



Ground Systems and Architectures

Col Thomas Fitzgerald
SMC Chief Engineer



Welcome

- Workshops (Kudos)
- Exciting Time For Space
 - Every topic you discuss needs a solution/further exploration
 - Endless opportunities
 - All of our activities under review
 - Possibilities for positive change great! ...
 - We can actual impact these changes!



Observation #1

- **Point #1:**
- Amazed at the scope of activity included under the heading “architectures”
 - National Security Space Architect
 - BMDO Chief Architect
 - BMC4I community focused on architectures
 - Every “system” discussed in terms of some architecture
 - Aerospace Chief Engineer to Chief of Engineering and Architectures
 - ESC reorganized around Architectural Councils
 - Last year over 20 presentations quoting “A” word

Confusing? Hard to do more than conceptualize?



Observation #1

Point #2:

- Caution! No one yet proved smart enough, with enough span of control or funding to be the architect we want, think is needed, or some believe already exists!

Reality

- We break things down into classes, divisions, work elements, programs, systems for a reason...
 - Work them incrementally and piecemeal out of practicality or manageability
 - Hard to really find one small group, which equates to efficiency, who also have budget, technical, contracting and savvy of many elements/functions that comprise modern systems



Favor systems engineering umbrella!

- **More concrete! Same goals -- if done right!**
 - More orderly, understood discipline
 - Formal education/training available to provide foundation for how to take requirements, develop possibilities and options, accomplish trades, flow-down to sub-elements while balancing cost, schedule, performance and risk against a system, systems of systems, or a system of system within a system of systems
 - ...to understand the “big picture, grand design or strategy and then break into manageable elements without breaking the whole
 - A process that most likely equates to seasoned veterans with years of hard-knocks behind them....



Observation #2

- Nevertheless, space is architectural demanding: space, ground, launch, BMC4I interfaces and elements -- the norm!
 - Different aircraft world I learned in
 - F-16 organized and managed around hardware components: structures, avionics, electronics, engines, support equipment, etc.
 - F-16 relatively autonomous weapons system at time, focus on single prime with no powerful users other than TAC: EPG and FMS customers important but US needs drove designs
- Today: Building for diverse, multiple users, with different needs
 - National intelligence, military and civil
 - All equal power and drive requirements!
 - SBIRS Low example!



Observation #3

SDIO/BMDO experiences point out struggle ground

Cold War era:

- Tall threats --trend to reduce vulnerability, enhance survivability, performance and responsiveness
 - Autonomy, single mission platforms, dedicated “everything”, proliferated -- buzz words behind concepts like Brilliant Pebbles and Brilliant Eyes
 - Cost almost non-factor

“Debatable” threat period of today:

- Focus on cost, multi-purpose, CAIV, common solutions and architectures, economies of scale
- Willingness to trade FOC schedule and performance
 - But, with vulnerability, complexity, interoperability and a host of new problems that may actually eat the cost savings of stovepiped, but often capable systems
 - Vulnerability analyses pointing out ground easiest link to exploit!



Observation #4

- **2001 environment:** Ground systems are integral to missions more than ever --demand for systems/architectural engineering greater than ever!
- **NMD experience...**
 - Interceptors and weapons element important, but equal are sensors, (ground and space), BMC2, & the whole ground infrastructure
 - NMD creating stand-alone network, but still must tie their system of systems into other systems: TMD, SBIRS, and strategic elements
 - Must fuse data from multiple sources on ground --from fiber optic cable to creating a comm network that rivals or surpasses the NROs, NMCAs, or Navy CEC
 - NMD buzz-words typical: “flexible”, “plug and defend”, “dial a threat/ response”
 - Biggest threats many systems face are political!!



Observation #5

“And along comes the Space Commission...”

- **Help or hindrance!**
 - For every action there is a reaction...with change comes risk
 - Space verses ground (infrastructure) and who owns
 - Information assurance mission and/or space mission
 - Separation of R&D and sustainability (in space O&M), from space operations/acquisition groups
 - Loss of cross systems, architectural push as you become more like an NRO who lets acquisition and operations mix with only recent changes to push architecture, commonality, chief engineering.
 - Could become more stovepiped again making it harder to look at COTS, commercial solutions, common rules, JTA, standards and specs
 - Return to performance dominance?



Summary

- Some great thought provoking topics at this meeting!
 - Some tough issues identified, with no one having all the answers, or maybe, even understanding all the issues
 - Nevertheless, good to expose ourselves to healthy doses of both ivory tower thinking along with the reality we cannot escape!

**Challenge! Get into the changes that are coming!
Embrace them or get run over!**