History/Background

- The desire was to implement a “flight proven” COTS product to lower risk to FIt SW and test development
  - The original trades spaces were open source, supported platforms, export control and upfront cost
    - Candidates were OASIS, OS Comet, SCL, Smart Sockets, ITOS, ASIST
  - Spacecraft Control Language (SCL) was selected for LAT command, control, and configuration
- Flight software baseline is not to use SCL for flight C³
- I&T Online has discovered issues that will require extensive work to support the LAT environment
  - SCL was created for a 16-bit environment and its data transport mechanism is built on 32-bit floating-point numbers (which have only 24 bits of precision)
  - SCL not augmentable to handle arbitrary precision data
  - The LAT hardware contains 32-bit and 64-bit registers
- I&T has decided to reevaluate the Online System architecture
Current Situation

• Updating LAT-SS-00456-02 LAT I&T Online Requirements
  – Remove SCL references to focus on requirements

• I&T/Online and LAT subsystems have continued EM development work using Python/Qt/XML (PQX)
  – Python, an interpreted, interactive, object-oriented scripting language used for program tests, calibration, etc.
  – Qt, a graphical user interface toolkit used for command & monitoring
  – XML, Extensible Markup Language, a standard for marking up structured documents used for configuration data, etc.
Test Executive Trades (3)

Spectrum Astro Inputs

• SAI has base-lined AstroRT as the observatory I&T test executive

GSFC Inputs

• GSFC has provided an example trade matrix used by Code 584 for spacecraft control product evaluation
  – An extensive trade matrix, comparing ASIST, EPOCH, and ITOS
  – We have used it as a guideline to address areas that are relevant to LAT

• GSFC has announced the project will pursue an ITOS-based architecture for the MOC and utilized the experience gained from Swift
  – The relevancy of the MOC decision is that the Ops software has potentials to become the observatory’s I&T test executive
Test Executive Flow Recommendation

- Use PQX for EM development
- Transition to a combination of PQX and Observatory I&T Test Executive during Subsystem and Instrument Acceptance Test

Advantages:
- Early integration of Observatory level test executive – which may be the MOC Ops SW
- All LAT test scripts will be validated by Instrument delivery

Dis-advantages
- Increased reliance on S/W that has ITAR issues
- Scripts developed for EM will need to be compatible with selected test executive
Use PQX from development through LAT I&T
- Transition to Observatory I&T test executive prior to instrument delivery

Advantages:
- Reduced reliance on S/W that has ITAR issues, such as AstroRT and ITOS
- Scripts developed for EM can be used through LAT test program

Dis-advantages
- Need to perform conversion and validation of test scripts late in the program cycle
- Increased risk and cost late in the project cycle

Test Executive Flow – Backup Option
Recommendation

• Current Path
  – Continue to use the Python/Qt/XML (PQX) for EM development
  – Establish and identify interfaces to AstroRT or ITOS test executives
    ✓ Evaluating ITAR impacts

• Primary and backup paths to ensure a smooth transition from LAT instrument to observatory to on-orbit operations (IOC)
Back-Up Slides

Block Diagrams
System Block diagram

- LAT
  - Analogs & Discretes
  - SSR
  - 1553

- Spacecraft Interface Simulator
  - Ethernet Debug
  - “MOC” CCSDS packets

- Online
  - "IOC" CCSDS packets

- MOC simulator
Command Model

Command Request → Raw Cmd Encoder → Raw Command Packet → Raw to CCSDS → Open CCSDS Command Packet → Ground/SC Encoding → NDA/ITAR Command Packet

Command Request → Raw Cmd Decoder → Raw Command Packet → CCSDS to Raw → Open CCSDS Command Packet → SC/Ground Decoding → NDA/ITAR Command Packet

“IOC” CCSDS packets

“MOC” CCSDS packets

Open Data Transport (Restricted?)