Ground System Architectures Workshop

Session 15

Workshop Summary
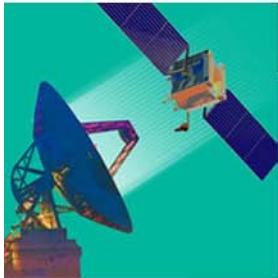
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Themes

- **<u>Innovation</u>**
  - Drivers:
    - Huge and growing need for information, usable product
    - Obsolescence, consolidation, lifecycle costs, improve efficiency
  - Opportunities:
    - What can I do from my iPhone? (tasking, data access)
    - How can I effectively share my data?
   - What new products can I create from current data?
  - Challenges:
    - Culture: "Why haven't GS's evolved like the internet?"
    - Security (data, TT&C), user tasking, data fusion, timeliness, user acceptance
  - Successes:
    - Legacy migrations, multi-mission integration, enabling IT technologies
    - Usable data exposure (e.g., sensor sidecars)
  - Lessons:
   - Innovation takes persistence, prototyping, commitment
   - Share Lessons Learned, especially failures

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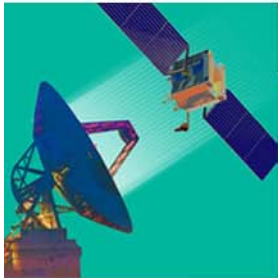
Themes

- **Cyber Threat**
  - Ubiquitous
  - What are specific threats? Risks? What is the guidance? What are the standards? What are the solutions? *What are all the questions?*
  - How to secure the data vs. securing servers (share securely)

- **"Harmonisation"** as path toward interoperability
  - Alternative to full systems integration
  - Evolution over revolution

- **Practical Modeling**
  - Model-Driven Engineering, architectures, development
  - Challenges speaking models to stakeholders
 - Mandatory prototyping

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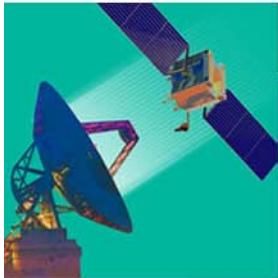
Downticks

- **Stovepipes**
  - Generally new systems are being engineered for sharing
  - Legacy "stovepipes" being upgraded with SOA, net-centric adapters

- **COTS – less blind acceptance**
  - Realities of licensing, lifecycle costs, upgrade timing, integration, "configurability", incompatibilities.
  - Open architectures, standards are viable, with careful use of COTS

- **Workforce**
  - Current workforce continues decline
  - Where will the future workforce come from?
    - Academic sponsorship, research (software)
    - K-12 engineering / sciences

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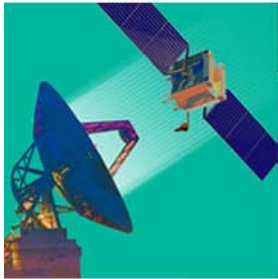
…the more they stay the same

- **Need to Engage Users**
  - Who are the users? Ops, Mission Planners, Analysts, Data producers, Scientists, the Public
  - Need to fit in the users' "Decision Loop"
  - Awareness, acceptance an uptick?

- **Exponential Growth (explosive?)**
  - Appetite for data
  - Fusion, production, exploitation opportunities
  - User base
  - IP addresses
  - Space Objects
  - Complexity Challenges!

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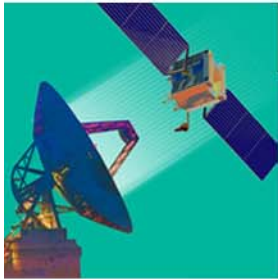
Upticks

- **Less Coupling of Hardware and Software**
  - Virtualization, Cloud, Grid, Homogenous platform base
  - Vendor / platform neutral software systems

- **Multi-Mission integration**
  - Consolidation of SOCs, ground systems, System-of-System integration
  - MMSOC, MI-S, McMurdo, Intelsat, GDPAA

- **Agility, Flexibility**
  - ORS, cubesats, small /short agile missions

- **Standards, commonality**
  - Broader standards adoption, consideration
  - xTEDS, XTCE, CCSDS, SCPS, GMSEC message bus
  - Product Line approaches, initiatives

- **Cybersecurity**

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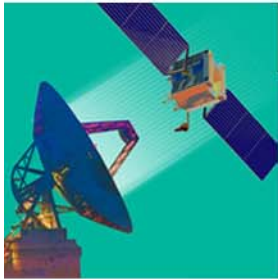
Upticks

- **Space Situational Awareness**
  - More vehicles, smaller objects, debris, conjunctions (and avoidance)
  - International community participation (ESA initiative)

- **Evolution (vs. revolution)**
  - Funding constraints
  - Technology insertion, refresh, and adaptation of legacy programs
  - Extended mission durations

- **Use of open systems architectures**
  - Considering vendor COTS vs. open source trade-offs.

- **Managing complexity**
  - Visualization for developers: Model-based engineering
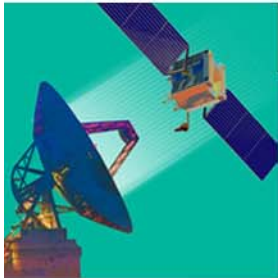 - Visualization for users: complex operations, fused products

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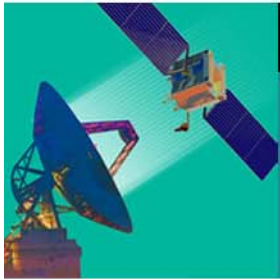
…and now for something completely different

- **Phased Array Geodesic Antenna**
  - Potential for quantum change in Ground System operations

- **IP-Based Crypto**
  - Fundamental changes to secure GS network architectures

- **Buy your own Cubesat ($40K from Pumpkin)**
 - Do I buy a Lexus or build MySat??

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What we heard

- **Einstein**
  - We cannot solve problems by using the same kind of thinking we used when we created them
  - I will back up my laptop every day!   (confirming handwriting)
- **Ground System**
  - Ground Systems should be viewed as a "Public Utility"
  - Can build spacecraft quickly, but if the GS and ops team aren't ready, you don't have a capability
  - The Ground System is _the_ flexible part of the system.
- **Innovation**
  - (Achieving innovation is..) the sweet-spot between requirements, technology, cost-schedule
  - Don't assume innovation won't be IA-compliant. Prototype innovation then work IA for operations.
  - The new system shall do everything that the legacy system does (faster), plus a lot more
  - "In Silico" = development through simulation
- **End-Product**
  - Hardware is a toaster, software processes the data. It's the data that's most important.
  - Data must be transportable, discoverable, usable
- **A.C.T.: Access, Content, Timeliness**
  - Access: To large datasets, full product
  - Content :   Fully exploited, relevant, comprehensive, not "Digital Junkyards"
  - Timeliness: Don't look at your calendar, look at your watch
            "We want more, now" (like teenagers)

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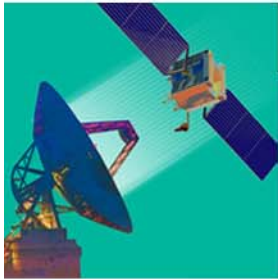
Take-Aways

- **GSAW Community is thriving, expanding**
  - GS experts around the world are here, available, focused
  - Tutorials, Working Groups, Evening Sessions = best attendance yet
    People are collaborating. Looking for commonality, opportunities !!!
    People are sharing a common vocabulary!!
    __Innovation sharing is feeding innovation!__

- **Reach of Ground System missions**
  - Global (Europe, Australia, Asia, the Americas, Antarctica, …)
  - Inter-planetary (LCROSS, LADEE, Solar System Internet)
  - Galaxy (Kepler)

> **Go forth and _Innovate_ …**
> **… and come back and share your stories at GSAW 2011 !!**

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