Introduction

Pathfinder Objectives
1 Year Concept to Launch Ready
7 Days Call-Up to Launch
24 Hour Autonomous SW Ops
11 Experiments:
Visible Imaging
ELINT
Atmospheric Science
Advanced Technologies
Autonomy Software

TacSat-2
a.k.a. Roadrunner
(Joint Warfighting Space Demonstration -1)
Capabilities Driven

Existing, Highly-Capable Bus

Existing Payload Designs

Final Spacecraft
Adapting Existing Payloads

Method

Alter Payload Side Interface

Harness Modifications

Software Changes

Firmware Changes

Bus Hardware Changes

Prerequisite

Easily Changed Interface

Available Pins/Signals

SW Protocol Issues, Empowered Engineers

Physical Layer Compatibility

Time

Minimize for OTP Devices!

45 min!

Finalize ICD’s Early!

Design Space for Late Additions!
Test Software Modularity

Ingredients For Success

- Universal Buy-In
- Repeated Tasks
- Interface Standards
- Programming Style Guide
- Appropriate Granularity
- Configuration Control

Results

- Reduced Development Time
- Easier Updates
- Increased Reliability
- Test Like You Fly
- Universal Understanding

Reduced Development Time

- Easier Updates
- Increased Reliability
- Test Like You Fly

Universal Understanding
Additional Test Software Lessons

• Use a Full Featured Compiler
  – Full error descriptions & line numbers are essential to debugging, don’t skimp

• Use Automatic Code Generation for Repeated Tasks Based On Varying Inputs
  – Don’t bother for one-time tasks or low repetitions

• Automatic Generation of Telemetry Displays in LabView Worked Very Well

• LabView Telemetry Tools Work Well for Test and Debug
  – More items displayed at once

• Interface Control Systems RIMS Telemetry Tools Work Well for Operations
  – Easier to customize, easier to find critical data
Automated Testing Benefits

Development of Automated Test

To Make Best Use of The Limits of 1 Flatsat And 1 S/C, Use Automated Testing to Decouple Personnel Required for Tests And Maximize Useful Test Time on Hardware

Component Tests -> Subsystem Tests -> System Tests

- Mission Sim
- Phasing Test
- Sun Sensor Test

Offline Troubleshooting

Trained S/C Operators
Use of Scripting

Benefits

– Speeds Regression Testing
– Test Code Reuse
– Coordinates Efforts of Designers, Testers, Flight Operators
– Decouples Expert Knowledge from Test Conductor
  • Allows Any Test Conductor to Run Any Test
  • Frees Subject Matter Experts from Being Tied to Test Floor

Drawbacks

– Take Longer to Develop
  • Start Earlier
– Long Tests Hard to Debug
  • Break into Stand Alone Test Modules
  • Avoid Complex Flow Control
  • Avoid Order Dependent Modules
– SCL Has Some Scripting Feature Limitations
  • Work Within Limits of SCL
  • Or Script Using C, Perl, or Visual Basic
Location of I&T

• Maximize AFRL Knowledge to Allow Maximum Dissemination of Lessons to Industry
  – Expose AF At Large to New Paradigms
  – Trained Next Gen Space Warriors in Responsive Space Techniques
• Work Within Base Access Restrictions
  – Rely on Base Personnel for 24/7 Access
• Some Travel Hardships
• Teamwork & Dedication on All Levels Necessary
Other Lessons

• Lean Documentation (For I&T)
  – Test Conductors Log (Word Document)
  – Problem/Failure Report + Tracking
  – Build Test Documentation Into Automation Scripts

• Weekly Meetings
  – Minimize # Meetings (1/week ideally)
  – All Parties Required, Especially if Many Organizations
Apply These Lessons; Develop Your Spacecraft Faster