



PROCEED
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CERTAINTY



OPERATIONAL CONSIDERATIONS

High Altitude Platform Systems

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HAPSMobile Sunlider

- High Altitude Platform Systems for long duration stratospheric flight

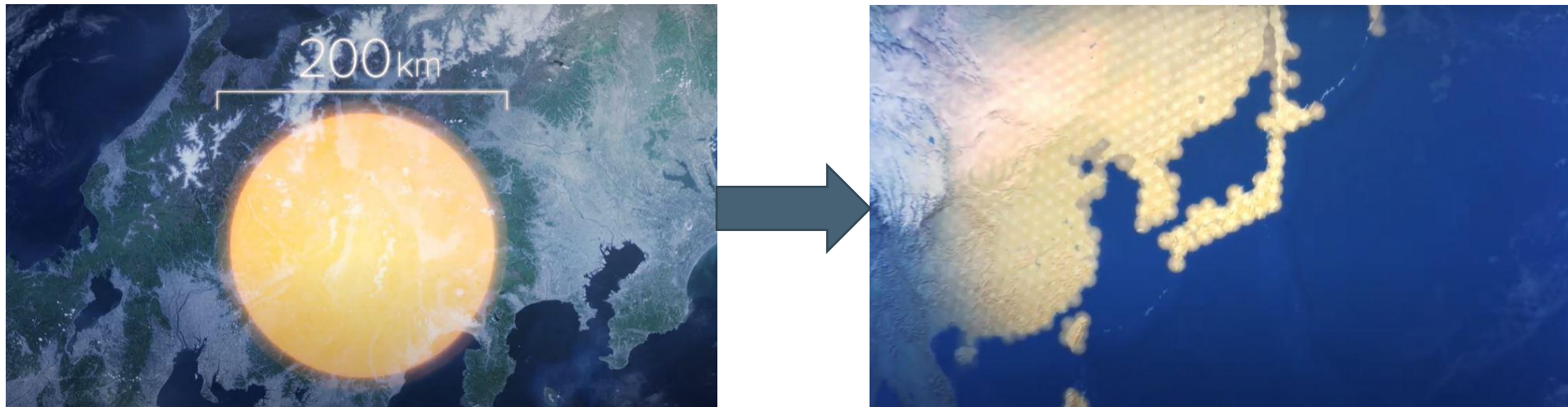


Sunlider in stratosphere
for 5h 38min (Alt. 62,500ft)

https://www.avinc.com/media_center

Sunlider Background: m:N why do we care?

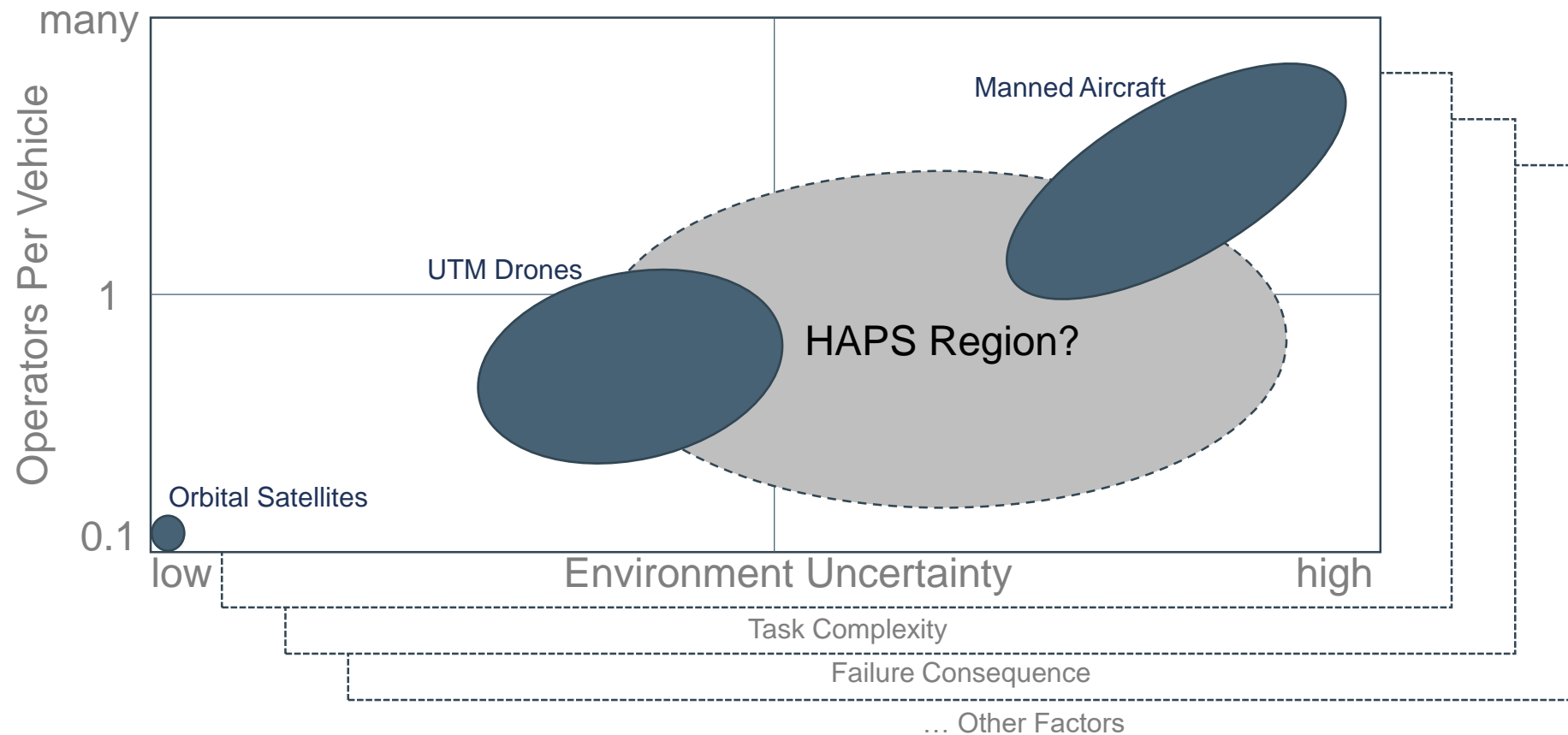
- Scaling the system leads to many simultaneous operations
 - On-station operation, launch/recovery pipeline, continual planning
- Maintain crew effectiveness, human errors increase with dull repetitive tasks like “watch for the red light”



<https://www.avinc.com/about/haps>

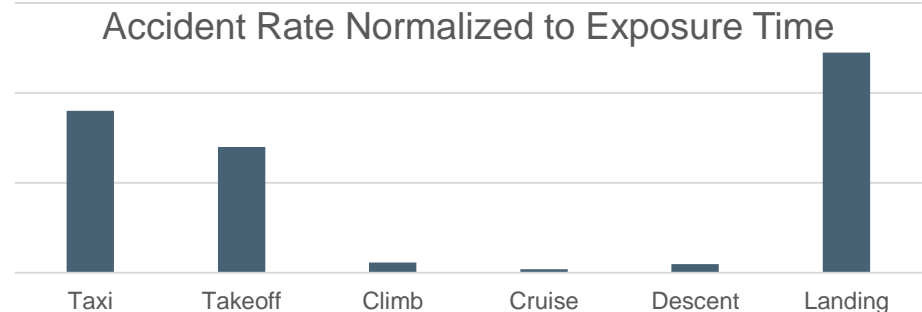
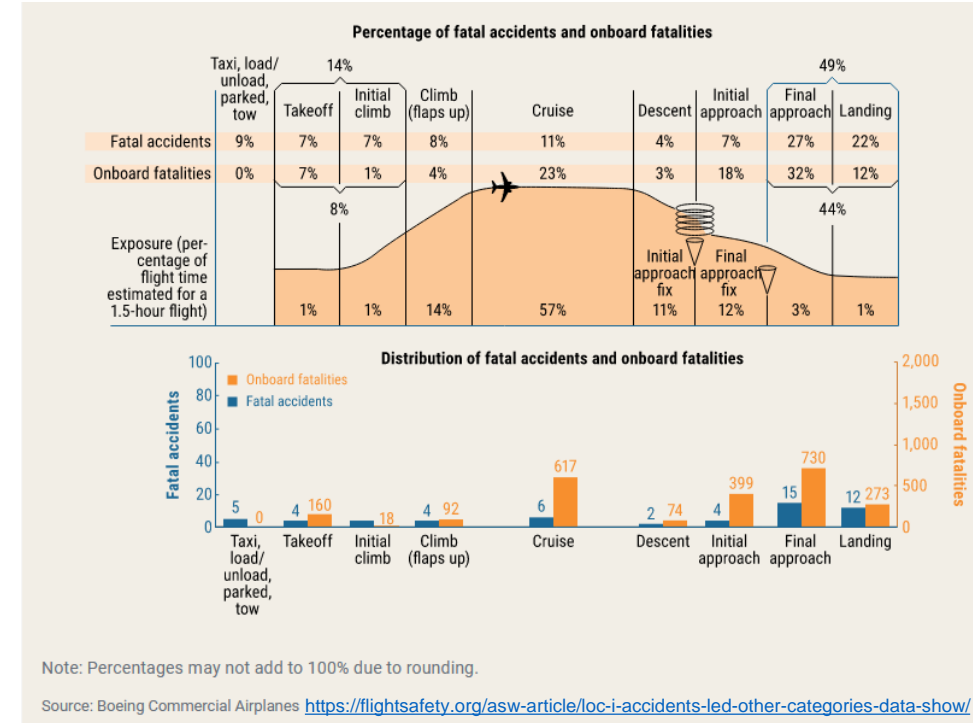
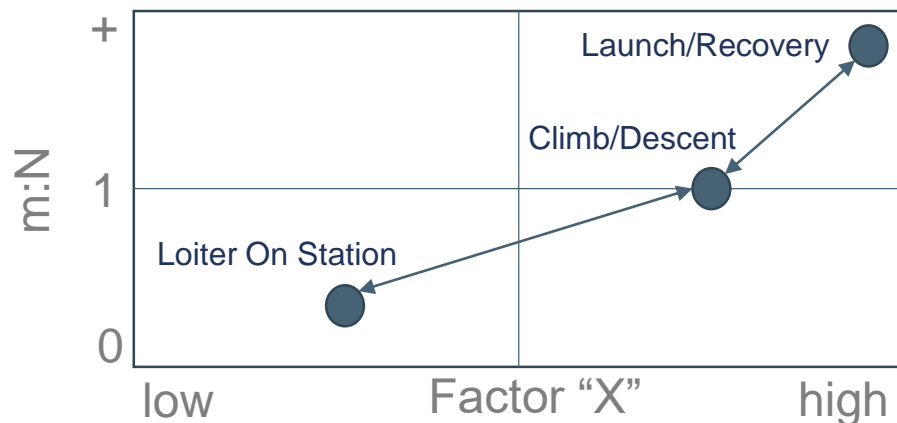
HAPS compared to baseline m:N examples

- There are many accepted m:N use cases already
- Can we pose a basis of comparison for our system?



Mission Segment m:N Approach

- $m \neq 0$ and may differ for various use cases or Mission Segments
- Factors like risk, consequence, etc drive decisions on crew size
- We expect regulator caution, and so will need to demonstrate acceptable workload (nominal and off-nominal) with progressive expansion





Sunlider-specific m:N Considerations

- Operator in the loop for airspace transitions
- Response to unplanned events
 - Atmospheric changes or risks
 - System health warnings/failures
 - Mission objectives changing
 - Uncooperative traffic
- Crew size flexibility, do we need to handle “whole fleet” events at 1:1 man in the loop?



These drive the question: what does it mean to be designated an “operator”?

How do we define “m” in m:N?

- Global harmonization of terms (see HAPS Alliance)
- Autonomy/Automation assists operators
 - One operator commanding waypoint change for aircraft cluster
 - Autopilots and autonomy engine create trajectories and perform GN&C
 - This is Autonomy enabling **more effective** human decision making
 - i.e. 30 pilots with joysticks likely less effective, more risk of failure than 1 mission manager with an autonomy engine
- How are operators classified?
 - Available actions (control trajectory / select course of action / flight term)
 - Accountability (certification of automatic systems, human licensing, insurability)
 - Evolution from Pilot in Command (PIC)  Fleet Operations Director 
Mission/Service Planner

Objectives for an m:N Community

- Outline specific hurdles to deployed capability
 - Perceived risk vs quantified risk
 - (Un)intended consequences of automation
- Outline specific benefits of deployed capability
 - Risk and safety benefits
 - Operational efficiencies
- Understand the factors driving $m:N \geq 1$
- Unify definition of terms
- Inspiration from the DoD Autonomy Community of Interest
 - “strategic assessment of the challenges, gaps, and opportunities to the development and advancement of autonomous systems, and identification of potential investments to advance or initiate critical enabling technology development” ¹

¹ <https://defenseinnovationmarketplace.dtic.mil/communities-of-interest/autonomy/>