

Strategies for Developing Web-based Satellite Operations

Rinsing the SOAP out of your eyes to look at Network-Enabled Operations (NEO)

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01-Mar-11

Don't bet against IT





"There is no reason for any individual to have a computer in his home." – Ken Olsen, 1977

"The number of components in an integrated circuit will double every two years." – Gordon Moore, 1965



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Don't bet against IT





"No one will send spacecraft commands over the Internet."
Name withheld, 2009

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Goals



- Our customer's goals did not require web-based tools, but web technologies make them less expensive to achieve
 - Platform independence (operating system, GUI tools, and language choices) for the local and remote operations console
 - 24x7 remote engineering support for operations





Typical OS maintenance cycle is 10 years, and security updates are critical for a system exposed to the Internet/Grid

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Obstacles to Web-based Operations



- Security of information and the control link
- Latency impact on operations
 - Increased time required for specific operations
 - Variability in time required for specific operations
- Reliability of remote operations
 - Assuring access
 - Assuring once-only operations
- Visibility into system operations
 - Space system state
 - Ground system state

Security: Defense-in-Depth HARRIS OS/COMET RESTful Web Service approach allows reuse of commercial web security practices **Operations Servers** Web Servers Authentication Gateway **Firewall** SSL/VPN

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Latency



- Scripted operations run locally in real-time with predictable latency.
 - Insure that critical time-related operations are run as local scripts or fault responses rather than across the web
- Analysis work requires more thought time than transit time. These tasks can be conducted locally or remotely:
 - Telemetry observation and analysis
 - Script selection
 - Command selection

Analysis Verification & Reaction

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Reliability of Operations

- Moving operations into scripts rather than individual commands enhances the reliability when the operator loop has to traverse the network. One initiation runs the operation to completion.
- Once-only operations (nonidempotent) must be able to be repeatedly status-checked.
 - Command request
 - Script Initiation



HARRIS

Warning: Do not press the submit button more than once or your card may be charged multiple times

Visibility	HARRIS OS COMET
 Next-level down visibility into operation plans and results provides confidence to the operator. 	
Scheduled Operations	Event-Driven Operations
Scripts (3 rd generation languages)	
Macros (macro assembler)	
Mnemonic Data (assembler)	
Binary Data (machine code)	
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Visibility



 Visibility into the space system state, ground system state, and operations history must be provided for troubleshooting.

State of both systems

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