Themes

• **Responsiveness - faster than “speed of need”**
• **User engagement**
  – Culture changes needed on multiple fronts
    • Resource, data sharing
    • Explosion of new technology and potential
  – Tools / techniques continue to mature
  – Mission, business focus
• **Enabling evolution**
  – Use of open systems, standards
  – Evolution-driven architectures (interoperability layers)
• **Enabling interoperability, integration and data sharing**
  – Continued fighting “isolated silos of information”
  – ‘Sharing’ in tension with IA and culture. “Need to share everything, except…”
• **Standards – key to enabling advances**
  – XML everywhere, but by itself is not sufficient
  – Some maturing well (XTCE for core CMD/TLM )
  – UML, GEMS, SOLM, UPMS/SOAML, CCSDS, DTN
• **SOA reality check**
  – Hard engineering work still must be done
  – Serious trade-offs at system level
  – Net-centricity / system-of-systems objectives even harder
Upticks

- SOA is taking root
  - DCGS, GMSEC, TSAT/TMOS
- Virtualization, cloud computing is real
  - Data centers are converting in ESA, DoD, NRO
- Key GS standards in operations
  - XTCE, CCSDS
- Explosion in consumer demand for data
  - All domains
- Information assurance, cyberspace, threat increases gaining recognition
  - As GS moves to share ...
  - As adversary threats mature
- GSAW community collaboration – advancing / increasing
  - USN, other commercial providers for link services
  - ORS using NASA GMSEC as a message passing protocol
  - Push for CMD/TLM standard across U.S. and international organizations
  - Lots of hall talk, networking, continuing efforts beyond GSAW
User engagement through lifecycle is key

- Challenges remain
  - Who are all the users?
  - Don’t know early on who will operate the system
  - Users have their day jobs (can reservists bridge gap?)
  - Unanticipated users
  - What to automate, can users trust/accept it
- Solutions continue to develop
  - Methodologies for capturing and validating user needs
  - Strategies for engagement throughout lifecycle
  - Defining quality attributes, rule- and scenario- driven engineering

Open source, open architectures key

- Continued challenge to define, implement, enforce

Political, economic, business, cultural barriers to information sharing
Information silos slowly merging, opening up

Current workforce
- Tail-end of baby-boomers

Future workforce
- Academic sponsorship, research (software)
- K-12 engineering / sciences

Stability
- Yesterday will always be more stable
  - Technology, national security, economics, workforce, exploding consumer demand, …
• **Responsiveness**
  - Faster than the speed of need
  - Space mission is a 3-dimensional chess match. Then mix in cyber space…
  - Many of our systems are old enough to vote (some old enough to drink)
  - Don’t look at your calendar, look at your watch

• **Users sharing computing services**
  - …like pay toilets on airlines
  - {various analogies to breaking down family structures}
  - …like convincing the user that a Tata car serves the same function as his Ferrari
  - “Mine, Mine”

• **Engineering**
  - We’re building enterprises, but we have no enterprise architects, enterprise engineers
  - Maybe we can’t integrate the systems, but we can interoperate them
  - We have a complete list of all the standards we don’t use

• **Space-Ground**
  - Only 2 things come from space: debris and data
  - A satellite without a ground system is like a kite without a string
  - Ground is the enabler of the mission, it is the heart and soul
Standards take persistence, time, application, but pay off

Architectures must be evolved in concert with users needs

Sharing means giving up control
  - Trust? Who will pay? Own?

Real collaboration everywhere
  - The GSAW community is alive, collaboration is spreading

Technological advances continue exponentially
  - Can I task the satellite from my iPhone yet?
  - The ground enables the mission

>> Have you overestimated next year, and underestimated the next 10? …

… Come back and share your vision at GSAW 2010

Innovation on the ground