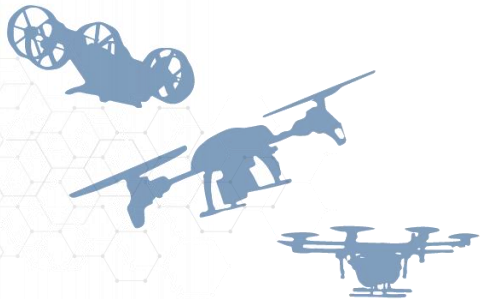




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Peter Sachs, AUS-440

UTM Roadmap and Deep Dive

March 16, 2021

UAS Traffic Management Deep Dive



- Future vision vs. present reality
- Implementation Roadmap
- Industry Priorities
- FAA Priorities
- Present Research Efforts
- Forthcoming Needs



What are we enabling?

- UTM provides distributed services that enable UAS operations below 400 feet AGL
- Controlled or uncontrolled airspace
- Concepts and service models *may also apply* to UAS operations at higher altitudes (e.g. drone cargo)
- This will also be the basis for cooperative management of AAM/UAM passenger-carrying flights.



Diverging Priorities

- Industry wants to be able to deploy and scale quickly
- Industry has short timelines
- FAA needs the regulatory framework first – be able to approve ***services*** independent of airframe and operator
- FAA inaction is already influencing negative outcomes



Who provides the services?

- Mostly industry!
- The FAA has some important roles:
 - Single source of truth for aeronautical information
 - System-wide safety assurance
 - Ensuring fair and equitable access
 - Defining and enabling integration with ATO functions
 - Approving new services
 - Ensuring ongoing compliance with regulations

Easier said
than done?

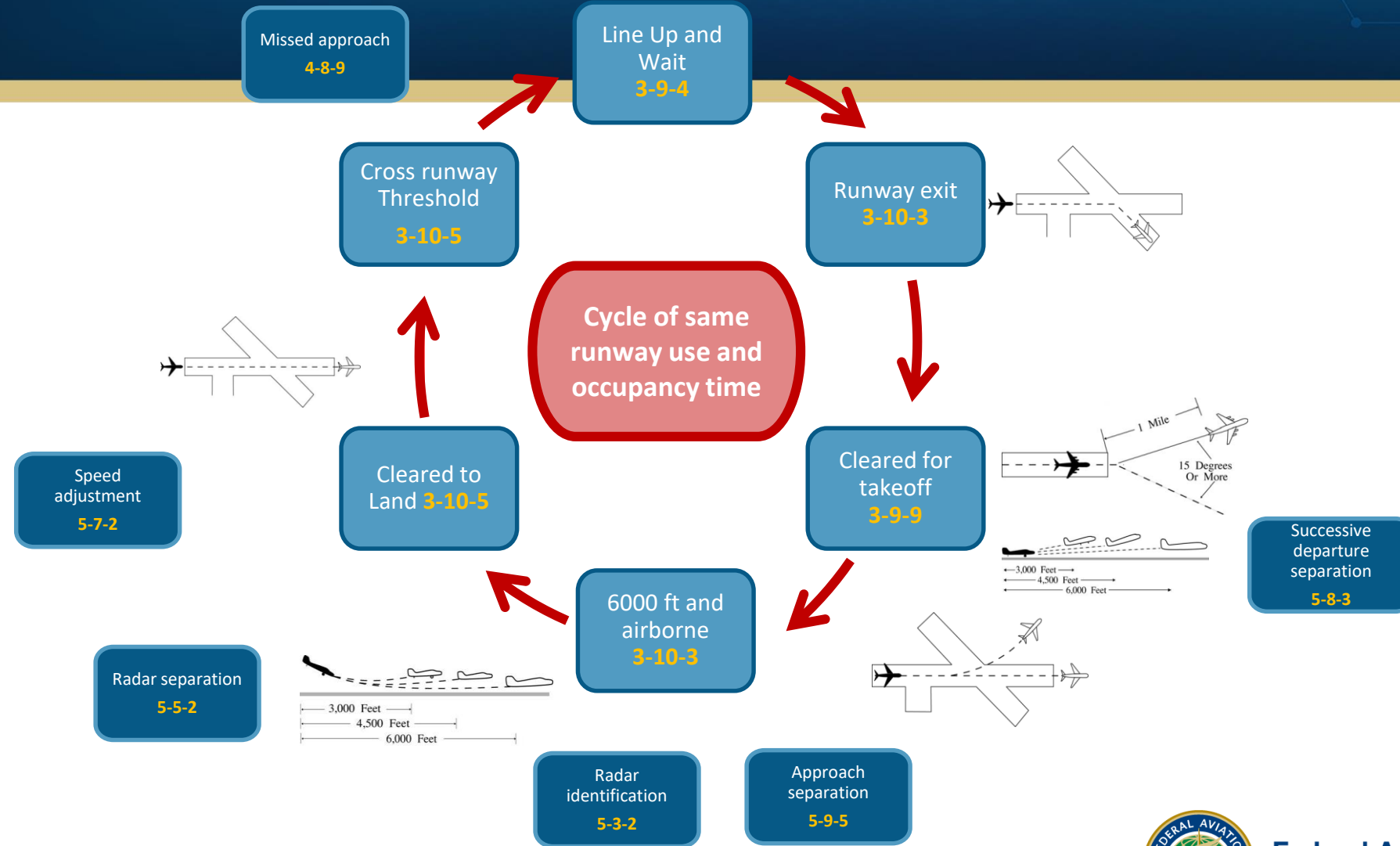
Requires
rulemaking

Two Rules of Air Traffic Control

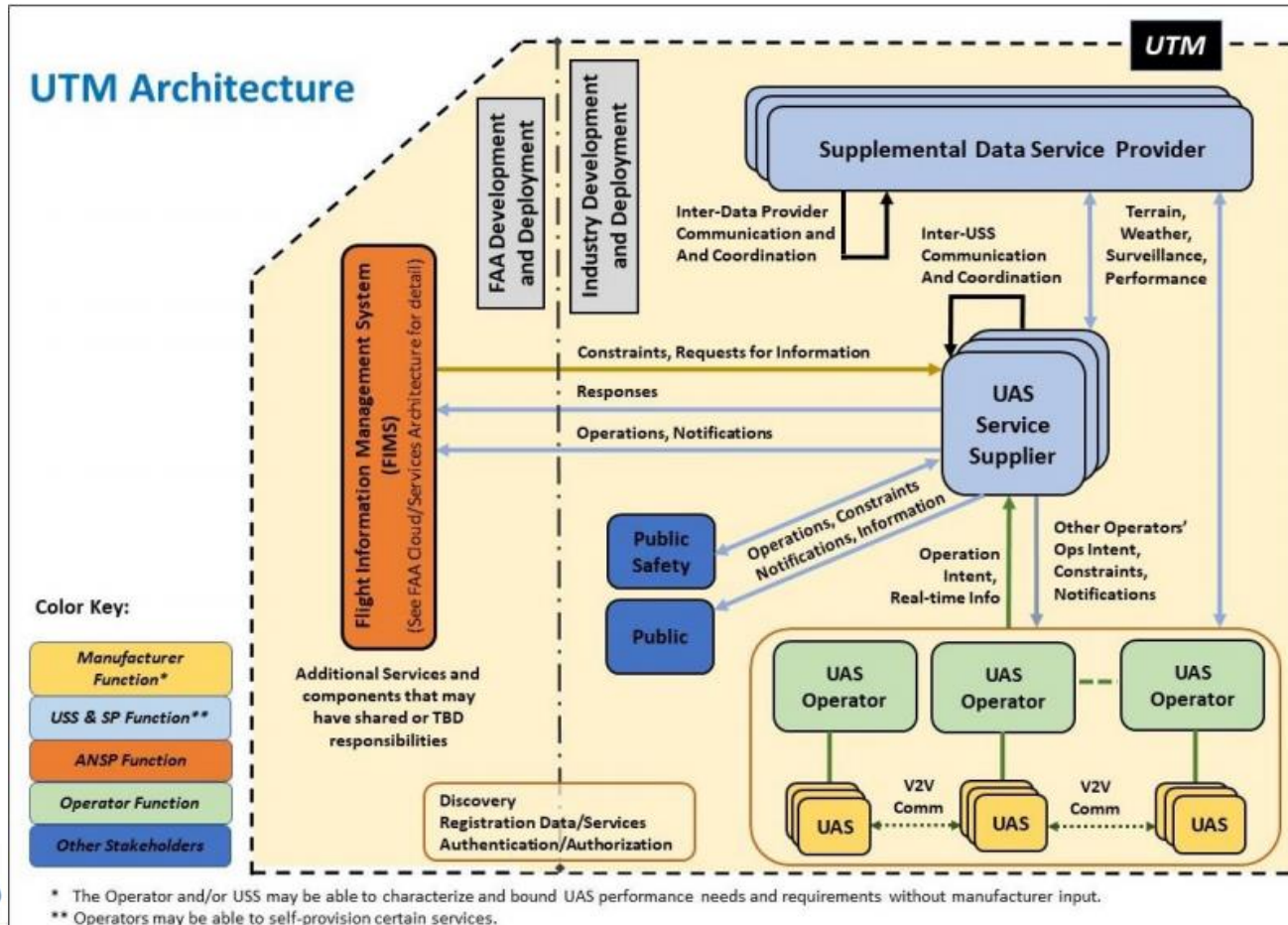
- Don't keep secrets.
- Work smarter, not harder.



ATCO Continuous decision loop



Future Vision for UTM



This is the end state of fully deployed services with high levels of autonomy

Enables high-tempo, complex operations coordinated and managed by UTM services

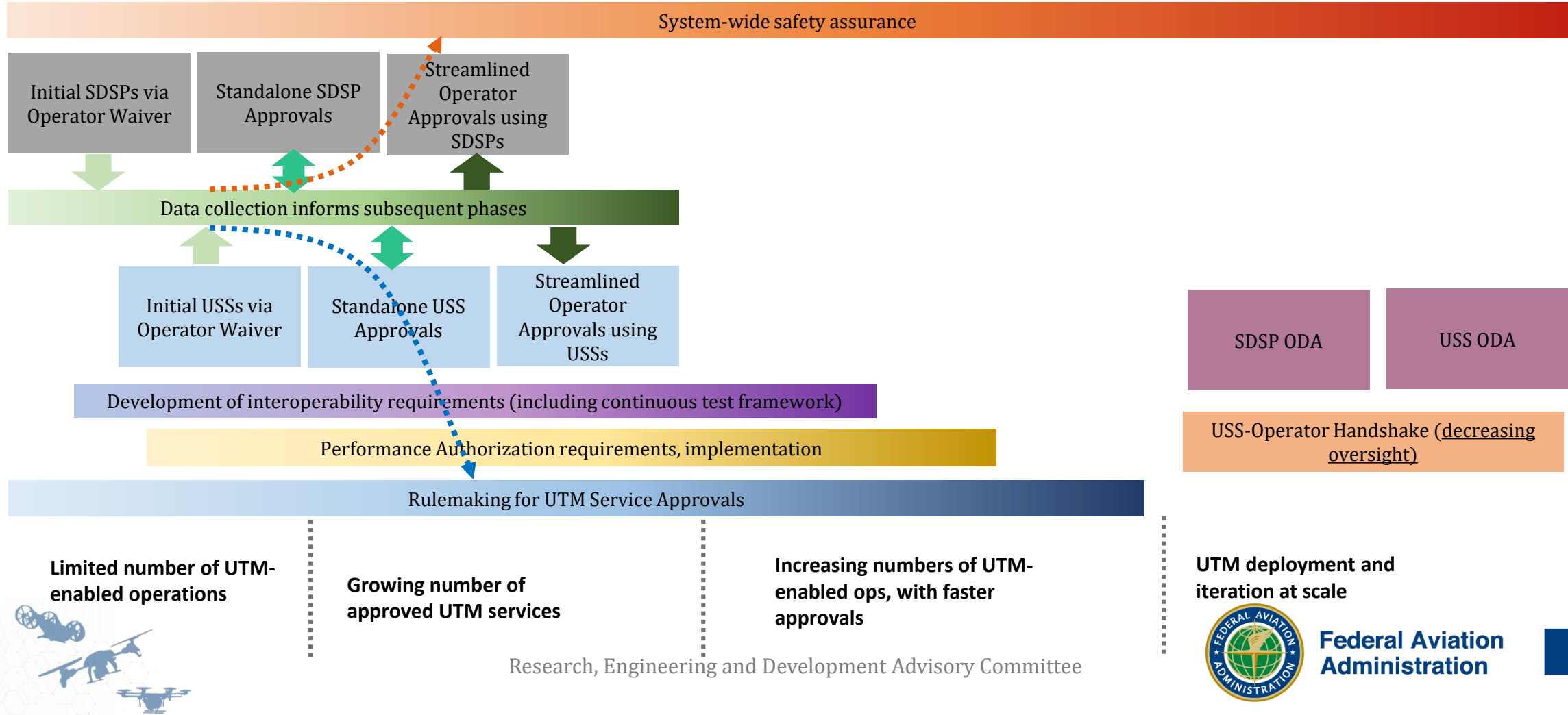
* The Operator and/or USS may be able to characterize and bound UAS performance needs and requirements without manufacturer input.
** Operators may be able to self-provision certain services.

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Notional Implementation Timeline



Why Interoperability Matters

- Common data requirements ensure quality of information exchange
- Successful strategic deconfliction requires that multiple actors have shared understanding
 - Other operations
 - ***Capabilities*** of other operators
 - Impact of constraints
- With time: Increasing need for fast and efficient solutions



Future Research Needs

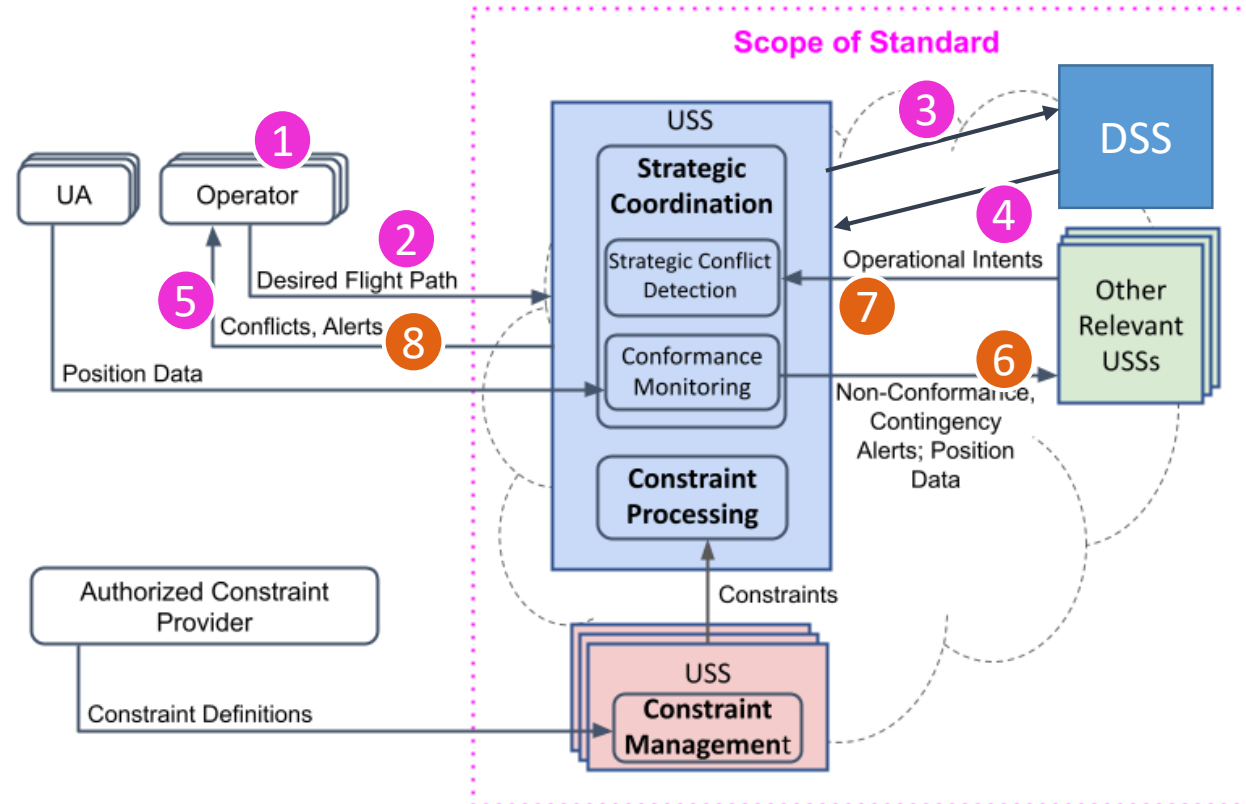
- Driven by gaps in service approvals
- How does the FAA know that a service interoperates correctly?
- How can service providers push updates without re-certifying?
- How does a service handle ***unknown*** edge and corner cases?
- What are the impacts on ***other services*** when one stops working?

Speaking of Deconfliction...

- Optimizing for operators vs optimizing for airspace
- DSS (Discovery and Synchronization Service) model
- How is quality of strategic deconfliction evaluated?
- How do all participants (including FAA) evaluate equity and fairness of solutions?
 - Are some operators being unwittingly locked out, or charged excessively?



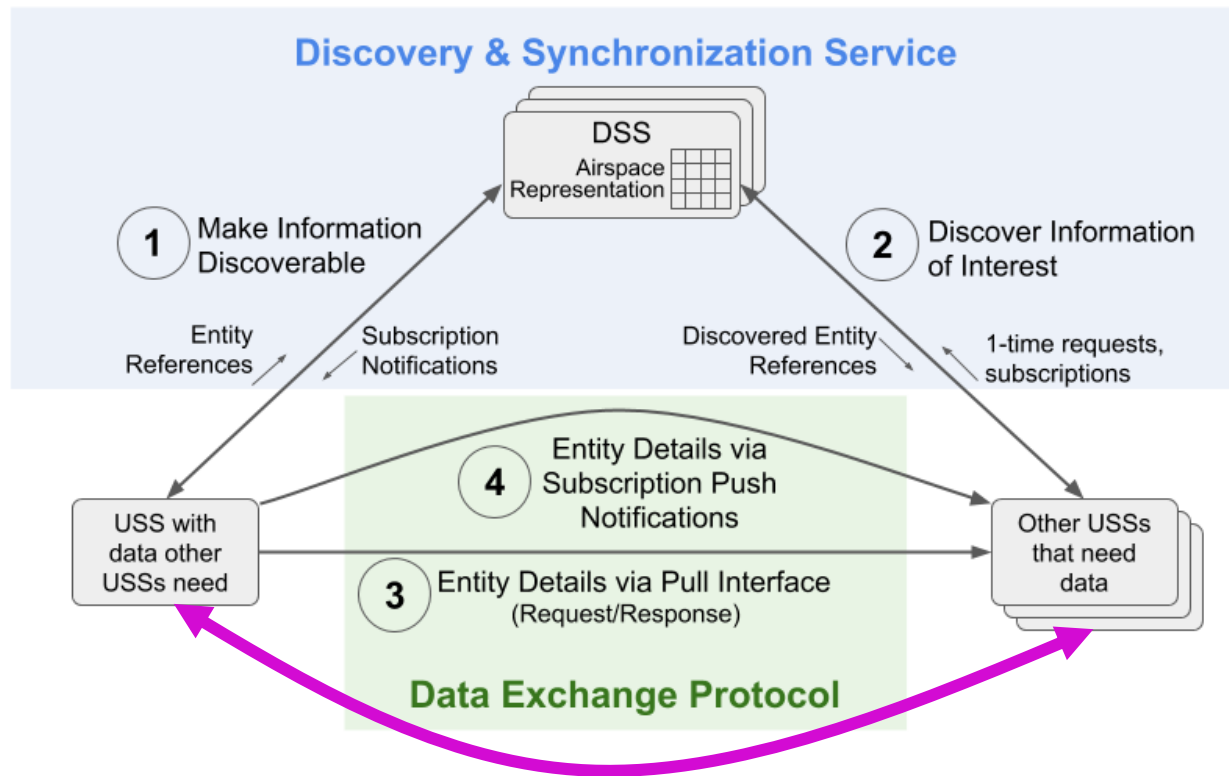
Strategic Deconfliction Flow



- Compute requirements and multi-combinatory solutions as number of operators and USSs increases

Source: ASTM UTM Draft Standard v0.3

DSS and USS-USS Interactions



- What is required to test interoperability of each connection?
- Are industry-defined message formats and contents sufficient?
- Should there be rules for direct negotiations? Side deals?
- How does the FAA monitor and enforce these interactions?

Source: ASTM UTM Draft Standard v0.3

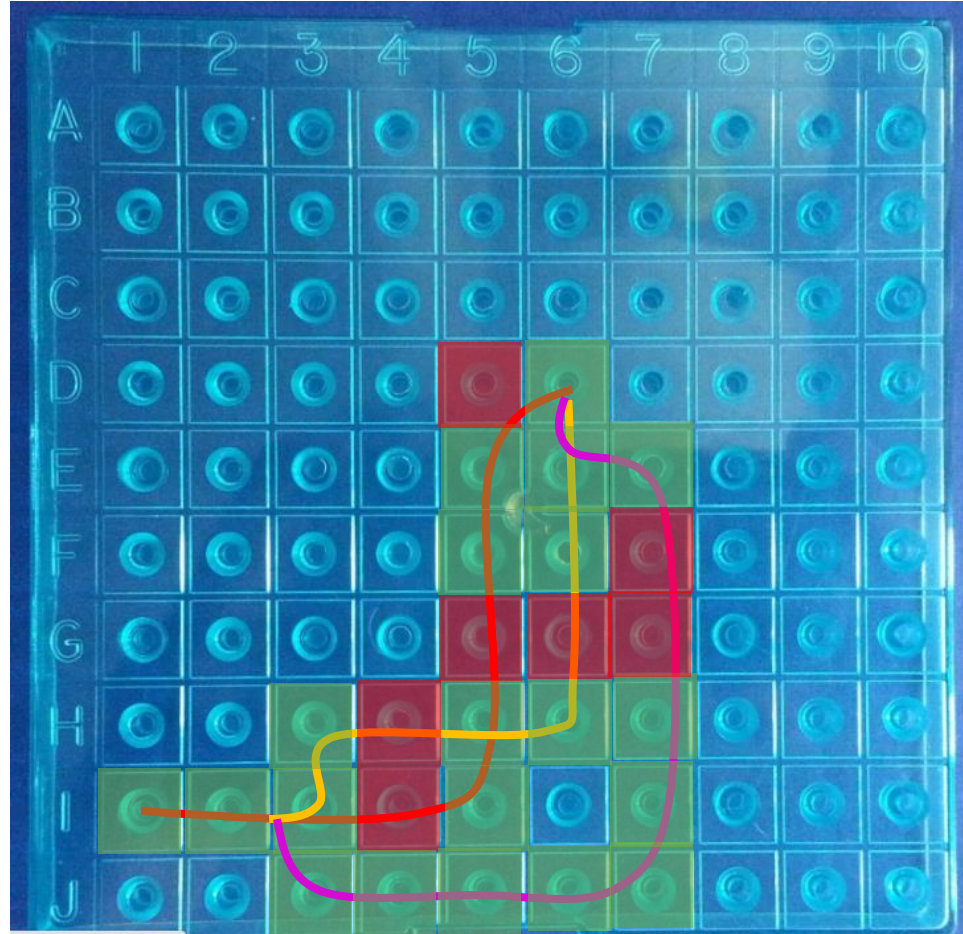
The Battleship Model

- Your operations are on the blue side of the board
- You (or your USS) must use the green side to “ping” the rest of the airspace and determine where you can fly.
- This is not the most efficient way to find a route!
 - But we also don’t know its limitations



The Battleship Model

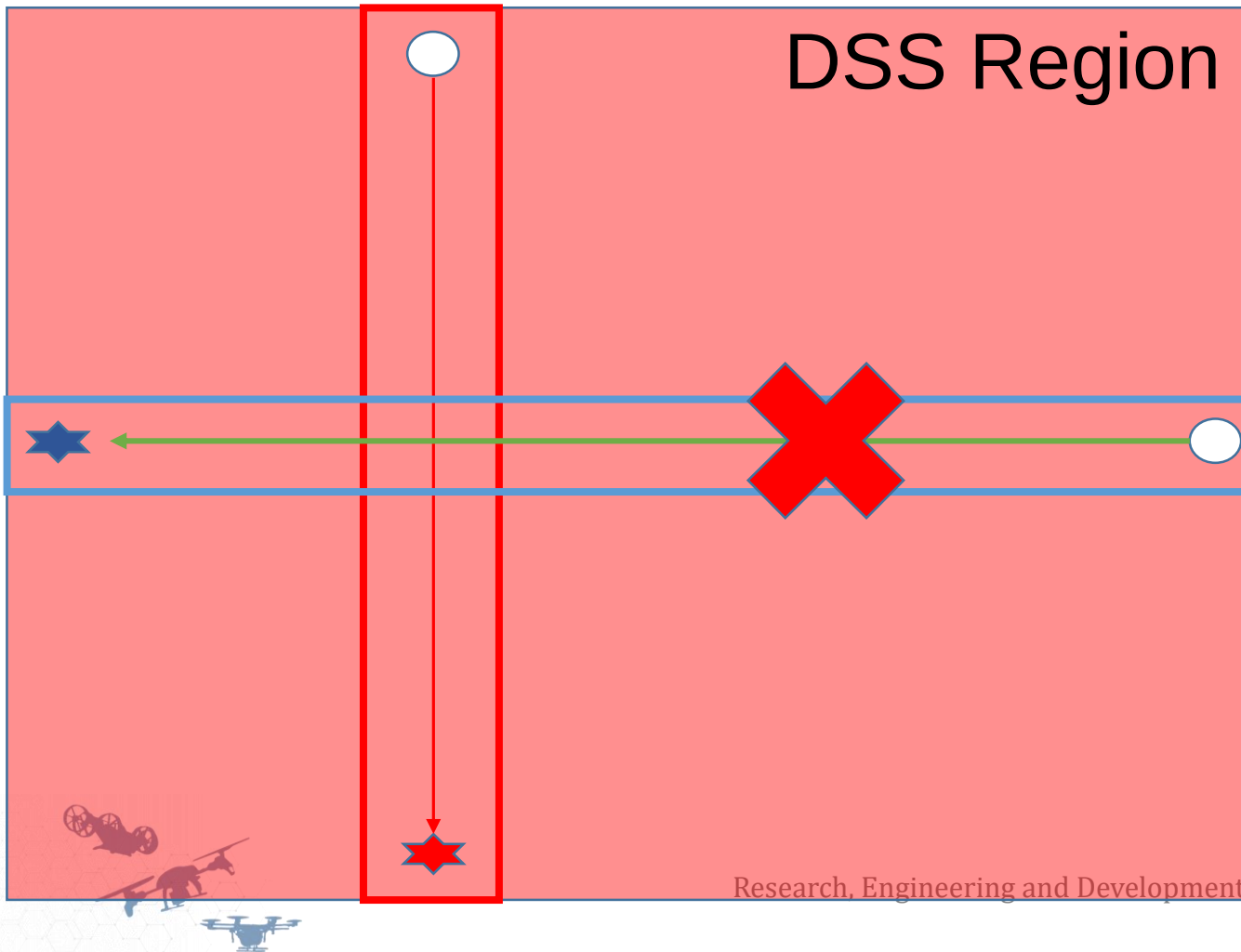
- **Remember, this is a five-dimensional problem!**
 - Adjust left/right (**X - Y**)
 - Adjust cruise height or climb/descent profile (**Z**)
 - Adjust departure time (**t**)
 - Adjust speed (**v**)
- 
- A decorative graphic at the bottom left of the slide shows three drones in flight. The background is a light blue hexagonal grid pattern. The drones are dark blue and are positioned at different heights and angles, suggesting movement through a 3D space.



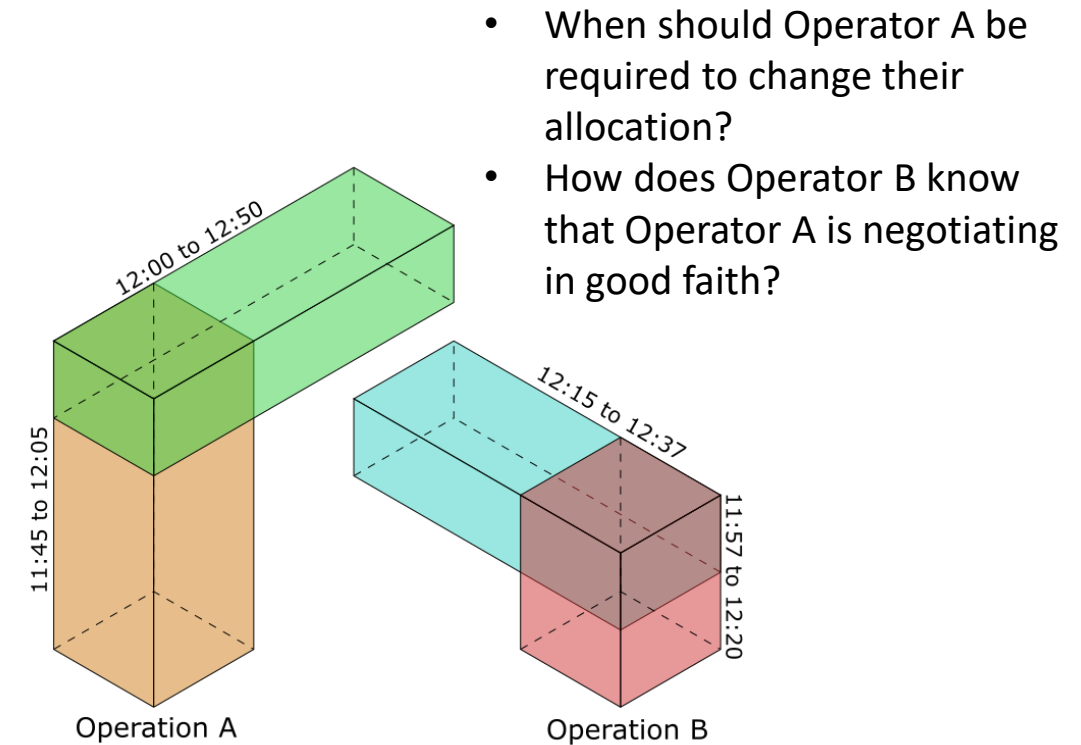
- Compute resources to find a solution for one operator at a time
- How well do different algorithms perform at solving these problems?
- Which variables should be probed to find a solution?
- What about high-priority operations that come after?
- What about multiple operators probing at the same time?
- Is it possible to find a solution that optimizes for multiple operators?



Volume Size and Strategic Deconfliction



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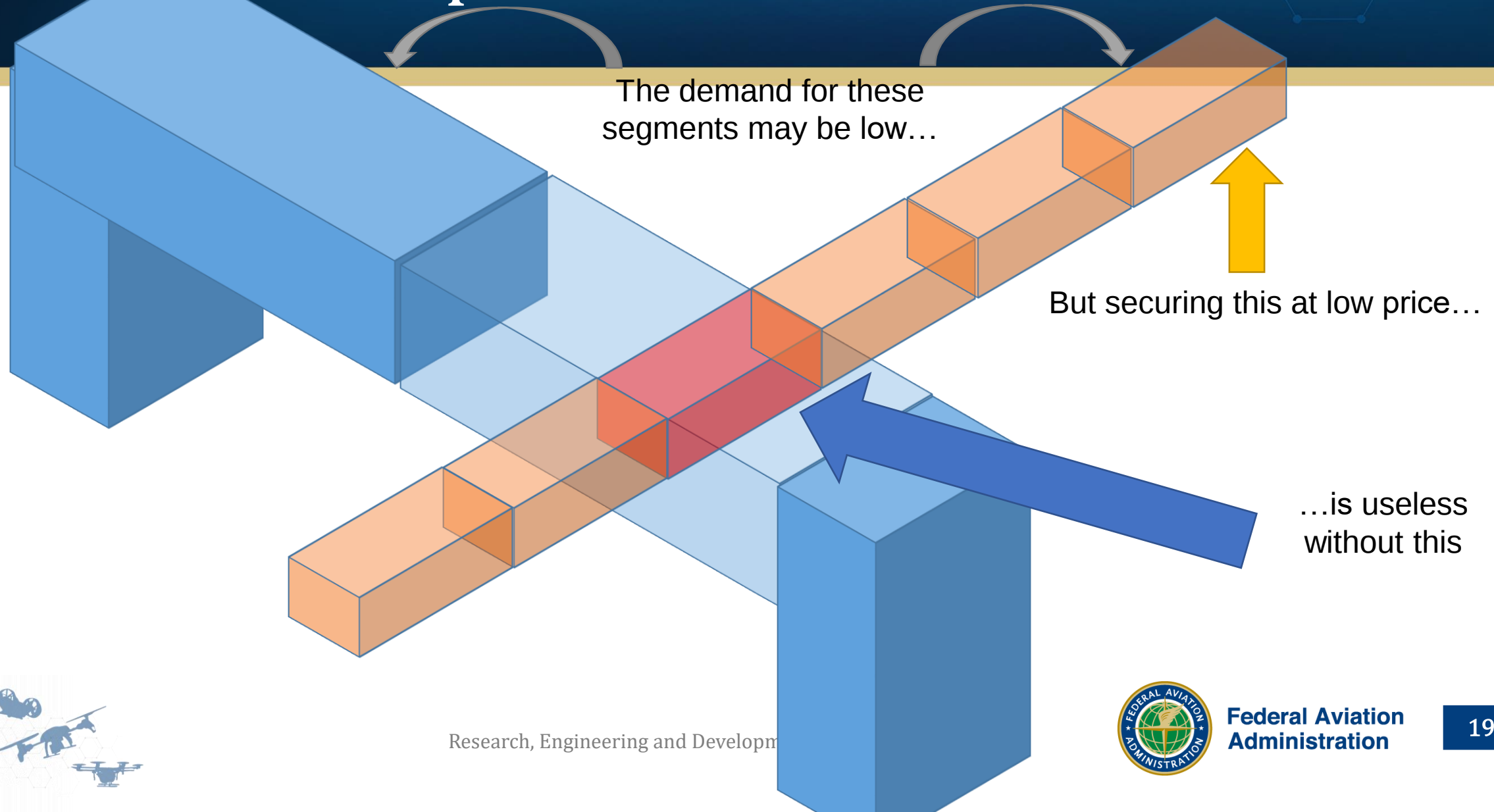


Source: Terry Martin, Revolution Aerospace



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Fairness Implications



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System-Wide Safety

- What metrics?
- What dependencies?
- Safety event chain traceability
- Service-level contribution to system-level safety outcomes
- What data? Where does it live and how is it processed?
- What tools do FAA, industry and partners need?

