Advanced Systems & Development

Satellite Operations Automation

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Overview

- **Automation Goals**

- **Research, Development, Test and Evaluation (RDT&E) Support Complex (RSC) Introduction**

- **RSC Automation History**

- **Automation Results and Status**

- **Next Steps**

Automation Goals

- **Move space personnel away from routine operations tasks to gain the ability to "rapidly characterize adversary intent, accelerate decisions, and ultimately support warfighter actions"**

- **Cost-savings**

- **'Lights-dim' operations**

RDT&E Support Complex (RSC) Introduction

- 24x7 contractor-operated Satellite Operations Center
    - Ops floor for day-to-day satellite housekeeping
    - 5 Payload Test Centers (PTCs) for experiment ops
  - From unclassified through classified ops
    - Tailorable data distribution over multiple networks
- Full range of TT&C capabilities
  - Mission planning, including orbit determination, antenna scheduling, and command plan generation
  - Ground equipment configuration and control
  - Real-time satellite commanding and anomaly response
  - Telemetry processing, analysis, and display
  - Mission and satellite bus data archiving and distribution

- Backup operations facility for operational satellites
- Access to Air Force Satellite Control Network (AFSCN) and organic antennas
- Flexible and reconfigurable capabilities to meet unique user requirements
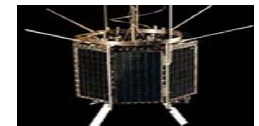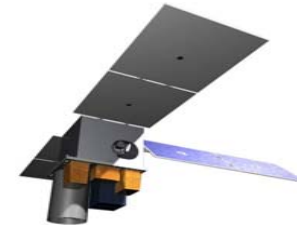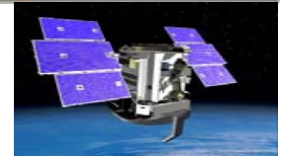
RSC Automation History

- **Began implementing contact execution automation on Space Test Program Satellite (STPSat)-2 in Spring 2014**
    - **Paused operations in Summer 2014**
    - **Completed automation when operations resumed in Summer 2015**

- **Began contact execution automation project for STPSat-3 in September 2014**
    - **Operationalized automation on STPSat-3 in January 2015**

- **Concurrently built scripts to reduce work for STPSat-2 and STPSat-3 Orbital Analysis**

- **Began Operationally Responsive Space (ORS)-1 Contact Execution Automation Project in March 2015**

  - **Phase 1 – Air Force Satellite Control Network (AFSCN) connections, track supports - completed September 2015**

  - **Phase 2 – Basic downloads – completed February 2016**

  - **Phase 3/4 – Uploads and Basic Anomaly Response – Expect completion April/May 2016**

Contact Execution Automation Results

- **STPSat-2 Automation – saving $5k per month**

- **STPSat-3 Automation – saving $15k per month**

- **ORS-1 – Enabled 12x7 operations, reduced needed personnel by 40%**

Horizon Automation Metrics

- **Stats from previous ten months (03/15-01/16) – prior data included testing periods**

- **1706 total automated contacts**
  - **343 STPSat-2**
  - **1363 STPSat-3**

- **220 failed contacts (88% contact success rate)**
  - **Automation designed to spacecraft tolerance**
  - **No data has ever been lost due to failed automated contacts – 100% mission success**

Orbital Analysis Automation

- **Automated Flight Dynamics Data Processor, Orbit Determination Tool Kit (ODTK), Systems Took Kit (STK) tasks via scripts**

- **Saves 92% of daily task time, 33% of weekly task time**

- **Total savings of 9 hours/week for each mission**

- ## Air Force Steps:
  - ### Incremental script improvements
  - ### Standardized scripting frameworks
  - ### Integrate automation into future missions

- ## Industry Steps:
  - ### Avoid graphical user interface dependence
  - ### Integrate standard ground system protocols (i.e. Goddard Mission Services Evolution Center (GMSEC))

- **Automation Goals**

- **RSC Automation History**

- **Horizon Automation**

- **Orbital Analysis Automation**

- **Next Steps**

Questions?

Backup Slides

- **Horizon Scripts: Evaluate telemetry, send commands, and log results automatically**

- **3 enabling tools:**
  - **Auto-Distributed Communications Control (DCC) Controller: Controls AFSCN connection**
  - **Auto-HEIM Tool: Controls telemetry recorder**
  - **ALERT Tool: Reviews script logs and sounds audible alarm if any issue found**

Automation Problem areas

Issue	Number of Occurrences	Percentage of Failed Contacts	Percentage of Total Contacts
AFSCN Site Timing	107	60%	8%
Communication Link Issues	32	18%	2.3%
Horizon/MMSOC 2.0 Issues	20	11%	1.5%
Fault with automation scripts or procedures	20	11%	1.5%