

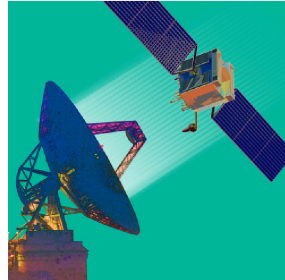


Ground System Architectures Workshop

Session 15

Creating Smarter Ground Systems

Workshop Summary



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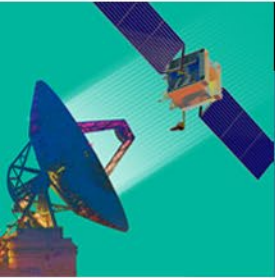


GSAW 2017 → 2019

- 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, Data, Data is everywhere

- 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 → more sensors → 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



Smart exercises / applications / infrastructure

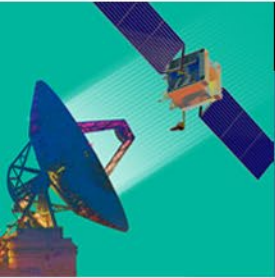
- Red Team / Blue Team / White Team
 - “You trained people to attack our spacecraft, that’s not cool.”
- Applications, Tools, and Prototypes
 - Catalina Sky Survey – to detect Near Earth Object
 - AUDREY – to support search and rescue
 - Cognitive Radio – to detect abnormal conditions for satellite interference
 - PenBox – to provide automated security testing
 - PLGSE – to provide intuitive modeling capabilities
- Software factory
 - Infrastructure-as-code, Recipe, Template



Smarter at the enterprise level

- 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

Constellation $>$ \sum *Satellites*



Smart train of thought

- 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