TITLE : TCS PI Planning Tool Software Specification

DOCUMENT NUMBER : 1732AS0004 ISSUE: A

SYNOPSIS : This document describes the software requirements for the PI planning tools software of the TCS.

KEYWORDS :

PREPARED BY : E. Romero Colmenero

APPROVED : Gerhard Swart
SALT Systems Engineer

Kobus Meiring
SALT Project Manager Engineer

DATE : May 2002

This issue is only valid when the above signatures are present.
Printed: 12.05.03 16:03
ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATP</td>
<td>Acceptance Test Procedure</td>
</tr>
<tr>
<td>ATR</td>
<td>Acceptance Test Report</td>
</tr>
<tr>
<td>BITE</td>
<td>Built-in Test Equipment</td>
</tr>
<tr>
<td>BMS</td>
<td>Building Management System</td>
</tr>
<tr>
<td>CCD</td>
<td>Charge-coupled Device (Camera)</td>
</tr>
<tr>
<td>CDR</td>
<td>Critical Design Review</td>
</tr>
<tr>
<td>COTS</td>
<td>Commercial off the shelf</td>
</tr>
<tr>
<td>HET</td>
<td>Hobby-Eberly Telescope</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/Output (Device)</td>
</tr>
<tr>
<td>ICD</td>
<td>Interface Control Dossier</td>
</tr>
<tr>
<td>MMI</td>
<td>Man-Machine Interface</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time Between Failures</td>
</tr>
<tr>
<td>MTTR</td>
<td>Mean Time to Repair</td>
</tr>
<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
</tr>
<tr>
<td>PC</td>
<td>Personal Computer</td>
</tr>
<tr>
<td>PDR</td>
<td>Preliminary Design Review</td>
</tr>
<tr>
<td>PFIS</td>
<td>Prime Focus Imaging Spectrograph</td>
</tr>
<tr>
<td>PI</td>
<td>Principal Investigator (Astronomer)</td>
</tr>
<tr>
<td>PLC</td>
<td>Programmable-Logic Controller</td>
</tr>
<tr>
<td>RT</td>
<td>Real-time</td>
</tr>
<tr>
<td>SA</td>
<td>SALT Astronomer</td>
</tr>
<tr>
<td>SALT</td>
<td>Southern African Large Telescope</td>
</tr>
<tr>
<td>SDD</td>
<td>Software Design Document</td>
</tr>
<tr>
<td>SDP</td>
<td>Software Development Plan</td>
</tr>
<tr>
<td>SO</td>
<td>SALT Operator</td>
</tr>
<tr>
<td>SPCT</td>
<td>Single-point Communication Test</td>
</tr>
<tr>
<td>SRS</td>
<td>Software Requirement Specification</td>
</tr>
<tr>
<td>SW</td>
<td>Software</td>
</tr>
<tr>
<td>TBC</td>
<td>To Be Confirmed</td>
</tr>
<tr>
<td>TBD</td>
<td>To Be Determined</td>
</tr>
<tr>
<td>TCS</td>
<td>Telescope Control System</td>
</tr>
<tr>
<td>VI</td>
<td>Virtual Instrument (Labview function)</td>
</tr>
<tr>
<td>PPT</td>
<td>PI Planning Tool</td>
</tr>
<tr>
<td>OPT</td>
<td>Observation Planning Tool</td>
</tr>
<tr>
<td>ODB</td>
<td>Observation Planning Database</td>
</tr>
<tr>
<td>SDB</td>
<td>Science Database</td>
</tr>
</tbody>
</table>
DEFINITIONS
# TABLE OF CONTENTS

1. **Scope** .......................................................................................................................... 5  
2. **Referenced Documents** ................................................................................................. 5  
3. **Customer Furnished Equipment and Responsibilities** ................................................ 5  
4. **Functional Requirements** ............................................................................................... 5  
   Basic information .............................................................................................................. 6  
   a. Inputs .......................................................................................................................... 6  
      i. RA, Dec, Equinox of the object ............................................................................... 6  
5. **Technical Requirements** ............................................................................................... 8  
5.1. **Software Architecture** ............................................................................................. 8  
5.2. **Software Interfaces** ................................................................................................. 17  
5.3. **Software Capabilities** .............................................................................................. 18  
   5.3.1. **Communication Capability** ........................................................................... 18  
   5.3.2. **Display Capability** ......................................................................................... 18  
   5.3.3. **Storage Capability** ......................................................................................... 18  
   5.3.4. **Calculation Capability** .................................................................................. 18  
5.4. **Man-Machine Interface** ........................................................................................... 18  
5.5. **Operating System** ................................................................................................... 18  
   The PI Planning Software shall be platform independent. .............................................. 18  
5.6. **Resource Allocation** ............................................................................................... 18  
6. **Generic Software Requirements** .................................................................................. 18  
7. **Software Testing** .......................................................................................................... 18  
   7.1. **Verification cross-reference matrix** ..................................................................... 18  
   7.2. **Detailed Test Requirements** ................................................................................. 19
1. **Scope**

This document specifies the requirements for the PI Planning Tool (PIPT) Software item of the SALT Telescope Control System (TCS).

The purpose of this software is to enable the PI to investigate if and when a particular object is visible by SALT and to plan his/her observation details accordingly. It will also allow the PI to submit a proposal over the internet, receive acknowledgements of receipt and produce hardcopies. The PIPT will input proposal details into the Observation Planning Database (ODB).

This software consists of two phases, Phase I and Phase II, as described in *whatever* document. It is further subdivided into four (five?) programs: Phase I PI planning tool, Phase I proposal form, Phase II planning tool, Phase II proposal form.

2. **Referenced Documents**

The following documents are referenced in this specification and are applicable to the extent specified herein.

- **1000AA0030** SALT Safety Analysis
- **1000AB0044** SALT Labview Coding Standard
- **1000AD0005** SALT Computer Architecture
- **1000AS0040** SALT Operational Requirements
- **1700BP0009** TCS Development Plan
- **1700AS0001** TCS Specification
- **1773AS0001** TCS Interlock Panel Specification
- **1000AS0049** SALT Data Interface Control Dossier

3. **Customer Furnished Equipment and Responsibilities**

This software will require detailed information of all the instrumentation capabilities and different modes of operation of all the available instruments on SALT in order to enable the PI to make accurate estimates of the exposure times required for his/her required signal to noise ratio. It will also require information about the status of the telescope (e.g. number of mirrors currently available etc) and vignetting information.

This software will require input/output access to the Observation Planning Database (ODB) via the proposal forms.

4. **Functional Requirements**

This software fits in the Data Processor computer. It does not require different modes of operation.

The PIPT will comprise 4 (5) programs:

- **4.1. Phase I planning tool**
- **4.2. Phase I proposal form**
- **4.3. Phase II planning tool (s ?)**
- **4.4. Phase II proposal form**

These four programs will share information as required.
They will log all operations, which will be made available to the PI for printing and/or downloading at any time.

4.1. **PHASE I PLANNING TOOL**
There are 2 sections on this:

Basic information

a. **Inputs**
   i. RA, Dec, Equinox of the object.
   ii. Observation date (optional).

b. **Outputs**
   i. Plot of Observing time available v Date, with Moon information (zoom in and zoom out capabilities)
   ii. Best observing date based on maximum track time.
   iii. Maximum tracking time
   iv. Moon brightness and distance to object (also in plot).
   v. Best azimuth for observation (?)
   vi. A plot of the path of the tracker over the primary mirror
   vii. An estimate amount of exposure time lost through vignetting.

**Basic Instrumentation information**

c. **Input**
   i. Target brightness.
   ii. Basic instrument configuration
   iii. Maximum Moon brightness
   iv. Minimum distance to target
   v. Either an unvignetted exposure time or a S/N requirement
   vi. Estimate of seeing
   vii. Estimate of sky transparency

d. **Output**
   i. Unvignetted required exposure time or S/N.

4.2. **PHASE I PROPOSAL FORM**
Web based.

It will allow the PI to prepare and submit a proposal on-line, to save and exit at any stage for later continuation and to submit the proposal.

The proposal details at any stage will be saved in the Phase I proposal database. On submission, the PI will no longer be able to modify his/her proposal. A printable version of the proposal will be sent to SALT and to the PI.

a. **Input**
   For a full list of input fields see proposed web form and the Observation Planning Database (ODB) Software Specification document (SALT-1732AS0002).
   i. PI's name, institution and contact details
   ii. Co-Is names and institutions
   iii. Observing time distribution among participating institutions
   iv. Title of proposal
   v. Abstract
   vi. Scientific Justification
   vii. Basic instrument configuration (drop-down list).
   viii. Extra calibration information
   ix. Input list of targets with specific details

4.3. **PHASE II PI TOOL**
On acceptance of Phase I proposal.
TCS PI Planning Tool Software Specification

It will allow the PI to prepare detail information about his/her projected observations:

a. **Input**
   - Detailed instrument configuration.
   - Target brightness

b. **Output**
   - Estimate maximum Moon brightness/minimum Moon distance
   - Estimate acceptable image quality (if required)
   - Estimate minimum exposure time and/or number of exposures (eg. time series)
   - Estimate total exposure time required and minimum S/N
   - Produce a finding chart in FITS format per target with WCS with the target clearly marked for direct inclusion in the Phase 2 proposal.

c. **Multi-slit tool**
   There will be a tool to allow the PI to configure his/her multi-slit observation. The details are still TBD.

4.4. **PHASE II PROPOSAL FORM**

   Web based
   It will allow the PI to prepare a phase II proposal on-line, to save and exit at any stage for later continuation and to submit the proposal.
   It will recall the Phase I proposal and allow the PI to add/delete/modify targets and/or details. It will prompt the PI for further details per target (see below).
   The proposal details at any stage will be saved in the Phase II proposal database.
   On submission, the PI will no longer be able to modify his/her proposal. A printable version of the proposal will be sent to SALT and to the PI.

a. **Further PI input fields**
   - Detailed instrument configuration (including Multi-Slit details if required).
   - Further details per target:
     - Target priority order
     - Finding chart with target clearly marked
     - Maximum Moon brightness
     - Minimum Moon distance
     - Maximum seeing (arcsecs)
     - Minimum sky transparency (photometric or spectroscopic)

b. **Other input fields**
   After Phase II proposal submission, other fields need to be created in the ODB for book-keeping purposes:
   - Priority of proposal (by TAC)
   - Status of proposal (% completed)
   - Target status:
     - Has the target been observed?
     - Remaining exposure time
     - Remaining number of visits
   - Percentage of time already allocated to PI institution(s).
5. Technical Requirements
   5.1. Software Architecture
PHASE I PROPOSAL REGISTRATION FORM

PI Name:

PI Email address:

PI Institute/University:

PI Postal Address:

PI Telephone number:  |  Fax number:

Preferred Username (up to 10 characters):

New Password:

New Password (again):

Please, contact us at SALT if you experience any problems with this form.
PHASE I PROPOSAL FORM

Upload from disk  Clear Form

Co-Is Names and institution (one per line):

Percentage of observing time to be allocated per PI/Co-I institution(s) on approval:

- The National Research Foundation of South Africa
- Nicolaus Copernicus Astronomical Centre of the Polish Academy of Sciences
- The Hobby-EBery Telescope Board
- Rutgers, the State University of New Jersey
- Gorg-August-Universität, Göttingen
- University of Wisconsin-Madison
- University of Canterbury (New Zealand)
- University of North Carolina-Chapel Hill
- Dartmouth College
- Carnegie Mellon University
- United Kingdom SALT Consortium
- Other

Submit and continue  Clear Form

Please, contact us at SALT if you experience any problems with this form.
PHASE I PROPOSAL FORM

Title of Proposal

Abstract

SAVE AND CONTINUE

Clear Form

Please, contact us at SALT if you experience any problems with this form.
**PHASE I PROPOSAL FORM**

**TARGET INFORMATION**

Please enter the following information per target.

If you would like to observe more than one target, click on 'next target' after completion of the current page. When you've finished with all your targets, click 'SUBMIT AND CONTINUE'. You will then be presented with a summary of all your observations for review.

If you would like to review details for a particular target, input target name and click on 'review target'.

Do not forget to fill in the information for your standards!

<table>
<thead>
<tr>
<th>Target name</th>
<th>Review Target</th>
<th>Clear Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equinox</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proper Motion?</td>
<td>YES NO</td>
<td>Delta RA</td>
</tr>
<tr>
<td>Moving target?</td>
<td>YES NO</td>
<td></td>
</tr>
<tr>
<td>TOO? Time restricted?</td>
<td>YES NO</td>
<td>Ephemeral at time of observation</td>
</tr>
<tr>
<td>Target Brightness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requested (un)filtered exposure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requested (unvignetted) exposure time per frame (seconds)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Number of frames</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of visits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum useful S/N</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Next Target] [SUBMIT AND CONTINUE] [Clear Form]

Please, contact us at SALT if you experience any problems with this form.
### PHASE I PROPOSAL FORM

**BASIC INSTRUMENTATION DETAILS**

- **UPLOAD FROM DISK**
- **Clear Form**

**PLEASE SELECT AN INSTRUMENT** (only one can be selected) and details:

#### PFIS

<table>
<thead>
<tr>
<th>Type of observation</th>
<th>Filters</th>
<th>Grating</th>
<th>Polarity?</th>
<th>Multi-slit?</th>
<th>High Time Resolution?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imaging, Fabry-Perot, Long-Slit Spectroscopy</td>
<td>Clear U, B, V, R, I</td>
<td>Grating 1, 2, 3, 4, 5, 6</td>
<td>Linear, Circular</td>
<td>Yes, No</td>
<td>Yes, No</td>
</tr>
</tbody>
</table>

#### SALTICAM

<table>
<thead>
<tr>
<th>Filters</th>
<th>Gain?</th>
<th>High Time Resolution?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear U, B, V, R, I, ND</td>
<td>1, 2, 4.75, 9.5</td>
<td>Yes, No</td>
</tr>
</tbody>
</table>

See attached diagrams for Phase I and Phase II tools and Phase I and Phase II web forms.

5.2. **Software Interfaces**
- The Pipt shall only communicate with the ODB via the Phase I and Phase II proposal web forms.
- The data transferred will be in ASCII format (HTML and PHP). Its update rate will be sporadic, at the request of the PI via 'buttons' on web forms.
The data indicated here is for information only. The most current data will be identified in the SALT Data ICD, referenced in section 2.

5.3. Software Capabilities

5.3.1. Communication Capability
a. This software is essentially standalone.
b. Input/output access to the planning database will be via proposal web forms.
c. It will only require updating at the request of the PI via a 'submit', 'save' or 'upload' button
d. Exceptions to the above shall only be allowed with approval of the SALT Systems Engineer.

5.3.2. Display Capability
a. This software will allow the display of graphics (e.g. the path of the tracker over the primary mirror) and allow user interaction (e.g. zoom-in or out, mark the position of their observing target etc.).
b. The PIPT will display the results in the form of figures, graphs and images
c. It shall be able to work over the internet via web pages, or be downloaded by the PI to be run locally.

5.3.3. Storage Capability
The storage of the PIPT data will be via the ODB.

5.3.4. Calculation Capability
The PIPT shall be able to perform double precision calculations.

5.4. Man-Machine Interface
The MMIs for the PI Planning Software will be user-friendly, self-explanatory as far as possible, and with in-built help capabilities.

5.5. Operating System
The PI Planning Software shall be platform independent.

5.6. Resource Allocation
The PI Planning software shall be capable of performing its function on a PC with the following specifications:
- 1.0 GHz Pentium
- 512MB memory
- 17" Monitor
- 1280 x 1024 resolution

6. Generic Software Requirements
a. The Phase I and II tools will be written in Java 2 to ensure its independence from operating systems. The web forms will be written in HTML and PHP
b. The PI Planning Software shall comply with the requirements specified in the SALT Software Standard as referenced in section 2..

7. Software Testing
7.1. Verification cross-reference matrix
The software specified herein must be verified for compliance with this specification, as indicated in the table below. Where appropriate, detailed test methods have been defined in the next section.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Scope</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Referenced Documents</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Customer Furnished Equipment and Responsibilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Functional Requirements</td>
<td>SI</td>
<td>D/T</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Technical Requirements</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>Software Architecture</td>
<td>SI</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>5.2</td>
<td>Software Interfaces</td>
<td>TCS</td>
<td>D/T</td>
<td></td>
</tr>
<tr>
<td>5.3</td>
<td>Software Capabilities</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3.1</td>
<td>Communication Capability</td>
<td>SI</td>
<td>D/T</td>
<td></td>
</tr>
<tr>
<td>5.3.2</td>
<td>Display Capability</td>
<td>SI</td>
<td>D/T</td>
<td></td>
</tr>
<tr>
<td>5.3.3</td>
<td>Storage Capability</td>
<td>SI</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>5.3.4</td>
<td>Calculation Capability</td>
<td>SI</td>
<td>T</td>
<td></td>
</tr>
<tr>
<td>5.4</td>
<td>Man-Machine Interface Requirements</td>
<td>SI</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>Operating System</td>
<td>SI</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>5.6</td>
<td>Resource Allocation</td>
<td>SI</td>
<td>T</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Generic Requirements</td>
<td>SI/SC</td>
<td>R/D/T</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Test Level defines the level of integration at which this particular requirement will be verified.
This could be SC - Software Component (parts of this software on their own), SI - Software Item (this spec's software on its own), TCS (this software integrated with other parts of the TCS), System (this software working with the whole telescope).

Note 2: Test method could be R- Review, D – demonstrate (not quantitative or precise), T – Test (most comprehensive).

### 7.2. Detailed Test Requirements

Add specific tests, reviews or demonstrations here, if it known now, or if it makes the interpretation of the requirement clearer.