IMPLEMENTING PORTALS OF THE UNIVERSE

LESSONS LEARNED *SWIFT*

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Basic Characteristics of *Swift*:

- Explorer mission to study Gamma-Ray Bursts (GRBs)
- Launched in 2004; 2012 Senior Review recommended another 4 years of ops.
- 3 instruments:
  - Burst Alert Telescope (BAT) surveys sky in 15-350 keV band
  - X-Ray Telescope (XRT) covers 0.3-10 keV
  - Ultra-Violet Optical Telescope (UVOT) covers 170-650 nm.
- GRBs are primary targets including autonomous observations of new GRBs
- Broad range of non-GRBs targets (SNe, AGN, normal galaxies, …)
- All data are immediately public
- Archive data volume of ~1.5 TB/year of Level 1, 2, 3 data
- Active Guest Observer Program:
  - In 2011, 151 proposals competed for 5 Ms and $0.8M
  - Also ~900 target-of-opportunity (TOO) observations/year

RECOMMENDED BEST PRACTICES

Highlight 1:
Data Processing & Archiving

- Rapid user access to data:
  - Data typically are processed and available on a *Swift* Web site within a few hours of an observation.
  - Permanent archive at HEASARC & data centers in England and Italy within 7 days
- Data are in standard, multi-mission FITS formats.
- Standard products provide overview of results:
  - Light curves, sky images, spectra
- Gamma-ray Coordinates Network (GCN) provides rapid release of results to community.
  - Effectively involves ground-based community.

Highlight 2: Science Scheduling

- *Swift* faces a large mission planning challenge:
  - Rapid response to unpredictable GRBs is a primary goal.
  - Autonomous s/c observations is a further complication.
- *Swift* also observes a broad range of rapid-response targets such as SNe.
- Monitoring campaigns with other missions is increasing.
- Recent software improvements have greatly increased the efficiency of this process.
- Software started from multi-mission TAKO program.
  - A DB system for tracking observations has been added.
  - Other Swift-specific tools were written.

Highlight 3: Science Analysis Software

- *Swift* uses the HEAsoft analysis package.
  - Users are familiar with the software.
  - Re-use of many tools (fv, xspec, …)
- *Swift's* effort focuses on *Swift*-unique tools.
- Provides for easy distribution.
- Ensures compatibility with popular operating systems.
- Ensures long-term maintenance.
- *Swift* also uses HEASARC's multi-mission CALDB for similar reasons.

WHAT ARE THE CONSTRAINTS IN CURRENT POLICIES?

Suggestions & Concerns (1

- User support is expensive.
  - Lack of tools to make it more efficient.
  - Community expertise is underutilized.
- Computer security is a threat.
  - Institutional response can be severe.
  - Installing science software is a burden for users.
  - Providing computer resources to community is difficult.
- Maintaining services with a declining budget is a challenge.

Swift Summary

- *Swift* is an Explorer doing first-class science with a modest budget.
- *Swift* utilizes existing infrastructure to improve services and reduce costs.
    - Adapted existing processing pipeline.
    - Uses existing data archives.
    - Uses HEASoft science analysis suite with CALDB.
- *Swift* has broad community involvement:
    - All data public immediately.
    - GRB results rapidly distributed via GCN & *Swift* web site.
    - Guest Observer & TOO time ~2/3rds of total time.
    - Familiar software & active user support.

BACKUP SLIDES

Discussion Items: Swift Proposal Process

- Swift awards part of its observing time via competitive proposals.
- Time is also awarded via a TOO web page (essentially DDT).
- What works:
  - Multi-mission software (ARK) for submitting proposal.
  - Two-stage process (only winners write budgets)
    reduces the budget writing effort.
  - Tools (e.g., spreadsheets) for compiling grades & evaluations.
- What could work better:
  - Coordinating observations using other observatories.
  - Obtaining reviewers