Ground System Architectures Workshop

Session 15

Creating Smarter Ground Systems
Workshop Summary

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Approved for public release. OTR 2019-00520.

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• GSAW 2017: Looking Beyond the Horizon
  – Alexa, Ask Jim
  – **As-a-service:** Telemetry / Navigation / Spacecraft / Flight Software / Ground Segment

• GSAW 2018: Achieving the Resilient Enterprise
  – Virtualization, stig, chaos monkey
  – **xOps:** DevOps, AcqOps, ParallelOps, DevService
  – **x-Agnostic:** Software / Hardware / Data / People Agnostic

• GSAW 2019: Creating Smarter Ground Systems

**Automate DATA**
Data Science, Data Lake, Data Swamp, Data Lab, Data Analytics, Data Exploration, Data Factory, Gold Data, Fast Data, Data Preprocessing, Data Augmentation, Data Fusion, Data visualization and interaction

More satellites $\rightarrow$ more sensors $\rightarrow$ more data from different sensors and sensor types, need data science techniques to exploit and fuse data sets and to optimize performance

Information overload is an issue, but data overload is not an issue

Data is in, do something with it
Automate the Automation

- Automatically transforming unstructured data into insight
  - Automatically learn from the constellation data and automate the exploitation of the patterns found, automate the recovery actions
  - Automatically synthesize workflows to answer questions
  - Autonomous IT is here – Autonomous Databases, Autonomous ML

- Testing & QAs
  - Automated and manual cybersecurity scans
  - Automated penetration testing

- New role: ground segment wide automated operations orchestrator

- BUT automated code and documentation generation may not meet customer standards or need
• Red Team / Blue Team / White Team
  – “You trained people to attack our spacecraft, that’s not cool.”

• Applications, Tools, and Prototypes
  – Catalina Sky Survey – to detect Near Earth Object
  – AUDREY – to support search and rescue
  – Cognitive Radio – to detect abnormal conditions for satellite interference
  – PenBox – to provide automated security testing
  – PLGSE – to provide intuitive modeling capabilities

• Software factory
  – Infrastructure-as-code, Recipe, Template
The long term success of “smarter systems” is not solely based on new algorithms and cool “apps”
A system only runs as fast as its slowest part.
If you are going Agile, you need Agile on the other side to match it.
Transition the world from technician to tactician
All programs now service the enterprise as part of their mission
Acquisition Lead becomes first Operations Lead for a delivered system?
Constellation is more than a sum of the satellites

\[
\text{Constellation} > \sum \text{Satellites}
\]
• From physical presence (You need to be in the room) to virtual presence with ability to communicate
  – Need smarter questions to get smarter requirements
• When we have 400 satellites, the contingency will be part of your nominal operations
• “Machine Learning is going to be watching you”
• “Internet of action”
• You have limited dollars, don’t duplicate your works when the commercial solutions are available
• Fly as you test and test as you fly
• Balancing between exploitation vs exploration
Now What?

- What should we stop doing?

Does it spark JOY?

-Marie Kondo