Astronomer’s Proposals Tool (APT)
Peer Review
Tony Krueger – May 22, 2000
Project Background
The Application

**Phase 0 Support**
- **Tools Today**
  - None
  - APT?
- **Tools Tomorrow**
  - APT
  - APT
  - APT

**Phase 1 Support**
- What Can I Do
- Propose Idea
- Latex Forms Exp Time
- APT

**Phase 2 Support**
- Accepted Proposal
- RPS2
- APT

**Black Box**
- Archival Support
  - Archival Research
  - Starview2
  - APT & Starview2
APT Goals

- To develop STScI’s Next Generation Proposal Preparation/Development Tools
- Provide PIs with an Integrated Observatory Tool
  - Provide Phase 1 Support
  - Provide Phase 2 Support
  - Provide Archival Research Support
- Replace Existing Support Tools
  - Phase 1 tools (latex forms, exp time calc)
  - Phase 2 tool (RPS2)
- Provide PIs with Usable tools as soon as possible
Scientist Expert Assistant (APT Foundation)

- Goddard Research Effort with HST Science Input
- SEA Goals
  - To apply expert system technology to Proposal Development
  - To apply visualization techniques to Proposal Development
- SEA Results
  - Expert System Technology use not fruitful
  - Produced a well received software prototype
  - Some tools useable today
- 3-4 developers for about 2 yrs
## Proposal Editing (RPS2)

### PED Fixed Target Editor - Editing Target 400

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</tr>
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<td>V = 13.38 +/- 0</td>
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<td>Comments</td>
<td>OFFSET TO ME TO EXCLUDE A1</td>
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</table>

[Buttons: Done, Check Target, Help]
Exposure Time Calculator

**Imaging ETC**

This form will calculate the counts rate and SN ratio for a simulated bandpass of ONE source in an ACS observation. For general help on how to use the Exposure Time Calculator or for help on various topics, click on the appropriate highlighted words. You may also like to see the list of known problems with the ETC.

[Submit Calculation]  [Reset All Parameters]

1. Select one Camera and an associated Filter:

<table>
<thead>
<tr>
<th>Detector</th>
<th>Filter Wheel 1</th>
<th>Filter Wheel 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>WFC</td>
<td>WFC Clear (CLEAR)</td>
<td>WFC Clear (CLEAR)</td>
</tr>
<tr>
<td>HRC</td>
<td>HRC Clear (CLEAR'S)</td>
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<tr>
<td>SBC</td>
<td>Long-Pass MgF2 (P1132)</td>
<td></td>
</tr>
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</table>

2. Specify the exposure parameters:

- Exposure time needed to obtain a SNR ratio of 10
- SN ratio reached in an exposure time of 500 seconds

3. Choose one of the following espectral distributions for the source:

- [User Supplied Spectrum]
ACS ETC Output (Web Based)

Exposure Time Calculator

Imaging ETC Results

ETC ID
You ETC ID is 29921

S/N Ratio and Exposure time:
  • Exposure time = 0.000407 seconds
  • S/N = 10

WFC/HRC Integrated Countrate Analysis
The brightest pixel in a single image would have 4.4 x electrons (22.3 ADU).

Breakdown of Detected Counts:
  Origin | Signal
  Source | 352.14
  Sky background | 0.000696
  Detector dark current | 0.003336

The RFI ratio calculations are based upon counts within a square aperture of 55 pixels which contains approximately 0.1% of the total energy.

The observational parameters for this calculation were:
  • Detector = nwd
  • Filter = Clear
  • Gain = 2 e-/ADU
  • CR-split (Total number of images) = 2
  • Target was a point source
  • Source spectrum: Flat Spectrum
  • Source Flux = 15
  • Average Galactic Reddening of E(B-V) = 0.0
  • The scaled Light is average
  • The background is average
Exposure Time Calculator (SEA)
Development Approach
APT – A Collaborative Effort

STScI

- Stefi Baum & Rick White
  Engineering & Software Services Division

- Tony Krueger
  Project Manager

  Software Development
  - Tony Krueger – Lead Developers
  - Testers
  - Technical Writer

  Science Support
  - Steve Lubow – Lead
  - Megan Donahue
  - Ron Downes
  - Chris O’Dea
  - Max Mutchler
  - Ray Lucas

Software & Ideas

Goddard

- Julie Breed
  Advanced Architectures & Automation Branch

- Jeremy Jones
  Project Manager

  Software Development
  - Jeremy Jones – Lead Developers
  - Testers

  Science Support
  - Anuradha Koratkar
Goddard/STScI Collaboration

- Technical Collaboration
  - STScI and Goddard sharing software enhancements
  - Joint technical meetings and email lists
  - Goddard providing technical assistance & training

- Science Collaboration
  - Numerous meetings on nature of ongoing work of the SEA & APT
  - Goddard’s priorities on research in image simulation & natural language
  - STScI priorities on building upon the SEA prototype for HST operational use

- Using Goddard SEA evaluation to help prioritize our work
APT Major Capabilities

Phase 1 Support
- Exposure Time Calculators
- Calculates Exposure Times

Phase 2 Support
- Orbit Planner
- Layout Exposures in Orbits
- Visit Planner
- Schedulability Analysis
- Visual Target Tuner
- Target Selection

Archival Support
- Archival Research
- Science from HST Archive

Observer

Top Level GUI & Architecture
- Glues Tools Together
Development Strategy

- **Phased development approach**
  - Make capabilities available as soon as possible
  - Currently defining requirements/capabilities for all phases
  - Six external releases 6 months apart
  - Six week internal releases when practical

- **Tool Teams**
  - Take Tools from Idea (innovation) to operations (fielding)
  - Consists of Developer(s), Testing Support, & Scientists
  - Similar to Goddard SEA development model

- Teams coordinate efforts through meetings & documentation

- Schedules budget for Innovation
Development Strategy

- **Software Development**
  - Requirement Reviews (within team and outside of team)
  - Design Reviews (within team mostly)
  - Code Reviews for compliance with coding standards (within team)
  - Keep Data Model separate from GUI and Control
  - Design is Object Oriented

- **GUI Software Development**
  - Iterate and Prototype approach with scientist before checking in software
  - Prototype concepts and ideas versus large requirements definition

- **Documentation available on team web page**
Design/Development Tools

- UML Tool is Rational Rose
- IDE Tool is Code Guide
- Configuration Management Tool is CVS
- Development Language is Java
- Java Help used for on-line User documentation
- Install Anywhere used for application installation
- Documentation in MS word or Framemaker
  - Needs to be web displayable
- User Support using STScI Help Desk Software
- Software Problem Reports using STScI OPR system
System Architecture
**APT Major Capabilities**

- **Phase 1 Support**
  - Exposure Time Calculators
    - Calculates Exposure Times
- **Phase 2 Support**
  - Orbit Planner
    - Layout Exposures in Orbits
  - Visit Planner
    - Schedulability Analysis
- **Archival Support**
  - Archival Research
    - Science from HST Archive
  - Visual Target Tuner
    - Target Selection
  - Top Level GUI & Architecture
    - Glues Tools Together

**Observer**
Architecture

Data Model

GUI

Events & Listeners
Architecture Design

- SEA uses the MVC design pattern
- Controller/Viewer are combined in the GUI “Modules”
- Data model is a collection of ScienceObjects
- Communication of changes to the data model are handled by Events & Listeners
Controller/Viewer Elements

- Frames
- Modules
- Canvases
- Other standard extensions to the Java Swing Toolkit
Modules

- A self-contained "Tool"
- Knows what displays to use
  - Individual GUI for each module
  - Same look & feel from common parent classes
- Examples
  - Exposure Time Calculator
  - Visual Target Tuner
Science Data Model

Proposal: descriptive info such as principal scientist, contact scientist, abstract, title, etc., and a list of all the data it contains.

Observatory: info common to all instruments in a single observatory: mirror size, atmospheric conditions.

Visit: set of exposures grouped by common primary target.

Exposure: single image of Target using an instrument for a specified amount of time, or to achieve a desired SNR.

Target: astronomical target, includes location, info about emission characteristics.

Morphology: shape and size of an object; for extended objects may include intensity variation across the object.

Spectrum: intensity of an object’s emissions over wavelengths. Can be formula, or list of values and wavelengths.

Normalization: adjusts brightness at a specific wavelength.

Instrument: housing framework for one or more detectors, a set of filters, and criteria for what filters may be used on what detectors. Other data common to all detectors of an instrument.

Detector: device that records photoelectric counts to make image.

Filter: filters light to a detector based on shape or wavelength.

Target Offset: offset of Target within the constraints of movement within a Visit.
Science Data Model Class Hierarchy
Some GUI objects create a change in state for a data object.

Other GUI objects register as event listeners for the particular data objects they display. Changes to those data objects then cause the GUI to update.
Anticipated Enhancements to the Architecture & GUI

- Connection to legacy systems
  - Trans – for orbit planning and overhead times
  - Spike – for schedulability and visit planning
  - NGSS – for Guide Star availability
  - Our experience with RPS2 and Distributed Object Controller indicate this is an important area for investigation

- Resolve Apply/Reset vs. Event/Listener issues
  - Some changes are too costly to propagate
  - Some changes need to update the view immediately

- Rework the GUI to be intuitive to HST users

- Add HST specific capabilities
Anticipated Enhancements to the Architecture & GUI

- **HST specific object hierarchy**
  - Want to be able to share the hierarchy with other HST tools
    - Transverse
    - Starview
  - Will include separating proposal objects from astronomical objects
    - Visits and exposures are in the same package as instruments, detectors, and targets

- **Proposal definition objects**
  - E.g. there is a philosophy discussion on how targets, visits and exposures are related. The SEA took an approach that we are investigating, but preliminary analysis is that it is the wrong model for users.
Strategy

- We will reuse much of the generic objects
- We will extend and re-design HST specific science class hierarchy
- APT began as wholesale reuse of the SEA, but we expect changes for the following reasons
  - Changes to support HST specific capabilities
  - Changes need to support new capabilities or to improve maintenance
What we expect to reuse

- Visual Target Tuner
- Exposure Time Calculator
- Generic utilities
  - File readers
  - Database connectivity
- Astronomical utilities
  - Coordinate system objects
  - Generic Science hierarchy
    - Instrument/Detector/Aperture
    - Target/Wavelength
    - Exposure/Visit
What we expect to reuse (continued)

- GUI widgets
  - Modules
  - Frames
  - Messages

- Items in the following packages will likely be reused:
  - GOV.nasa.gsfc.util
  - GOV.nasa.gsfc.sea
  - GOV.nasa.gsfc.sea.database
  - GOV.nasa.gsfc.sea.errcorr
  - GOV.nasa.gsfc.sea.event
  - GOV.nasa.gsfc.sea.science
  - GOV.nasa.gsfc.sea.targettuner
  - GOV.nasa.gsfc.sea.util
Making the Architecture more Re-Usable

- Currently working with Goddard SEA Team on reshuffling of data objects and packages.
- We see the separation of the infrastructure from the Data Model as an area where we can improve maintainability. This may just be a further shuffling of some packages to separate the two areas more logically.
Test Process

- Unit, Integration, Documentation Testing
- Code Configured
- Internal STScI Release
- Scientific, Integration, Installation, Usability, & Documentation Testing
- External Release

Developers & Scientists

Testers & Scientists
Development Supports Testing

- Trying for 6 week internal releases whenever possible
  - Smaller amount to test
  - Get new features into user and tester hands quickly
- Development performed on all the delivery hardware and Oss
- Installation Checks by developers on Personal Systems
Manpower Effort & Schedule
Risk Management

- STScI has existing tools to support Phase 1, Phase 2, and Archival Research
- Concentrate on Phase 2 Tools (RPS2 Replacement)
- Phased Release Schedule
  - Get user feedback as early as possible
  - Don’t deliver everything at once
- Study/Prototype areas of risk
  - Already studying different approaches to orbit planning
Release Schedule without Overguide

<table>
<thead>
<tr>
<th>TimeLine</th>
<th>Cycle 10 Phase 1</th>
<th>Cycle 10 Phase 2</th>
<th>Cycle 11 Phase 1</th>
<th>Cycle 11 Phase 2</th>
<th>Cycle 12 Phase 1</th>
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X – Release doesn’t contain all major capabilities (Incremental Release)
M – Contains all major capabilities (Maintenance Mode)
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<th>Cycle 10</th>
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Areas of Technical Risk

- Will the Current Architecture Scale
  - No STScI legacy systems integrated
  - Need to integrate client/server methodology

- Achieving a responsive GUI when communicating to legacy systems and Databases at STScI
  - Orbit & Visit Planners need to be integrated

- Current SEA prototype already slow on Sun computers
  - No major compute engines hooked up
  - No client/server issues to legacy systems over internet
Minimize Technical Risk Earlier in the Project

- Apply resources to integrating legacy systems
- Apply resources to client/server
- Apply resources to APT responsiveness

Higher Quality Tool

- Apply resources to testing
- Apply resource to improved on-line user documentation
- Apply resources to GUIs to Evaluate look/feel and usability
Overguide Benefits

- Two areas enter maintenance mode 6 months sooner
  - Orbit Planner Tool
  - APT Architecture
- Provides users with more on-line help capabilities
  - Help Wizards
  - Tool Tips
- More Fully Functional Phase 2 Cycle 11 tool
# Release Schedule with Overguide

<table>
<thead>
<tr>
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# FTE Level with Overguide

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More Information

- **APT Project**
  - [http://ra.stsci.edu/apst/apt](http://ra.stsci.edu/apst/apt)
  - krueger@stsci.edu