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Hubble Space Telescope

Cycle 5

Phase I Proposal Instructions

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This document has the following purposes:

- It describes the information that must be submitted tooSTScI by Phase I proposers, both electronically and on paper, and describes h ow to submit it (Section 2).
- It describes how to fill out the proposal LATEX templates (Section 3).
- It describes how to estimate the number of spacecraft orbits that the proposed observations will require (Section 4 and Appendix G).
- It provides detailed information about the parameters that are used in the forms to describe the requested observations (Appendices A and B).
- It provides information about the preparation and electronic submission of proposal files (Appendices C and D). Examples of completed proposal forms are included.

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1 INTRODUCTION

The review of proposals for use of the *Hubble Space Telescope (HST)* is carried out in two phases, which are managed by the Space Telescope Science Institute (STScI). In Phase I, proposers submit a scientific justification and observation summary for review by the Telescope Allocation Committee (TAC). The TAC review results in a list of projects that are recommended to the STScI Director for preliminary approval and implementation. During Phase II, the General Observers (GOs) whose projects have been recommended provide complete details of their proposed observations, to allow the STScI to conduct a full technical feasibility review of the programs. Also in Phase II, a cross-proposal exposure duplication test searches for similar exposures among previous and current *HST* programs. Up-to-date Exposure Catalogs are made available to proposers prior to the proposal deadline (Phase I) in order to avoid duplication-related problems during the Phase II implementation and review. Upon final approval by the Director, the Phase II information is then used to schedule and obtain the actual observations.

Starting in Cycle 5, the TAC will recommend observing time in units of spacecraft orbits, instead of the spacecraft time used previously. We believe that this is a more robust metric and that it better reflects the actual resources used. Also, we have drastically revised the submission format in Cycle 5 to make it simpler for *HST* proposers.

This document, the *Phase I Proposal Instructions*, has the following purposes:

- It describes the information that must be submitted to STScI by Phase I proposers, both electronically and on paper, and describes how to submit it (Section 2).
- It describes how to fill out the proposal LaTeX templates (Section 3).
- It describes how to estimate the number of spacecraft orbits that the proposed observations will require (Section 4 and Appendix G).
- It provides detailed information about the parameters that are used in the forms to describe the requested observations (Appendices A and B).
- It provides information about the preparation and electronic submission of proposal files (Appendices C and D). Examples of completed proposal forms are included.

It is assumed that readers of this document are familiar with the Cycle 5 *Call for Proposals* and the appropriate *Instrument Handbooks*. These documents are available in most institutional libraries or from the STScI User Support Branch (USB, see Section 2.1), as described in Section 2 of the *Call for Proposals*.

2 HOW TO SUBMIT A PHASE I HST PROPOSAL

2.1 PAPER AND ELECTRONIC PROPOSAL SUBMISSION

There are three options for preparing and submitting proposals:

- Submission of both a paper proposal and an electronic proposal file. This is the "standard" procedure for the majority of proposers. The submission deadline is **August 12, 1994**. This is the only option offered for Archival Research proposals.

- Submission of a paper proposal only. This is allowed only for the small number of observing proposers without access to electronic mail, and the deadline is **July 29, 1994.**

- Submission of an electronic proposal file only. This is a new experimental option *for observing proposals only*, with the same **August 12** submission deadline.

It is the responsibility of applicants to mail their proposals early enough to assure arrival in Baltimore by the appropriate deadline. We also urge applicants to submit their electronic versions well before the deadline, to avoid possible last-minute hardware or overloading problems.

Paper-plus-Electronic Submission

Under this option, observing and Archival research proposals are submitted in both electronic and paper form. **Two (2) complete, single-sided copies** of the paper proposal should be submitted to STScI. Proposers who wish to include glossies or color illustrations must make and send 20 double-sided copies of the proposal. Small (< 100 orbits) observing, Snapshot Survey, and Archival Research proposals should be no longer than 10 pages, while large (> 100 orbits) observing proposals should not exceed 15 pages. Panel reviewers may ignore any pages beyond these limits.

U. S. proposers who are requesting funding for **Archival Research** should also include the following:

- ☐ Budget Forms GF-95-1 through GF-95-3 (attached to *both* copies of the proposal), with required institutional signatures.

Note that the Budget Forms *are not required in Phase I for observing proposals.* Budget Forms will be requested in Phase II from successful U.S. observers only.

Student Principal Investigators (PIs) should enclose one copy of the

- ☐ Certification letter from faculty advisor, as described in Section 5.3 of the *Call for Proposals.*

The following options exist for preparing the *paper* forms. All of them are acceptable, but the format and contents of the forms should not be changed in any way.

1. Request the proposal templates and the style file by return e-mail (see Section 2.2) or download them from the STScI Electronic Information Service (STEIS; refer to Section 2.2 and to Appendix D). Fill out the templates using standard text-editing software, run LaTeX, and then print out the proposal forms for submission. This option will be the most advantageous for the majority of proposers, since the identical template files can also be sent electronically to STScI to satisfy the electronic-submission requirement.

2. Use word-processing equipment or a typewriter to prepare facsimiles of the Phase I proposal. Note that the format of the submitted proposal should not deviate from that of the example provided in Appendix C.

Paper-only Submission

If access to U.S. electronic mail is not available to a proposer, then it is permissible to submit the Phase I information to STScI solely on the paper forms. Explanation for this mode of submission should be provided in a cover letter. Note that the submission deadline for paper-only proposals is two weeks earlier than for paper-plus-electronic submissions, in order to reflect the significant additional STScI processing effort.

Fully Electronic Proposal Submission (Experimental)

For Cycle 5 STScI is planning to offer fully electronic submission on an experimental basis. In this mode of submission, the proposer sends via electronic mail both the filled-in LaTeX proposal template and the PostScript file output from LaTeX (which can incorporate any desired monochrome figures as encapsulated PostScript). This fully electronic submission would be in lieu of any paper submission. Proposers who are interested in taking advantage of this mode are invited to contact USB to indicate their interest no later than two weeks before the electronic deadline. This mode does not apply to Archival Research proposals, for which signed budget forms are required. The deadline for this mode of submission will be the same as the electronic+paper deadline.

Where to Submit Proposals

Paper forms should be sent to the following address:

User Support Branch, Room S420
Space Telescope Science Institute
3700 San Martin Dr.
Baltimore, MD 21218 USA

The electronic version of the Proposal Template file should be sent via computer network mail directly to one of the following proposal-submission electronic mail addresses:

INTERNET: newprop@stsci.edu
NSI/DECnet: STSCIC::NEWPROP

Proposers will receive an acknowledgement of their e-mail transmission immediately after it is received at the STScI; if no acknowledgement is received within a few days, proposers should contact the User Support Branch. The electronic-mail user-id for general correspondence is **USB** (to be used with one of the networks and computer node names given above), and the telephone number is 800-544-8125 (toll-free within the U.S.) or 410-338-4413.

European PIs and Co-Investigators (Co-Is) should send an electronic version of the proposal template file to the ESA Project Scientist (for accounting and statistical purposes). The ESA *HST* Project Scientist electronic mail address is:

INTERNET: esahstps@eso.org
NSI/DECnet: ESO::ESAHSTPS

Alternatively, a paper copy should be sent to:

ESA *HST* Project Scientist
Space Telescope European Co-ordinating Facility
European Southern Observatory
Karl-Schwarzschild-Strasse 2
D-85748 Garching
Germany

2.2 PREPARATION AND SUBMISSION INSTRUCTIONS

This subsection discusses general procedures for proposal preparation and submission. Specific instructions for the different forms can be found in Section 3, and information about filling out the electronic proposal template can be found in Appendix C (page 34). Examples of completed proposal forms are also included in Appendix C.

The computer software used in the review and feasibility analysis of proposed *HST* observations can interpret the proposal information only if it is in the correct format. It is therefore essential that the proposal template be filled out carefully, accurately, completely, and in accordance with the instructions in this document.

Step-by-step Instructions

1. **Obtain the Template and Style Files**

   To obtain electronic copies of the .tex template files and the style file, please send an e-mail message to user-id **newprop** (to be used with one of the networks and computer node names given in Section 2.1), containing the words "request templates" in the subject line. Proposers will receive the following files by automatic "return e-mail":

   - the Phase I Observing Proposal Template file **obstemplate.tex** and the Phase I Archival Research Proposal Template file **artemplate.tex**,
   - the style file **phase1.sty**,
   - an example of a completed observing template file in **obsexample.tex**,
   - a helpful **how_to_submit** file, describing the template files and what to do with them.

     The same files can also be downloaded from STEIS (refer to Appendix D). They can be found in the **proposer** directory under the **cycle5** subdirectory.

   If access to e-mail or STEIS is impossible, then the proposal should be prepared with a typewriter or a word processor as a facsimile of the example in Appendix C.

2. **Fill out the Template File**

   Fill out the Phase I Proposal Template file using any text editor on the proposer's local computer. Instructions can be found in the template itself, and in Section 3 of this manual. The examples in Appendix C should also be examined carefully. Electronic submission of the questions 10–15 is optional.

3. **Prepare a Paper Copy of the Proposal**

   For most proposers, the easiest way to produce a paper copy of the proposal is to run LaTeX and then print the formatted proposal. If you are not familiar with LaTeX, please check with your system manager for how to run it on your system, and how to incorporate figures or diagrams. The User Support Branch may also be contacted for assistance with any questions or problems. Rather than completing the LaTeX template version, some proposers may prefer to use different word processing software to produce a paper copy of the proposal.

4. **Send the Template File Electronically**

   Send the completed Phase I proposal LaTeX template file to the STScI by e-mail to the account named **newprop**, (see Section 2.1 for the complete address) before the deadline for electronic submission. *Please do not e-mail the PostScript version of the proposal that was produced as output by the LaTeX formatter.*

5. **Make 2 Paper Copies and Send Them to STScI**

   Send the paper forms to the STScI before the appropriate deadline for paper or paper-plus-electronic submissions, as appropriate. The STScI will make the requisite copies for the proposal review process. These copies will be standard black and white Xerox copies. Proposers who wish to include glossies or color material must send 20 double-sided paper copies to the STScI. Archival Research proposals must include Budget Forms GF-95-1 through GF-95-3 with *each* copy of the proposal, and student PIs must include one copy of the certification letter from their faculty advisor.

3 INSTRUCTIONS FOR FILLING OUT HST OBSERVING PROPOSAL FORMS

This section provides guidelines for filling out the various observing proposal forms, beginning with some general comments pertaining to all forms, and followed by more specific instructions for each form. *Examples of completed forms in Appendix C should be examined carefully.* Archival Researchers should skip Sections 3 and 4 and go directly to Section 5 where complete instructions for the AR proposal forms are provided.

Proposers should observe the following general instructions and conventions when filling out the forms:

- All proposals for *HST* observations must be submitted on current Cycle 5 versions of the appropriate STScI forms; the forms provided for previous proposal cycles must not be used.
- A detailed budget will be required for General Observers *only* in Phase II. Budget Forms will be provided to GOs after the review and approval of proposals for Cycle 5.
- All copies must be be legible and in English. For legibility, use no more than 80 characters per line and 50 lines per page, or their equivalent in a 12-point font, if using a word processor with proportional spacing.
- Page limits must be strictly observed. Small ($<$ 100 orbits) and Snapshot Survey proposals are limited to 10 pages *total*, while large ones ($>$ 100 orbits) are limited to 15 pages.

3.1 CYCLE 5 OBSERVING PROPOSAL

Specific instructions for filling out various items in the proposal are given in this section and in the LaTeX template. Refer to Appendix C for completed examples of the form.

- Item #1 – Give a concise title for the proposal.
- Item #2 – Specify the appropriate proposal category. Valid entries are one (and only one) of the following:

GO	—	General Observer proposal
SNAP	—	Snapshot Survey proposal
DD	—	Director's Discretionary Time proposal

The STScI Director has approved short-exposure survey programs **SNAP** for Cycles 1, 2, 3, and 4 to utilize gaps in the *HST* schedule (see the *Call for Proposals* for details). Astronomers may propose similar surveys for Cycle 5. Under the guidelines for Director's Discretionary Programs (see the *Call for Proposals*), **DD** proposals may be submitted at any time during the year.

- Item #3 – Select the appropriate scientific category for the proposed project. Pick one and only one category from the following list:

  AGN
  COOL STARS
  GALAXIES & CLUSTERS
  HOT STARS
  INTERSTELLAR MEDIUM
  QUASARS
  SOLAR SYSTEM
  STELLAR POPULATIONS

  The proposal classifications provided here reflect the distributions in prior cycles. Under the stellar categories, there may be some ambiguity in cases of binaries or clusters involving both hot and cool components; in general a decision should be based on the principal focus of the study. COOL STARS generally comprise spectral types later than F0. Most astrometry proposals should be sent to COOL STARS, although astrometric studies directed towards the astrophysics of HOT STARS may be sent to the latter. Studies of absorption by intervening galaxies should be sent to one of the extragalactic categories; again, there may be ambiguity in the case of nearby galaxies, and the principal focus should be the guide.

- Item #4 – Enter the name, institutional affiliation, complete address, telephone, electronic mail, and ESA member-state affiliation (if appropriate) of the PI. There must be one *and only one* PI for each proposal.

- Item #5 – Identify which Scientific Instrument(s) (SIs) will be used in the project. The allowable choices are one or more of the following: **WFPC2**, **FOC**, **FOS**, **GHRS**, and **FGS**.

- Item #6 – In the case of GO or DD observing proposal, enter the total number of orbits requested for both primary and parallel observations. The values must be calculated as described in Section 4. For long-term projects, provide a year-by-year breakdown of the orbits requested. For SNAP observing proposals, the proposer should specify the total number of targets requested. Only a fraction of the sample targets may actually be observed (typically no more than 1 target per day for all such programs).

- Item #7 – Provide a concise abstract describing the proposed observations. The abstract must fit on the first page of the printed proposal: typically this will be no more than 20 lines, 80 characters per line. Include the main scientific goals and justify the necessity of *HST* data.

- Item #8 – List the names, institutional affiliations, and countries of all Co-Is. Also indicate whether each Co-I is affiliated with the European Space Agency or with an ESA member-state institution.

- Item #9 – Observation Summary (OS).

  – The OS accommodates observations of (a) fixed targets (i.e., all targets outside the solar system whose positions can be defined by specific celestial coordinates), (b) generic targets (i.e., targets defined by certain general properties, rather than by specific coordinates), and (c) solar-system targets (i.e., moving targets).

  – For multi-cycle projects (see the *Call for Proposals*), include only visits requested for Cycle 5.

  – All visits and exposures for a given target that use the same instrument and mode may be summarized using a single OS line.

  – Special calibration exposures on internal sources and calibration exposures using the Earth should *not* be indicated here, but should be listed only in Item #11 — Description of the Observations — of the proposal form. They also should not be counted toward the total number of orbits given on the Cover Page; these additional orbits will be estimated by STScI staff and then communicated to the TAC reviewers. External astronomical calibration targets *should* be entered as separate lines on the OS, with the appropriate number of orbits.

  – For SNAP proposals, the OS should be filled out with a typical example of a snapshot exposure (less than one orbit), including spectral element, etc.

  – For each row of the observation summary, the following information must be provided:

  1. TARGET NAME

     Targets should be named using the conventions recommended in Appendix A (page 24).

  2. TARGET RA AND DEC. (J2000)

     Supply the coordinates for fixed targets only. For generic targets use a *very short* text description either of the target location (e.g., **HIGH-GALACTIC LATITUDE FIELD**) or of the target itself.

     It is important to note that the *HST* Scientific Instruments typically have very small apertures and fields of view. Target-acquisition apertures in some cases are only a few seconds of arc in size. *It will be the successful proposer's responsibility in Phase II to provide coordinates accurate to about $\pm 1''$ for all approved targets which require onboard acquisition.* See the *Call for Proposals* for information on how to use the STScI Guide Star Selection System Astrometric Support Package (GASP) to obtain this accuracy in Phase II. For Phase I, however, target positions with accuracies better than $\pm 1'$ are sufficient for the TAC review (except in crowded fields where the identity of the target may be in question).

  3. TARGET MAGNITUDE

     Supply the apparent *total* magnitude in the V passband for the entire target (galaxy, planet, etc.), if known. This information is used only for scientific review, not for exposure-time calculations.

Note that some of the Scientific Instruments have limits on the brightness of the objects that they can observe safely. For more information, refer to the *Call for Proposals* and the *Instrument Handbooks*.

4. SCIENTIFIC INSTRUMENT CONFIGURATION AND OPERATING MODE

   Enter the Scientific Instrument configuration first, and then the operating mode. All of the allowable options are listed in Table 4 (page 26), details of which can be found in the *Instrument Handbooks*.

5. SPECTRAL ELEMENT(S) (AND λ RANGE IF GHRS)

   All of the desired spectral element(s) (i.e., filters or gratings) should be entered (see Table 4 on page 26 and the lists in Appendix B for the allowable options). Several different spectral elements for ***different*** exposures may be included on the same OS exposure line, ***each separated with a comma and a space*** (e.g., **F120M, F220W, F320W**). If more than one element is required for the ***same*** exposure, then join the elements with a "+" (e.g., **F277M+POL45**). Enter only the first polarizer for an FOS polarization sequence (e.g., **POL0-A**), but include all polarization exposures (4, 8, or 16) in calculating the overall number of orbits. If the GHRS is used, then list ***in parentheses (immediately following the spectral element listing)*** the total wavelength range in angstroms for the exposures defined on the given line; for example: **(1100-1400)**.

6. TOTAL NUMBER OF ORBITS

   Specify the total number of orbits (i.e., the sum of the orbits for all of the exposures from all target visits requested) (see Section 4).

7. SPECIAL REQUIREMENTS

   Enter the flags listed in the Table below, where applicable. These five options are the only allowable entries.

Table 1: Flags for the Observation Summary

Parameter	Description
CVZ	Continuous Viewing Zones observations. See Section 4 of this document and the *Call for Proposals*.
DUP	Observations which duplicate previous or upcoming GO and/or GTO exposures. See Item #15 — Justify Duplications — below and the *Call for Proposals*.
DT	Dark Time observations. See Section 4 of this document.
PAR	Parallel observations. All of the exposures specified on this OS line are to be done in parallel mode. See the *Call for Proposals*.
TOO	Target of Opportunity observations. See the *Call for Proposals*.

- Item #10 — **Scientific Justification** — This section should include a balanced discussion of both background information and the program's goals and significance to astronomy. For SNAP proposals, the scientific justification should describe the nature of the target sample and the potential use of the survey images by the investigator and the astronomical community. The maximum allowed length of the scientific justification depends on the number of orbits requested, as follows:

Program Size	Total Number of Orbits	Maximum Length
Small	$<$ 100 orbits	3 pages
Large	$\geq$ 100 orbits	6 pages
(SNAP)		(3 pages)

  For long-term proposals, the total number of orbits refers to all cycles combined. Up to two additional (optional) pages for figures, references, or tables are allowed.

  For the individual items below (#11–15) there are no specific page limits, however the *total* proposal page limits (given at the beginning of this section) must be observed.

- Item #11 — **Description of the Observations** — Provide a short description of the proposed observations - by cycle for Long-Term projects. Explain the amount of exposure time and number of orbits requested (e.g., number of objects, examples of exposure-time calculations and orbit estimations for some typical observations, etc.). List any special internal or Earth calibration requirements for the proposed observations here. The additional number of orbits required for these special calibrations will be estimated by STScI staff and considered by TAC. However, any special calibration involving observations of external astronomical targets other than the Earth should not be entered here, but rather as exposures in the OS. Snapshot proposals should specifically identify the requested guiding mode and the requested proprietary data-rights period for the exposures.

  Certain observatory or instrument capabilities may not be available for Cycle 5 and should be specifically discussed in the answer to this question if either the feasibility or the required number of orbits would be impacted. For Cycle 5 these capabilities are:

  - FOS spectropolarimetry.
  - Use of GHRS FLYLIM.
  - GHRS target acquisitions on faint targets assisted by FOS acquisitions.

- Item #12 — **Special Requirements** — Justify any special scheduling requirements for real-time, dark-time, time-critical, continuous-viewing-zone (CVZ), and target-of-opportunity (TOO) observations. For TOO objects, indicate their probability of occurrence during Cycle 5, and how soon *HST* must begin observing them after occurrence. Note that the earliest *HST* can begin TOO observations is 2–5 days after notification.

- Item #13 — **Supporting/Coordinated Observations** — Describe plans for conducting coordinated and/or supporting observations with other facilities.

- Item #14 — **Related HST Programs** — List your own and your Co-Investigators' allocations of *HST* observing time over the past two years, together with the current status of the data (cite publications, where appropriate). Highlight and describe any allocations of time related to the current proposal.

- Item #15 — **Justify Duplications** — Justify, on a target-by-target basis, any possible or potential duplication with previously accepted GO or GTO observing programs. Use the DUP flag in the observation summary to identify the duplicated observations. See the *Call for Proposals* for a discussion and definition of duplications.

  A catalog of all past and planned GO and GTO observing programs will be available to allow proposers to check for duplications. This catalog will consist of two parts: a list of exposures, and the proposal abstracts. Proposers can use the "Duplication Check" and "Abstracts" screens in StarView (see Appendix E for detailed instructions) to search this catalog for existing or planned HST observations which conflict with (or support) those they are proposing. Although most users will find it easiest to use StarView to search for duplications, ASCII versions of the duplication exposures and abstracts catalogs are also available for anonymous ftp or online examination on STEIS. If necessary, a hardcopy version of this catalog may be obtained from USB upon request.

  Snapshot survey targets may not duplicate approved GO or GTO programs. Following selection, investigators will define the target samples and may be called upon to assist in the elimination of target duplications.

4 HOW TO CALCULATE ORBITS FOR OBSERVING PROPOSALS

Beginning with Cycle 5, *HST* observing time will be allocated in units of spacecraft orbits instead of spacecraft time as in the past. For this reason, we have created a new procedure for estimating resources, which will allow GOs to determine the number of orbits needed to accomplish their science objectives. The new procedure is "paper-and-pencil" only, with no software needed, and is more accurate than the old Phase I Resource Estimator since the times and overheads are broken out rather than averaged. In the past, many GOs have implicitly tried to pack orbits (thus allowing for a more efficient observing program), which sometimes resulted in a large oversubscription in Phase II. This new procedure allows for explicit orbit packing, and dramatically reduces the possibility of inconsistencies with the more detailed Phase II submission. Finally, this procedure will serve as an introduction to Phase II, which requires a similar layout of the observations (only at a more detailed level). For assistance with any questions or problems, please contact the User Support Branch before the appropriate proposal deadline.

An *HST* orbit normally contains 52-60 minutes (depending on the declination of the target) of useful observing time (the "visibility period"). Some fraction of this time must be used for various overheads. The exact amount of overhead time is determined by several different factors. This document describes a simple way of determining the number of orbits required for your proposal, taking all these factors into account. Before we explain how this is done we first need to define the concept of a *visit*.

4.1 VISITS

A **visit** is an exposure or series of consecutive exposures, with overheads, on a given target, and may consist of the following parts:

1. guide-star acquisition (to point *HST* at the target)
2. target acquisition (to place the target in an instrument aperture)
3. science exposure(s) (to obtain the data)
4. instrument overheads (to set up the instrument and read out the data)
5. instrument calibrations/overheads (if more than standard calibration is required)

   If the visit lasts more than one orbit, it will continue with the following for each subsequent orbit:

6. guide-star re-acquisition (to keep *HST* pointed and locked after earth occultation)
7. science exposure(s)

8. instrument overheads

9. instrument calibrations/overheads

Thus, a typical visit for a spectroscopic observation (for the cameras, a target acquisition is not required) may look schematically like the following:

Orbit 1	G.S. Acq.	Target Acq.	Science Exp.	Over head	Science Exp.	Over head	Earth Occult.
Orbit 2	G.S. Reacq.	Science Exp.	Over head	Science Exp.	Over head	End of Visit	

Note that some portion of the overheads may occur before the science exposure, but for the purposes of this calculation the overheads are all assumed to follow.

A *new visit* is required whenever a new set of guide stars must be acquired. Thus, whenever the following occurs, a new visit must be defined:

1. *A change in target position* of greater than 2′. Note that solar-system objects that move more than 2′ during the observations may not necessarily require a new visit. Any questions concerning solar-system targets may be addressed to the scientists in the STScI Science Planning Branch (410-338-5080).

2. *Repeated, periodic, or other time-separated observations* with an interval between exposures such that one or more empty visibility periods would otherwise be required (e.g., to obtain an image of an object every 30 days for 5 times, or to obtain a spectrum of an object at phases 0.0, 0.3, 0.6). As a result, no visit should contain empty visibility periods.

3. *Required large ($> 5°$) changes in spacecraft roll orientation.* These generally force the usage of different guide star pairs, and are therefore treated as separate visits.

4. *A change in instrument* (e.g., FOC/96 to FOS/RD), except that coordinated primary and parallel observations are contained within the same visit. The switching of instruments requires a change of guide stars. However, switching between FOS/RD and FOS/BL, as well as GHRS Side 1 and Side 2, may be done within a single visit.

The maximum duration for a single visit is generally limited by the number of consecutive SAA-free orbits (9 orbits); for shorter visits the impact of the SAA can be eliminated or minimized by careful scheduling (to place the SAA in the portion of the orbit when the target is occulted). **Visits longer than 9 orbits must be broken into separate smaller visits,** each with their own guide star and target acquisitions. If you feel that this does not apply to your program, please contact the User Support Branch. For astrometric observations using the FGS, each individual set (consisting of target object and reference objects) may be obtained in one visit if there is no telescope motion made during the sequence.

4.2 HOW TO CALCULATE THE NUMBER OF ORBITS

Step 1. Define your Observations and Group them into Visits

The first step in determining the number of orbits is to define the observations (instrument, mode, disperser, number of exposures, and exposure time) you need to execute on each target to accomplish your scientific objectives. You will then need to group your observations into separate visits following the rules given above.

Step 2. Determine the Visibility Period

The second step is for you to determine the "visibility period" for each target, which is defined as the amount of unocculted time per orbit (i.e., the amount of time per orbit during which observations can be made). This is done by using Table 2 below, which gives the visibility period as a function of target declination; values are also provided for moving targets, and for observations requiring dark or CVZ observing conditions.

Dark Time: this refers to observing when *HST* is in Earth shadow. It hence does *not* correspond to the ground-based concept of the sky being dark, but of the telescope being in the dark. If you **require** dark time for your observations, then you have 25 minutes in which to obtain your science exposures regardless of target declination. Note that you may perform guide-star acquisitions/re-acquisitions, as well as end-of-orbit overheads, outside the narrower dark-time window (see the WFPC2 example in Appendix G).

MT (Moving Targets): these objects are generally in or near the ecliptic plane, so the visibility period will be ~53 minutes.

CVZ (Continuous Viewing Zone): the parts of the sky where the telescope can point continuously for an entire orbit(s) without being occulted by the Earth (see the *Call for Proposals* for details). If you can utilize CVZ time for your observations, then the visibility period is 96 minutes per orbit for 9 orbits, beyond which time SAA interference will limit the visibility to 75 minutes per orbit for the next 7 orbits. A detailed examination of all the observing constraints has shown that substantial scheduling opportunities for CVZ observing exist in the zones $57^\circ \leq |\delta| \leq 72^\circ$ (see Appendix F). It is to the proposer's advantage to select CVZ targets if possible, since the long visibility period of 96 minutes per orbit will allow a factor of two competitive advantage in terms of required resource charge (orbits) to perform the same science observations relative to typical non-CVZ targets. For Cycle 5 proposers may take advantage of the CVZ based solely on efficiency grounds. Some special requirements, especially DARK TIME, are inconsistent with CVZ observations; there are no orbits for which *HST* remains occulted from solar illumination. (CVZ orbits do not, in general,

Table 2: Orbital Visibility

|Declination|	Visibility (minutes)
0°-13°	52
13°-33°	53
33°-43°	54
43°-48°	55
48°-53°	56
53°-58°	59
58°-63°	58
63°-68°	60
68°-73°	59
73°-78°	58
78°-88°	56
83°-90°	55
See text for the following:	
DARK TIME	25
MT	53
CVZ	96

encounter brighter sky conditions than occur for ordinary observations.) It is also not possible to schedule observations that require special timing as CVZ targets. Observations sets that will use (Phase II Special Requirements): ORIENT, TARG OF OPPortunity, AFTER, AT, BEFORE, or PHASE restrictions should therefore adopt the non-CVZ target visibility period for resource estimation.

Only limited CVZ observing opportunities exist for targets in the 53°-56° and 73°-77° declination zones, e.g., a target at the extreme CVZ declination limits may have only one CVZ passage of only several hours at one time during the yearly cycle. In this case scheduling becomes time critical and could come into conflict with other observations or contingencies. For these declination ranges the proposer may choose from two options: 1) Utilize the high efficiency assumption of 96 minutes per orbit CVZ visibility for Phase I. An allocation that proves infeasible to schedule during the CVZ opportunity will not, however, be executed, since the award was made based on the associated low resource request. Through the more competitive resource request, this option would improve your odds with a TAC that may be a factor of many oversubscribed, but would incur a small risk of proving impossible to schedule. 2) Use the standard orbit visibility (Table 2). The observation might still be executed while in the CVZ for reason of overall efficiency, or, if necessary, at the lower efficiency outside the CVZ.

Step 3. Map out the Orbits in each Visit

The third step is for you to fit science exposures and necessary overheads into the visibility period of each orbit, for all the visits required. The better you can pack your orbits, the more efficient your proposal will be. Examples of how this can be done for each instrument, and for several observing modes, are provided in Appendix G. Standard worksheets are provided for each science instrument in Appendix G. However, you **should not** submit the worksheets with your Phase I proposal.

Step 3.1 Guide Star Acquisitions

For all observations (except WFPC2 SNAPs, see below), a guide-star acquisition is required, which takes 12 minutes. At the beginning of subsequent orbits in a multi-orbit visit, a shorter guide-star re-acquisition is required, which takes 6 minutes. For CVZ observations in which the visibility period is 96 minutes, guide-star re-acquisitions are not required; however, if your CVZ observation extends into SAA-impacted orbits (see discussion following Table 2), then guide-star re-acquisitions are required for those orbits. If you are obtaining very short exposures with the WFPC2 (in a Snapshot proposal) and wish to utilize the gyro guiding mode (see the *Call for Proposals* for pointing accuracy information), then use of guide stars is not required.

Step 3.2 Target Acquisitions

Following the guide-star acquisition, a target acquisition may be required, depending on the instrument used.

FGS, WFPC2, FOC: For the FGS, there is no target acquisition needed. Most WFPC2 and FOC observations also do not require a target acquisition. However, if you require precise positioning of the target (accuracy better than 1-2″) with the cameras, you will need an interactive acquisition (see the *Call for Proposals*, the *Instrument Handbooks*, and below).

GHRS: Essentially all observations with the GHRS require an onboard target acquisition. If you plan to obtain your observations in the Large Science Aperture (1.″74), then allocate 11 minutes for the acquisition. If you plan to obtain your observations in the Small Science Aperture (0.″22), or if you need extremely accurate centering in the Large Science Aperture, then you must also perform a peakup target acquisition, which takes an additional 8 minutes.

Note that for extremely bright targets, you will need to use the attentuated mirror A2, which has acquisition times of 20 minutes for the Large Science Aperture, and 17 minutes for the additional peakup. To determine if you must use the A2 mirror, see the updated Figure 7-6 in the GHRS *Instrument Handbook.*

FOS: As with the GHRS, almost all observations with the FOS require a target acquisition. However, there are more options with the FOS, based on the type of target and the aperture you wish to utilize for your science exposures. For targets whose magnitude at the time of observation are certain to be within ±0.5 mag **of the submitted values**, are not extended, have a known energy distribution, and are faint enough for the MIRROR to be safe, then a Binary Search acquisition, which takes 9 minutes, can be used. If your science exposures utilize an aperture other than the 4″.3 or the 1″.0 (either single or pair), then you need to perform an additional peakup acquisition to center the target properly, which takes 12, 25, 10, or 13 minutes for the 0″.5, 0″.3, SLIT, or BAR, respectively.

For objects that do not fit the above, then a series of peakup target acquisitions must be performed, with the number of steps dependent on the aperture used to obtain your science:

- The use of the 4″.3 or 1″.0 apertures need a 3-stage peakup, which takes 7 + 14 + 25 (=46) minutes.
- The 0″.5 aperture needs a 4-stage peakup, which takes 7 + 14 + 12 + 17 (=50) minutes.
- The 0″.3 aperture needs a 4-stage peakup, which takes 7 + 14 + 25 + 25 (=71) minutes.
- The SLIT aperture needs a 4-stage peakup, which takes 7 + 14 + 25 + 10 (=56) minutes.
- The BAR aperture needs a 4-stage peakup, which takes 7 + 14 + 25 + 13 (=59) minutes.

Note that an FOS target acquisition sequence *may require more than one orbit*, and can be broken up between stages as shown above (see the FOS example in Appendix G). If you are doing an offset target acquisition (e.g., acquire a bright star, then offset to a fainter target), you need to perform an extra (25 minutes) peakup to properly center the faint target.

Early Acquisitions: Early Acquisitions are simply science images obtained in visit 1, followed by science images/spectra obtained in visit 2 (scheduled at a later time).

Interactive Acquisition: If you require an interactive acquisition, treat the image obtained as a science exposure (see below), then add 30 minutes for the realtime contact (which may overlap the occultation interval at the end of an orbit). Interactive acquisition with the FOS and GHRS are generally not recommended; if you feel you need to utilize this capability, please consult the *Instrument Handbooks* and contact the Science Instruments Branch.

Step 3.3 Science Exposures and Instrument Overheads

Following the target acquisition, you should place the science exposures in the orbit. The time allocation for these exposures consist of two parts — the exposure time and the instrument overhead. The exposure times were determined in Step 1, while the instrument overheads are given in Table 3 below (and on the worksheets) for each instrument operating mode.

WFPC2: Note that all WFPC2 images with exposure times longer than 10 minutes will be split (by default in the ratio 0.5±0.2) to allow for cosmic-ray subtraction (CR-SPLIT). These should be counted as separate exposures when mapping out your observations, although one overhead time is required (this time accounts for the fact that there are two exposures). If you have exposures shorter than 10 minutes, or do not wish to split your exposures, then

Table 3: Instrument Overheads

SI	Mode	Time (minutes)	Notes
WFPC2	IMAGE	3	NO CR-SPLIT
		5	CR-SPLIT (2 exposures)
		2	LRF exposures
FOC/96	IMAGE	7	
	ACQ	12	
	OCC	7	
FOS	ACCUM	6	
	RAPID	7	
	IMAGE	6	
	PERIOD	6	
GHRS	IMAGE	6	
	IMAGE	15	For extremely bright targets
	ACCUM	4	
	WSCAN	3	+ 1 minute/wavelength
	OSCAN	5	+ 1 minute/order
	RAPID	4	
		3	Per **WAVECAL** due to grating change
FGS	POS	2	$V < 14^m$
		3	$14^m < V < 15^m$
		4	$15^m < V < 16^m$
		9	$V > 16^m$
	TRANS	3	

use the NO CR-SPLIT overhead time. All exposures with the Linear Ramp Filters (LRF) require an additional 2 minutes of overhead due to repositioning of the telescope.

When placing the science observations into the visit, it is important to note that WFPC2 exposures cannot be paused across orbits. This means that if you have 20 minutes left in an orbit, you can only insert an exposure that takes 20 minutes or less (including overhead). If you wish to obtain a 30 minute exposure, then you can either put it all into the next orbit, or you can specify, e.g., a 20 minute exposure in the first orbit, and a second exposure of 10 minutes in the next orbit (and thus include two exposure overheads).

FOC: FOC exposures cannot be paused across orbits.

FOS: FOS exposures cannot be paused across orbits. FOS side switches may occur within one visit, but there must be 30 minutes between exposures on different sides (which may occur during occultation).

GHRS: GHRS exposures can be paused across orbits (i.e. they are interruptible). User-requested GHRS WAVECALs should be accounted for with a 3-minute overhead. Each use of a new spectral element on GHRS generates a standard WAVECAL (referred to as a SPYBAL); therefore an additional overhead of 3 minutes should be added for each observation that causes a new grating to be used. Note that, for IMAGE mode, if the target is extremely bright, you must use the attenuated mirror A2, which results in a greater overhead (see the GHRS *Instrument Handbook* for details). GHRS side switches may occur within one visit, but there must be 45 minutes between exposures on different sides (which may occur partly during occultation).

FGS: FGS observations cannot be paused across orbits.

Moving Targets: The onboard tracking command that is used for moving-target observations does not allow an observation (exposure plus overhead) to be longer than 33 minutes. The result is that long exposures must be split into two or more shorter exposures with separate instrument overheads for each piece.

Parallel Observations: These are treated just like primary observations. Although the primary program will be responsible for performing the guide-star acquisitions and target acquisitions, the time for these overheads must still be considered in mapping parallel exposures.

For coordinated parallel observations, where you know the visit structure of the prime observations, the mapping of parallels should be straightforward. For pure parallel observations, where you may not know the prime target declinations, you should use one of the following to determine the visibility period:

1. the minimum allowable visibility period based on the target selection criteria converted to a declination range (e.g., if the generic requirement calls for $\delta > 80°$, use 55 minutes)

or

2. if you cannot do the above, map out the exposures (plus overheads) you wish to obtain in an orbit for any legal visibility period (52-60 minutes). If you choose this method, you may need to decrease your exposure times when you are matched with the prime observation if it has a lesser visibility period than you selected; you will be contacted by STScI if a reduction is required.

Step 4. Add up all the orbits

Once all the visits are defined, simply add the number of orbits in each visit, and insert the number of orbits for each target/instrument combination into the proposal template. Note that only **whole** orbits can be requested, and only **whole** orbits will be allocated. (The reason for this limitation is that the combined overhead for slew, guide star acquisition, and other overheads makes it very unlikely that an unused portion of a visibility period can be effectively used by another science program.)

Note that **Snapshot** proposals (see the *Call for Proposals*) will most likely take less than one orbit per observation. Proposers should make certain that each of their exposures (with overheads) require $\leq$1 visibility period. Although whole orbits will be allocated, the actual schedule construction may result in a few orbits per week not being completely filled. It is these holes that are candidate times for SNAPs.

4.0 Special Cases

If you are planning any of the following types of observations, please contact the User Support Branch for assistance in determining your resources:

- Spatial Scans (overhead calculations are complex).
- More than 14 short (1-3 minute) WFPC2 exposures in a visit (these can overload the data paths).
- FOC bright target acquisitions (overheads under review).
- FOS POLSCAN observations (overhead calculations are complex).
- GHRS FLYLIM (see the GHRS *Instrument Handbook*) for controlling background noise on very faint targets (use is complicated).
- GHRS target acquisitions on faint targets assisted by FOS acquisition (capability under final review).

5 INSTRUCTIONS FOR ARCHIVAL RESEARCH PROPOSALS

Completed *HST* observations whose proprietary periods have expired are available to the community through the *HST* Archival Research Program. Funding may also be available for U.S. astronomers to support the analysis of such data. This section describes how to prepare and submit Archival Research proposals *for cases where funding is requested.* See the *Call for Proposals* for a discussion of the *HST* Archival Research Program, and refer to Appendix E for instructions on how to access the *HST* Archive using StarView. Consult the *Archive Primer* for more detailed information about the *HST* Archive, and refer to the *STScI Newsletter* for instructions on how to request archival data when funding is not requested.

Researchers proposing an archival research program that will also utilize data from other NASA centers should submit their AR proposals to the STScI if the majority of the program involves *HST* archival data and its analysis. Conversely, requests for support of archival research programs utilizing data primarily from other missions should follow the guidelines in the appropriate NASA Announcements of Opportunity.

Archival Research proposals (that request funding) should be submitted using the Cycle 5 Phase I Archival Research Proposal Template and budget forms. The scientific justification for AR proposals must be no more than 3 pages in length. Two additional pages for figures, references, and tables are also allowed. Specific instructions for filling out various items in the AR proposal form are given in this section and in the LaTeX template (Appendix C).

- Item #1 – Give a concise title for the proposal.

- Item #2 – Select the appropriate scientific category for the proposed project.

- Item #3 – Enter the name, institutional affiliation, complete address, telephone, electronic mail, and ESA affiliation (if appropriate) of the PI. There must be one *and only one* PI for each proposal.

- Item #4 – Enter the total funds (in U.S. dollars) that are requested.

- Item #5 – Provide a concise abstract describing the proposed observations.

- Item #6 – List the names, institutional affiliations, and countries of all Co-Is. Also indicate whether each Co-I is affiliated with the European Space Agency or with an ESA member-state institution.

- Item #7 – Enter the requested information of an authorizing official of the institution assuming responsibility for the project. The authorizing official should sign and date the paper copy of the Cover Page.

- Item #8 — **Scientific Justification** — Present the scientific justification for the proposed archival program. Do not exceed 3 pages plus an additional two pages for figures, references, and tables.

- Item #9 — **Description of Archival Program** — Provide a generic description of the requested data, and specify the number of exposures requested from the archive.

- Item #10 — **Related, Funded Archival Research** — If you or your Co-Investigators have received any funding for *HST* archival research which is related to this proposal, list the *HST* program IDs, PIs, and titles, and briefly summarize their main results. If this proposal is related to any other Cycle 5 proposals, describe how so.

- Include Budget Forms GF-95-1 through GF-95-3.

5.1 BUDGET FORMS

STScI may provide financial support to U.S. observers and Archival Researchers, subject to availability of funds from NASA. Information concerning the allowability of costs and funding procedures will be found in the *Call for Proposals*.

Archival Researchers must indicate the need for funding on the Proposal Cover Page. Budget Forms GF-95-1 through GF-95-3 are required *only* for Archival Research Proposals. The instructions for filling out the Budget Forms are included on the back of the forms in Appendix H. A copy of the forms should be attached to *both* copies of the proposal.

Specific questions concerning the allowability of costs or the preparation of the budget should be directed to the Grants Administration Branch (410-338-4200).

A TARGET NAMING CONVENTIONS

Target names are used to provide unique designations for the targets throughout the proposal. These names will generally also be used in Phase II, in the *HST* observing schedule, and ultimately to designate targets in the *HST* data archives. Prospective proposers and archival researchers will use these names to determine whether *HST* has observed a particular object. This facility will be most useful if consistent naming conventions are used for targets.

The following convention should be followed in naming targets:

- Each time a distinct telescope pointing is requested, a new target name should be defined. For example, for several pointings within a galaxy, one might define target names like `NGC4486-NUC`, `NGC4486-JET`, `NGC4486-POS1`, and `NGC4486-POS2`.

Catalog Name

The preferred order for catalogs to be used for the designation of various classes of objects is provided below. It is arranged in order of decreasing priority. If a target is not contained in these catalogs, then other catalog designations may be used (e.g., IRC or IRAS Catalog numbers, 4U X-ray Catalog designation, Villanova White-Dwarf Catalog number, etc.). The use of positional catalogs (SAO, Boss, GC, AGK3, FK4, *etc.*) is discouraged. For uncataloged targets, see below.

Stars

1. *Henry Draper Catalog* number (e.g., `HD140283`). HDE numbers are discouraged, except in the Magellanic Clouds.

2. *Durchmusterung* number (BD, CD, or CPD). In the southern hemisphere, adopt the convention of using CD north of −52° and CPD south of that limit (e.g., `BD+30D3639`, `CD-42D14462`).

3. *General Catalog of Variable Stars* designation, if one exists (e.g., `RR-LYR`, `SS-CYG`).

Star Clusters and Nebulae

1. *New General Catalog* (NGC) number (e.g., `NGC6397`, `NGC7027`).

2. *Index Catalog* (IC) number (e.g., `IC418`).

3. For planetary nebulae, the Perek-Kohoutek designation (e.g., `PK208+33D1`).

4. For H II regions, the Sharpless Catalog number (e.g., `S106`).

Galaxies and Clusters of Galaxies

1. NGC number (e.g., NGC4536).
2. IC number (e.g., IC724).
3. Uppsala Catalog number (e.g., UGC11810).
4. For clusters of galaxies, the Abell Catalog number (e.g., ABELL2029).

Quasars and Active Galaxies

The name defined in the compilation by Veron-Cetty and Veron (*ESO Report No. 13*, 1993) should be used (e.g., 3C273).

Uncataloged Targets

Objects that have not been catalogued or named should be assigned one of the following designations:

1. Isolated objects should be designated by a code name (the allowed codes are STAR, NEB, GAL, STAR-CLUS, GAL-CLUS, QSO, SKY, FIELD, and OBJ), followed by a hyphen and the object's J2000 equatorial coordinates, if possible, rounded to minutes of time and minutes of arc (e.g., for an optical binary star at J2000 coordinates $\alpha = 1^h34^m28^s$, $\delta = -15°31'38''$, the designations would be STAR-0134-1531A and STAR-0134-1531B).
2. Uncataloged objects within star clusters, nebulae, or galaxies should be designated by the name of the parent body followed by a hyphen and a type designation of the object (e.g., for a star cluster within NGC 224, the designation would be NGC224-STARCLUS).
3. Known objects within nebulae or galaxies may also be designated by the name of the parent object followed by a hyphen and an identifier of the target object. The identifier should be brief, but informative (e.g., the jet in NGC 4486 could be designated NGC4486-JET). Other examples are: NGC5139-ROA24, LMC-R136A, ABELL30-CENSTAR, NGC205-NUC.

External Calibration Targets

The name of a target that is being observed only as a calibration standard for other observations should be designated by appending the code -CAL to the target name (e.g., BD28D4211-CAL). Internal calibration targets (e.g., WAVE, INTFLAT) and calibrations using the Earth should *not* be included in the OS, but in Item #11 — Description of the Observations — of the proposal form.

B SCIENTIFIC INSTRUMENT PARAMETERS

This section provides tabular listings of the valid configurations, modes, and spectral elements for the various Scientific Instruments for use in the Observation Summary (Item #9 of the observing proposal form). Refer to the respective *Instrument Handbook(s)* for more detail.

Table 4: Scientific Instrument Configurations, Modes, and Spectral Elements

Configuration	Mode	Spectral Elements
WFPC2	IMAGE	Any entry in Table 5 (Appendix B).
FOC/96	IMAGE	(see Table 6, Appendix B)
	ACQ	
	OCC	
FOS/BL or FOS/RD	ACCUM	Any entry in Table 7 (Appendix B).
	IMAGE	
	PERIOD	
	RAPID	
HRS	ACCUM	Any entry in Table 8 (Appendix B).
	IMAGE	
	RAPID	
	WSCAN	Any entry in Table 8, except the mirrors.
	OSCAN	ECH-A, ECH-B (see Table 8)
FGS	POS	F550W, F583W, F605W, F650W, F5ND, PUPIL
	TRANS	

Table 5: Spectral Elements for the WFPC2

The following Spectral Elements are available for the WFPC2. See the WFPC2 *Instrument Handbook* for more detailed descriptions and a discussion of combinations of Spectral Elements that are not allowed. Only one filter per filter wheel (column 2) may be selected.

Name[1]	Wheel	Comments	Central Wavelength (Å)	Effective Width (Å)
		FILTERS		
F122M	1	(red leak)	1368	340
F130LP	2		4796	5365
F160BW	1	Woods B	1523	483
F165LP	2		5002	5036
F170W	8		1730	500
F185W	8		1933	308
F218W	8		2159	358
F255W	8		2553	393
F300W	9	"Wide *U*"	2911	745
F336W	3	"*U*"	3344	381
F343N	5	Ne V	3424	25
F375N	5	3727 redshifted	3737	27
F380W	9		3960	675
F390N	5	CN	3889	45
F410M	3		4090	147
F437N	5	[O III]	4369	25
F439W	4	"*B*"	4300	475
F450W	10	"Wide *B*"	4521	958
F467M	3		4669	166
F469N	6	He II	4695	25
F487N	6	Hβ	4866	26
F502N	6	[O III]	5013	27
F547M	3		5479	486
F555W	9		5407	1236
F569W	4	"*V*"	5624	974
F588N	6	He I, Na I	5893	49
F606W	10	"Wide *V*"	5957	1509
F622W	9		6170	917
F631N	7	[O I]	6283	31
F656N	7	Hα	6564	21
F658N	7	[N II]	6590	29
F673N	7	[S II]	6732	47
F675W	4	"*R*"	6714	877
F702W	10	"Wide *R*"	6895	1389
F785LP	2		8674	1407
F791W	4	"*I*"	7829	1218
F814W	10	"Wide *I*"	7940	1531

— *continued* —

Table 5 - Spectral Elements for the WFPC2 (continued)

Name[1]	Wheel	Comments	Central Wave-length (Å)	Effective Width (Å)
		FILTERS		
F850LP	2		9124	1051
F953N	1	[S III]	9534	61
F1042M	11		10201	382
FQUVN	11	Redshifted [O II]	3765-3992	63
FQCH4N	11	Methane Bands	5443-8922	46
POLQ[2]	11	Polarizer Quad 0,45,90,135°	5592 (7191)	4489 (5144)
LRF[3]	12	Linear Ramp Filter Set	3700-9802	1.06% of CW

Notes to Table 5:

[1]Name codes: F = filter, FQ = quadrant filter, LP = long-wavelength pass, LRF = linear ramp filter set, POLQ = polarizer quad (must be used with a filter for focus). See the WFPC2 *Instrument Handbook* for details. Narrow filters (N) have R < 3%, medium filters (M) have R = 3%–15%, and wide filters (W) have R > 15% (where R = FWHM/Effective Wavelength).

[2] The polarized light component parallel (perpendicular) to filters encounters the mean responses as listed (see the WFPC2 *Instrument Handbook*). The polarizers must always be used in conjunction with a filter to provide in-focus images (e.g., enter F336W+POLQ on the OS). See the WFPC2 *Instrument Handbook* for legal combinations. Note that F1042M and the quad filters may not be used with a polarizer since they are on the same wheel.

[3] There are small gaps in the available coverage; see the WFPC2 *Instrument Handbook* for details.

Table 6: Spectral Elements for the FOC

The following Spectral Elements are available for the FOC. See the FOC *Instrument Handbook* for more detailed descriptions and a discussion of combinations of Spectral Elements that are not allowed.

Name	Wheel-Position	Comments	Wavelength at Peak (Å)	Full Width at Half Maximum (Å)
		FOC/96		
F120M	3-3	Medium Band	1230	84
F130M	3-6	Medium Band	1280	88
F130LP	4-7	Long Pass (≥1300)	3450	2224
F140M	3-9	Medium Band	1400	178
F140W	2-6	Wide Band	1370	294
F152M	3-4	Medium Band	1500	186
F165W	3-11	Wide Band	1652	884
F170M	3-8	Medium Band	1760	184
F175W	2-7	Wide Band	1730	706
F190M	3-7	Medium Band	1990	276
F195W	3-10	Wide Band	2100	952
F210M	3-2	Medium Band	2150	212
F220W	2-8	Wide Band	2270	482
F231M	3-12	Medium Band	2330	230
F253M	4-9	Medium Band	2550	234
F275W	2-9	Wide Band	2760	592
F278M	4-10	Medium Band	2800	314
F307M	4-11	Medium Band	3080	326
F320W [1]	2-10	Wide Band	3360	860
F342W	2-3	Wide Band, "U"	3400	704
F346M	4-2	Medium Band, "u"	3480	434
F370LP	2-2	Long Pass (≥3700)	4000	878
F372M [2]	4-6	Medium Band	3700	410
F410M	4-3	Medium Band, "v"	4090	194
F430W	2-4	Wide Band, "B"	3990	788
F437M [3]	4-12	Medium Band	4290	436
F470M	4-4	Medium Band, "b"	4710	212
F480LP	2-5	Long Pass (≥4800), "V"	5080	718
F486N	2-11	Interference	4870	34
F501N [3]	2-12	Interference	5010	74

— *continued* —

Table 6 – Spectral Elements for the FOC (continued)

Name	Wheel-Position	Comments	Wavelength at Peak (Å)	Full Width at Half Maximum (Å)
		FOC/96 - continued		
F502M [3]	4-8	Medium Band	4940	530
F550M	4-5	Medium Band, "y"	5460	188
F600M	1-5	Medium Band	5800	402
F630M	1-6	Medium Band	6380	208
F1ND	3-5	Neutral Density (1 mag)	3398	2164
F2ND	1-4	Neutral Density (2 mag)	3250	2166
F4ND	1-8	Neutral Density (4 mag)	3398	2166
F6ND	1-9	Neutral Density (6 mag)	3090	2338
F8ND	1-2	Neutral density (8 mag)	3420	2106
POL0	1-7	Polarizer (0 deg)	3400	2214
POL60	1-11	Polarizer (60 deg)	3402	2456
POL120	1-3	Polarizer (120 deg)	3402	2580
PRISM1	1-12	Objective Prism (FUVOP)	3400	2260
PRISM2	1-10	Objective Prism (NUVOP)	3400	2162
CLEAR	1-1,	Clear Aperture (no element)	—	—
	2-1,	Clear Aperture (no element)	—	—
	3-1,	Clear Aperture (no element)	—	—
	4-1	Clear Aperture (no element)	—	—

Notes to Table 6:

[1] Filter F320W produces a large shift (~85 pixels) in position in FOC/96.

[1] Filter F372M produces a bar across the PSF core.

[3] Filters F437M, F501N, and F502M produce ghosts in FOC/96.

Table 7: Spectral Elements for the FOS

The following Spectral Elements are available for the FOS. See the FOS *Instrument Handbook* for more information.

Name	Spectral Range, FOS/BL (Å)	Spectral Range, FOS/RD (Å)	Resolving Power
	DISPERSERS AND MIRROR		
G130H	1150 – 1606	————	1300
G190H	1573 – 2330	1565 – 2312	1300
G270H	2222 – 3301	2223 – 3278	1300
G400H	3240 – 4823	3238 – 4784	1300
G570H	4575 – 6872[1]	4571 – 6820	1300
G780H	————	6272 – 9219[3]	1300
G160L	1150 – 2510[2]	1600 – 2430	250
G650L	3540 – 9022[1]	3540 – 8729	250
PRISM	1850 – 5500	1850 – 8950[3]	400 – 25
MIRROR	1150 – 5500	1650 – 9000	——

POLARIZERS[4]

Name	Description
POL<angle>-A	This requests the use of waveplate A. Fill in <angle> with the appropriate value of the polarization angle. The 16 options are 0, 22.5, ..., 337.5, in steps of 22°5. (e.g., POL45-A specifies waveplate A at 45° and POL67.5-A specifies 67°5). If more than one polarization angle is requested, then list *only the first polarization angle* on the OS.
POL<angle>-B	This requests the use of waveplate B. The polarization angles are the same as for waveplate A.

Notes to Table 7:

[1]Quantum efficiency of the blue tube is very low longward of 5500 Å.

[2]Note that the first-order spectrum longward of 2300 Å is contaminated by the second-order spectrum, but its contribution is at a few percent level.

[3]Quantum efficiency of the red tube is very low longward of 8600 Å.

[4]The waveplates must be used with the G190H or G270H spectral elements. Polarization capabilities will be diminished by the two extra reflections introduced by COSTAR optics. At the time of writing, the polarization calibrations were not yet carried out. See STEIS for the most up-to-date status of polarimetry. Implementation of accepted polarimetric proposals is contingent on successful polarimetry calibration tests.

Table 8: Spectral Elements for the GHRS

The following Spectral Elements are available for the GHRS. See the GHRS *Instrument Handbook* for more information.

Name	Useful Range (Å)	Detector[1]	Spectral Coverage (Å)	Dispersion (Å/diode)
		FIRST-ORDER GRATINGS		
G140L	1050–1900	Digicon 1	300	0.60
G140M	1050–1900	Digicon 1	30	0.060
G160M	1100–2000	Digicon 2	34	0.069
G200M	1600–2400	Digicon 2	40	0.078
G270M	2200–3200	Digicon 2	46	0.092
		ECHELLE		
ECH-A	1050–1700 (orders 53–33)[2]	Digicon 1	5–9	0.011–0.017
ECH-B	1677–3209 (orders 33–18)[2]	Digicon 2	8–18	0.017–0.035
		MIRRORS		
	(MIRROR selected on the basis of target brightness) [3]			
MIRROR-N1	"normal" reflectivity with Digicon 1			
MIRROR-N2	"normal" reflectivity with Digicon 2			
MIRROR-A1	"attenuated" reflectivity with Digicon 1			
MIRROR-A2	"attenuated" reflectivity with Digicon 2			

Notes to Table 8:

[1] Digicon 1 has a CsI photocathode and a LiF_2 entrance window. Digicon 2 has a CsTe photocathode and a MgF_2 entrance window.

[2] Generally the grating orders will be determined by the central wavelengths of the observations. The proposer may override this default by appending the grating order number to the grating name (e.g., ECH-B29 would be used to request the 29th order of Echelle B). Note that in Phase I a series of echelle observations at a variety of wavelengths can be combined on a single OS exposure line so that grating order numbers can be omitted (see page 10).

[3] Under normal circumstances observers should acquire an object with a mirror appropriate to the same detector being used for their science observations. Switching from one detector to the other requires as much as 1.5 hours.

Table 9: Spectral Elements for the FGS

The following Spectral Elements are available for the FGS. See the FGS *Instrument Handbook* for more information.

Name	Comments	Effective Wavelength (Å)	Full Width at Half Maximum (Å)
F583W	"Clear" filter	5830	2340
F5ND	Neutral Density (5 mag)	.....	.....
F605W[1]	"Astrometry Clear" filter	6050	1900
F650W[2]	"Red" filter	6500	750
F550W	"Yellow" filter	5500	750
PUPIL	Pupil Stop	.....	.....

Notes to Table 9:

[1] F605W is to be used only with FGS3.

[2] F650W is to be used with FGS1 and FGS2.

C THE HST PHASE I PROPOSAL TEMPLATES

The *HST* Phase I Observing Proposal Template and the *HST* Phase I Archival Research Proposal Template are available from STEIS. These files should be transferred to the proposer's local computer for editing. See Appendix D for details on how to access the relevant files.

C.1 Blank Observing Proposal Template

```
%       obstemplate.tex  (use artemplate.tex for Archival Research proposals)
%
%
%       HUBBLE SPACE TELESCOPE
%       PHASE I OBSERVING PROPOSAL TEMPLATE
%       FOR CYCLE 5 (1994)
%
%       Version 1.2                            May 9 1994
%
%         Both a PAPER and an ELECTRONIC version of each proposal must be
%       submitted.  This LaTeX template is needed to prepare the electronic
%       version.  You may also use LaTeX to format and print this template,
%       (using the accompanying style file) and use the output for the
%       paper submission.  Most of the input you will be asked to provide
%       must be given within the curly braces {} provided.  The LaTeX
%       comment character is the percent sign -- anything you type that
%       has a percent sign to the left of it on the same line will be
%       ignored; if you need to have a percent sign appear in your text,
%       use \% instead.  Experienced LaTeX users may be tempted to alter
%       styles and fonts to squeeze more text into the allowed space --
%       PLEASE DO NOT DO THIS!
%
%         Since this is a LaTeX document, you can use the special
%       characters you may need.  In addition, a few astronomical
%       symbols have been defined for you in the style file
%
%               \ang            the Angstrom unit
%               \degpoint       degree symbol and decimal point together
%               \halpha         H alpha
%               \hbeta          H beta
%               \hgamma         H gamma
%               \kms            kilometers per second
%               \minpoint       arcmin symbol and decimal point together
%               \peryr          yr superscript -1
%               \secpoint       arcsec symbol and decimal point together
%               \subsun         subscripted solar symbol
%               \sun            solar symbol
%
%         Many LaTeX users will be familiar with ways to incorporate
%       Encapsulated PostScript graphics into a document.  If you are
```

```
%       using this form to prepare formatted output for submission on
%       paper, feel free to use any of these methods to add figures
%       to your scientific justification or to any of the questions
%       that follow the scientific justification.
%
%         To use this template for proposal submission on PAPER, edit this
%       file, format it using LaTeX, and print out a paper copy of
%       the formatted proposal.  If you want us to do most of the
%       copying, make 2 copies of the formatted proposal; otherwise,
%       make 20 copies.  Append any supplementary materials to each
%       copy, and mail them to:
%
%               Space Telescope Science Institute
%               User Support Branch, Room S420
%               3700 San Martin Drive
%               Baltimore, Maryland USA 21218
%
%       Then e-mail your completed LaTeX template (THIS file, not any of the
%       other LaTeX output files) by the Phase I proposal deadline to:
%
%               newprop@stsci.edu  (Internet)
%           or  stscic::newprop    (NSI/DECnet)
%
%       You will receive an acknowledgement message via e-mail within one
%       working day of your proposal submission.  Contact the User Support
%       Branch at STScI (410-338-5015 or usb@stsci.edu) if you need assistance
%       with any aspect of proposing for and using HST.
%
%       The template begins below.  Do not alter the following two lines:

\documentstyle[phase1]{article}
\begin{document}

%    1. TITLE
%
%       Please supply a TITLE for your proposal, within the curly braces.
%       Keep your title short enough to be formatted onto no more than
%       two lines.  This translates roughly into 100-120 characters.

\title  {}

%    2. PROPOSAL CATEGORY
%
%       Specify the appropriate PROPOSAL CATEGORY by uncommenting
%       (deleting the percent sign in front of) only one of the entries
%       in the following list.  Leave the other categories commented out.

\proposalcategory       {GO}    % General Observer proposal
%\proposalcategory      {SNAP}  % Snapshot proposal
%\proposalcategory      {DD}    % Director's Discretionary proposal

%    3. SCIENTIFIC CATEGORY
%
%       Select the SCIENTIFIC CATEGORY that best describes your
```

```
%       proposal by uncommenting its entry in the following list.
%       Leave the other categories commented out.

%\scientificcategory    {Galaxies \& Clusters}
%\scientificcategory    {Cool Stars}
%\scientificcategory    {Hot Stars}
%\scientificcategory    {Stellar Populations}
%\scientificcategory    {Quasars}
%\scientificcategory    {AGN}
%\scientificcategory    {Interstellar Medium}
%\scientificcategory    {Solar System}

%    4. 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}.
%
%       Use \\ to break lines in your address, as in
%
%       \address{Science Hall\\4321 University Avenue\\Anytown, MD 21218}
%
%       but limit yourself to four lines (three \\'s).

\PIfirstname    {}
\PIlastname     {}
\institution    {}      % Please do not abbreviate.
\address        {}      % Complete the postal address for your institution.
\telephone      {}
\email          {}
\country        {}      % Country of above named institution.
\USstate        {}      % 2-letter code required for US proposers only
%\ESAmember     {yes}   % Uncomment this line only if you are an ESA member.

%    5. INSTRUMENTS
%
%       Indicate the INSTRUMENTS requested in your proposal by
%       uncommenting all of the relevant lines in the list below.
%       Leave the other instruments commented out (or delete them):

%\instrument    {WFPC2}         % Wide Field Planetary Camera 2
%\instrument    {FOC}           % Faint Object Camera
%\instrument    {FOS}           % Faint Object Spectrograph
%\instrument    {GHRS}          % Goddard High Resolution Spectrograph
%\instrument    {FGS}           % Fine Guidance Sensor


%   6.  TOTAL NUMBER OF ORBITS or TOTAL NUMBER OF TARGETS
%
%       There are two questions here, but only one applies to
%       your proposal:
%
%   6a. IF (and only if) this is a General Observer or Director's
```

```
%       Discretionary observing proposal, please indicate the
%       TOTAL NUMBER OF ORBITS requested in the primary and parallel
%       categories for each of this observing cycle, the next
%       observing cycle, and the observing cycle after next.

\thiscycleprimary       {}      % Cycle 5 primary orbits
\thiscycleparallel      {}      % Cycle 5 parallel orbits

\nextcycleprimary       {}      % Cycle 6 primary orbits
\nextcycleparallel      {}      % Cycle 6 parallel orbits

\afternextprimary       {}      % Cycle 7 primary orbits
\afternextparallel      {}      % Cycle 7 parallel orbits

%   6b. On the other hand, IF this is a Snapshot observing proposal,
%       please indicate the TOTAL NUMBER OF TARGETS requested.

\totaltargets           {}      % Total number of SNAPshot targets.

%    7. ABSTRACT
%
%       Enter your ABSTRACT between the \begin{abstract} and
%       \end{abstract} commands.  The text of your abstract, when typeset
%       with the style file provided with this form, must fit on the
%       first page of printed output.  This translates into approximately
%       20 lines of 80 characters each.

\begin{abstract}
%       Your text goes here.

\end{abstract}

%    8. CO-INVESTIGATORS
%
%       Identify each CO-INVESTIGATOR (CoI) by replicating the following items
%       for each (space for 2 CoIs are provided below; add more as needed).
%       If you have no CoIs, leave these lines unchanged and proceed to
%       the next section:  the OBSERVATION SUMMARY.

\begin{investigators}

\CoIfirstname   {}      % include title here if desired; ex: {Dr. Bob}
\CoIlastname    {}
\institution    {}      % Please do not abbreviate.
\country        {}      % Country of above named institution.
\USstate        {}      % 2-letter code required for US investigators only
%\ESAmember     {yes}   % Uncomment this line only if you are an ESA member.

\CoIfirstname   {}      % Next Co-Investigator.... (add more as needed)
\CoIlastname    {}
\institution    {}
\country        {}
\USstate        {}
%\ESAmember     {yes}
```

```
\end{investigators}

%    9. OBSERVATION SUMMARY
%
%       Enter an OBSERVATION SUMMARY for proposed Cycle 5 observation
%       between the \begin{observations} and \end{observations} commands.
%       For each individual observation, please specify each of the items
%       that follow (2 sets are provided below to start off).  For
%       observations of moving and generic targets, leave the braces {}
%       empty for \ra{} and \dec{}.
%
%       For General Observer and Director's Discretionary proposals,
%       list all of the proposed observations for the current cycle.
%       Please check that the sum of \totalorbits is equal to the sum
%       of \thiscycleprimary and \thiscycleparallel in section 6a.
%
%       For SNAPshot proposals, list sample observations.

\begin{observations}

\target          {}      % Target name (see Target Naming Conventions in
                         %  the Phase I Proposal Instructions).
\ra              {}      % Right ascension coodinates, ex: {05 23}
\dec             {}      % Declination coordinates, ex: {-37 55}
\magnitude       {}      % Visual magnitude of the target
\configuration   {}      % WFPC2,FOC/96,FOS/RD,FOS/BL,HRS, or FGS
\mode            {}      % Instrument mode (see Table 4 of the Instructions)
\spectralelements{}      % Spectral elements (filters,gratings...)  Use
                         %  spaces to separate items in a list.
\totalorbits     {}      % Orbits required for this observation
\flags           {}      % Enter PAR,CVZ,TOO,DUP,DT as applicable, where:
                         %       PAR <==> parallel,
                         %       CVZ <==> continuous viewing zone,
                         %       TOO <==> target of opportunity,
                         %       DUP <==> duplicate, and
                         %       DT  <==> dark time.

\target          {}      % Next observation....  add more as needed
\ra              {}
\dec             {}
\magnitude       {}
\configuration   {}
\mode            {}
\spectralelements{}
\totalorbits     {}
\flags           {}

\end{observations}

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%                                                                          %
%       If you are NOT using this form for your PAPER submission, and      %
%       are using it only for ELECTRONIC SUBMISSION, STOP HERE.            %
```

```
%                                                                    %
%       However, if you plan to use this form for PAPER submission as  %
%       well, please continue on to the general questions that follow. %
%                                                                    %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%   10. SCIENTIFIC JUSTIFICATION
%
%       Present the SCIENTIFIC JUSTIFICATION for the proposed program,
%       including its goals and expected significance to astronomy.
%       Include a brief description of the scientific background and
%       previous relevant work.  Justify the need for the capabilities
%       of HST, and discuss the extent to which the program has been
%       pursued by means of ground-based or other space observations.
%       Enter your justification after the \justification command.
%       For small (less than 100 orbits) and SNAPshot  proposals, do
%       not exceed 3 pages.  For large proposals requesting more than
%       100 orbits, up to 6 pages are allowed.

\justification          % Do not delete this command

% Enter your justification here.


%   11. DESCRIPTION OF THE OBSERVATIONS
%
%       Provide a short DESCRIPTION of the proposed observations ---
%       by cycle for Long-Term projects.  Explain the amount of
%       exposure time and number of orbits requested (e.g., number of
%       objects, examples of exposure-time calculations and orbit
%       estimations for some typical observations, etc.).  Explicitly
%       describe any calibration requirements for your observations.
%       SNAPshot proposals should identify the requested guiding mode
%       and the requested proprietary data-rights period for the exposures.

\describeobservations   % Do not delete this command.

% Enter your description here.


%   12. SPECIAL REQUIREMENTS
%
%       Justify any SPECIAL SCHEDULING REQUIREMENTS for real-time,
%       dark-time, time-critical, continuous-viewing-zone (CVZ), and/or
%       target-of-opportunity (TOO) observations.  For TOO objects,
%       indicate their probability of occurrence during Cycle 5, and how
%       soon HST must begin observing them after occurrence.  Note that
%       the earliest HST can begin TOO observations is 2--5 days after
%       notification.

\specialreq             % Do not delete this command.

% Enter your requirements here, if any.
```

```
%   13. SUPPORTING/COORDINATED OBSERVATIONS
%
%       Describe plans for conducting coordinated and/or SUPPORTING
%       OBSERVATIONS with other facilities.


\supportingobs          % Do not delete this command.

% Enter your plans here, if any.


%   14. RELATED HST PROGRAMS
%
%       List your own and your Co-Investigators' allocation of HST
%       OBSERVING TIME over the past two years, together with the
%       current status of the data (cite publications, where appropriate).
%       Highlight and describe any allocations of time related to the
%       current proposal.

\relatedprograms        % Do not delete this command.

% Enter your summary here, if any.


%   15. JUSTIFY DUPLICATIONS
%
%       Justify, on a target by target basis, any DUPLICATION with
%       previously accepted GO or GTO observing programs.  Use the
%       DUP flag in the observation summary to identify the duplicated
%       observations.

\duplications           % Do not delete this command.

% Enter your comments here, if any.


\end{document}          % End of proposal.  Do not delete this line.
```

C.2 Example of Completed Observing Template

```
%       obsexample.tex
%
%       obstemplate.tex  (use artemplate.tex for Archival Research proposals)
%
%
%       HUBBLE SPACE TELESCOPE
%       PHASE I OBSERVING PROPOSAL TEMPLATE
%       FOR CYCLE 5 (1994)
%
%       Version 1.2                           May 9 1994
%
%         Both a PAPER and an ELECTRONIC version of each proposal must be
%       submitted.  This LaTeX template is needed to prepare the electronic
%       version.  You may also use LaTeX to format and print this template,
%       (using the accompanying style file) and use the output for the
%       paper submission.  Most of the input you will be asked to provide
%       must be given within the curly braces {} provided.  The LaTeX
%       comment character is the percent sign -- anything you type that
%       has a percent sign to the left of it on the same line will be
%       ignored; if you need to have a percent sign appear in your text,
%       use \% instead.  Experienced LaTeX users may be tempted to alter
%       styles and fonts to squeeze more text into the allowed space --
%       PLEASE DO NOT DO THIS!
%
%         Since this is a LaTeX document, you can use the special
%       characters you may need.  In addition, a few astronomical
%       symbols have been defined for you in the style file
%
%               \ang            the Angstrom unit
%               \degpoint       degree symbol and decimal point together
%               \halpha         H alpha
%               \hbeta          H beta
%               \hgamma         H gamma
%               \kms            kilometers per second
%               \minpoint       arcmin symbol and decimal point together
%               \peryr          yr superscript -1
%               \secpoint       arcsec symbol and decimal point together
%               \subsun         subscripted solar symbol
%               \sun            solar symbol
%
%         Many LaTeX users will be familiar with ways to incorporate
%       Encapsulated PostScript graphics into a document.  If you are
%       using this form to prepare formatted output for submission on
%       paper, feel free to use any of these methods to add figures
%       to your scientific justification or to any of the questions
%       that follow the scientific justification.
%
%         To use this template for proposal submission on PAPER, edit this
%       file, format it using LaTeX, and print out a paper copy of
%       the formatted proposal.   If you want us to do most of the
```

```
%       copying, make 2 copies of the formatted proposal; otherwise,
%       make 20 copies.  Append any supplementary materials to each
%       copy, and mail them to:
%
%               Space Telescope Science Institute
%               User Support Branch, Room S420
%               3700 San Martin Drive
%               Baltimore, Maryland USA 21218
%
%       Then e-mail your completed LaTeX template (THIS file, not any of the
%       other LaTeX output files) by the Phase I proposal deadline to:
%
%               newprop@stsci.edu  (Internet)
%           or  stscic::newprop    (NSI/DECnet)
%
%       You will receive an acknowledgement message via e-mail within one
%       working day of your proposal submission.  Contact the User Support
%       Branch at STScI (410-338-5015 or usb@stsci.edu) if you need assistance
%       with any aspect of proposing for and using HST.
%
%       The template begins below.  Do not alter the following two lines:

\documentstyle[phase1]{article}
\begin{document}

%     1. TITLE
%
%       Please supply a TITLE for your proposal, within the curly braces.
%       Keep your title short enough to be formatted onto no more than
%       two lines.  This translates roughly into 100-120 characters.

\title  {High-resolution imagery of the recurrent nova T~Pyx's next eruption}

%     2. PROPOSAL CATEGORY
%
%       Specify the appropriate PROPOSAL CATEGORY by uncommenting
%       (deleting the percent sign in front of) only one of the entries
%       in the following list.  Leave the other categories commented out.

\proposalcategory       {GO}    % General Observer proposal
%\proposalcategory      {SNAP}  % Snapshot proposal
%\proposalcategory      {DD}    % Director's Discretionary proposal

%     3. SCIENTIFIC CATEGORY
%
%       Select the SCIENTIFIC CATEGORY that best describes your
%       proposal by uncommenting its entry in the following list.
%       Leave the other categories commented out.

%\scientificcategory    {Galaxies \& Clusters}
%\scientificcategory    {Cool Stars}
%\scientificcategory    {Hot Stars}
%\scientificcategory    {Stellar Populations}
%\scientificcategory    {Quasars}
```

```
%\scientificcategory    {AGN}
\scientificcategory     {Interstellar Medium}
%\scientificcategory    {Solar System}

%    4. 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}.
%
%       Use \\ to break lines in your address, as in
%
%       \address{Science Hall\\4321 University Avenue\\Anytown, MD 21218}
%
%       but limit yourself to four lines (three \\'s).

\PIfirstname    {Michael}
\PIlastname     {Shara}
\institution    {Space Telescope Science Institute}
                        % Please do not abbreviate.
\address        {3700 San Martin Drive\\Baltimore, MD USA 21218}
                        % Complete the postal address for your institution.
\telephone      {410-516-4543}
\email          {mshara@stsci.edu}
\country        {USA}   % Country of above named institution.
\USstate        {MD}    % 2-letter code required for US proposers only
%\ESAmember     {yes}   % Uncomment this line only if you are an ESA member.


%    5. INSTRUMENTS
%
%       Indicate the INSTRUMENTS requested in your proposal by
%       uncommenting all of the relevant lines in the list below.
%       Leave the other instruments commented out (or delete them):

\instrument     {WFPC2}         % Wide Field Planetary Camera 2
%\instrument    {FOC}           % Faint Object Camera
%\instrument    {FOS}           % Faint Object Spectrograph
%\instrument    {GHRS}          % Goddard High Resolution Spectrograph
%\instrument    {FGS}           % Fine Guidance Sensor

%   6.  TOTAL NUMBER OF ORBITS or TOTAL NUMBER OF TARGETS
%
%       There are two questions here, but only one applies to
%       your proposal:
%
%   6a. IF (and only if) this is a General Observer or Director's
%       Discretionary observing proposal, please indicate the
%       TOTAL NUMBER OF ORBITS requested in the primary and parallel
%       categories for each of this observing cycle, the next
%       observing cycle, and the observing cycle after next.

\thiscycleprimary       {30}    % Cycle 5 primary orbits
```

```
\thiscycleparallel      {}      % Cycle 5 parallel orbits

\nextcycleprimary       {5}     % Cycle 6 primary orbits
\nextcycleparallel      {}      % Cycle 6 parallel orbits

\afternextprimary       {5}     % Cycle 7 primary orbits
\afternextparallel      {}      % Cycle 7 parallel orbits


%   6b. On the other hand, IF this is a SNAPshot observing proposal,
%       please indicate the TOTAL NUMBER OF TARGETS requested.

\totaltargets           {}      % Total number of SNAPshot targets.

%    7. ABSTRACT
%
%       Enter your ABSTRACT between the \begin{abstract} and
%       \end{abstract} commands.  The text of your abstract, when typeset
%       with the style file provided with this form, must fit on the
%       first page of printed output.  This translates into approximately
%       20 lines of 80 characters each.

\begin{abstract}

The recurrent nova T~Pyxidis displays at least three concentric shells
from its most recent eruptions (1920, 1944, and 1966).  It is one
of only a dozen novae with known shells, and the only recurrent nova
with clearly resolved circumstellar matter.  A unique and once-only
opportunity will exist during T~Pyxidis' next eruption (now overdue)
to determine 1) The uniformity and isotropy of material (both dust
and different chemical elements) ejected in previous eruptions, and 2)
The smallest structures formed in nova eruptions.  The Planetary Camera
will be used to obtain narrowband hydrogen, helium, nitrogen and oxygen
images, as well as broadband images.  These will be used to search for
fluorescence and reflection light echoes from, and small-scale structure
in, the nova circumstellar gas and dust ejecta.  This proposal was granted
HST time during Cycle~1.  The time was rescinded after the spherical
aberration problem was discovered.  The refurbished {\it HST\/} and WFPC2 will
be able to carry out the scientific goals of the original proposal.

\end{abstract}

%    8. CO-INVESTIGATORS
%
%       Identify each CO-INVESTIGATOR (CoI) by replicating the following items
%       for each (space for 2 CoIs are provided below; add more as needed).
%       If you have no CoIs, leave these lines unchanged and proceed to
%       the next section:  the OBSERVATION SUMMARY.

\begin{investigators}

\CoIfirstname   {Robert}% include title here if desired; ex: {Dr. Bob}
\CoIlastname    {Williams}
\institution    {Space Telescope Science Institute}
```

```
                         % Please do not abbreviate.
\country        {USA}    % Country of above named institution.
\USstate        {MD}     % 2-letter code required for US investigators only
%\ESAmember     {yes}    % Uncomment this line only if you are an ESA member.

\CoIfirstname   {Dina}   % Next Co-Investigator.... (add more as needed)
\CoIlastname    {Prialnik}
\institution    {Tel-Aviv University}
\country        {Israel}
\USstate        {}
%\ESAmember     {yes}

\end{investigators}

%    9. OBSERVATION SUMMARY
%
%       Enter an OBSERVATION SUMMARY for proposed Cycle 5 observation
%       between the \begin{observations} and \end{observations} commands.
%       For each individual observation, please specify each of the items
%       that follow (2 sets are provided below to start off).  For
%       observations of moving and generic targets, leave the braces {}
%       empty for \ra{} and \dec{}.
%
%       For General Observer and Director's Discretionary proposals,
%       list all of the proposed observations for the current cycle.
%       Please check that the sum of \totalorbits is equal to the sum
%       of \thiscycleprimary and \thiscycleparallel in section 6a.
%
%       For SNAPshot proposals, list sample observations.

\begin{observations}

\target         {TPYX}  % Target name (see Target Naming Conventions in
                        %  the Phase I Proposal Instructions).
\ra             {09 05} % Right ascension coodinates, ex: {05 23}
\dec            {$-32$ 23}% Declination coordinates, ex: {-37 55}
\magnitude      {18.3}  % Visual magnitude of the target
\configuration  {WFPC2} % WFPC2,FOC/96,FOS/RD,FOS/BL,HRS, or FGS
\mode           {IMAGE} % Instrument mode (see Table 4 of the Instructions)
\spectralelements{F450W F622W F375N F469N F502N F656N F658N}
                        % Spectral elements (filters,gratings...)  Use
                        %  spaces to separate items in a list.
\totalorbits    {5}     % Orbits required for this observation
\flags          {TOO}   % Enter PAR,CVZ,TOO,DUP,DT as applicable, where:
                        %       PAR <==> parallel,
                        %       CVZ <==> continuous viewing zone,
                        %       TOO <==> target of opportunity,
                        %       DUP <==> duplicate, and
                        %       DT  <==> dark time.

\target         {TPYX}  % Target name (see Target Naming Conventions in
                        %  the Phase I Proposal Instructions).
\ra             {09 05} % Right ascension coodinates, ex: {05 23}
\dec            {$-32$ 23}% Declination coordinates, ex: {-37 55}
```

```
\magnitude       {18.3}  % Visual magnitude of the target
\configuration   {WFPC2} % WFPC2,FOC/96,FOS/RD,FOS/BL,HRS, or FGS
\mode            {IMAGE} % Instrument mode (see Table 4 of the Instructions)
\spectralelements{F450W F622W F375N F469N F502N F656N F658N}
\totalorbits     {5}     % Orbits required for this observation
\flags           {TOO}   % Enter PAR,CVZ,TOO,DUP,DT as applicable, where:

\target          {TPYX}  % Target name (see Target Naming Conventions in
                         %  the Phase I Proposal Instructions).
\ra              {09 05} % Right ascension coodinates, ex: {05 23}
\dec             {$-32$ 23}% Declination coordinates, ex: {-37 55}
\magnitude       {18.3}  % Visual magnitude of the target
\configuration   {WFPC2} % WFPC2,FOC/96,FOS/RD,FOS/BL,HRS, or FGS
\mode            {IMAGE} % Instrument mode (see Table 4 of the Instructions)
\spectralelements{F450W F622W F375N F469N F502N F656N F658N}
\totalorbits     {5}     % Orbits required for this observation
\flags           {TOO}   % Enter PAR,CVZ,TOO,DUP,DT as applicable, where:

\target          {TPYX}  % Target name (see Target Naming Conventions in
                         %  the Phase I Proposal Instructions).
\ra              {09 05} % Right ascension coodinates, ex: {05 23}
\dec             {$-32$ 23}% Declination coordinates, ex: {-37 55}
\magnitude       {18.3}  % Visual magnitude of the target
\configuration   {WFPC2} % WFPC2,FOC/96,FOS/RD,FOS/BL,HRS, or FGS
\mode            {IMAGE} % Instrument mode (see Table 4 of the Instructions)
\spectralelements{F450W F622W F375N F469N F502N F656N F658N}
\totalorbits     {5}     % Orbits required for this observation
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\target          {TPYX}  % Target name (see Target Naming Conventions in
                         %  the Phase I Proposal Instructions).
\ra              {09 05} % Right ascension coodinates, ex: {05 23}
\dec             {$-32$ 23}% Declination coordinates, ex: {-37 55}
\magnitude       {18.3}  % Visual magnitude of the target
\configuration   {WFPC2} % WFPC2,FOC/96,FOS/RD,FOS/BL,HRS, or FGS
\mode            {IMAGE} % Instrument mode (see Table 4 of the Instructions)
\spectralelements{F450W F622W F375N F469N F502N F656N F658N}
\totalorbits     {5}     % Orbits required for this observation
\flags           {TOO}   % Enter PAR,CVZ,TOO,DUP,DT as applicable, where:

\target          {TPYX}  % Target name (see Target Naming Conventions in
                         %  the Phase I Proposal Instructions).
\ra              {09 05} % Right ascension coodinates, ex: {05 23}
\dec             {$-32$ 23}% Declination coordinates, ex: {-37 55}
\magnitude       {18.3}  % Visual magnitude of the target
\configuration   {WFPC2} % WFPC2,FOC/96,FOS/RD,FOS/BL,HRS, or FGS
\mode            {IMAGE} % Instrument mode (see Table 4 of the Instructions)
\spectralelements{F450W F622W F375N F469N F502N F656N F658N}
\totalorbits     {5}     % Orbits required for this observation
\flags           {TOO}   % Enter PAR,CVZ,TOO,DUP,DT as applicable, where:

\end{observations}

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
%                                                                   %
%       If you are NOT using this form for your PAPER submission, and   %
%       are using it only for ELECTRONIC SUBMISSION, STOP HERE.         %
%                                                                   %
%       However, if you plan to use this form for PAPER submission as   %
%       well, please continue on to the general questions that follow.  %
%                                                                   %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%   10. SCIENTIFIC JUSTIFICATION
%
%       Present the SCIENTIFIC JUSTIFICATION for the proposed program,
%       including its goals and expected significance to astronomy.
%       Include a brief description of the scientific background and
%       previous relevant work.  Justify the need for the capabilities
%       of HST, and discuss the extent to which the program has been
%       pursued by means of ground-based or other space observations.
%       Enter your justification after the \justification command.
%       For small (less than 100 orbits) and SNAPshot  proposals, do
%       not exceed 3 pages.  For large proposals requesting more than
%       100 orbits, up to 6 pages are allowed.

\justification          % Do not delete this command

% Enter your justification here.

%       %%%%%%% NOTE %%%%%%%
%
%       The text that follows was re-cast into LaTeX from Mike Shara's
%       proposal in a manner that preserves much of the look of
%       the original, while making use of the special characters,
%       sectioning, and table layout commands available in LaTeX.
%       We did this simply to illustrate the possibilities, and do not
%       suggest that you are REQUIRED to make use of any of these
%       features, or that your proposal should be altered to look
%       like this one.

\section{Scientific Background and Previous Work}

 Recurrent novae (RN) are the rarest class of cataclysmic variables,
 brightening dramatically for a few weeks every few decades.  All
 classical-nova explosions are believed to be violent thermonuclear
 runaways on the surfaces of white dwarfs accreting hydrogen-rich matter
 from a very close nondegenerate companion star.  Although RN outbursts
 resemble those of classical novae, the latter are believed to have
 eruptions separated by thousands of years (Patterson 1984, ApJS, 54, 433;
 Shara et al.\ 1986, ApJ, 311, 163).  Several authors have proposed that RN
 occur only on white dwarfs near the Chandrasekhar mass limit.  Such
 massive white dwarfs need only accrete a very thin hydrogen-rich shell
 from their main-sequence companions before erupting.  A few decades
 is long enough for this process to occur.

 In an exhaustive review of the subject of recurrent novae, Webbink et al.\
 (1987, ApJ, 314, 653) concluded that there were only four certain members
```

of the class: RS~Oph, T~CrB, U~Sco, and T~Pyx. Furthermore, only the U~Sco and T~Pyx outbursts appear to be certain thermonuclear runaways (TNRs), and thus genuinely related to classical novae. (V693~CrA and LMC~1990~1 have recently been proposed as recurrent TNR novae.) T~Pyx is considerably brighter than U~Sco (when both are at minimum) and probably considerably closer (Webbink et al.\ 1987). A better understanding of T~Pyx is therefore central to the nature of recurrent novae, and to what differentiates them from classical novae. This is particularly true because the rather slow outbursts (see below) of T~Pyx disagree with the TNR simulations on very massive white dwarfs, which predict extremely rapid outbursts and declines.

The recurrent nova T~Pyx has five recorded outbursts to its credit (1890, 1902, 1920, 1944, 1966), all of which were very similar photometrically (Mayall 1967, JRAS Canada, 61, 349). The slow rise and decline of the optical light curves indicate that the luminosity of T~Pyx at maximum cannot greatly exceed the Eddington limit (Webbink et al.\ 1987), and suggest that the underlying white dwarf is not particularly massive.

Catchpole's (1969, MNRAS, 142, 119) spectroscopic observations showed ''principal ejecta'' absorption features at $V=850$\kms, and other absorption indicative of velocities up to $2,000$\kms. While Catchpole (1969) found no spectroscopic evidence of circumstellar matter, narrowband \halpha\ imaging of T~Pyx by Duerbeck and Seitter (1979, ESO Messenger, 17, 3) and Williams (1982, ApJ, 261, 170) has revealed a shell with diameter $15''$ surrounding the star.

Shara, Moffat, Williams, and Cohen (1989, ApJ, 337, 720) have obtained deep CCD images of T~Pyx that have revealed a faint extended \halpha\ + [N~II] halo twice as large as the previously detected shell. A net [O~III] image displays a smooth, significantly smaller shell (see figures). We have ruled out the possibility of the T~Pyx shell being associated with a planetary nebula-type ejection for two reasons: the shell mass is less than $10^{-4}\,M\subsun$, and the shell expansion velocity is 350\kms.

Comparison of the 1980 and 1985 images of the shell (Shara et al.\ 1989) show an expansion of less than 10\%. If the bright, inner shell is due to the 1966 eruption, it should have expanded about 36\% from 1980 to 1985 (assuming uniform shell expansion).

This expansion velocity is much slower than the 850\kms and $2,000$\kms velocities reported by Catchpole (1969) during the 1966 outburst.
If the $15''$ diameter shell is from the 1966 outburst, then the ejecta have given up most of their bulk kinetic energy by interaction with circumstellar matter. Alternately, significant amounts of (now visible) low-velocity material were ejected during the last outburst. The lack of strong [O~I] λ6300 and [S~II] λ6717,34 emission lines argues against much shock interaction at the present era and, indirectly for the 1944 identification of the $15''$ shell, while thermonuclear runaway models support the idea of multiple velocity ejection. A point-spread function subtracted from an \halpha\ + [N~II] image of T~Pyx has revealed a $2''$ radius ring around the central star. This is probably the ejecta from the 1966 eruption. We are proposing to image the T~Pyx shell,

```
(and particularly the $2''$ ring) before, during, and after the next
eruption.  This will yield the highest resolution (by an order of
magnitude) imagery ever obtained for the matter ejected from a compact
object.

\section{Significance to Astronomy}

Nova shells are well worth studying because their morphologies and
dynamics contain information about the ejection process from the
underlying white dwarf, and the interaction of the ejecta with the
white dwarf's companion star.  It is likely that some or all nova
thermonuclear runaways (TNR) begin in small, localized areas
(Shara 1982, ApJ, 261, 649) on the host white dwarf.  The isotropy
and homogeneity of the mass-ejection process, and possibly the chemical
homogeneity of of the ejecta is then largely dependent on how quickly
spheri-symmetrization of the TNR occurs.

If much of the hydrogen-rich mass is ejected before
spheri-symmetrization occurs, irregularly shaped, clumpy and/or unipolar
outflows should be observed.  Only a handful of novae are well-enough
resolved to derive conclusions about shapes; most are claimed to be
prolate ellipsoids.  However, {\it no information exists about small-scale
structures\/} ($<1'' = 10^{16}\,$cm at 1~kpc) in the ejecta, or about the
ejecta morphology shortly after eruption.  A few narrowband
images indicate strong chemical and/or ionization inhomogeneities in the
ejecta (Shara et al.\ 1989; Duerbeck 1987, ESO Messenger, 50, 8), but no
quantitative data exist.

\section{Scientific Goals}

A once-in-twenty-five years opportunity for nova studies will arise when
T~Pyx next erupts.  Based on its past 5 eruptions (every 20--24~years), an
explosion is almost certainly due in the next year or two.  T~Pyx is the
only recurrent nova with clearly visible ejecta, and hence the only nova
certain to illuminate its circumstellar shells during the lifetime of
{\it HST\/}.  We propose to use the Planetary Camera CCD to image the nova
shell in the brightest emission lines seen its spectra (Williams 1982, ApJ,
261, 170) before, during and after eruption.  Narrowband filters at \halpha,
He~II, [N~II], [O~II] and [O~III], as well as reference images in $B$ and
$R$, will be taken as soon as possible after {\it HST\/} refurbishment
(hopefully before the next eruption!); and then 5, 10, 20, 40, 100, 200, and
600~days after eruption. (This proposal is thus, of necessity, a
(rather urgent) GO cycle 4 proposal, a target-of-opportunity proposal,
and a long-term proposal.)

As ejected material expands away from the explosion at roughly
$2 \times 10^8\,$cm/s, the newly formed shell should begin to be resolvable
(0.1--0.2 arcsec) in $5 \times 10^6\,$seconds, i.e.\ 2~months.  After 2~years
ground-based imagery will be able to resolve the inner shell and follow
subsequent evolution and expansion of the ejected gas.  This dictates
the timescale and frequency of the last three observation sets in the
previous paragraph.

The light sphere from the nova flash expands at
```

```
 the rate of $1''$/week at the distance of T~Pyx (1~kpc). (This dictates the
 timescale of the first four proposed visits).  We will search
 for successively more distant dust and gas from previous eruptions
 to determine how much previous debris has now become too faint to see,
 and the smallest visible structures in older ejecta.  We will also search
 for systematic chemical and/or ionization structures in the previous
 eruptions ejecta as the expanding nova flash lights it up.

 In summary, we expect to be able to resolve spatial and chemical
 structures in the ejecta of a nova only a few nova photospheric
 radii in size ($10^{15}\,$cm).  We will also see light echoes and
 fluorescence from the dust and gas, respectively, ejected in the last
 two or three eruptions.  Because T~Pyx erupts only once per generation
 (and is now overdue), and because this is the only known nova with
 multiple concentric shells, this is an important target which is
 perfectly suited to the refurbished HST's capabilities.

\section{The Need for HST}

 The highest possible spatial resolution is essential to resolve the
 nova ejecta, and follow the expanding light flash and echoes
 during the first two years after eruption.  We also need
 one set of images (to compare the ``before'' with the ``after'') before
 the nova erupts.

 One target, T~Pyx, the only recurrent nova with multiple shells.
 Quiescent emission line fluxes from the T~Pyx shell (Williams, ApJ,
 261,170) imply  $V + AB_v = 23$--24; we use the $QT$ integral = 0.05\%
 for the \halpha\ filter, and an exposure time of 1800~seconds
 to find $N_e = 100$--300 electrons/PC pixel.

 Five narrowband filters $\times 0.5$~hours/filter +
 two broadband filters $\times 0.1$ hours/filter= 5.0 orbits/visit.

 Observing time spread over 2--3 years.

%   11. DESCRIPTION OF THE OBSERVATIONS
%
%       Provide a short DESCRIPTION of the proposed observations ---
%       by cycle for Long-Term projects.  Explain the amount of
%       exposure time and number of orbits requested (e.g., number of
%       objects, examples of exposure-time calculations and orbit
%       estimations for some typical observations, etc.).  Explicitly
%       describe any calibration requirements for your observations.
%       SNAPshot proposals should identify the requested guiding mode
%       and the requested proprietary data-rights period for the exposures.

\describeobservations          % Do not delete this command.

% Enter your description here.

 We propose to image the environs of the only recurrent nova with a
 shell, before (Cycle~4), during, and after (Cycle~4, 5, or~6) its upcoming
 eruption.  We will image through narrow-band filters corresponding to the
```

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 most common elements and ionization stages seen in nova ejecta.  We will
 also obtain reference broadband images to allow narrowband-broadband
 differencing.

\begin{tabular}{lll}
 Cycle 5  & Primary Orbits:30  & Exposures:84\\
 Cycle 6  & Primary Orbits:5   & Exposures:14\\
 Cycle 7  & Primary Orbits:5   & Exposures:14
\end{tabular}

%   12. SPECIAL REQUIREMENTS
%
%       Justify any SPECIAL SCHEDULING REQUIREMENTS for real-time,
%       dark-time, time-critical, continuous-viewing-zone (CVZ), and/or
%       target-of-opportunity (TOO) observations.  For TOO objects,
%       indicate their probability of occurrence during Cycle 5, and how
%       soon HST must begin observing them after occurrence.  Note that
%       the earliest HST can begin TOO observations is 2--5 days after
%       notification.

\specialreq

% Enter your requirements here, or delete this item entirely.

 First set of (pre-eruption) images requested immediately (before next
 eruption).  Target of opportunity; first exposures requested 100 hours
 after eruption discovery.  Then about 5, 10, 20, 40, 100, 200 and 600
 days after eruption.

%   13. SUPPORTING/COORDINATED OBSERVATIONS
%
%       Describe plans for conducting coordinated and/or SUPPORTING
%       OBSERVATIONS with other facilities.

\supportingobs          % Do not delete this command.

% Enter your plans here, if any.
None.

%   14. RELATED HST PROGRAMS
%
%       List your own and your Co-Investigators' allocation of HST
%       OBSERVING TIME over the past two years, together with the
%       current status of the data (cite publications, where appropriate).
%       Highlight and describe any allocations of time related to the
%       current proposal.

\relatedprograms

% Enter your summary here, or delete this item entirely.

\begin{tabular}{lll}
GO-2472 & Binaries in Globular Clusters                        & Shara\\
GO-2441 & Search for Wolf-Rayet Stars in Local Group
```

```
        Giant H~II Regions  & Shara\\
GO-3872 & Blue Stragglers in the Cores of Globular Clusters   & Shara
\end{tabular}

\section{Unrelated programs:}

GO-2472  Using time resolved photometry of a Galactic globular core to
search for binaries.  The present proposal uses color-magnitude diagrams
to search for binaries (as well as blue stragglers) in Magellanic
clusters.  The data reductions are complete and a paper is being written.
Two low-amplitude variable candidates were found in the core of NGC~6752,
far fewer than expected in this dense cluster.

GO-3872  Color-magnitude diagrams of the cores of several Galactic
globulars are being constructed to search for blue stragglers.
First observations were obtained less than a month ago, reductions
are beginning.

GO-2441  Use narrowband versus broadband He~II 4686 imagery to resolve
Wolf-Rayet stars in the cores of Giant H~II regions in M33.
All datasets reduced and paper published.

%   15. JUSTIFY DUPLICATIONS
%
%       Justify, on a target by target basis, any DUPLICATION with
%       previously accepted GO or GTO observing programs.  Use the
%       DUP flag in the observation summary to identify the duplicated
%       observations.

\duplications           % Do not delete this command.

% Enter your comments here, if any.
None.
\end{document}          % End of proposal.  Do not delete this line.
```

C.3 Example of Printed Observing Proposal

The following example is the printed version of the completed observing template in Appendix C.2.

High-resolution imagery of the recurrent nova T Pyx's next eruption

Principal Investigator:	Michael Shara
Institution:	Space Telescope Science Institute 3700 San Martin Drive Baltimore, MD USA 21218
Telephone:	410-516-4543
Electronic mail:	mshara@stsci.edu
ESA member:	No

Scientific category:	Interstellar Medium
Instruments:	WFPC2

Cycle 5 primary orbits:	30	Cycle 7 primary orbits:	5
Cycle 5 parallel orbits:	0	Cycle 7 parallel orbits:	0
Cycle 6 primary orbits:	5	Total all cycles primary orbits:	40
Cycle 6 parallel orbits:	0	Total all cycles parallel orbits:	0

Abstract

The recurrent nova T Pyxidis displays at least three concentric shells from its most recent eruptions (1920, 1944, and 1966). It is one of only a dozen novae with known shells, and the only recurrent nova with clearly resolved circumstellar matter. A unique and once-only opportunity will exist during T Pyxidis' next eruption (now overdue) to determine 1) The uniformity and isotropy of material (both dust and different chemical elements) ejected in previous eruptions, and 2) The smallest structures formed in nova eruptions. The Planetary Camera will be used to obtain narrowband hydrogen, helium, nitrogen and oxygen images, as well as broadband images. These will be used to search for fluorescence and reflection light echoes from, and small-scale structure in, the nova circumstellar gas and dust ejecta. This proposal was granted HST time during Cycle 1. The time was rescinded after the spherical aberration problem was discovered. The refurbished *HST* and WFPC2 will be able to carry out the scientific goals of the original proposal.

	Investigator	Institution	Country
PI:	Michael Shara	Space Telescope Science Institute	USA/MD
CoI:	Robert Williams	Space Telescope Science Institute	USA/MD
CoI:	Dina Prialnik	Tel-Aviv University	Israel

Total number of investigators: 3
Number of ESA investigators: 0 (indicated by * after name)

Target	RA	DEC	V	Configuration,mode,spectral elements	Total orbits	Flags
TPYX	09 05	−32 23	18.3	WFPC2 IMAGE F450W F622W F375N F469N F502N F656N F658N	5	TOO
TPYX	09 05	−32 23	18.3	WFPC2 IMAGE F450W F622W F375N F469N F502N F656N F658N	5	TOO
TPYX	09 05	−32 23	18.3	WFPC2 IMAGE F450W F622W F375N F469N F502N F656N F658N	5	TOO
TPYX	09 05	−32 23	18.3	WFPC2 IMAGE F450W F622W F375N F469N F502N F656N F658N	5	TOO
TPYX	09 05	−32 23	18.3	WFPC2 IMAGE F450W F622W F375N F469N F502N F656N F658N	5	TOO
TPYX	09 05	−32 23	18.3	WFPC2 IMAGE F450W F622W F375N F469N F502N F656N F658N	5	TOO
				Grand total orbit request	30	

Scientific Justification

1 Scientific Background and Previous Work

Recurrent novae (RN) are the rarest class of cataclysmic variables, brightening dramatically for a few weeks every few decades. All classical-nova explosions are believed to be violent thermonuclear runaways on the surfaces of white dwarfs accreting hydrogen-rich matter from a very close nondegenerate companion star. Although RN outbursts resemble those of classical novae, the latter are believed to have eruptions separated by thousands of years (Patterson 1984, ApJS, 54, 433; Shara et al. 1986, ApJ, 311, 163). Several authors have proposed that RN occur only on white dwarfs near the Chandrasekhar mass limit. Such massive white dwarfs need only accrete a very thin hydrogen-rich shell from their main-sequence companions before erupting. A few decades is long enough for this process to occur.

In an exhaustive review of the subject of recurrent novae, Webbink et al. (1987, ApJ, 314, 653) concluded that there were only four certain members of the class: RS Oph, T CrB, U Sco, and T Pyx. Furthermore, only the U Sco and T Pyx outbursts appear to be certain thermonuclear runaways (TNRs), and thus genuinely related to classical novae. (V693 CrA and LMC 1990 1 have recently been proposed as recurrent TNR novae.) T Pyx is considerably brighter than U Sco (when both are at minimum) and probably considerably closer (Webbink et al. 1987). A better understanding of T Pyx is therefore central to the nature of recurrent novae, and to what differentiates them from classical novae. This is particularly true because the rather slow outbursts (see below) of T Pyx disagree with the TNR simulations on very massive white dwarfs, which predict extremely rapid outbursts and declines.

The recurrent nova T Pyx has five recorded outbursts to its credit (1890, 1902, 1920, 1944, 1966), all of which were very similar photometrically (Mayall 1967, JRAS Canada, 61, 349). The slow rise and decline of the optical light curves indicate that the luminosity of T Pyx at maximum cannot greatly exceed the Eddington limit (Webbink et al. 1987), and suggest that the underlying white dwarf is not particularly massive.

Catchpole's (1969, MNRAS, 142, 119) spectroscopic observations showed "principal ejecta" absorption features at $V = 850\,\mathrm{km\ s^{-1}}$, and other absorption indicative of velocities up to $2,000\,\mathrm{km\ s^{-1}}$. While Catchpole (1969) found no spectroscopic evidence of circumstellar matter, narrowband Hα imaging of T Pyx by Duerbeck and Seitter (1979, ESO Messenger, 17, 3) and Williams (1982, ApJ, 261, 170) has revealed a shell with diameter 15″ surrounding the star.

Shara, Moffat, Williams, and Cohen (1989, ApJ, 337, 720) have obtained deep CCD images of T Pyx that have revealed a faint extended Hα + [N II] halo twice as large as the previously detected shell. A net [O III] image displays a smooth, significantly smaller shell (see figures). We have ruled out the possibility of the T Pyx shell being associated with a planetary nebula-type ejection for two reasons: the shell mass is less than $10^{-4}\,M_{\odot}$, and the shell expansion velocity is $350\,\mathrm{km\ s^{-1}}$.

Comparison of the 1980 and 1985 images of the shell (Shara et al. 1989) show an expansion of less than 10%. If the bright, inner shell is due to the 1966 eruption, it should have expanded about 36% from 1980 to 1985 (assuming uniform shell expansion).

This expansion velocity is much slower than the 850 km $s^{-1}$and 2,000 km s^{-1}velocities reported by Catchpole (1969) during the 1966 outburst. If the 15″ diameter shell is from the 1966 outburst, then the ejecta have given up most of their bulk kinetic energy by interaction with circumstellar matter. Alternately, significant amounts of (now visible) low-velocity material were ejected during the last outburst. The lack of strong [O I] λ6300 and [S II] λ6717,34 emission lines argues against much shock interaction at the present era and, indirectly for the 1944 identification of the 15″ shell, while thermonuclear runaway models support the idea of multiple velocity ejection. A point-spread function subtracted from an Hα + [N II] image of T Pyx has revealed a 2″ radius ring around the central star. This is probably the ejecta from the 1966 eruption. We are proposing to image the T Pyx shell, (and particularly the 2″ ring) before, during, and after the next eruption. This will yield the highest resolution (by an order of magnitude) imagery ever obtained for the matter ejected from a compact object.

2 Significance to Astronomy

Nova shells are well worth studying because their morphologies and dynamics contain information about the ejection process from the underlying white dwarf, and the interaction of the ejecta with the white dwarf's companion star. It is likely that some or all nova thermonuclear runaways (TNR) begin in small, localized areas (Shara 1982, ApJ, 261, 649) on the host white dwarf. The isotropy and homogeneity of the mass-ejection process, and possibly the chemical homogeneity of of the ejecta is then largely dependent on how quickly spheri-symmetrization of the TNR occurs.

If much of the hydrogen-rich mass is ejected before spheri-symmetrization occurs, irregularly shaped, clumpy and/or unipolar outflows should be observed. Only a handful of novae are well-enough resolved to derive conclusions about shapes; most are claimed to be prolate ellipsoids. However, *no information exists about small-scale structures* ($< 1'' = 10^{16}$ cm at 1 kpc) in the ejecta, or about the ejecta morphology shortly after eruption. A few narrowband images indicate strong chemical and/or ionization inhomogeneities in the ejecta (Shara et al. 1989; Duerbeck 1987, ESO Messenger, 50, 8), but no quantitative data exist.

3 Scientific Goals

A once-in-twenty-five years opportunity for nova studies will arise when T Pyx next erupts. Based on its past 5 eruptions (every 20–24 years), an explosion is almost certainly due in the next year or two. T Pyx is the only recurrent nova with clearly visible ejecta, and hence the only nova certain to illuminate its circumstellar shells during the lifetime of *HST*. We propose to use the Planetary Camera CCD to image the nova shell in the brightest emission lines seen its spectra (Williams 1982, ApJ, 261, 170) before, during and after eruption. Narrowband filters at Hα, He II, [N II], [O II] and [O III], as well as reference images in *B* and R, will be taken as soon as possible after *HST* refurbishment (hopefully before the next eruption!); and then 5, 10, 20, 40, 100, 200, and 600 days after eruption. (This proposal is thus, of necessity, a (rather urgent) GO cycle 4 proposal, a target-of-opportunity proposal, and a long-term proposal.)

As ejected material expands away from the explosion at roughly 2×10^8 cm/s, the newly formed shell should begin to be resolvable (0.1–0.2 arcsec) in 5×10^6 seconds, i.e. 2 months. After 2 years ground-based imagery will be able to resolve the inner shell and follow subsequent evolution and expansion of the ejected gas. This dictates the timescale and frequency of the last three observation sets in the previous paragraph.

The light sphere from the nova flash expands at the rate of 1″/week at the distance of T Pyx (1 kpc). (This dictates the timescale of the first four proposed visits). We will search for successively more distant dust and gas from previous eruptions to determine how much previous debris has now become too faint to see, and the smallest visible structures in older ejecta. We will also search for systematic chemical and/or ionization structures in the previous eruptions ejecta as the expanding nova flash lights it up.

In summary, we expect to be able to resolve spatial and chemical structures in the ejecta of a nova only a few nova photospheric radii in size (10^{15} cm). We will also see light echoes and fluorescence from the dust and gas, respectively, ejected in the last two or three eruptions. Because T Pyx erupts only once per generation (and is now overdue), and because this is the only known nova with multiple concentric shells, this is an important target which is perfectly suited to the refurbished HST's capabilities.

4 The Need for HST

The highest possible spatial resolution is essential to resolve the nova ejecta, and follow the expanding light flash and echoes during the first two years after eruption. We also need one set of images (to compare the "before" with the "after") before the nova erupts.

One target, T Pyx, the only recurrent nova with multiple shells. Quiescent emission line fluxes from the T Pyx shell (Williams, ApJ, 261,170) imply $V + AB_v$ = 23–24; we use the QT integral = 0.05% for the Hα filter, and an exposure time of 1800 seconds to find N_e = 100–300 electrons/PC pixel.

Five narrowband filters ×0.5 hours/filter + two broadband filters ×0.1 hours/filter= 5.0 orbits/visit.

Observing time spread over 2–3 years.

Description of the Observations

We propose to image the environs of the only recurrent nova with a shell, before (Cycle 4), during, and after (Cycle 4, 5, or 6) its upcoming eruption. We will image through narrow-band filters corresponding to the most common elements and ionization stages seen in nova ejecta. We will also obtain reference broadband images to allow narrowband-broadband differencing.

Cycle 5	Primary Orbits:30	Exposures:84
Cycle 6	Primary Orbits:5	Exposures:14
Cycle 7	Primary Orbits:5	Exposures:14

Special Requirements

First set of (pre-eruption) images requested immediately (before next eruption). Target of opportunity; first exposures requested 100 hours after eruption discovery. Then about 5, 10, 20, 40, 100, 200 and 600 days after eruption.

Supporting/coordinated Observations

None.

Related HST Programs

GO-2472	Binaries in Globular Clusters	Shara
GO-2441	Search for Wolf-Rayet Stars in Local Group Giant H II Regions	Shara
GO-3872	Blue Stragglers in the Cores of Globular Clusters	Shara

1 Unrelated programs:

GO-2472 Using time resolved photometry of a Galactic globular core to search for binaries. The present proposal uses color-magnitude diagrams to search for binaries (as well as blue stragglers) in Magellanic clusters. The data reductions are complete and a paper is being written. Two low-amplitude variable candidates were found in the core of NGC 6752, far fewer than expected in this dense cluster.

GO-3872 Color-magnitude diagrams of the cores of several Galactic globulars are being constructed to search for blue stragglers. First observations were obtained less than a month ago, reductions are beginning.

GO-2441 Use narrowband versus broadband He II 4686 imagery to resolve Wolf-Rayet stars in the cores of Giant H II regions in M33. All datasets reduced and paper published.

Justify Duplications

None.

C.4 Blank Archival Research Proposal Template

```
%       artemplate.tex  (use obstemplate.tex for observing proposals)
%
%
%       HUBBLE SPACE TELESCOPE
%       PHASE I ARCHIVAL RESEARCH PROPOSAL TEMPLATE
%       FOR CYCLE 5 (1994)
%
%       Version 1.2                             May 9 1994
%
%         Both a PAPER and an ELECTRONIC version of each proposal must be
%       submitted.  This LaTeX template is needed to prepare the electronic
%       version.  You may also use LaTeX to format and print this template,
%       (using the accompanying style file) and use the output for the
%       paper submission.  Most of the input you will be asked to provide
%       must be given within the curly braces {} provided.  The LaTeX
%       comment character is the percent sign -- anything you type that
%       has a percent sign to the left of it on the same line will be
%       ignored; if you need to have a percent sign appear in your text,
%       use \% instead.  Experienced LaTeX users may be tempted to alter
%       styles and fonts to squeeze more text into the allowed space --
%       PLEASE DO NOT DO THIS!
%
%         Since this is a LaTeX document, you can use the special
%       characters you may need.  In addition, a few astronomical
%       symbols have been defined for you in the style file
%
%               \ang            the Angstrom unit
%               \degpoint       degree symbol and decimal point together
%               \halpha         H alpha
%               \hbeta          H beta
%               \hgamma         H gamma
%               \kms            kilometers per second
%               \minpoint       arcmin symbol and decimal point together
%               \peryr          yr superscript -1
%               \secpoint       arcsec symbol and decimal point together
%               \subsun         subscripted solar symbol
%               \sun            solar symbol
%
%         Many LaTeX users will be familiar with ways to incorporate
%       Encapsulated PostScript graphics into a document.  If you are
%       using this form to prepare formatted output for submission on
%       paper, feel free to use any of these methods to add figures
%       to your scientific justification or to any of the questions
%       that follow the scientific justification.
%
%         To use this template for proposal submission on PAPER, edit this
%       file, format it using LaTeX, and print out a paper copy of
%       the formatted proposal.  If you want us to do most of the
%       copying, make 2 copies of the formatted proposal; otherwise,
%       make 20 copies.  Append any supplementary materials to each
%       copy, and mail them to:
```

```
%
%              Space Telescope Science Institute
%              User Support Branch, Room S420
%              3700 San Martin Drive
%              Baltimore, Maryland USA 21218
%
%       Then e-mail your completed LaTeX template (THIS file, not any of the
%       other LaTeX output files) by the Phase I proposal deadline to:
%
%              newprop@stsci.edu  (Internet)
%           or stscic::newprop    (NSI/DECnet)
%
%       You will receive an acknowledgement message via e-mail within one
%       working day of your proposal submission.  Contact the User Support
%       Branch at STScI (410-338-5015 or usb@stsci.edu) if you need assistance
%       with any aspect of proposing for and using HST.
%
%       The template begins below.  Do not alter the following three lines:

\documentstyle[phase1]{article}
\begin{document}
\proposalcategory{AR}

%    1. TITLE
%
%       Please supply a TITLE for your proposal, within the curly braces.
%       Keep your title short enough to be formatted onto no more than
%       two lines.  This translates roughly into 100-120 characters.

\title  {}

%    2. SCIENTIFIC CATEGORY
%
%       Specify the appropriate SCIENTIFIC CATEGORY by uncommenting
%       (deleting the percent sign in front of) only one of the entries
%       in the following list.  Leave the other categories commented out.

%\scientificcategory    {Galaxies \& Clusters}
%\scientificcategory    {Cool Stars}
%\scientificcategory    {Hot Stars}
%\scientificcategory    {Stellar Populations}
%\scientificcategory    {Quasars}
%\scientificcategory    {AGN}
%\scientificcategory    {Interstellar Medium}
%\scientificcategory    {Solar System}

%    3. 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}.
%
%       Use \\ to break lines in your address, as in
```

```
%
%       \address{Science Hall\\4321 University Avenue\\Anytown, MD 21218}
%
%       but limit yourself to four lines (three \\'s).

\PIfirstname    {}
\PIlastname     {}
\institution    {}      % Please do not abbreviate.
\address        {}      % Complete the postal address for your institution.
\telephone      {}
\email          {}
\country        {}      % Country of above named institution.
\USstate        {}      % 2-letter code required for US proposers only.
%\ESAmember{yes}        % Uncomment this line only if you are an ESA member.

%    4. TOTAL BUDGET REQUEST
%
%       Please enter a US dollar figure for your TOTAL BUDGET REQUEST.
%       (Do not use the dollar sign "$", which is a special character
%       in LaTeX.)

\totalbudgetamount{}

%    5. ABSTRACT
%
%       Enter your ABSTRACT between the \begin{abstract} and
%       \end{abstract} commands.  The text of your abstract, when typeset
%       with the style file provided with this form, must fit on the
%       first page of printed output.  This translates into approximately
%       20 lines of 80 characters each.

\begin{abstract}
%       Your text goes here.

\end{abstract}

%    6. CO-INVESTIGATORS
%
%       Identify each CO-INVESTIGATOR (CoI) by replicating the following items
%       for each (space for 2 CoIs are provided below; add more as needed).
%       If you have no CoIs, leave these lines unchanged and proceed to
%       the next section:  the AUTHORIZING OFFICIAL.

\begin{investigators}

\CoIfirstname   {}      % include title here if desired; ex: {Dr. Bob}
\CoIlastname    {}
\institution    {}      % Please do not abbreviate.
\country        {}
\USstate        {}      % 2-letter code required for US investigators only
%\ESAmember     {yes}   % Uncomment this line only if you are an ESA member.

\CoIfirstname   {}      % Next Co-Investigator.... (add more as needed)
\CoIlastname    {}
```

```
\institution    {}
\country        {}
\USstate        {}
%\ESAmember     {yes}

\end{investigators}

%    7. AUTHORIZING OFFICIAL
%
%       Please identify the AUTHORIZING OFFICIAL.
%
\begin{authorizingofficial}

\AOfirstname    {}
\AOlastname     {}
\institution    {}       % Please do not abbreviate.
\address        {}
\telephone      {}
\email          {}
\country        {}
\USstate        {}

\end{authorizingofficial}

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%                                                                       %
%       If you are NOT using this form for your PAPER submission, and   %
%       are using it only for ELECTRONIC SUBMISSION, STOP HERE.         %
%                                                                       %
%       However, if you plan to use this form for PAPER submission as   %
%       well, please continue on to the general questions that follow.  %
%                                                                       %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%    8. SCIENTIFIC JUSTIFICATION
%
%       Present the SCIENTIFIC JUSTIFICATION for the proposed program,
%       including its goals and expected significance to astronomy.
%       Include a brief description of the scientific background and
%       previous relevant work.  Enter your justification after the
%       \justification command.  Do not exceed 3 pages.
%
\justification          % Do not delete this command.

% Enter your justification here.


%    9. DESCRIPTION OF ARCHIVAL PROGRAM
%
%       Provide a short DESCRIPTION of your archival program.  Specify
%       the type of observation you will be analyzing, including the
%       object names or class of object, type of data (spectral or
%       image data), and the number of exposures you will be requesting
%       from the archive.  Describe any non-standard data analysis
```

```
%       techniques you will be employing, and how the analysis will
%       allow you to obtain your scientific objectives.
%
\describearchival       % Do not delete this command.

% Enter your description here.


%   10. RELATED, FUNDED ARCHIVAL RESEARCH
%
%       Have your or your Co-Investigators received any funding for
%       HST archival research which is related to this proposal?  If so,
%       list the HST program ID's, PI's, and titles, and briefly
%       summarize their main results.  If this proposal is related to
%       any other Cycle 5 proposals, describe how so.
%
\relatedprograms        % Do not delete this command.

% Enter your list here, if any.

\end{document}
```

D STScI ELECTRONIC INFORMATION SERVICE (STEIS)

STEIS is the electronic information system for *HST* users. This service provides access to a wide variety of *HST*-related information, including the latest updates on mission schedules and status, spacecraft and instrument performance, proposal deadlines, and data-analysis software (including updates and bug fixes).

There are three ways to access information via STEIS, all of which provide access to the same information. The first and by far the easiest is via the World-Wide Web (WWW) using a client such as Mosaic for X-windows, Macintosh, or MS-Windows (from the National Center for Supercomputing Applications), or Lynx for ASCII terminals (from the University of Kansas). For proposers with access to one of these WWW clients, the URL (Universal Resouce Locator) which gives access to the STEIS "page" is:

http://stsci.edu/steis.html

From this page proposers can follow the WWW hypertext links to information of interest, including documentation updates and last-minute news. A detailed description of WWW may be found in the April 1994 ST-ECF Newsletter.

The second access method is via "Gopher" which provides a menu-like interface to the files on the STScI server. Those with access to the xgopher program for X-windows can start a session to browse the STScI server directories by issuing the command:

xgopher stsci.edu

Detailed descriptions of Gopher (including how to obtain the software) may be found in the September 1993 STScI Newsletter and in the August 1993 ST-ECF Newsletter.

The third (and least convenient) way to access information on STEIS is via the anonymous file transfer protocol (FTP) mechanism. This allows users with Internet access to connect to the STScI server machine (stsci.edu, or 130.167.1.2) to browse and retrieve files of interest. Instructions for anonymous FTP access may be found in the March 1992 STScI Newsletter. Users may also contact USB assistance or for a copy of *The STEIS Guide*.

Each directory (including the top level) has a **README** file, which will provide a description of what is available at that level in the directory hierarchy. Other items in the top level directory are the **instrument_news, observer, pasp, policy, proposer, software**, and **stsci** directories. Subdirectories within the **proposer** directory include **documents** and **cycle5**. The proposal template files, style file, and completed template example are named **obstemplate.tex, artemplate.tex, phase1.sty**, and **obsexample.tex**, respectively. These files can be found in the **cycle5** subdirectory under the **proposer** directory.

If you are connected to Internet (NSFNET, ARPANET, NSI, etc.), then you may download any available information from the STScI anonymous FTP server into your own computer. The following instructions describe how to use FTP to gain access to STEIS and download the required files. More details can then be found by downloading the **README** file. Note that UNIX commands and file names are case-sensitive, so the commands should be entered exactly as shown.

1. Log in to a host at your site that is connected to Internet and is running software that supports the **ftp** command.

2. Invoke FTP by entering one of the following commands containing the Internet address of the STScI server:

   ftp stsci.edu
   or
   ftp 130.167.1.2

3. Log in to **stsci** using "**anonymous**" for the username. If you are not prompted with "Name:", then you should enter "**user anonymous**" and proceed.

4. Enter your local login name (e.g., "**smith**") for the password.

5. Enter "**get README**" to transfer the ASCII instruction file to your local host. Give the filename to use on the local host when prompted, or just give a carriage return to use the same file name. Remember that the commands and file names are case sensitive. To list other files that are available for downloading, enter the "**ls**" command. Other files can be downloaded with the "**get <filename>**" command. Files cannot be read until you return to your host operating system (see Step 12 below for how to quit and read the transferred files).

6. Enter "**cd proposer**" to change to the **proposer** directory.

7. Enter "**ls**" to list the files in the **proposer** directory.

8. Enter "**get how_to_submit**" to transfer the file to your local host.

9. Enter "**cd cycle5**" to change to the **software** subdirectory within the **proposer** directory.

10. Enter "**ls**" to list the files in the **software** subdirectory.

11. Enter "**get obstemplate.tex**" to transfer, e.g., the observing proposal template file to your local host. Do the same for **phase1.sty** to download the style file. You may also want to transfer with the "**get**" command an example of a completed observing proposal template in **obsexample.tex**.

12. Enter "**quit**" to exit FTP and return to your local host.

If you have any problems connecting to the STScI system, then please consult your local system administrator or network expert, or contact the User Support Branch (userid USB) at STScI. Comments or suggestions regarding this service should also be addressed to USB. For more information on STEIS, refer to *The STEIS Guide* (available from USB upon request).

E STARVIEW DUPLICATION AND ARCHIVAL SEARCHES

The simplest and most robust way to determine whether your proposed observations conflict with previously accepted GO or GTO observing programs is to use StarView, the interface to the *HST* archive. Within StarView users will find a Duplication Check Screen which they can use to perform RA and Dec based or target name based searches of all planned or completed *HST* observations. Data browsing (display of images and plotting of spectra) is available for all public *HST* data in the archive. Archival proposers will also find the Duplication Check screen useful for preparing their archival proposals.

To access StarView, telnet to one of the two archive host computers, **stdatu.stsci.edu** (**unix**) or **stdata.stsci.edu** (**VMS**). If you are not a registered archive user, log in with username **archive** and password **guest**. You *do not* need to register as an archive user to do duplication checking or to browse the data. You need to register as an archival user only if you wish to retrieve public *HST* data. For those who wish to retrieve data, registration is a simple process- just type register from the command line on one of the host computers. For more information about the archive, type **readnews** (or **help**) from the command line.

Once on one of the archive host computers, simply type **xstarview** to fire up the xwindows based version of StarView, or type **starview** to use crt StarView. While there is extensive help available within StarView (via the Strategy button and the pull down Help menu), xstarview is fairly intuitive. When StarView starts up, it places you in the Welcome Screen. Select the <Duplication Check> button from the bottom (command) portion of the screen, by clicking with the mouse on the xversion or entering Esc-2 on the crt version. This will place you in the "Duplication Check Search" screen. To search for observations of a specific fixed target, enter the RA and Dec in J2000 coordinates of the target and a search radius. If you know only the name of your fixed target, but not the coordinates, select the <SIMBAD Coordinates> button and enter your source name; the software will then connect to the SIMBAD database to determine the coordinates of your source. To search for observations of moving targets, specify target name embedded in stars (e.g., *JUPITER*) in the target name field on the "Duplication Check Search" screen. You can also enter specifications in any of the other fields to further constrain your search. When you are ready, select <BEGIN SEARCH> from the command area. (Note: The current duplication checking screen requires you to check targets one at a time. We are currently working on adding a feature in StarView which will allow you to cross correlate a list of target RA and Decs against the catalog all at once. When available, you will be able to employ this capability by selecting the <Cross Correlation> button from the command area of the "Duplication Check Search" screen. More information about the cross correlation capability will be provided as part of the Strategy for the "Duplication Check" screen at that time).

If a planned or completed HST observation is found which matches your search criteria, the screen will change to the "Duplication Check Results" screen where more detailed information about the matching observation will be displayed. You can step through matching observations one at a time by using the <Step Forward> button, or you can use the

<Table Row Format> button to display the information in tabular form and step through the matching observations a page at a time. Completed observations (i.e., those having exposure status = "completed") which are public (with release dates less than the current date) can be previewed using the <Preview> button.

The duplication checking screen is designed only to identify potential conflicts; you will have to decide whether the apparent conflicts are "real". The formal duplication policy is described in detail in Section 3.6 of the *Call for Proposals*. An observation is defined as duplicating a previous one if it is on the same astronomical target, with the same or similar instrument, a similar instrument mode, and a similar spectral range. Proposed observations which duplicate any existing or planned observations must be justified in the Proposal. In particular proposed observations which conflict with GTO-Reserved Cycle 5 targets, which are not specifically endorsed by the TAC, will be disallowed or restricted during Phase II checking. Planned exposures of GTO-Reserved Cycle 5 targets are identified by conflict type = "GTO-Reserved" and exposure status = "planned - cycle 5". Proposers should also be aware that exposures with conflict type = "Carryover" and exposure status = "planned - cycle 4" are the high priority carryover proposals from cycles 1–3; the exposure times and instrumental configurations displayed are those from the original proposals. It is expected that the targets for these observations will not change, however exposure times and instrumental configurations may change, constrained by the requirement that the same science is achieved.

Abstracts of all proposals which have been approved for observation (including both executed and pending proposals) can be displayed using the "Abstracts" screen in StarView. This screen can be accessed via the <Other Searches> button on the "Welcome Screen" of StarView or by pulling down the "Searches" menu, in the menu bar on the top of the screen. Enter the proposal id of the proposal whose abstract you wish to view or qualify on proposal title or descriptive keywords to search for proposals of a particular type of object (e.g., type *SEYFERTS* in the descriptive keywords field). Push <Begin Search> when you are ready. To find observations of a particular class of object you can also use the General Screen and qualify on the target description field in this same way.

More information about StarView and the HST Archive is provided in the Archive Primer. For help, documentation, or information about any aspect of the HST Archive, contact the archive hotseat (e-mail archive@stsci.edu or phone 410-338-4547).

F CONTINUOUS VIEWING ZONE TABLES

The tables in this Appendix will be useful for proposing observations that can take advantage of Continuous Viewing Zone (CVZ) observing (see Section 4). Included are three tables for each of northern and southern declinations for a one-year sample period:

1. the total duration in hours of all CVZ opportunities for targets at the specified RA and Declination,
2. the maximum duration in hours of any single CVZ interval, and
3. the total number of CVZ intervals.

The sample period for these tables was taken to be April 1994 through April 1995: because of limitations on the predictability of the *HST* orbit, the actual Cycle 5 values (July 1995 through July 1996) will not be known for some time. Proposers should be aware that near the "edges" of the CVZ area (i.e. where there is only one CVZ interval), the actual availability of CVZ observing will depend in detail on the geometry of the *HST* orbit during Cycle 5.

Maximum duration (hours) of any single CVZ interval (Northern Declinations)

RA° / Dec°	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
52																													5	5	2					
53																					4	3	8	8	8	5	5	10	11	11	13	6	3			
54	2								14										19		15	16	16	16	15	15	18	19	19	19	18	18	19	3	5	3
55	14	8							32									6	32	26	31	24	24	24	24	32	27	26	26	26	26	29	32	36	15	15
56	29	31	26						52						22	8	18	18	53	48	40	36	31	31	52	42	37	37	39	32	34	37	42	50	40	26
57	39	42	53	17					55						49	39	34	29	93	60	50	40	39	77	64	52	45	50	64	39	40	45	52	63	94	35
58	57	55	68	100	65	27	25	13	30	30	29	50	24	72	71	55	56	102	97	68	56	50	77	121	74	58	52	60	71	111	61	50	58	71	103	106
59	98	70	76	100	114	77	58	46	61	69	68	61	80	111	74	69	99	138	95	71	65	83	119	108	93	65	58	74	104	110	101	74	61	74	98	138
60	125	98	77	90	136	104	85	71	76	86	77	87	106	100	77	96	124	148	87	76	85	109	140	95	87	90	82	101	97	97	127	99	79	76	87	148
61	145	114	93	81	153	125	103	85	95	79	88	106	129	86	93	114	141	121	79	85	101	129	155	86	79	109	100	121	86	87	145	117	96	80	81	126
62	156	129	105	88	94	138	116	98	91	89	101	121	123	90	106	127	154	91	84	95	116	140	108	76	82	95	114	110	80	74	107	132	109	92	89	92
63	156	137	113	97	82	151	125	106	90	97	111	130	98	97	114	137	156	82	90	103	126	150	87	81	90	105	124	100	89	79	74	142	117	100	87	77
64	74	142	118	98	85	87	132	111	95	102	118	139	103	100	118	142	68	85	92	108	131	153	92	82	95	110	131	105	94	81	73	148	124	103	89	77
65	73	81	114	95	82	87	86	108	90	100	124	95	82	95	121	78	66	76	89	110	126	62	68	78	95	106	78	95	89	76	66	71	121	100	84	71
66	60	55	73	78	70	63	58	66	71	68	63	66	73	76	74	58	61	68	73	70	52	55	58	63	57	55	52	45	47	57	55	53	52	68	68	65
67	55	53	58	66	63	60	58	55	58	60	60	60	66	63	57	53	58	58	58	55	49	50	50	50	44	42	37	39	37	42	45	45	45	50	57	57
68	50	50	49	55	60	55	53	52	50	53	55	57	58	55	52	52	57	53	53	45	45	45	44	39	37	34	33	31	33	33	37	39	41	42	49	50
69	47	47	45	49	52	53	50	52	50	50	50	53	52	49	49	50	50	49	45	41	39	39	37	36	31	26	26	26	26	29	29	34	36	36	42	44
70	42	42	42	44	50	50	49	47	47	47	49	47	47	47	47	49	47	44	41	37	36	36	33	28	25	20	20	18	21	21	23	29	31	31	36	41
71	37	39	39	41	42	47	45	45	44	45	47	44	44	44	45	42	42	39	36	33	33	31	28	23	20	15	15	13	15	17	18	23	26	28	29	37
72	34	36	36	37	37	40	44	45	44	44	42	44	39	41	41	39	39	36	31	29	29	26	23	18	13	10	10	9	10	10	13	17	23	25	26	33
73	29	34	34	34	34	41	41	42	41	41	42	37	36	37	37	36	34	33	28	26	25	21	17	13	7	5	4		5	5	7	15	17	20	20	28
74	28	29	33	33	30	34	39	41	41	39	39	36	34	34	34	34	33	28	21	23	21	17	13	8	3			3			2	8	13	13	15	25
75	26	26	28	28	28	31	36	37	36	37	33	31	31	33	31	29	28	18	18	18	15	13	7	3								4	8	10	12	12
76	17	25	25	25	25	21	31	34	34	31	29	26	28	28	28	28	20	12	15	13	12	8	2										2	7	7	5
77		9	21	21	20	7	10	28	29	29	9	7	25	26	26	15	7	7	10	10	3													3	4	

Total duration (hours) of all CVZ opportunities in one year (Northern Declinations)

RA ° / Dec°	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
52																													5	5	2					
53																					4	6	8	8	8	5	5	10	11	11	13	6	3			
54	2								14										19		15	16	16	16	15	30	28	19	19	19	18	18	19	3	5	3
55	14	8							32									6	39	33	33	24	24	24	24	55	51	46	26	26	26	36	46	49	15	15
56	29	31	26						52						22	11	18	18	78	65	57	47	31	31	83	75	70	71	70	32	52	60	67	75	69	29
57	39	45	53	17					55						49	43	37	29	172	92	81	70	69	116	105	95	91	89	104	93	80	81	86	96	126	39
58	150	118	126	150	111	67	59	54	72	74	91	127	77	117	184	120	153	195	202	183	156	181	235	272	204	172	165	190	228	260	197	155	157	162	187	194
59	338	252	248	267	278	247	177	170	233	258	284	295	265	278	310	305	314	352	368	348	347	357	393	386	379	348	342	361	387	354	343	309	287	292	308	357
60	413	414	313	324	370	337	249	240	309	351	373	391	376	327	379	377	397	416	426	428	426	444	475	436	434	437	436	452	441	408	409	374	357	358	369	433
61	454	447	359	355	424	394	299	295	358	391	424	452	478	354	417	436	458	486	454	458	485	506	524	460	460	497	502	515	470	435	448	418	404	399	412	451
62	475	473	376	371	374	441	333	365	380	405	445	500	505	375	437	462	491	479	465	471	499	534	503	467	472	504	541	523	473	441	421	444	428	420	424	423
63	472	477	380	367	354	438	355	410	367	394	454	500	460	387	439	455	495	461	456	460	488	543	468	465	462	486	555	499	469	418	386	451	431	422	401	392
64	385	444	379	329	324	378	364	355	342	334	444	473	438	421	418	436	425	423	432	431	449	483	428	427	433	445	489	460	439	338	341	437	416	404	351	348
65	256	354	304	260	259	267	345	289	272	283	348	324	291	358	383	352	271	276	334	349	370	287	259	327	338	364	282	338	303	250	243	271	351	281	255	249
66	142	162	184	186	179	163	170	189	195	194	171	171	184	218	233	211	168	174	188	206	199	154	156	178	193	186	150	140	147	152	147	138	154	161	161	163
67	113	125	155	160	156	134	139	160	171	166	150	140	161	163	187	165	149	149	149	162	162	129	131	133	142	137	110	95	104	117	115	99	118	134	137	131
68	96	101	132	141	136	116	112	142	147	156	131	123	140	149	156	134	136	137	137	136	127	110	113	110	106	100	84	67	80	91	89	75	97	113	116	108
69	87	83	115	121	118	99	100	129	132	131	105	105	123	134	127	110	116	120	123	113	89	92	96	96	80	71	62	51	54	72	65	63	73	96	99	86
70	77	77	94	117	102	91	91	109	120	118	93	93	111	115	102	96	110	108	115	102	67	78	80	75	60	46	41	37	37	47	45	51	51	76	79	74
71	66	67	77	104	87	85	82	88	108	99	88	87	95	104	83	79	94	96	99	77	59	60	63	57	43	30	21	26	24	30	34	38	40	54	60	66
72	58	56	56	86	78	80	78	75	94	78	80	85	81	81	62	69	75	84	81	59	51	48	49	41	27	19	10	14	14	13	24	29	32	30	51	58
73	48	51	48	52	67	72	72	69	74	70	77	74	73	62	58	58	65	73	64	43	45	40	34	22	11	5	4		10	5	16	21	19	23	39	48
74	42	42	42	33	62	67	66	64	41	64	69	69	63	38	46	51	53	55	40	35	37	30	25	11	5			3			2	12	13	13	18	40
75	37	32	28	28	40	58	60	48	36	45	64	61	42	33	38	42	45	35	22	25	27	24	14	5								7	8	10	12	24
76	23	28	25	25	25	37	47	34	37	31	40	42	28	28	28	37	31	12	15	16	21	11	2										2	7	7	5
77		9	21	21	20	7	13	31	29	29	9	7	25	26	26	15	7	7	10	10	3													3	7	

Total number of CVZ viewing opportunities in one year (Northern Declinations)

RA° / Dec°	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
52																													1	1	1					
53																					1	2	1	1	1	1	1	1	1	1	1	1	1			
54	1								1										1		1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1
55	1	1							1									1	2	2	2	1	1	1	1	2	2	2	1	1	1	2	2	2	1	1
56	1	1	1						1						1	2	1	1	3	2	2	2	1	1	2	2	2	2	2	1	2	2	2	2	4	2
57	1	2	1	1					1						1	2	2	1	3	3	3	2	3	3	3	3	3	2	2	4	2	2	2	2	2	2
58	6	6	5	6	5	5	4	5	5	5	7	9	5	6	10	7	6	7	8	9	7	8	11	7	9	8	7	8	9	6	8	6	7	7	6	6
59	8	6	5	5	5	6	4	4	5	6	8	8	6	5	8	8	6	7	7	8	10	8	7	7	7	8	8	7	7	7	7	7	6	6	6	7
60	7	7	5	7	6	5	4	4	7	7	7	7	7	5	7	6	6	6	7	8	7	7	8	8	8	8	7	7	8	8	8	6	6	6	7	7
61	6	7	7	6	5	6	4	5	6	7	6	6	7	5	6	6	6	7	8	7	7	8	8	8	7	7	7	8	8	8	7	6	6	7	7	6
62	7	9	7	5	5	6	4	5	6	6	7	6	8	5	6	6	6	8	7	7	7	9	9	7	7	8	8	7	8	7	7	7	7	7	7	6
63	7	8	5	7	6	6	4	6	6	7	6	6	6	6	6	6	6	7	7	7	8	10	8	9	8	9	8	8	7	7	8	7	7	6	6	7
64	8	7	6	6	6	8	4	5	6	5	6	6	6	7	6	6	9	7	9	8	7	7	7	9	9	7	8	8	8	7	7	7	8	7	7	7
65	6	8	7	6	5	6	7	6	5	5	8	11	7	7	7	10	8	9	8	9	10	9	8	8	9	10	9	9	11	8	7	9	7	7	7	6
66	3	5	4	3	3	4	5	3	4	3	4	5	3	6	5	5	4	4	5	5	5	5	5	6	5	6	5	5	5	4	4	5	5	3	3	5
67	3	3	3	3	4	3	3	3	4	4	4	4	3	3	4	5	3	3	3	4	4	3	3	3	4	5	3	4	4	3	4	3	3	3	3	3
68	3	3	3	3	3	4	3	3	3	6	4	4	3	3	4	4	3	4	3	6	4	3	3	3	4	4	3	3	3	3	3	3	4	3	3	3
69	3	2	3	3	4	2	4	3	3	4	3	3	3	4	4	3	3	3	4	3	4	3	3	3	3	4	3	2	3	3	3	2	4	3	3	3
70	3	3	3	5	3	2	2	3	3	4	2	2	4	3	3	3	4	3	4	3	2	3	3	3	3	4	3	2	2	3	2	2	2	3	3	2
71	2	3	4	5	3	2	2	3	3	3	2	2	3	4	3	3	4	3	4	3	2	3	3	3	3	3	2	2	2	3	2	2	2	3	3	2
72	2	2	3	5	3	3	2	2	3	2	2	3	3	3	2	3	3	4	3	3	2	2	3	3	3	3	1	2	2	2	2	2	2	3	2	2
73	2	2	3	3	2	2	2	2	3	2	2	2	3	4	3	2	4	4	3	2	2	2	2	2	2	1	1		2	1	3	2	2	2	2	2
74	2	2	3	1	3	3	2	2	1	2	2	2	2	2	2	2	2	3	3	2	2	2	2	2	2			1			1	2	1	1	2	2
75	2	2	1	1	2	2	3	2	1	2	3	2	2	1	2	2	2	2	2	2	3	3	2	2								2	1	1	1	2
76	2	2	1	1	1	2	2	1	2	1	2	2	1	1	1	2	2	1	1	2	3	2	1										1	1	1	1
77		1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1													1	2	

Maximum duration (hours) of any single CVZ interval (Southern Declinations)

RA ° / Dec°	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
-77	4	5	5															
-76	10	10	10	7	2											3	2	
-75	18	13	15	10	7	2								4	5	7	7	4
-74	26	20	18	17	12	5	2			3			3	7	10	13	12	10
-73	31	25	23	21	18	12	7	5	4	2	4	4	8	13	17	18	18	15
-72	36	31	26	25	23	17	12	10	7	9	9	10	15	18	21	23	21	21
-71	39	34	31	29	26	21	18	17	13	15	15	15	21	23	26	25	25	31
-70	42	37	36	34	31	28	23	23	20	20	21	21	25	28	31	29	31	34
-69	47	44	39	39	37	33	28	28	28	25	26	28	33	34	36	36	36	39
-68	52	52	45	42	42	41	36	34	33	31	33	36	37	37	37	39	37	52
-67	57	58	55	47	47	49	45	39	39	39	37	42	44	42	42	42	47	58
-66	65	71	71	55	55	58	58	50	45	47	54	54	50	49	47	47	63	71
-65	74	84	103	119	73	71	76	94	105	86	76	68	81	55	54	58	116	97
-64	76	89	105	124	147	76	81	94	108	89	79	73	82	92	60	143	121	101
-63	81	85	100	118	142	83	79	114	103	121	77	73	77	87	103	137	116	98
-62	156	81	92	109	132	156	86	103	95	109	100	73	73	83	156	127	106	90
-61	153	91	79	97	117	145	106	92	92	97	117	81	76	98	143	114	93	79
-60	146	103	78	79	100	128	105	78	106	79	96	90	87	119	125	96	81	82
-59	120	118	81	68	75	103	123	82	98	62	71	96	89	140	101	70	69	90
-58	85	124	79	61	60	62	110	77	60	52	55	66	89	102	56	56	66	89
-57	37	80	73	53	47	42	40	66	53	45	47	56	74	37	40	48	56	77
-56	26	23	58	43	37	34	32	45	40	36	39	45	37	32	34	39	45	61
-55	15	13	13	32	31	26	26	26	26	27	29	28	24	26	26	29	31	11
-54	6	2	3	15	21	19	18	18	18	18	16	16	16	18	18	19		
-53	10	19			6	10	11	13	10	7	7	8	11	11	8	3		
-52							2	5	2				2	2				

RA ° / Dec°	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
-77				25	25	25	22		25	29	29	20	4	23	23	23	14	2
-76		4	26	26	28	28	26	31	33	34	36	31	26	26	28	28	25	21
-75		28	29	29	31	31	29	36	36	36	37	37	33	31	29	29	28	26
-74	18	29	31	34	33	34	36	37	41	41	41	41	39	33	33	31	33	29
-73	31	33	36	36	37	36	37	42	41	42	42	42	42	37	34	36	34	33
-72	33	36	37	39	39	37	44	45	44	44	44	44	44	41	39	37	37	37
-71	37	39	42	44	42	44	45	47	45	45	45	47	47	44	41	41	41	39
-70	41	44	47	45	45	47	50	50	49	47	49	47	49	50	44	44	44	44
-69	47	49	49	49	50	50	55	52	50	50	50	50	52	55	52	49	47	49
-68	52	55	52	52	53	61	58	55	55	52	53	53	55	58	57	50	50	52
-67	62	58	55	55	63	68	63	60	58	60	58	57	58	63	66	60	55	55
-66	70	65	58	66	78	76	68	61	65	70	71	61	63	70	78	76	63	60
-65	81	70	63	123	100	86	73	124	105	89	97	119	87	78	90	108	131	71
-64	85	76	151	127	106	92	76	127	106	92	98	118	139	82	95	111	132	153
-63	85	99	146	122	101	89	143	122	103	89	113	111	132	156	92	106	127	151
-62	81	156	135	113	96	97	133	111	93	86	101	103	122	146	88	98	117	143
-61	97	153	124	101	82	145	116	98	82	103	88	90	106	132	104	88	105	130
-60	124	135	104	82	90	124	96	79	82	82	71	72	103	111	132	84	87	111
-59	145	111	78	76	103	95	67	69	77	67	48	61	93	82	117	87	68	87
-58	120	72	55	66	91	45	45	46	24	24	17	14	43	81	70	87	63	52
-57	48	35	42	47			17							7	34	53	47	42
-56	21	26	23				18								10	8	19	27
-55	11	8					47											10
-54							11											
-53																		
-52																		

Total duration (hours) of all CVZ opportunities in one year (Southern Declinations)

RA° / Dec°	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
-77	4	5	5																			25	25	25	22		25	29	29	20	4	23	23	23	14	2
-76	10	10	10	7	2											5	2			4	26	26	28	28	32	58	37	34	36	42	51	26	28	28	29	29
-75	34	13	15	10	7	2								4	5	10	10	8		28	29	29	31	31	59	73	61	36	43	62	61	53	29	35	38	40
-74	46	31	18	17	12	5	2			3			5	10	13	13	12	13	26	29	31	34	33	53	69	75	70	56	64	69	75	66	46	40	46	46
-73	54	48	23	24	24	19	11	5	7	2	4	4	14	13	17	18	18	19	51	38	36	36	46	75	77	80	74	81	70	74	75	74	72	53	56	58
-72	62	59	41	35	35	29	21	10	13	11	9	17	27	24	21	23	21	40	50	48	48	39	56	74	86	86	80	100	93	82	80	85	89	64	61	66
-71	75	70	65	43	43	40	32	26	24	26	15	30	35	35	32	25	25	58	61	58	53	44	74	88	91	90	99	110	110	86	91	97	100	91	69	69
-70	83	83	83	53	54	51	47	47	37	35	39	46	45	46	45	29	42	64	69	67	64	62	86	93	95	98	120	124	123	104	93	113	112	114	75	78
-69	90	100	100	80	67	64	68	65	51	48	59	60	59	58	56	48	60	74	80	80	74	89	98	99	104	99	129	137	136	125	99	121	129	132	101	91
-68	108	121	118	109	74	83	91	84	69	72	83	84	69	69	66	61	88	91	90	93	85	115	116	112	112	118	147	153	155	145	115	136	147	140	123	95
-67	128	139	139	126	87	110	117	112	94	97	112	109	88	80	79	85	113	107	109	101	104	147	136	120	120	147	165	171	169	161	148	155	163	157	147	112
-66	161	172	169	155	135	146	154	145	125	132	153	146	119	97	94	122	154	150	124	116	134	176	169	139	125	163	185	196	195	181	198	182	198	194	180	150
-65	284	281	302	342	313	271	276	278	352	281	266	246	257	225	204	255	299	287	262	222	265	313	305	267	222	293	281	280	295	351	345	284	284	300	396	309
-64	397	392	417	463	482	389	391	418	466	449	370	337	344	348	325	403	383	376	367	348	430	402	416	340	353	361	334	335	370	433	460	371	369	396	433	497
-63	456	447	489	490	514	455	443	497	502	511	422	376	369	387	471	437	418	406	408	475	464	432	414	368	436	385	358	356	438	413	474	494	418	441	446	522
-62	536	480	485	492	508	539	481	502	505	510	452	389	392	406	489	456	423	420	422	502	422	385	408	383	417	399	367	368	420	393	463	493	450	432	437	516
-61	528	479	465	470	490	527	506	491	496	476	459	387	388	410	459	438	414	402	436	494	387	376	333	405	377	375	361	369	404	359	425	473	438	412	413	493
-60	492	442	420	423	449	499	478	446	469	434	408	372	373	399	411	387	387	370	426	359	336	331	266	355	327	324	338	294	359	304	375	415	426	379	373	449
-59	391	385	349	355	376	419	422	385	385	357	333	335	328	372	336	307	308	328	398	291	265	257	228	281	255	250	257	247	270	234	285	333	354	315	308	372
-58	226	252	211	199	220	229	273	245	205	178	175	191	236	236	184	155	160	195	251	157	121	124	130	102	113	103	74	79	62	67	88	171	179	184	151	191
-57	66	143	136	110	81	84	116	104	92	86	88	98	118	81	73	81	92	110	82	35	42	47			17							7	38	87	75	77
-56	42	34	91	65	60	55	32	76	71	70	71	76	68	32	55	59	65	86	21	29	23				29								10	8	34	42
-55	18	21	13	44	41	26	26	26	52	54	54	52	24	26	26	36	41	11	11	8					47											10
-54	10	4	3	15	21	19	18	18	18	30	31	16	16	18	18	19									11											
-53	10	19			6	10	11	13	10	7	7	8	11	11	8	3																				
-52							2	5	2				2	2																						

Total number of CVZ viewing opportunities in one year (Southern Declinations)

RA ° / Dec°	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
-77	1	1	1																			1	1	1	1		1	1	1	1	1	1	1	1	1	1
-76	1	1	1	1	1											2	1			1	1	1	1	1	2	2	2	1	1	2	2	1	1	1	2	2
-75	2	1	1	1	1	1								1	1	2	2	2		1	1	1	1	1	3	4	2	1	2	2	2	2	1	2	2	2
-74	2	2	1	1	1	1	1			1			2	2	2	1	1	2	2	1	1	1	1	2	2	4	2	2	2	2	3	2	3	2	2	2
-73	2	2	1	2	2	2	2	1	2	1	1	1	3	1	1	1	1	2	3	2	1	1	3	4	3	3	2	3	2	2	2	2	4	3	3	3
-72	2	2	3	2	2	2	2	1	2	2	1	2	3	2	1	1	1	2	2	2	3	1	2	2	3	3	2	3	3	2	2	4	4	3	2	3
-71	3	3	3	2	2	2	2	4	2	2	1	3	2	2	2	1	1	2	2	2	2	1	2	3	3	2	4	3	3	2	3	5	4	4	2	2
-70	3	3	3	2	2	2	3	4	2	2	3	3	2	2	2	1	2	2	2	2	2	3	2	2	2	3	4	3	3	4	2	5	3	4	2	2
-69	3	3	3	3	2	3	3	3	2	2	3	3	2	2	2	2	2	2	2	2	2	3	2	2	2	2	3	3	3	4	2	3	3	4	3	3
-68	3	3	3	3	2	3	3	3	3	3	3	3	2	2	2	2	3	2	2	2	2	3	4	2	2	3	3	3	3	4	3	3	4	3	3	2
-67	3	3	3	3	2	3	3	3	4	3	3	3	3	2	2	3	3	3	3	2	3	4	3	2	3	4	3	3	3	4	5	3	3	3	3	3
-66	4	5	4	4	5	5	5	4	5	4	6	5	4	4	3	3	5	5	4	2	3	4	3	4	2	3	3	4	4	3	6	4	5	6	5	5
-65	9	8	8	12	9	8	8	7	12	8	8	7	7	10	9	8	7	7	8	8	8	6	6	7	7	5	5	5	8	8	7	6	7	7	11	11
-64	8	8	8	8	8	9	9	9	8	9	7	8	8	7	6	6	7	9	7	6	7	6	9	6	7	5	5	6	6	6	6	6	6	7	6	8
-63	7	7	8	8	9	7	7	7	8	8	8	7	6	7	8	7	7	8	8	9	7	7	7	6	5	5	5	6	7	5	7	6	6	8	6	7
-62	7	7	8	8	8	8	8	7	7	8	8	7	7	6	7	7	7	8	7	8	7	8	7	6	6	6	5	5	7	5	6	6	6	6	6	7
-61	7	7	8	7	8	7	8	8	7	7	7	7	7	7	6	6	7	7	10	7	6	7	8	5	5	6	6	5	8	5	6	6	6	6	7	7
-60	8	8	7	7	7	8	8	8	9	8	7	6	6	7	7	6	6	7	8	5	5	7	5	7	5	5	6	5	8	5	6	6	6	6	7	8
-59	8	9	7	7	7	8	8	8	7	9	8	6	6	6	7	7	6	6	7	6	6	5	4	7	6	5	5	6	8	5	6	7	8	6	6	7
-58	9	7	7	9	7	9	9	7	8	8	8	7	8	6	6	6	6	7	7	5	5	6	5	5	7	6	6	6	6	6	5	7	8	6	6	8
-57	3	4	4	4	2	3	4	2	2	2	2	3	4	3	2	3	3	3	3	1	1	1			1							1	2	3	2	3
-56	3	2	5	2	2	2	1	2	2	2	2	2	2	1	3	2	2	3	1	2	1				2								1	1	2	2
-55	2	2	1	2	2	1	1	1	2	2	2	2	1	1	1	2	2	1	1	1					1											1
-54	2	2	1	1	1	1	1	1	1	2	2	1	1	1	1	1									1											
-53	1	1			1	1	1	1	1	1	1	1	1	1	1	1																				
-52							1	1	1				1	1																						

G EXAMPLES AND BLANK WORKSHEETS

This appendix contains example orbit calculations and blank "worksheets" for each instrument, that can be used to help lay out the exposures and overheads needed to calculate the number of orbits required. Detailed instructions for how to make the calculations are provided in Section 4. **Note that these worksheets are not for submission with the Phase I proposal, but are strictly for your convenience for calculating the number of orbits.**

FOC Worksheet

Overheads:

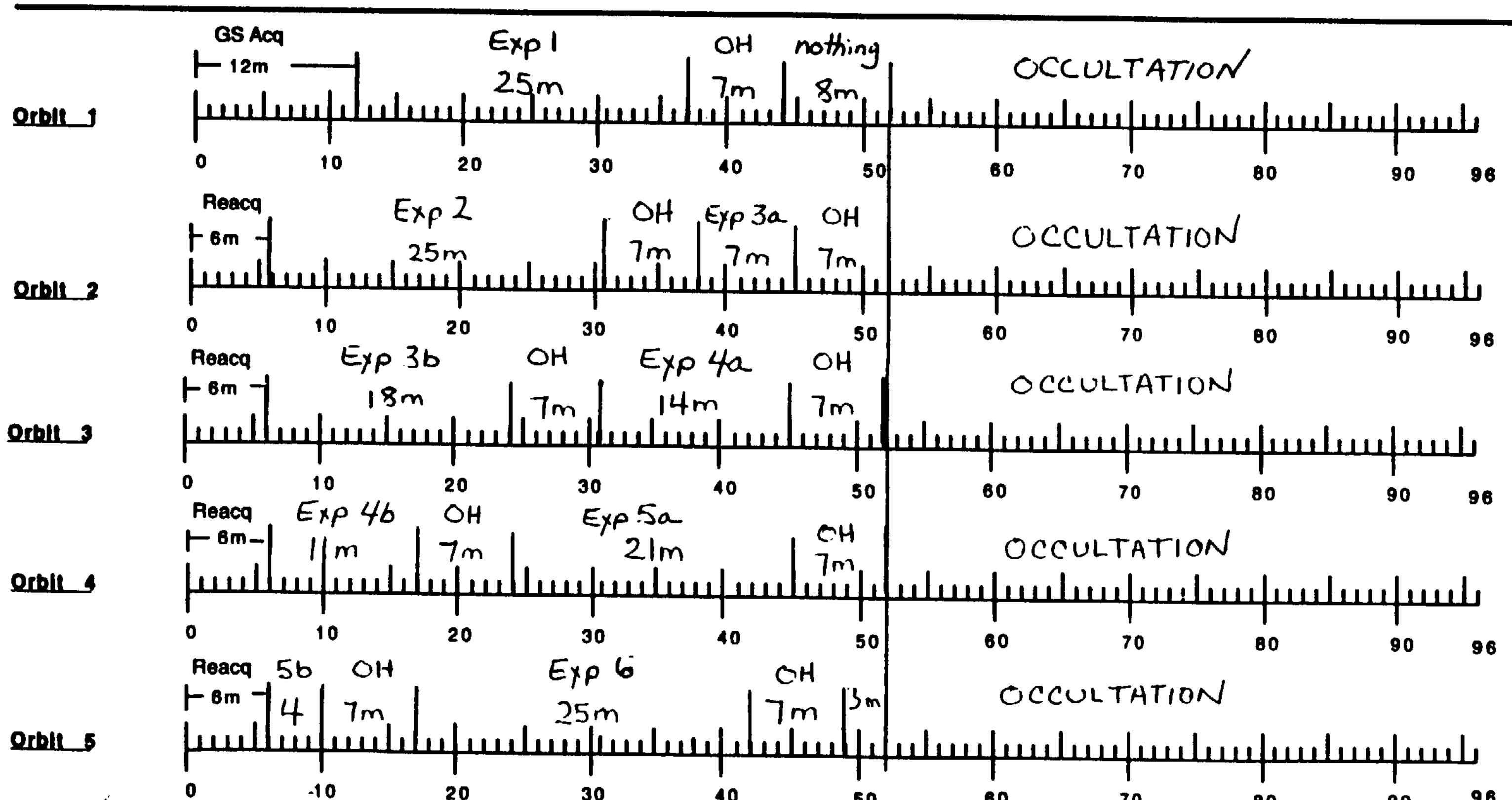
IMAGE	7 minutes
ACQ	12 minutes
OCC	7 minutes

Target Name: MYG50 **Declination:** 1

Visibility: 52m

SI	MODE	APERTURE	ELEMENT	NUM EXP.	EXP. TIME
FOC/96	IMAGE	512x512	PRISM1	7	25M

Notes:
1) The exposure 3 is split across orbits 2 and 3.
2) The exposure 4 is split across orbits 3 and 4.
3) The exposure 5 is split across orbits 4 and 5.
4) The 14m at the end of orbit 6 is "wasted" in this example. In the real world, you should increase exposure time/add exposures to efficiently fill the orbit.



FOC Worksheet con't

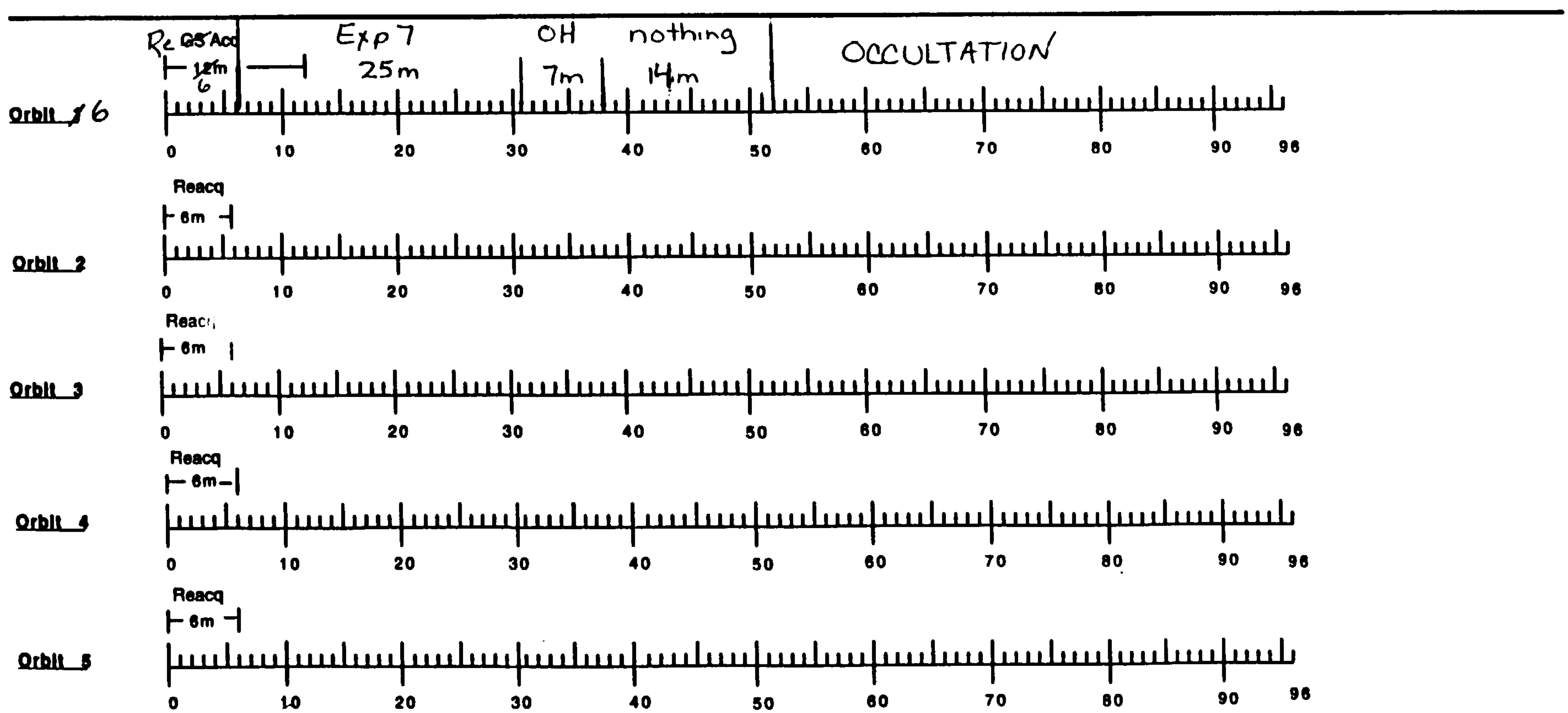
Overheads:

IMAGE	7 minutes
ACQ	12 minutes
OCC	7 minutes

Target Name: MYQSO **Declination:** |

Visibility: 52m

SI	MODE	APERTURE	ELEMENT	NUM EXP.	EXP. TIME
FOC/96	IMAGE	512x512	PRISM1	7	25M



FOS Worksheet

Overheads:

ACCUM/IMAGE/PERIOD	6 minutes
RAPID	7 minutes

Target Acquisition

non-variable. non-extended. known energy distribution

Aperture:	
4.3, 1.0	9 minutes
0.5	9+12 minutes
0.3	9+25 minutes
SLIT	9+10 minutes
BAR	9+13 minutes

variable, extended, unknown energy distribution

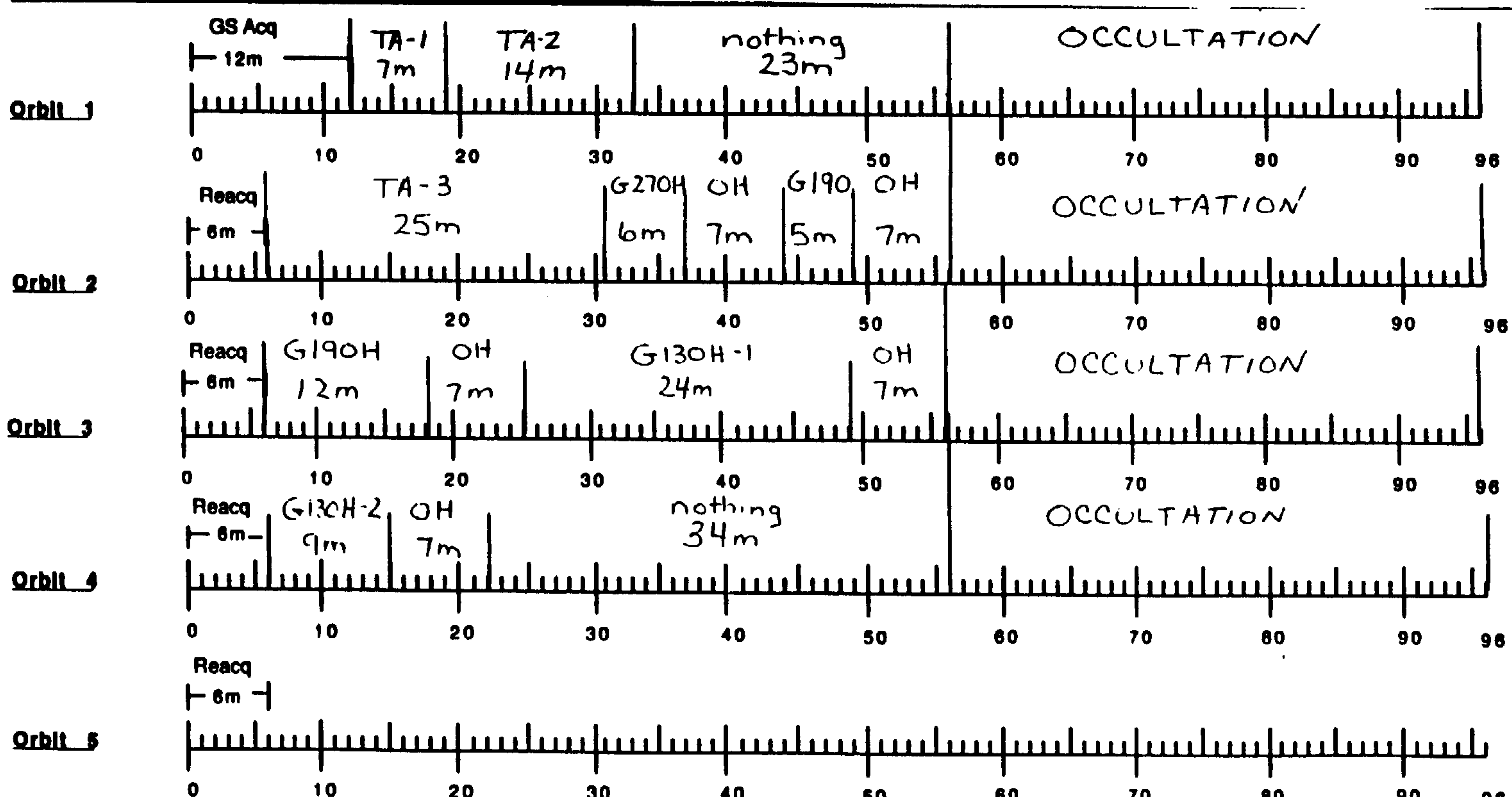
Aperture:	
4.3, 1.0	7+14+25 minutes
0.5	7+14+12+17 minutes
0.3	7+14+25+25 minutes
SLIT	7+14+25+10 minutes
BAR	7+14+25+13 minutes

Target Name: MYSTAR **Declination:** -48 **V:** 9.9

Visibility: 56M **TA mode:** 3 STAGE (7+14+25) (too bright for MIRROR)

SI	MODE	APERTURE	ELEMENT	NUM EXP.	EXP. TIME
FOS/BL	RAPID	1.0	G270H	1	6M
			G190H	1	17M
			G130H	1	33M

Notes:
1) The 23m at the end of orbit 1 is unusable since the next step is a 25m TA stage.
2) The G190H observation is split across orbits 2 and 3.
3) The G130H observation is split across orbits 3 and 4.
4) The 34 minutes at the end of orbit 4 is "wasted" in this example. In the real world, you should increase exposure time/add exposures (or decrease exposure time) to efficiently fill the orbit.



FOS(ɔrksheet

Overheads:

ACCUM/IMAGE/PERIOD	6 minutes
RAPID	7 minutes

Target Acquisition

non-variable. non-extended. known energy distribution

Aperture:	4.3, 1.0	9 minutes
	0.5	9+12 minutes
	0.3	9+25 minutes
	SLIT	9+10 minutes
	BAR	9+13 minutes

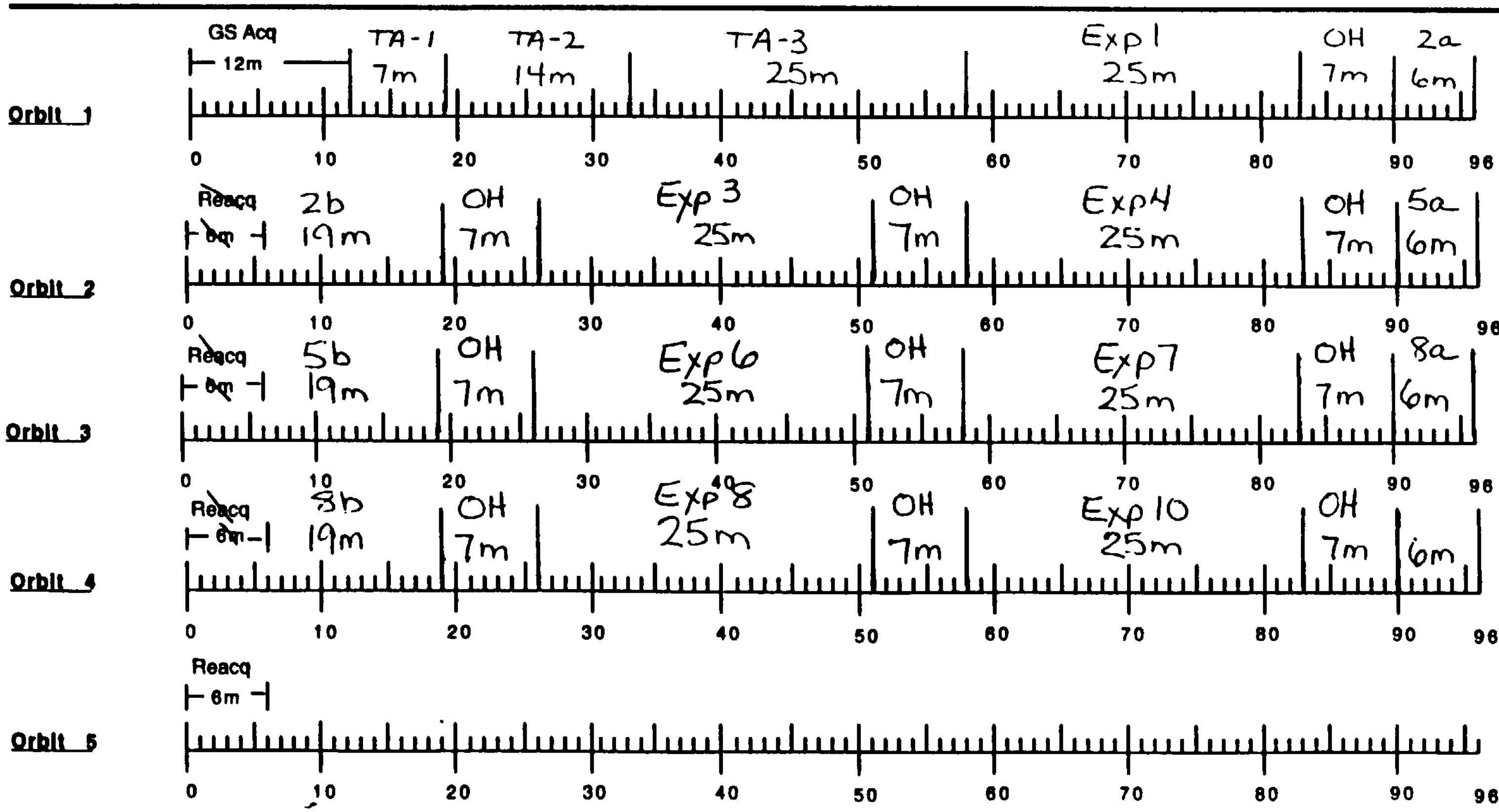
variable, extended, unknown energy distribution

Aperture:	4.3, 1.0	7+14+25 minutes
	0.5	7+14+12+17 minutes
	0.3	7+14+25+25 minutes
	SLIT	7+14+25+10 minutes
	BAR	7+14+25+13 minutes

Target Name: MYSTAR **Declination**: -64 **V:** 15 5 +/- 0.8

Visibility: 96M(CVZ) **TA mode**: 3 STAGE (7+14+25) (variable)

SI	MODE	APERTURE	ELEMENT	NUM EXP.	EXP. TIME
FOS/BL	RAPID	1.0	G270H	10	25M



GHRS Worksheet

Overheads:

IMAGE	6 minutes
IMAGE	15 minutes (Bright Object)
ACCUM/RAPID	4 minutes
WSCAN	3 minutes + 1 minutes/wavelength
OSCAN	5 minutes + 1 minutes/order

Target Acquisition ***Most Targets***

Large Science Aperture (nominal accuracy)	11 minutes
Large Science Aperture (extreme accuracy)	11+8 minutes
Small Science Aperture	11+8 minutes

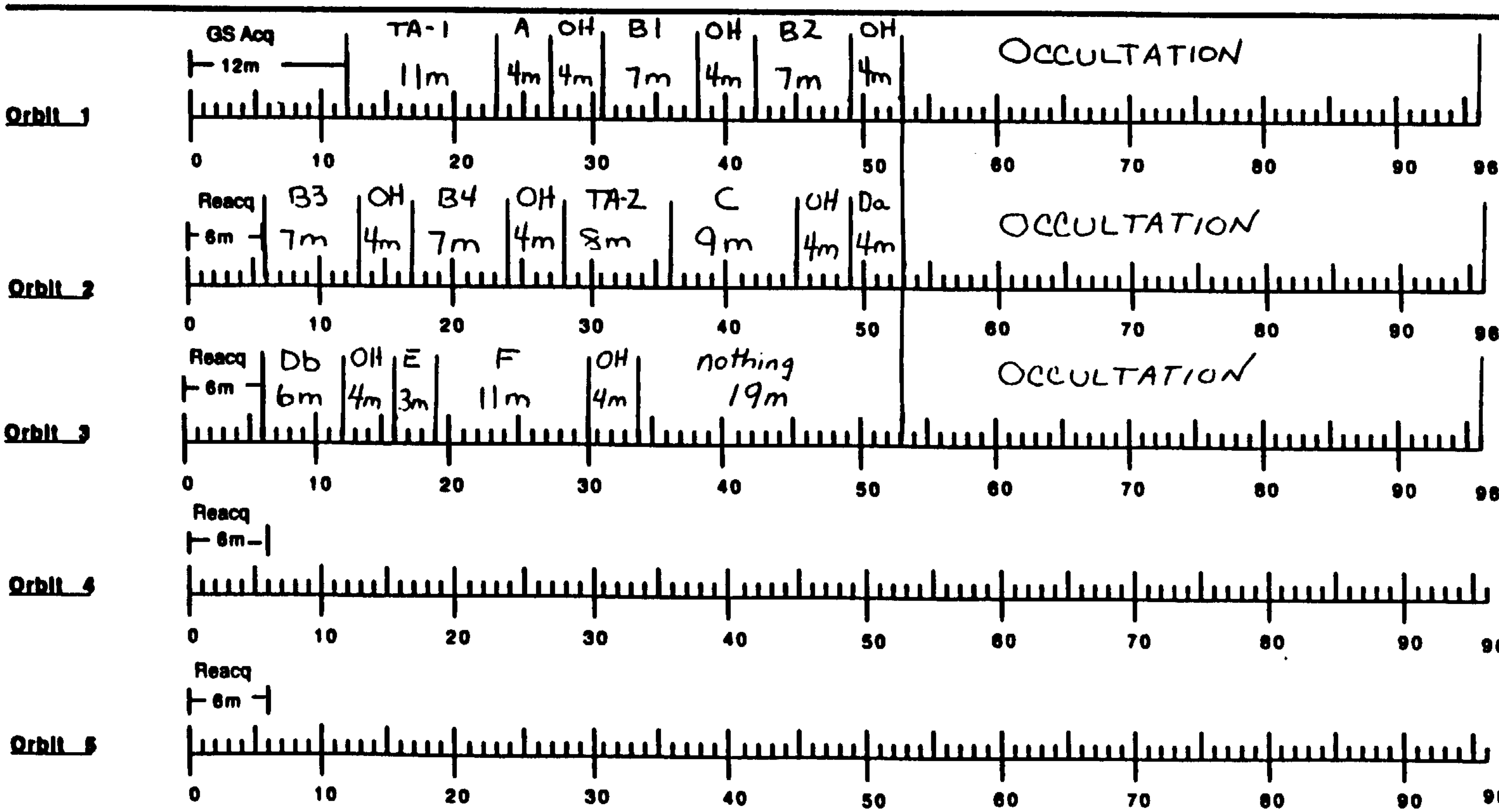
Target Acquisition ***Bright Targets***

Large Science Aperture (nominal accuracy)	20 minutes
Large Science Aperture (extreme accuracy)	20+17 minutes
Small Science Aperture	20+17 minutes

Target Name: MYSTAR **Declination:** -23 **V:** 10.0

Visibility: 53m **TA mode:** 11minute (A,B) + 8minute (C-F) **B-V:** 0.0

SI	MODE	APERTURE	ELEMENT	NUM EXP.	EXP. TIME	
HRS	ACCUM	2.0	G160M	1	4M	A
				4	7M	B
		0.25		1	9M	C
				1	10M	D
		WAVECAL		1	3M	E
				1	11M	F



Notes:
1) Note the paused exposure D between orbits 2 and 3.
2) The 19m at the end of orbit 3 is "wasted" in this example. In the real world, you should increase exposure time or add exposures to efficiently fill the orbit.

NOT TO BE SUBMITTED WITH PHASE I PROPOSAL

WFPC2 Worksheet

Overheads:

IMAGE (NO CR-SPLIT)	3 minutes
IMAGE (CR-SPLIT)	5 minutes
LRF	2 minutes

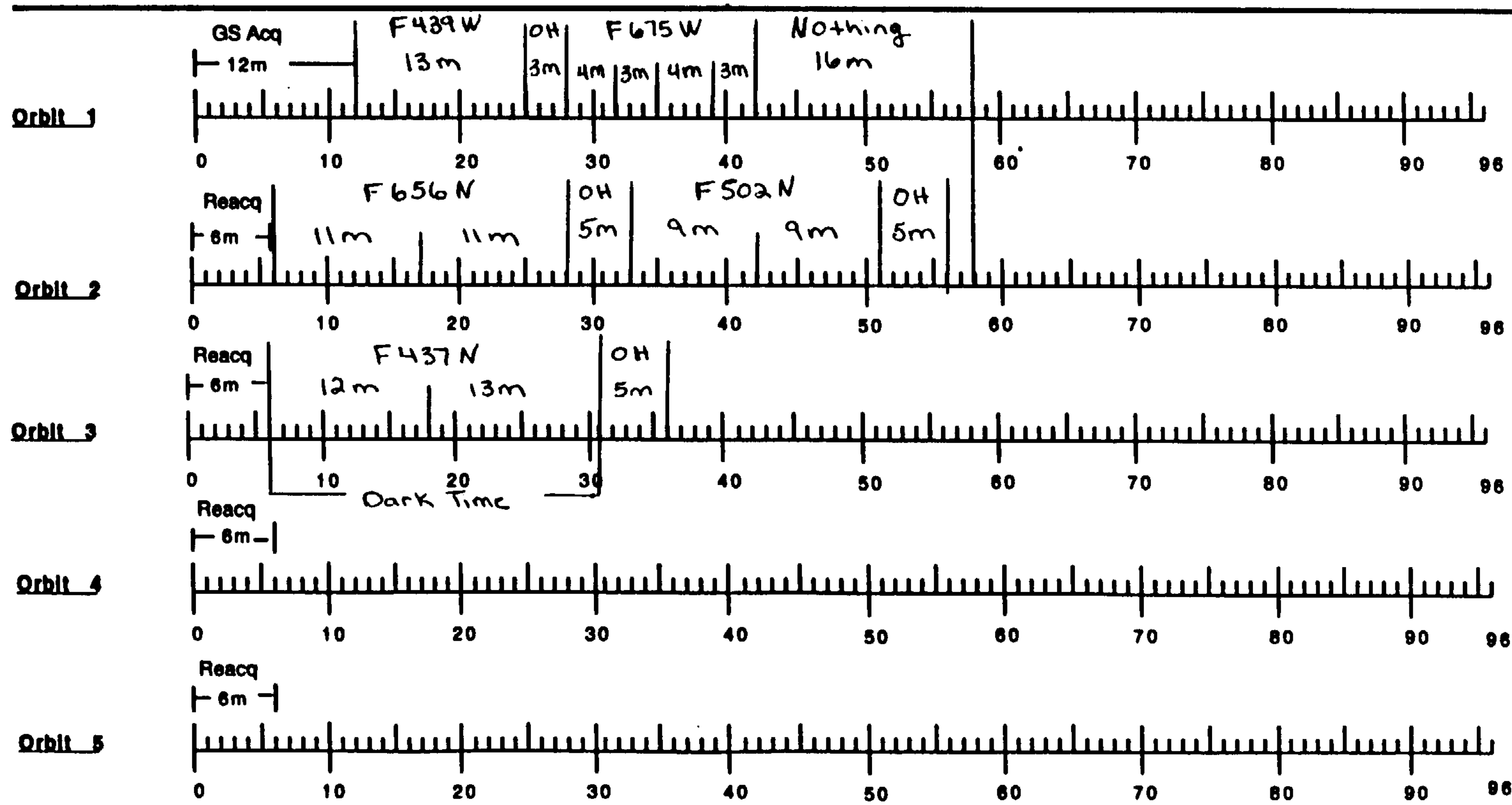
Target Name: GLOB_CLUST **Declination:** -77

Visibility: 58

Notes: 1) The 16m at the end of orbit 1 is "wasted" in this example. In the real world, you should increase exposure time/add exposures to efficiently fill the orbit.

2) The guide star re-acquisition time and end-of-orbit overhead occur outside the DARK TIME window.

SI	MODE	APERTURE	ELEMENT	NUM EXP.	EXP. TIME	
WF/PC2	IMAGE	PC1	F439W	1	13m	NO CR-SPLIT
			F675W	2	4m	
			F656N	1	22m	
			F502N	1	18m	
			F437N	1	25m	DARK TIME



FGS Worksheet

Overheads:

TRANS	3 minutes	
POS	2 minutes	V < 14 ᵐ
	3 minutes	14 ᵐ < V < 15 ᵐ
	4 minutes	15 ᵐ < V < 16 ᵐ
	9 minutes	V > 16 ᵐ

Target Name: NEARBY-STAR

Declination: +5

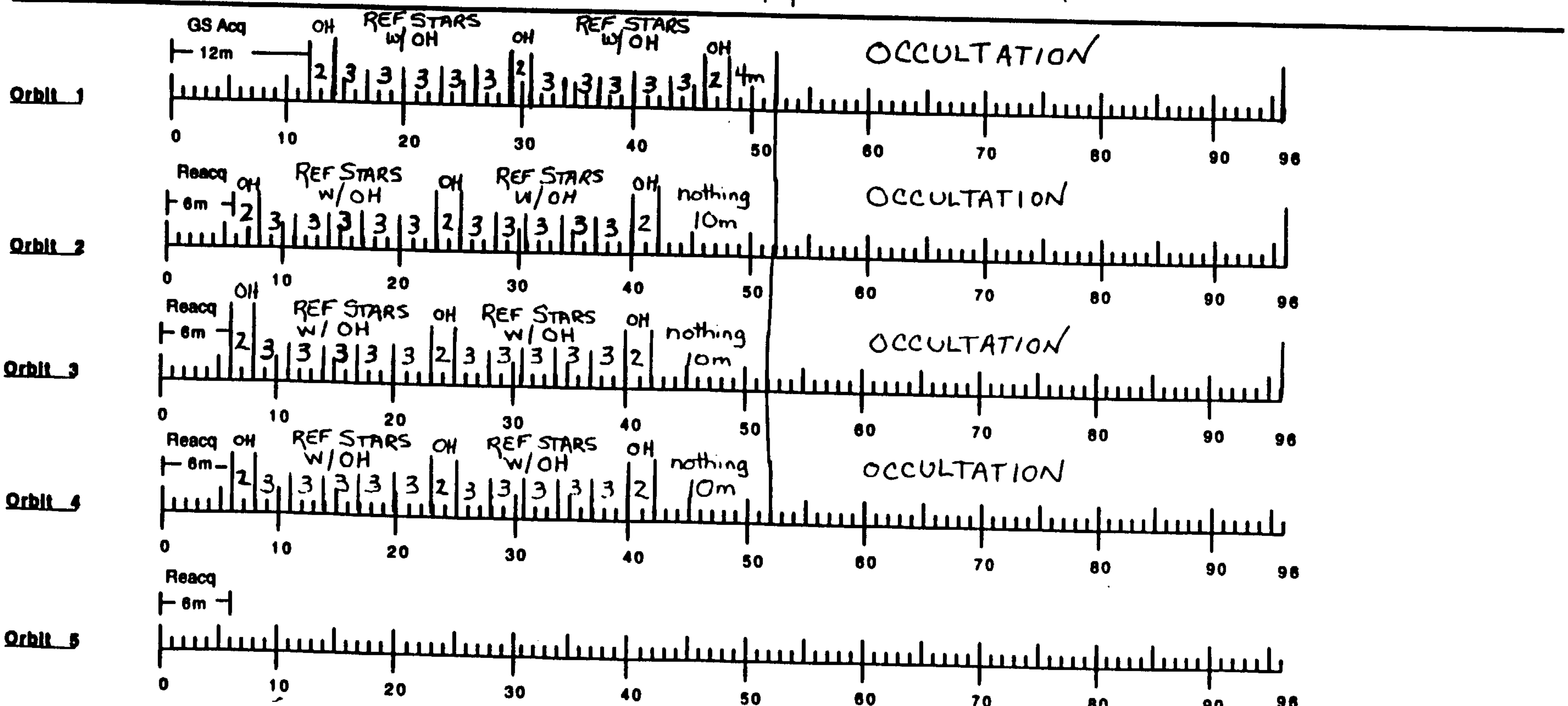
V: 15

Visibility: 52m

SI	MODE	APERTURE	ELEMENT	NUM EXP.	EXP. TIME	
FGS	POS	PRIME	F583W	1	10 S	
				5	1 M	REF STARS
				1	10 S	
				5	1 M	REF STARS
				1	10 S	

Notes: 1) Exposures on the prime target are too short to be mapped.

Repeat the series 4 times.



NOT TO BE SUBMITTED WITH PHASE I PROPOSAL

FOC Worksheet

Overheads:

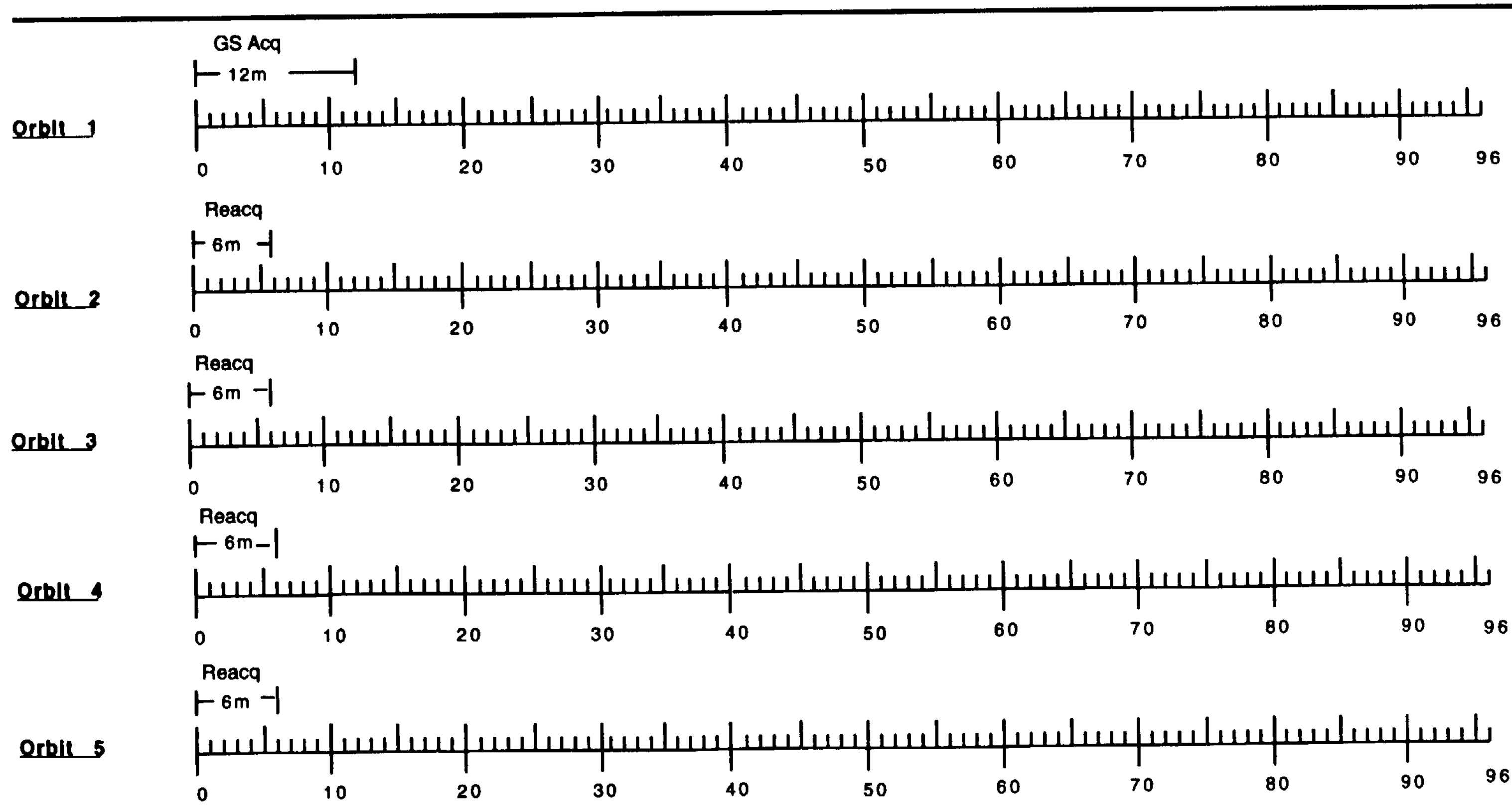
IMAGE	7 minutes
ACQ	12 minutes
OCC	7 minutes

Target Name:

Declination:

Visibility:

SI	MODE	APERTURE	ELEMENT	NUM EXP.	EXP. TIME



NOT TO BE SUBMITTED WITH PHASE I PROPOSAL

FGS Worksheet

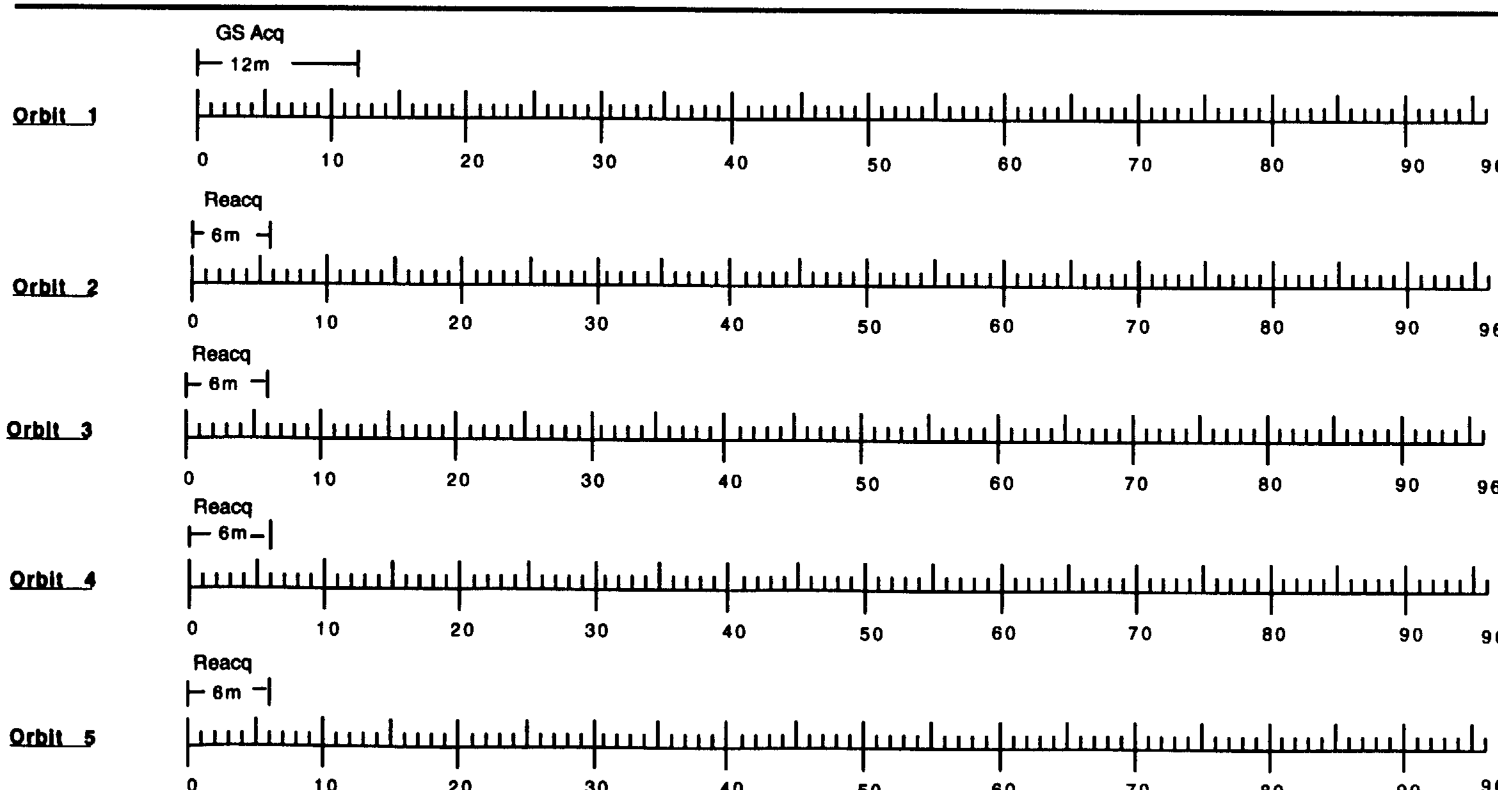
Overheads:

TRANS	3 minutes	
POS	2 minutes	$V < 14^m$
	3 minutes	$14^m < V < 15^m$
	4 minutes	$15^m < V < 16^m$
	9 minutes	$V > 16^m$

Target Name: **Declination:** **V:**

Visibility:

SI	MODE	APERTURE	ELEMENT	NUM EXP.	EXP. TIME



NOT TO BE SUBMITTED WITH PHASE I PROPOSAL

FOS Worksheet

Overheads:
ACCUM/IMAGE/PERIOD 6 minutes
RAPID 7 minutes

Target Acquisition

non-variable, non-extended, known energy distribution

Aperture:		
	4.3, 1.0	9 minutes
	0.5	9+12 minutes
	0.3	9+25 minutes
	SLIT	9+10 minutes
	BAR	9+13 minutes

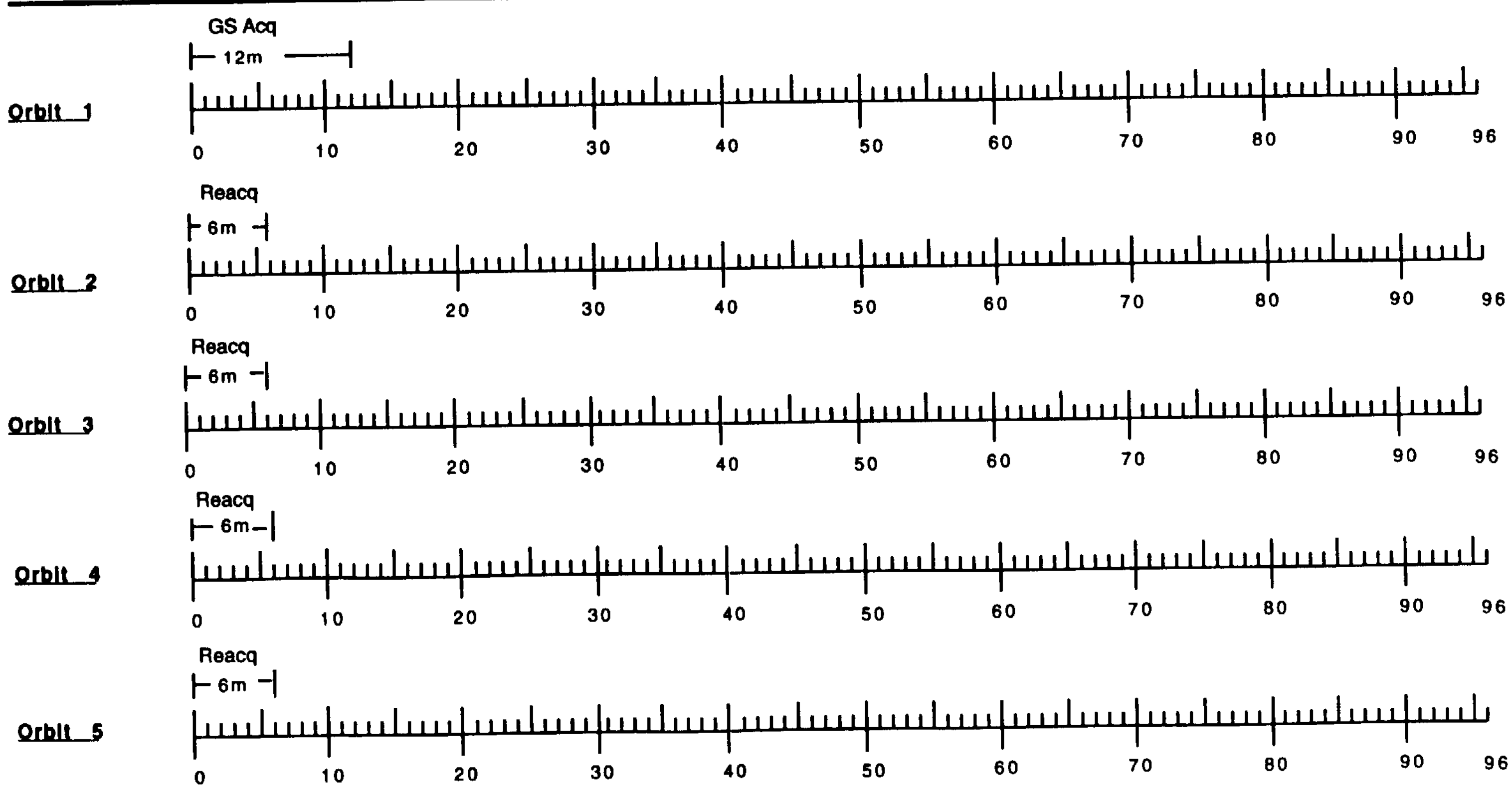
variable, extended, unknown energy distribution

Aperture:		
	4.3, 1.0	7+14+25 minutes
	0.5	7+14+12+17 minutes
	0.3	7+14+25+25 minutes
	SLIT	7+14+25+10 minutes
	BAR	7+14+25+13 minutes

Target Name: **Declination:** **V:**

Visibility: **TA mode:**

SI	MODE	APERTURE	ELEMENT	NUM EXP.	EXP. TIME



NOT TO BE SUBMITTED WITH PHASE I PROPOSAL

GHRS Worksheet

Overheads:

IMAGE	6 minutes
IMAGE	15 minutes (Bright Object)
ACCUM/RAPID	4 minutes
WSCAN	3 minutes + 1 minutes/wavelength
OSCAN	5 minutes + 1 minutes/order

Target Acquisition *Most Targets*

Large Science Aperture (nominal accuracy)	11 minutes
Large Science Aperture (extreme accuracy)	11+8 minutes
Small Science Aperture	11+8 minutes

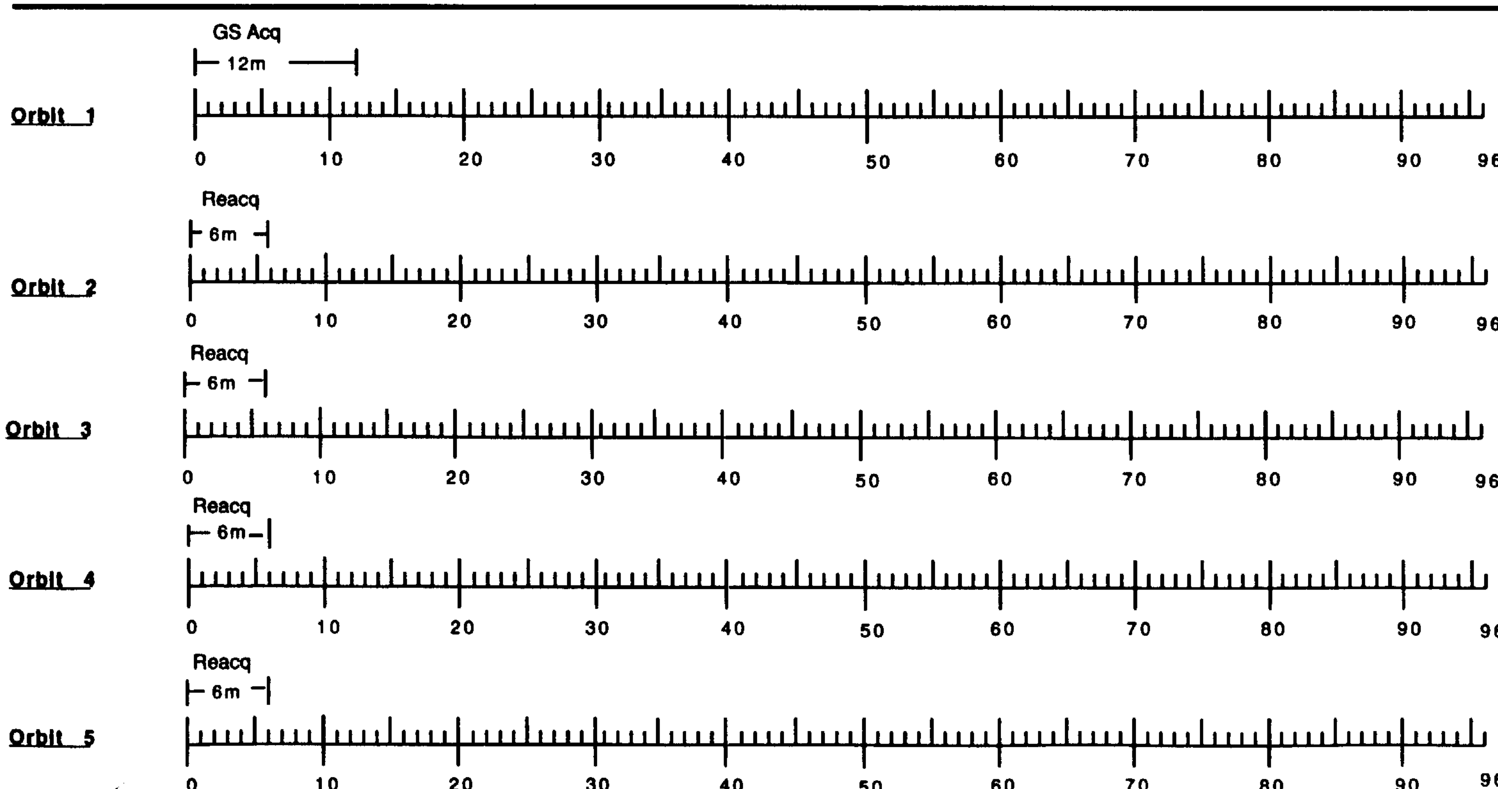
Target Acquisition *Bright Targets*

Large Science Aperture (nominal accuracy)	20 minutes
Large Science Aperture (extreme accuracy)	20+17 minutes
Small Science Aperture	20+17 minutes

Target Name: **Declination:** **V:**

Visibility: **TA mode:** **B-V:**

SI	MODE	APERTURE	ELEMENT	NUM EXP.	EXP. TIME



NOT TO BE SUBMITTED WITH PHASE I PROPOSAL

WFPC2 Worksheet

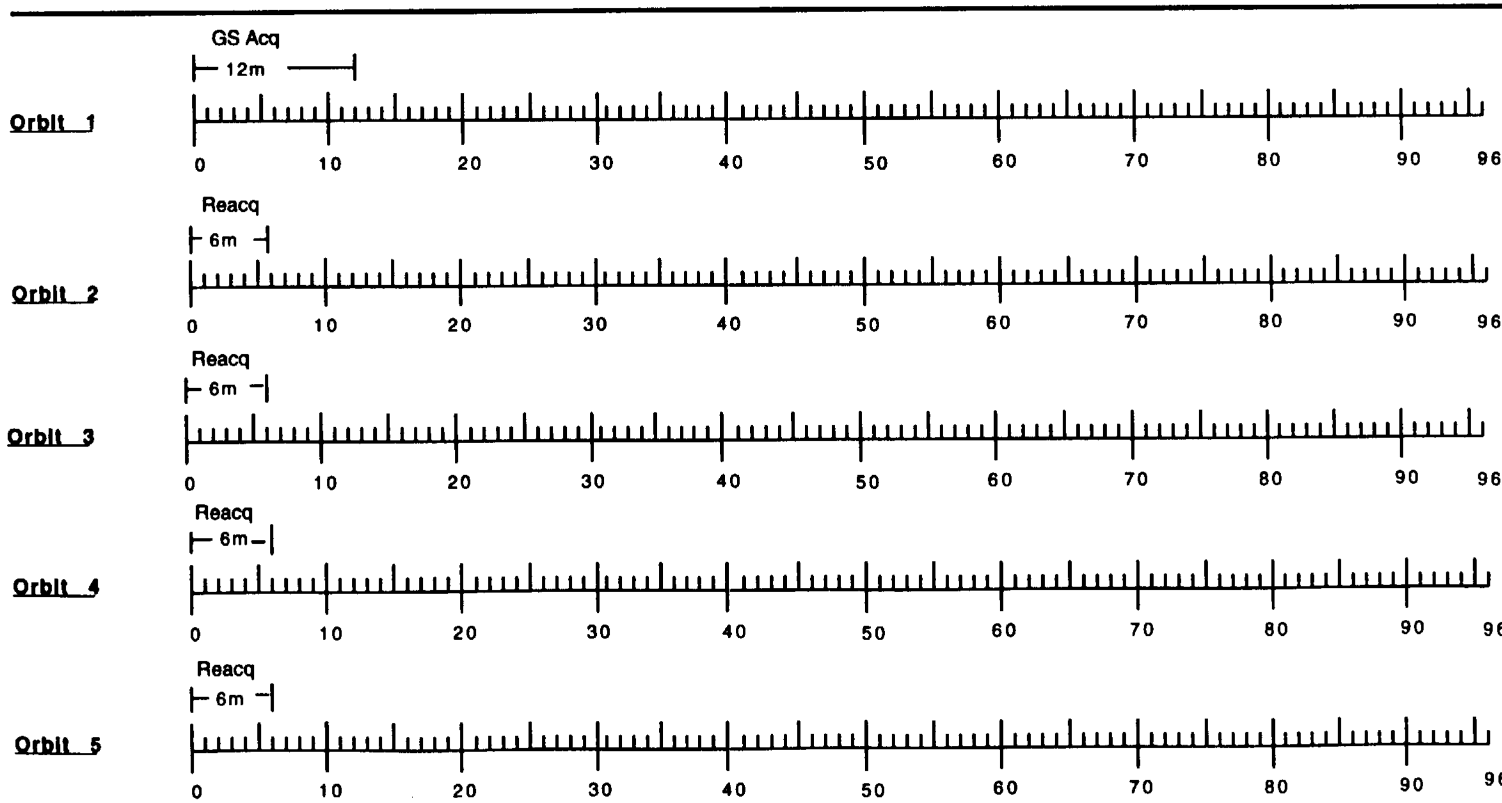
Overheads:

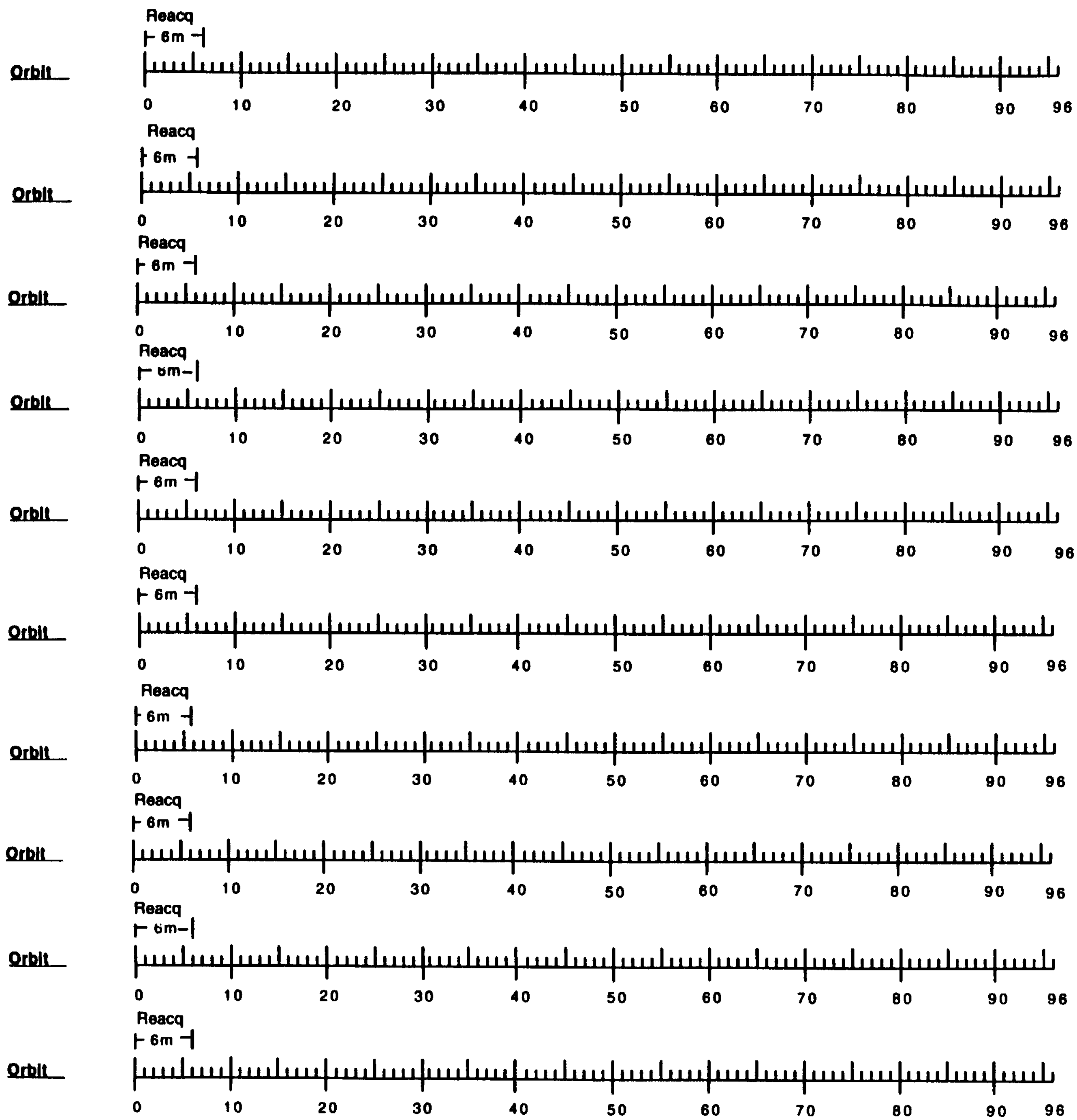
IMAGE (NO CR-SPLIT)	3 minutes
IMAGE (CR-SPLIT)	5 minutes
LRF	2 minutes

Target Name: **Declination:**

Visibility:

SI	MODE	APERTURE	ELEMENT	NUM EXP.	EXP. TIME




Reacq
6m
Orbit
0 10 20 30 40 50 60 70 80 90 96
Reacq
6m
Orbit
0 10 20 30 40 50 60 70 80 90 96
Reacq
6m
Orbit
0 10 20 30 40 50 60 70 80 90 96
Reacq
6m
Orbit
0 10 20 30 40 50 60 70 80 90 96
Reacq
6m
Orbit
0 10 20 30 40 50 60 70 80 90 96
Reacq
6m
Orbit
0 10 20 30 40 50 60 70 80 90 96
Reacq
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Orbit
0 10 20 30 40 50 60 70 80 90 96
Reacq
6m
Orbit
0 10 20 30 40 50 60 70 80 90 96
Reacq
6m
Orbit
0 10 20 30 40 50 60 70 80 90 96
Reacq
6m
Orbit
0 10 20 30 40 50 60 70 80 90 96

H BLANK BUDGET FORMS

The following blank forms are provided:

- □ Budget Forms GF-95-1, GF-95-2, and GF-95-3 (to be completed in Phase I by U.S. Archival Researchers only)

GO/AR BU[obscured]T FORMS

GF-95-1

C-2

1. Institution	**2. Investigator**	**3. Proposal Type** GO [ ] AR [ ]	**4. Date**
5. Type of Submission Proposal [ ] Revision [ ] Proposal/Grant Number ______ Institutional Identifying Number (if applicable) ______	**6. Institution/Principal Investigator** (if different from 1 & 2)	**7. Continuation of HST Grant** Number ______	

8. Proposal Title

9. Budget Items

A. Salaries and Wages

	Cycle ___ Period From: ___ To: ___				Cycle ___ Period From: ___ To: ___				Total Cost
1. Senior Personnel Principal Investigator, Co-Investigators 1 (d)-2 (e): Show number in [ ]	Monthy (or) Hourly Rate ×	No. of Months ×	Percent of Time =	Amount Charged to Project	Monthy (or) Hourly Rate ×	No. of Months ×	Percent of Time =	Amount Charged to Project	
a. ______	$ ______ ×	______ ×	______ % =	$ ______	$ ______ ×	______ ×	______ % =	$ ______	
b. ______	$ ______ ×	______ ×	______ % =	$ ______	$ ______ ×	______ ×	______ % =	$ ______	
c. ______	$ ______ ×	______ ×	______ % =	$ ______	$ ______ ×	______ ×	______ % =	$ ______	
d. [ ] Others (List Details on Separate Page)				$ ______				$ ______	
2. Other Personnel: show numbers in [ ]									
a. [ ] Post Doctoral Associates	$ ______ ×	______ ×	______ % =	$ ______	$ ______ ×	______ ×	______ % =	$ ______	
b. [ ] Graduate Students	$ ______ ×	______ ×	______ % =	$ ______	$ ______ ×	______ ×	______ % =	$ ______	
c. [ ] Undergraduate Students	$ ______ ×	______ ×	______ % =	$ ______	$ ______ ×	______ ×	______ % =	$ ______	
d. [ ] Secretarial/Clerical	$ ______ ×	______ ×	______ % =	$ ______	$ ______ ×	______ ×	______ % =	$ ______	
e. [ ] Other—Specify (use separate sheet if necessary)	$ ______ ×	______ ×	______ % =	$ ______	$ ______ ×	______ ×	______ % =	$ ______	
Total Salaries and Wages				$ ______				$ ______	$ ______

	Rate	Base	Total	Rate	Base	Total	
B. Fringe Benefits (if charged as a direct cost) If more than one rate is used, list each rate separately.	______ % ×	$ ______ =	$ ______	______ % ×	$ ______ =	$ ______	
	______ % ×	$ ______ =	$ ______	______ % ×	$ ______ =	$ ______	$ ______

C. Travel Destinations	Transportation Cost	Lodging & Subsistence Cost	No. of Days in travel Status	Total	Transportation Cost	Lodging & Subsistence Cost	No. of Days in travel Status	Total	
1. ______	$ ______ +	$ ______	______	$ ______	$ ______ +	$ ______	______	$ ______	
2. ______	$ ______ +	$ ______	______	$ ______	$ ______ +	$ ______	______	$ ______	
3. ______	$ ______ +	$ ______	______	$ ______	$ ______ +	$ ______	______	$ ______	$ ______

D. Supplies and Materials	Basis/Method of Cost Computation	Totals	Basis/Method of Cost Computation	Totals	
1. ______	______	$ ______	______	$ ______	
2. ______	______	$ ______	______	$ ______	$ ______

INSTRUCTIONS FOR COMPLETING THE DETAILED GO/AR BUDGET FORMS

GENERAL INFORMATION

GO/AR Budget Forms GF-95-1 and GF-95-2 provide ST ScI with a breakdown of the anticipated costs to analyze HST data. An original and one copy of these forms, together with Budget Narrative Form GF-95-3, must be submitted to the ST ScI Grants Administration Branch for the Phase II deadline. Forms GF-95-1 and 95-2 must also be submitted for a revision of an approved grant budget. For multi-institutional budget requests, one copy of the three budget forms from each Co-I institution must be attached to the Principal Investigator's (PI's) budget. The PI will submit all budgets for an HST program to ST ScI. In addition, please attach a copy of the institution's current Federal Indirect Cost Negotiation Agreement that supports the rate used in the budget.

INSTRUCTIONS FOR COMPLETING FORM GF-95-1

Information concerning the allowability of costs may be found in the Call For Proposals and in the ST ScI General Grant Provisions. A separate page should be attached if additional space is required to list all of the costs for any item on the forms. Additional information or justifications of specific items should be provided on the Budget Narrative Form (GF-95-3).

Item 1-8: Self-explanatory.

Item 9(A): List the salaries and wages for the personnel associated with the Program.

Item 9(A)-1: List the senior personnel who will be working on the project and provide a breakdown of their salaries and wages. If the data analysis will take more than 12 months, indicate the amount of funds needed in each twelve month period.

Item 9(A)-2: List the costs for the Other Personnel associated with the Program.

Item 9(B): List the amount of fringe benefits applicable to 9(A)-1 and -2, provided such costs are not included in the organization's indirect cost pool. Please provide the rate(s), base(s) and total fringe benefits.

Item 9(C): Itemize travel by destination and the cost of each trip. All travel outside of the United States, its possessions, and Canada, must be performed on U.S. flag carriers to the extent service is available.

Item 9(D): Indicate the types of supplies and materials needed and the basis or method of computation.

Institution	Investigator		Proposal / Grant Number		
E. Computer Services	Basis/Method of Cost Computation	Totals	Basis/Method of Cost Computation	Totals	Total Cost
1. ______	______	$ ______	______	$ ______	
2. ______	______	$ ______	______	$ ______	$ ______
F. Publication Costs/Page Charges	Number of Pages × $/page	Totals	Number of Pages × $/page	Totals	
1. ______	______ $ ______	= $ ______	______ $ ______	= $ ______	$ ______
G. Equipment		Totals		Totals	
1. ______		$ ______		$ ______	
2. ______		$ ______		$ ______	$ ______
H. Co-I Awards (awarded directly by ST ScI) List additional Co-I awards on separate page.		Totals		Totals	
1. ______		$ ______		$ ______	
2. ______		$ ______		$ ______	$ ______
I. Other (including subcontracts)		Totals		Totals	
1. ______		$ ______		$ ______	$ ______
J. Indirect Costs		Totals		Totals	
Date of Negotiation Agreement with Federal Agency ______ (Attach Copy)					
Agency ______	______ % of $ ______ (Base) =	$ ______	______ % of $ ______ (Base) =	$ ______	
Agreement Date ______	______ % of $ ______ (Base) =	$ ______	______ % of $ ______ (Base) =	$ ______	$ ______
10. Total Project Costs		$ ______		$ ______	$ ______

11. A. Approved Funding for Previous Cycles	$ ______
B. Total Costs for Later Cycles	$ ______
C. Total Program Costs (Sum of 9 + 10A + 10B)	$ ______
12. Preparatory Grant (If a preparatory grant will be necessary, please indicate the amount of funds required.)	$ ______
13. Cost-Sharing (Please list any cost that will be funded by sources other than ST ScI.)	$ ______

14. A. List on a separate sheet all non U.S. Scientists who will be working on the project (if applicable).
B. Please check the box to certify that only U.S. Scientists will be provided grant funds. ☐

15. A. List on a separate sheet all Federal Employees working on the project (if applicable). ST ScI funds may NOT be used to support foreign investigators.
B. Please check the box to certify that the cost associated with the work of the Federal employee(s) is not available through their Federal Agency. ☐

16. List a summary of current and pending research support of the senior personnel (from all sources) on a seperate sheet of paper.
Please include the funding source, amount awarded, project period, and project title for each award.

17. Authorizing Official

______ Signature ______ Name (Please Type or Print) ______ Date ( ) ______ Telephone ______ Ext.

______ Title ______ Address

INSTRUCTIONS FOR COMPLETING THE DETAILED GO/AR BUDGET FORMS

INSTRUCTIONS FOR COMPLETING FORM GF-95-2

Item 9(E): Include a breakdown of costs based on established computer service rates.

Item 9(F): Provide an estimate of the amount of publishing costs.

Item 9(G): List all items of equipment (any item exceeding $1,000 and 2 years useful life). Please see the Call For Proposals or General Grant Provisions for more information on the ST ScI policy concerning such purchases.

Item 9(H): Funds to be awarded directly by ST ScI to Co-Investigators should be listed in this category. Detailed budgets (Forms GF-95-1 and GF-95-3) should be attached to the PI's budget.

Item 9(I): Itemize each item and provide a justification. Please use a separate page if necessary.

Item 9(J): Indirect costs based on a rate established with a Federal Agency are allowable. Please attach a copy of your institution's current Federal Indirect Cost Negotiation Agreement that supports the rate used in the budget. Institutions which do not have an established rate may charge an amount up to 10% of total direct costs not to exceed $5,000. The indirect cost rate should not be applied to item 9(H) since ST ScI will award those funds directly to each Co-Investigator. Please see the Call For Proposals or the General Grant Provisions for more information on the ST ScI policies concerning indirect costs.

Item 10: Total of Items 9(A) through 9(J).

Item 11: Indicate the funding requirements for future observing cycles as well as the approved funding for previous cycles (if applicable).

Item 12: With the exception of preparatory funding, ST ScI grant funds will not be awarded until observational data is obtained for a project. ST ScI encourages proposers to request up to 25% of the total project costs for preparatory activities prior to the receipt of observational data. For Archival Rsearcher Programs, full funding will be provided shortly after funds are allocated to each Program.

Item 13: Indicate whether any of the costs of the project will be provided by a source other than ST ScI. Normally, the grantee institution will be expected to provide at least one half of the cost of all major items of equipment.

Item 14: Provide a list on a separate page of all non-U.S. scientists who will be working on the project. Certification is required that only U.S. scientists will receive grant funds.

Item 15: Provide a list on a separate page of all Federal Employees who are associated with the project. Certification is required that none of the research costs of those employees are available through their Federal Agency.

Item 16: Provide a list of current and pending research support.

Item 17: The signature of an authorizing official of the institution assuming responsibility for the project should be provided in the space indicated. The signature of an unaffiliated U.S. scientist should be provided in this space, if applicable.

SPACE TELESCOPE SCIENCE INSTITUTE

Budget Narrative Form

GF-95-3

Institution	Principal Investigator	Proposal Number
Proposal Title		

Targets/Exposures

Please provide target and exposure information below:

Instrument(s)	Number of Target(s)	Number of Exposure(s)

Please provide a brief description of the budgeted costs, especially Personnel, Travel, and Equipment along with a justification for the level of support requested. If the program involves multiple investigators, please discuss the role of each investigator in the scientific program. Include an additional page if needed.

I ACRONYMS AND ABBREVIATIONS

AR	Archival Research
CCD	Charge-Coupled Device
Co-I	Co-Investigator
COSTAR	Corrective Optics Space Telescope Axial Replacement
CVZ	Continuos Viewing Zones
DUP	Duplicate Observation
DT	Dark Time Observation
ESA	European Space Agency
FGS	Fine Guidance Sensor
FOC	Faint Object Camera
FOS	Faint Object Spectrograph
FTP	File Transport Protocol
GASP	GSSS Astrometric Support Package
GHRS	Goddard High Resolution Spectrograph
GO	General Observer
GSSS	Guide Star Selection System
GTO	Guaranteed Time Observer
HST	Hubble Space Telescope
MT	Moving Target
OS	Observation Summary
PAR	Parallel Observation
PI	Principal Investigator
SAA	South Atlantic Anomaly
SI	Scientific Instrument
STEIS	STScI Electronic Information Service
STScI	Space Telescope Science Institute
TAC	Telescope Allocation Committee
TOO	Target of Opportunity Observation
USB	User Support Branch
WFPC2	Wide Field Planetary Camera 2