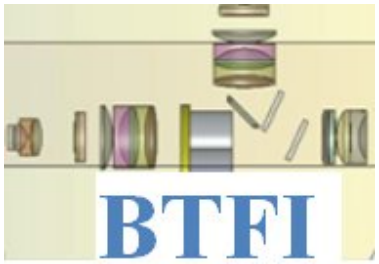

Brazilian Tunable Filter Imager (BTFI)

Project Management Plan

Doc# BTFI_10.01_ManagementPlan_v01

Version 1

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Change Log

Version	Date	Author	Affected Sections	Comments & Justification
1	2007-09-22	PG	All	Original of this document Doc# BTFI-00.00.00-02-DOC-A_ManagePlan written in March 2007 at project kickoff. Major revision 21 sept 2007 at CoDR to include lates managemnt changes.
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Summary

This document describes the project management plan for the BTFI Instrument Project. It was developed in consultation with the staff involved from Universidade de São Paulo and Laboratório Nacional de Astrofísica, Itajubá. Ithe original version of this document has doc# BTFI-00.00.00-02-DOC-A_ManagePlan and was produced during a visit to Brazil by Peter Gray, Atacama Engineering Consulting during the period 1st-22nd February, 2007. This version BTFI_10.01_ManagementPlan_v01 (note new doc# system) was written in September 2007 prior to the Conceptual Design Review. It includes several new plans and ideas developed during 2007 for managing the BTFI project, however much of the managemnt plan is unchanged form the March, 2007 version.

This document describes a set of project documents which would form the basis for the project which includes: a Work Breakdown Structure (WBS) list; Requirements Document; Project Documentation System, Project Schedule and Budget. Suggestions are given on ways documentation management could be organized using a web-based tool such as wiki. A detailed description is given on the important role, responsibilities and duties of the Project Manager. A structured management system using Work Packages is described which will would suit a distributed organization of the project between different institutions.

Some suggestions of how project meetings could be organized using internet-based communications. A list of technical staffing estimates for the project is also given. A project schedule is described which includes Project Milestones. The importance of these milestones is discussed.

A detailed description is given of a set of project reviews, starting with the Conceptual Design Review (CoDR), through the Preliminary Design Review (PDR) and the Critical Design Review (CDR) prior to construction. Comments and suggestions are made on the purpose, expected information and the outcomes expected from each of these reviews levels.

Finally, suggestions and comments are made on various other aspects of the project, including: Interface Control and Systems Engineering; Project Mechanical Engineering.

Applicable Documents

Related Document	Document Name	Doc#
(1)	BTFI Instrument – Requirements & Specifications	BTFI_11.01_Requirements_v01
(2)	BTFI Project Schedule	BTFI_12.01_ProjectSchedule_v01
(3)	BTFI Project Project Budget - Hardware & Manpower	BTFI_13.01_Budget_v01
(4)	BTFI Project WBS (Work Breakdown Structure) - Simplified	BTFI_14.01_WBSList_v01
(5)	BTFI Project WBS Document Numbering System & List of Documents	BTFI_14.02_DocumentNumber_v01

Abbreviations and Acronyms

This document employs several abbreviations and acronyms to refer concisely to an item, after it has been introduced. The following list is aimed to help the reader in recalling the meaning of each short expression:

API	Application Programming Interface
ICS	Instrument Control System
BTFI	Brazilian Tunable Filter Imager
F-P	Fabry-Perot
FITS	Flexible Image Transport Format
FoV	Field of View
GLAO	Ground Layer Adaptive Optics
GUI	Graphical User Interface
iBTF	imaging Bragg Tunable Filter
OCS	Observatory Control System
PSF	Point Spread Function
SAM	SOAR Adaptive Module
SCL	SOAR Communications Library
SDSU	San Diego State University
SL	Seeing-Limited
SOAR	Southern Astrophysical Research Telescope
TCS	Telescope Control System
VPHG	Volume Phase Holographic Grating

1. Work Break Down Structure

A document (4) "BTFI Project WBS (Work Breakdown Structure) - Simplified "Doc# BTFI_14.01_WBSList_v01 has been produced. This Work Breakdown Structure (WBS) list lays out, using a simplified two digit number to designate the structure, sub-systems and components of the project and instrument. The purpose of this structure is to allow all aspects of the project to be managed in the same systematic way. It provides an easy reference to the work which will be covered by the project. The same structure and numbering system can be utilized across the project for document numbering, document archive file structure, requirements and interface numbering. The structure can also be employed for all management aspects such as project schedule and budget and work package division. It forms a useful basis for structuring the agenda of regular project meetings and reviews as well as reports. The 100 number designation WBS system should allow sufficient detail to include most individual mechanisms and components which need to be identified.

The WBS list is a working document which needs to be regularly updated and revised as new parts of the project are added and changed. It is an important key project document on which much of the project is based, so must be revised and modified through a carefully controlled system of change control, revision numbering and approval (see following section on Document Management System). Updates to the WBS should be regularly distributed to all project staff (via a web based link) since they will need to use the list for their own documents and project structuring.

2. Requirements Document

An important project document which is needed early in the project is the Requirements Document. A document (1) "BTFI Instrument – Requirements & Specifications" "(Doc# BTFI_11.01_Requirements_v01) which gathers together in one place the fundamental science-driven technical requirements and specifications of related systems. In the early stages of the project, this document can be a working document which can be revised and added to as the design evolves, but which should be subject to the project's strict change control, revision, approval and release. This is particularly important as once the technical investigations and design commences, it is important that everyone on the project is working with the same assumptions and design data.

Control of the Requirements Document is an important project management task. It is important to ensure that the project work is well-match to the requirements to prevent the inevitable "scope-creep" which results from gradual additions of "bells and whistles" by the science users and over-design by the engineering staff. A gradual evolution of the Requirements lis is expected leading up to Conceptual Design Review, however once the Detailed Design phase is started, changes should only be made with careful consideration of their likely cost to budget, schedule and risk.

The Requirements list is structured using the WBS elements. Individual requirements for each system/sub-system are given a sequence number for each new requirement. The

Requirements list includes a “Change Log” which should be used to track modifications and revisions.

It is important to include only those requirements and specifications that are fundamental and likely to be used for design work or to fulfill the end use performance of the BTFI instrument. It is not necessary to include all technical data in the Requirements list. *(Note: the difference between a Requirement and a Specification. A Requirement is the requested performance or needed characteristic which is “required” for the instrument. A Specification is the derived specified performance and characteristic of the as-designed or as-built system.)*

3. Document Management

The archiving, control and distribution of documentation and information is an important part of the project, especially considering the distributed nature of the BTFI project. It is necessary to provide a place to store all the documents so that they can be accessed easily and ensure they are using the most recent version.

The three main parts of document management are: the system used to upload, archive and retrieve the documents; a standardized document numbering and template; and a procedure for change control with revision, approval and release. The documents and information of the project can be divided into two main types. First, there is the official project documentation which follows the formal system of numbering, format and change control. Secondly, there is the project information which can be a loosely controlled, for-information-only collection of emails, datasheets, memos and diagrams. Both sets of documents and information can utilize the same document storage system with the official project documents being distinguished by their document number and configuration control.

A web-based document archive for the BTFI Project has been established (http://www.astro.iag.usp.br/~btfi/doku.php?id=home) which uses the shareware Twiki system (http://twiki.org/). This sysem will require someone with system administration experience to setup and maintain the system. It is important also configure the system to make it easy to use and not overly complicated or burdensome for project staff to use. It needs to be easy to use and used by everyone to be an effective project tool. Once the system is installed and configured, a detailed training and explanation is a good idea to get everyone up-to-speed. The BTFI wiki has been divided into sections of Folder and Sub-Folders to group certain kinds of documents together. It includeds areas forproject documents, management, design reviews and presentations. A Technical Section has been created with sections approximatelt corresponding to the WBS structure. There is a search engine built into the archive to locate documents.

A standardized document numbering system has been developed using the WBS numbering. This is described in document (5) “BTFI Project WBS Document Numbering System & List of Documents” “(Doc# BTFI_14.02_DocumentNumber_v01)
The document number uses the WBS list to identify the appropriate sub-category, plus a document sequence number, short desciption and version number.

The format is:
BTFI_XX.YY_abcdefghijk_vZZ
where:
XX is WBS number for category of document.
YY is sequence number for the documents in this WBS category starting 01,02,03,etc.
"abcdefghijk" is a short name to identify the document.
ZZ is version number of document v01,v02,v03,etc.
Filenames can use the same document number with an extension. ie
BTFI_XX.YY_abcdefghijk_vZZ.xls

Standard templates (.doc and other) will be developed for project documents and made available for use. This template should have the necessary fields for the project document numbering, approvals and change control.

4. Project Manager & Project Organization

The Project Manager (PM) position is the most important component of the project. The person needs to take responsibility for delivering a successful instrument project on-time and on-schedule. For the major portion of the project, this needs to be a full-time position for the project to be successful. The PM should work closely with the Principal Investigator (PI), especially during the initial phase when requirements, schedule and budget are being defined and compromises made. However, once the project is underway, they should be given the authority to make decisions and push the project along. When problems are encountered, the PM should be the one to try to solve them within the resources that are available. If this is not possible, the PM should inform the PI of a potential problem and seek assistance. This should be done well before the problem reaches a deadline. Project monitoring of schedule and budget (see below) should be used to identify these problems beforehand. In a mid-sized project such as BTFI, the PM can participate in some areas of the technical work, but remembering the overall project management to be the first priority.

The PM needs to have at least two or more senior engineers or technical staff working on the project >75% of the time and have a broad knowledge and experience of several technical areas. These senior engineers provide the day to day close supervision of the work and have the authority, via a Work Package Management (WPM) to make their own technical decisions and management decisions. This frees the PM to manage and coordinate the entire project.

5. Work Package Management

A WPM system can be structured using the work break down list as a basis but dividing the project into a number of “work packages (WP)” which can be assigned to the various organizations with a senior person leading each as the Work Package Manager (WPM). Each WPM should be given budget and management responsibility for the work package.

The PM working with the WPMs prepares a list of work packages, required resources and prerequisites for the WP to start. A WP budget, schedule and milestone for each WP is defined together with a clear deliverable. As mentioned above, this system allows the PM to assign some of the project responsibility to other senior people, who carry out and manage

the detailed work with clearly defined goals. The WPs should utilize their own monitoring of their work package progress and report regularly to the PM.

The amount to which the WPM system is applied to the project depends on how large a project is and how many senior staff are available to run the system. However the principle can be applied usefully to any size project since it allows a structuring of the work activities and assists the monitoring of progress. It also is well suited to breaking the project up into sub-projects which can be built in various locations, while still allowing a centralized project manager to coordinate the overall project.

6. Distributed Project

The BTFI project which involves collaboration between various organizations within Brazil, as well as in UK, USA, Canada and France is widely distributed. This reinforces the need for a clear project organization and distribution of work activities using the WPM system as described above. Good communication and coordination will be important. Regular weekly meeting (see below) will be critical to keeping the distributed project on-track. A good on-line documentation system will be important to distribute and control information and documentation. Where parts and components will be designed and built in different places, it will be important to maintain a good system of up-to-date interface control documents, to ensure the entire instrument will fit together. During the final phases of construction and integration as soon as possible the distributed project should identify one location where the assembly and testing will be carried out. Staff at the distributed locations should be able to travel to this location to assist in the integration of their systems.

7. Project Mechanical Engineering

A majority of the design work required to build the BTFI instrument will consist of opto-mechanical design. Many of the major components (collimator, camera, fold-mirrors, etc.) will be designed and ordered as complete sub-assemblies, as will the filters, Fabry-Perot components, iBTF and science detectors. All of these componets will need to be fitted within a relatively compact space within the instrument, aligned and supported rigidly. This will require s considerable amount of opto-mechanical design effort and expertise.

The most suitable combination of technical staff to undertake this work would be a:
Senior mechanical engineer - who can: guide the design work; investigate alternatives; interface with the science group; coordinate with the optical designers and instrument controls designer. This person should have at least 5-10 years of experience in the design and construction of precision instrument mechanisms, ideally within a science environment. They should be capable of laying out mechanical drawings with CAD and analysis of mechanical systems using calculations and finite element analysis. The senior mechanical engineer would not be expected to undertake the detailed design and drafting of mechanical mechanisms and components.

Senior mechanical designer – this person would perform the more detailed mechanical design and drafting of instrument structure and mechanisms starting from conceptual mechanical design leading to finalize design and shop drawings. They should have extensive experience with the use of CAD systems to generate detailed designs and drawings capable

of being manufactured in machine shops. They should be able to work with partial supervision to take concepts and design suggestions and complete the detailed design using their own ideas and experience.

8. Staffing

The table below lists the project staff required for the BTFI project. As described above, the PM needs to be assigned to the project for a substantial proportion of the time, four or more senior staff need >50% of their time assigned. The remainder of the work activities can employ fractional parts of staff depending on availability. Use of contracted staff provides more flexibility and allows a concentrated effort during times of peak workload. In the final phases of construction and assembly, integration and verification there will be a peak of activity which will require a substantial number of staff to be available full-time for a period of several months.

Title	*WBS*	FTE	*Durn. Months*
Management - Project Manager - tbd	*10*	0.75	*30*
Management/Science - Principal Investigator - Claudia Oliveira	20	0.1	30
Management/Science- Project Scientist - Keith Taylor	20	1	24
Instrument Scientist#1 - Bruno Quint	20	1	30
Instrument Scientist#2 - tbd	20	1	24
Mechanical Engineer#2 - Rene Laporte	60	0.75	18
Mechanical Engineer#3- 2nd INPE person	60	0.75	18
Electronics Engineer#1 - Luis Cavalcanti	70	1	24
Electronics Engineer #2- tbc	70	1	24
Software Engineer#1- Giseli Ramos	80	1	30
Software Engineer#2 - tbc	80	1	12
	FTE-Yrs.	18.38	

9. Meetings

As mentioned, a distributed project requires good communications and coordination. Regular project meetings are an important part of good project management. Meetings should have an agenda sent beforehand with consideration of the time required to discuss each agenda item properly. The meeting should be run by either the PM or his designated replacement, and this person should limit the discussion of each agenda item and close out each with a conclusion which should be documented via a action item.

A good communication linkup is important for the meeting to be run smoothly. An administrative person should be responsible for soliciting and confirming the meeting time, testing the communications link and being available to handle problems during the meeting.

This is important to allow the PM or persons running the meeting to concentrate on the business of the meeting..

While the use of video conferencing has the benefit of face-to-face contact between the project team member, however a good audio link such as Skype program provides a cost-effective solution. According to the Skype information, up to five sites can be simultaneously connected via Skype conferencing (10 if the PC has a dual processor). Desirably, each BTFI project person could obtain a Skype name, however this is not necessary if a generic Skype login (e.g. BTFI_1, BTFI_2, etc.) is generated for each site. Skype conferencing requires the availability of a PC in the meeting room with Skype installed (consider having one there permanently for this purpose). Most of the Skype webcams e.g. Logitech Quickcam have excellent microphones and when used together with external PC speakers are a cheap and effective way of holding audio Skype conferences. See:
http://www.logitech.com/index.cfm/products/details/US/EN,CRID=2204,CONTENTID=11932

10. Project Reviews

The use of project reviews at selected phases is an excellent way of focusing the projects attention at critical times to document, set milestones and report progress. Feedback and recommendations from a review panel is an excellent source of additional information and independent opinion and judgment for the project staff. The reviews are usually divided into three stages which reflect the phases of the project prior to construction. These are:

- Conceptual Design Review (CoDR)
- Preliminary Design Review (PDR)
- Critical Design Review (CDR)

The following sections describe each of these reviews in more detail. The phase of the project they should be held, the type of material which should be generated for review and the expected outcome of the review.

10.1 Conceptual Design Review (CoDR) – the purpose of the CoDR is to gather together the information that has been discussed and collected during the project kickoff and startup discussions and to freeze the project scope, concept and plan into clear set of documented requirements, information, schedule and budget. The technical staff of the project can then use these to undertake design investigations in more detail based on a defined choice or more limited set of choices. The mechanical engineer and designer should prepare for the CoDR a set of overall instrument layouts based on the evolving requirements and instrument scope. They could also select several of the more challenging aspects of the design for more thorough investigation during this CoDR design phase. The project electronics and controls engineer should investigate and document controls hardware and software choices in cooperation with the mechanical design activities. The project management can develop and document the proposed management structure together with a more detailed schedule and proposed budget. During this conceptual design stage, the science team could develop further the science case for the instrument, based on a clear set of technical specifications, as well as investigating, planning and documenting issues such as preliminary commissioning plans, observing support requirements and data reduction.

10.2 Preliminary Design Review (PDR) – the purpose of the PDR is to report on the project progress during the design phase and present the detailed design of the optics, mechanics, controls and software of the instrument. At the time of the PDR, the majority of the design work should be completed and most technical choices been made. The design should be essentially ready to proceed to construction with sufficient detail to obtain accurate costings of staff time, materials and procurements. The PDR is an opportunity for external reviewers to critically examine the design and identify any shortcomings or changes that need to be made. The project management plan can be assessed for effectiveness during the design phase and any adjustments and enhancements made prior to the construction phase.
The organization and presentations can follow the same structure as for the CoDR, but with more emphasis on technical detail and final design choices. The PDR is an important project milestone since a decision will be made at this point whether to proceed with full construction. Information on both the technical feasibility and the project schedule and budget will be assessed by the external reviewers. Typically additional work and changes may be suggested at PDR which can be carried out in the project phase between PDR and CDR. Depending on the amount of additional work, it may be necessary to delay the CDR milestone and hold an additional PDR. A decision could also be made at PDR to cancel or postpone the construction phase if the technical feasibility does not meet requirements or the detailed costing exceeds the originally projected budget.

10.3 Critical Design Review (CDR) – the purpose of the CDR is to provide a final review of the instrument design and project plan before proceeding to construction. If the project has been successful during the design phase and no major redesign or investigation is thought necessary, then the CDR can be held soon after PDR to speed the project progress. It is also possible, if a successful PDR has been passed, to start the procurement of several of any long-lead time purchases. If major redesigns are recommended at PDR, then the period between PDR and CDR will be scheduled with sufficient time for further technical work to be undertaken to ensure that the new designs are properly done and stand a good chance of passing CDR.

11. Interface Control and Systems Engineering

BTFI will probably be designed and constructed as a distributed project with parts being designed and built at several locations. Several major sub-assemblies and components will be procured from outside vendors. The BTFI instrument must interface correctly with the telescope mounting and in the within the space constraints of the SAM AO module. In each of these cases interface control will be very important. A person within the project should be assigned to be responsible for systems engineering and interface control. Interface control documents (ICDs) could be part of the formal project documentation and kept under the same strict version control. The WBS list of sub-systems can be used to generate an ICD numbering system which clearly identifies the sub-systems which are interfaced. The small size of the BTFI project does not require a full-time systems engineer. The PM or senior mechanical engineer to act in this capacity for the project.

12. Schedule

The project schedule is an important tool for project management. It allows the PM to monitor progress in real-time of individual task and ensure the overall progress matches the

plan. There are many software tools which allow a project schedule to be developed and maintained. The most common is Microsoft Project which is widely used and available to anyone using the Microsoft Office software system. Whilst these programs offer sophisticated tools and analysis such as linked interdependent tasks and so-called "critical path analysis", it is recommended that the schedule be kept as simple as possible and avoid over complicated analysis. It is sometimes useful for a critical analysis to be done in very large projects where it is important to understand the flow of critical work, however in the BTFI project it would be better to just list tasks and enter expected dates of start and completion of work. The PM needs to be kept aware in a general way as to how the project is linked and how one task depends on another. It is a simple matter to create and monitor this by entering and updating tasks as the project progresses. The project staff should be encouraged to utilize MS project themselves in their own planning and Work Package management. If a standard format is created and distributed, then the PM can easily cut-paste the information from the project staff into the overall Project Schedule.

The first draft version (2) of the Project Schedule has been produced (Doc# BTFI_12.01_ProjectSchedule_v01). It should be considered a working document, particularly in the early stages of the project as the instrument requirements and design are developed. The overall project schedule as defined by the major milestones (see below) should be kept fixed.

13. Milestones & Monitoring Progress

One important component of project scheduling is the creation and monitoring of Project Milestones. Within the Project Schedule there are usually many individual tasks and activities which each contribute to the project progress. It is difficult to monitor the overall progress of the project with just these tasks. A set of Project Milestones creates a series of "goal posts" which the project needs to meet in order to maintain the planned schedule. These milestones can be developed in several levels.
The top-level Level One milestones can be used to report overall progress to management and funding agencies. These should be set after a careful analysis and include enough time contingency that they can be achieved despite the inevitable technical problems that may occur. The PM then needs to take "ownership" of these Level One milestones and commit to meeting them as steps along the way to deliver the overall project on-schedule. They can be changed in the event of serious problems or delays, but should only be done after full consultation and discussion. Note that the three major project reviews, CoDR, PDR and CDR are themselves major Level One milestones, which is part of their function.

A set of Level Two milestones can also be created by the PM to monitor the work within each Work Package. These Level Two milestones are the steps needed in order to meet the Level One milestones. The Project Manager will expect the senior project staff to commit to deliver their milestones in the same way as is done for the Level One milestones.

A set of Project Milestones and a suggested way of identifying and numbering these has been shown the Project Schedule (2).

14. Budget

The preparation and monitoring of project budgets are another important responsibility of PM. Usually project schedule overruns and project overspends are linked. If a careful analysis has been done during the initial design phase for the cost of the major hardware items, the budget overruns will result primarily for project staff costs continuing past planned dates. Some project budget contingency should be included during the budget planning and the PM should hold this contingency to cope with any unforeseen technical problems or hardware costs. In the same way as the Project Schedule is monitored, the PM should develop a way of maintaining a detailed real-time current cost and cost to complete. By monitoring the running project cost, the PM can take steps to predict and offset project cost overruns during the project.

The draft version (of the Project Budget (3) “BTFI Project Project Budget - Hardware & Manpower “ has been produced (Doc# BTFI_13.01_Budget_v01).