This working group will address challenges and opportunities associated with Space Enterprise Integration for high profile use cases such as

- Integrating Space for National Defense
- Harmonizing Space Traffic Coordination (STC)
- Master Planning a Sustainable Cislunar Ecosystem

U.S. government agency panelists address high profile use cases:

- Colonel Wallace ‘Rhett’ Turnbull - Deputy Director, Space Systems Integration Office, Space Systems Command
- Scott Leonard – Technical Director, Office of Space Commerce
- Wes Fuhrman – Senior Professional Staff, Johns Hopkins University Applied Physics Laboratory

The workshop includes a leadership panel and a town hall.

Information @ link: Working Group A – Ground System Architectures Workshop (gsaw.org)
The discussion will be framed around a ‘3×3’ approach to assess each of these three Use Cases through three lenses to gain insight into how organizations conduct enterprise integration:

- Interoperability
- Tactics, Techniques, Procedures (TTPs)
- Threats

The working group session consists of two parts:

Part 1 will include a moderated panel session with presentations and discussions related to strategic foundational elements for space enterprise integration, outlining applicability to several use cases to advance U.S space capabilities in the national interest.

Part 2 will be a town hall meeting to include key representatives from government and private sector organizations sharing a common goal to advance space capabilities in the national interest.
End-to-end integration of systems, data flows, decision processes across an enterprise to sustain operations.
- Others think interoperability is easy for the military – just issue an order – but it’s not; many chains of command
- No one reports to a single authority – it’s a “wicked problem” – but we are making a tremendous amount of progress
- Having an integrated view of the architecture will help in the priority decision-making identified below
- Space is a commons for all our agencies – and it’s easy to screw up for everyone

- How do we convince multiple players to interoperate? Thought this was easy for the military!
- Have to partner with people you have no control over – see “wicked problems”
- Vendor agnostic has obstacles in the cloud world
- Can be mitigated: Infrastructure as code through Kubernetes

- Strict coordinate systems on the lunar surface
- Decomposition of architectures – need to focus on interfaces.
- What are the DE gaps for interoperability?
- Need to understand how models fit together and how models can be chained together
- We need to be out there setting the norms now, before it’s decided by someone else.

- No longer possible to go through central node
- How do we define what data goes to the edge, and what’s the format?
- How does that data make it to the edge? What networks are needed?
- Decision making hybrid – mission command empowerment
- Enterprise roadmap – how is it evolving? Conducting workshops now. Going to publish soon, want feedback

- Learned a lot about getting the data “there,” vetting data, and data security
- But still need to determine how to balance data vetting and security with getting new data and tools more quickly
- Also need to balance doing the thing that is fast, and doing the thing that is sustainable.
- How to get feedback? Sent out RFPs / RFIs asking users “what do you want?” What do you need in a modeling and sim environment to do stuff with our data? Currently recruiting beta users for their new systems.
- Getting to good enough: STC conops is to do a general screening, followed by more detailed analysis of high-interest conjunctions. Basic screening first, followed by filling in gaps
- How good is good enough? How close is close enough? How do we determine that? Ground truth is absent for debris.

- Cloud aspect can become a cost sink
- “Storage will eat our lunch if we’re not careful.” Data grows stale quickly – archive it quickly
- Timelines help us envision how the roadmap changes. Analogy of hopping from rock to rock – need our current rock to be stable.
- Use of proving grounds to show stability with little risk.
- Need consensus on where we need to be in 10 years. One system for all has drawbacks in the short term, you get more feedback and buy-in by taking smaller steps.
- Threat detection and reporting – Report threats to DoD. What can we learn about adversary action from telemetry?

- Important to remember that adversaries still exist in the civil world too
- How do we avoid analysis paralysis? Coordination, and communication – faster decision making
- Need sustainment of purpose
- Cislunar orbits are energetically complex
- Custody problems – like the rocket body that hit the moon – are exponentially harder in the vast area of cislunar
- Key is to shift countermeasures far left – need to be thinking right now
- Priorities / resource contention: human safety first
- “We need a department of the exterior” to share threats
Interoperability is a “wicked problem”
- Many stakeholders with different priorities
- No single authority or decision-maker (and there never will be); must partner with agencies you have no control over
- No closed-form solution – the problem can never be solved definitively

How do we tackle the “wicked problem” of interoperability?
- Have an integrated view of the architecture
- Focus on the interfaces
- Understand how models chain together
Techniques, Tactics, and Procedures (TTPs) that empower decision-making at the edge are increasingly critical:

- Lunar surface will go through regular comms outages
- Users (especially military users) are in austere, contested, and disrupted environments
- No longer possible to aggregate data and decision-making at a central node

Understand what is “good enough” for decision-making and iterate:

- CONOPS for Space Traffic Coordination provides a model: basic screening first, followed by “filling in the gaps” with more refined analysis
- Avoid “analysis paralysis” and make decisions quickly
- Embrace a hybrid model that empowers decision-makers in the field who have most relevant data, backed up by strategists who can evaluate the longer view
Envision – and evolve – the end state
- Need consensus on where we need to be in 10 years
- Need “sustainment of purpose” for the long haul
- Yet, “always in motion, is the future” – Yoda

Build roadmaps to evolve over time and invite feedback
- “Hop from rock to rock” – ensure you are stable where you are, then take small steps
- Invite feedback through workshops, RFIs, and RFPs – and participate by giving feedback
- Use cislunar as a proving ground

Threats are multidimensional
- Capacity / capability (“storage will eat our lunch”)
- Resource contention
- Complexity (e.g., cislunar orbits and debris)
- As well as traditional adversary threats

Share data and shift planning left
- National defense is sharing more openly now than ever
- Sharing goes both ways: civil / commercial “satellite as a sensor” telemetry can augment threat reporting
- Civil and commercial space is not immune to adversary threat
- “We need a Department of the Exterior to share threats”
- Need to be thinking of countermeasures in the planning phase
Thank you