb 1998 12:53:14 -0500

Analysis of /marian/data2/operational/cycle7_5-ar/error/0004.no_pi_name:
Sender of e-mail was: blacker@stsci.edu
-----
Inconsistencies Found
  No PI name given.
  No proposal category.
  No scientific category.
  Missing formattedsubmission value
  No title provided
  No instruments listed.
-----
Percentage of investigators that are ESA: 0
  Percent orbits devoted to
    WFPC20          FOC:    0
    STIS:           0       NIC:    0
    FGS:           0
-----
Scientific Category:          Proposal Category:
```

Figure 4. Type of Error Analysis Message

Additional routines are run on the proposals to determine peer review conflicts of interest as well as determining peer review proposal assignments. For the accepted proposals, an additional routine is run that creates a partially filled out Phase II proposal template that includes information from the Phase I that is required in Phase II.

4.4 Performance Statistics

Since the inception of the Electronic Phase I submission during HST's Cycle 5 in the Summer of 1994, the system has proven to be very robust. It has processed over 10,000 e-mail messages. It has handled over 5,000 requests for proposal templates, more than 3,600 proposal submissions, and more than 2,100 PostScript submissions. Not a single proposal submission has been lost since this system has been put in place.

One problem that should be mentioned occurred during the Cycle 7 Phase I period in September 1996. Overall, the system worked extremely well processing over 1000 proposals that were submitted on the last day of the deadline. The problem that occurred was due to the workstation that was handling the incoming mail processing. That machine was an old Sparcstation 2 with only 32 Megabytes of memory. It produced an out of memory error, when it was trying to process submissions that were being received roughly 1 every few seconds. All of the incoming submissions were queued up along with the outgoing acknowledgment messages, which resulted in proposers not receiving their automatic acknowledgment messages within a short amount of time as was advertised. This resulted in several proposers resubmitting their proposals several times, until they received an acknowledgment message. Duplicate submissions were identified and removed by the Phase I analysis team. Subsequent to that event, the mail processing machine was moved from the old Sparc2 workstation to an UltraSparc, and it worked flawlessly during the Cycle 7-NICMOS Phase I period in September of 1997.

4.5 User Community Reaction and Maintenance

The HST user community continues to be pleased with the new Phase I system. It sees it as a vast improvement over previous cycles after the initial use in Cycle 5, based on a user survey that was conducted. The community has continued to be pleased with the system, because the process is simple, well known, and well documented.

Maintenance of the system is straightforward. Subtle changes have been made to the templates and the software as required to improve the process, without causing the users to learn a new system each cycle. Modification is done before the issuance of the next CP or at the beginning of the next cycle.

5. OTHER FACILITIES USING OUR SYSTEM

The STScI makes our proposal submission software available to the scientific community under a no-cost license. To find out more about the no-cost license visit our Electronic Phase I Submission Systems WEB page at the following URL: <http://www.stsci.edu/public/proposal-submission-software/>.

Below are some of the projects and observatories that are either using our Electronic Phase I Submission System, or are evaluating it.

5.1 Far Ultraviolet Spectroscopic Explorer (FUSE) System

FUSE is a NASA-supported astronomy mission to be launched in late 1998, to explore the Universe using the technique of high-resolution spectroscopy in the far-ultraviolet spectral region. The Johns Hopkins University has the lead role in developing and operating the mission, in collaboration with other universities, contractors, and international partners.

As part of the FUSE Project, the STScI is providing systems engineering support in the areas of architecture, design and development for the FUSE Phase I Submission system. The HST Phase I System is being used as a model for their implementation. For additional information about the FUSE program visit their WEB page at the following URL: <http://fuse.pha.jhu.edu/>.

5.2 James Clerk Maxwell Telescope (JCMT)

The 15-m diameter James Clerk Maxwell Telescope (JCMT) is the largest facility in the world designed specifically to operate in the sub-mm region of the spectrum. It is situated close to the summit of Mauna Kea, Hawaii, at an altitude of 4092m (13400 feet). The JCMT is operated by the Joint Astronomy Centre in Hilo, Hawaii on behalf of the parent organizations, the Particle Physics and Astronomy Research Council in the United Kingdom, the National Research Council of Canada and The Netherlands Organization for Scientific Research.

The JCMT has implemented their Phase I submission system based on our Electronic Phase I Submission System. They have modified the LaTeX templates and software as necessary for their observing needs. For additional information about the JCMT program visit their WEB page at the following URL: <http://www.jach.hawaii.edu/JCMT/home.html>

5.3 High Energy Astrophysics Space Archival Research Center (HEASARC)

The HEASARC is a multi-mission astronomy archive for the X-ray and Gamma ray wave bands located at the Goddard Space Flight Center. They have developed a Remote Proposal Submission (RPS) system that is used to generate the proposals for submission to the mission-specific NASA Research Announcements that are released by NASA's Office of Space Science. They are investigating using an all electronic submission system and are reviewing our system to understand how to handle the scientific justification submission part. For additional information about the RPS group visit their WEB page at the following URL: <http://heasarc.gsfc.nasa.gov/docs/asca/rps.html>

6. FUTURE DEVELOPMENTS

In the continuing era of reducing costs, while still maintaining a high level of service, we must strive to more fully automate the entire Phase I review process, in addition to our Electronic Phase I Submission System. We are describing a concept for proposal solicitation and selection for the 21st century, in another paper being presented at this conference.

In addition, to the KPNO system described in the original paper, they have recently introduced a Web based interface to handle proposal submissions as well as their LaTeX and paper version¹¹. As the Web becomes more popular and stabilizes, we will continue to investigate and assess whether to move towards an all Web based submission system as well.

We will continue to offer our Electronic Phase I Submission System to the science community on a no-cost basis and investigate other projects and programs that could benefit from this work.

7. ACKNOWLEDGMENTS

The continued success and future of the Electronic Phase I Submission System is due to the hard work and talented effort of the diverse team of developers and scientists that were assembled to improve a much needed system.

8. REFERENCES

1. Asson, Drew J, Computer-assisted Proposal Submission Systems, in Telescope Control Systems, Patrick T. Wallace, Editor, Proc. SPIE 2479, 445-452, 1995.
2. Payne, H.E., and Asson, D.J., "Electronic Submission of HST Phase I Observing Proposals", in the Astronomical Society of the Pacific (ASP) Conference Series, Volume 77, Astronomical Data Analysis Software and Systems IV, ed. R. A. Shaw, H.E. Payne, and J.J.E Hayes (San Francisco: ASP), 65.
3. Mutchler, M., Anderson, K., Asson, D., Downes, R., Lucas, R., Madau, P., and Payne, H., "Observing with HST I: A New Phase I Proposal Process", presented at the 184th Meeting of the American Astronomical Society, Minneapolis, Minnesota, 29 May-2 June 1994.
4. Massey, Phil, and Pilachowski, Caty, "A New Procedure to Apply for Telescope Time at KPNO", KPNO, NOAO Newsletter No. 37, 1 March 1994.
6. Massey, Phil, Barnes, Jeannette, and Patterson, Pat, "Electronic Submission of Telescope Proposals", KPNO, NOAO Newsletter No. 38, 1 June 1994.
7. Massey, Phil, "Electronic Proposal Submission Continues", KPNO, NOAO Newsletter No. 41, 1 March 1995.
8. Lamport, Leslie, LaTeX - A Document Preparation System, Addison-Wesley, Reading, 1986.
9. Schwartz, Randal L., Learning Perl, O'Reilly & Associates, Sebastopol, 1993.
10. Ousterhout, John K., Tcl and the Tk Toolkit, Addison-Wesley, Reading, 1994.
11. Pilachowski, Caty, Barnes, Jeannette, Bell, Dave, Probst, Ron, "Submitting Observing Proposals By the Web", KPNO, NOAO Newsletter No. 51, September 1997.