UAS Symposium
Key Research Challenges and Opportunities

Sabrina Saunders-Hodge,
UAS R&D Portfolio Manager, FAA/NextGen

Federal Aviation Administration

Federal Aviation Administration

EMBRY-RIDDLE Aeronautical University.

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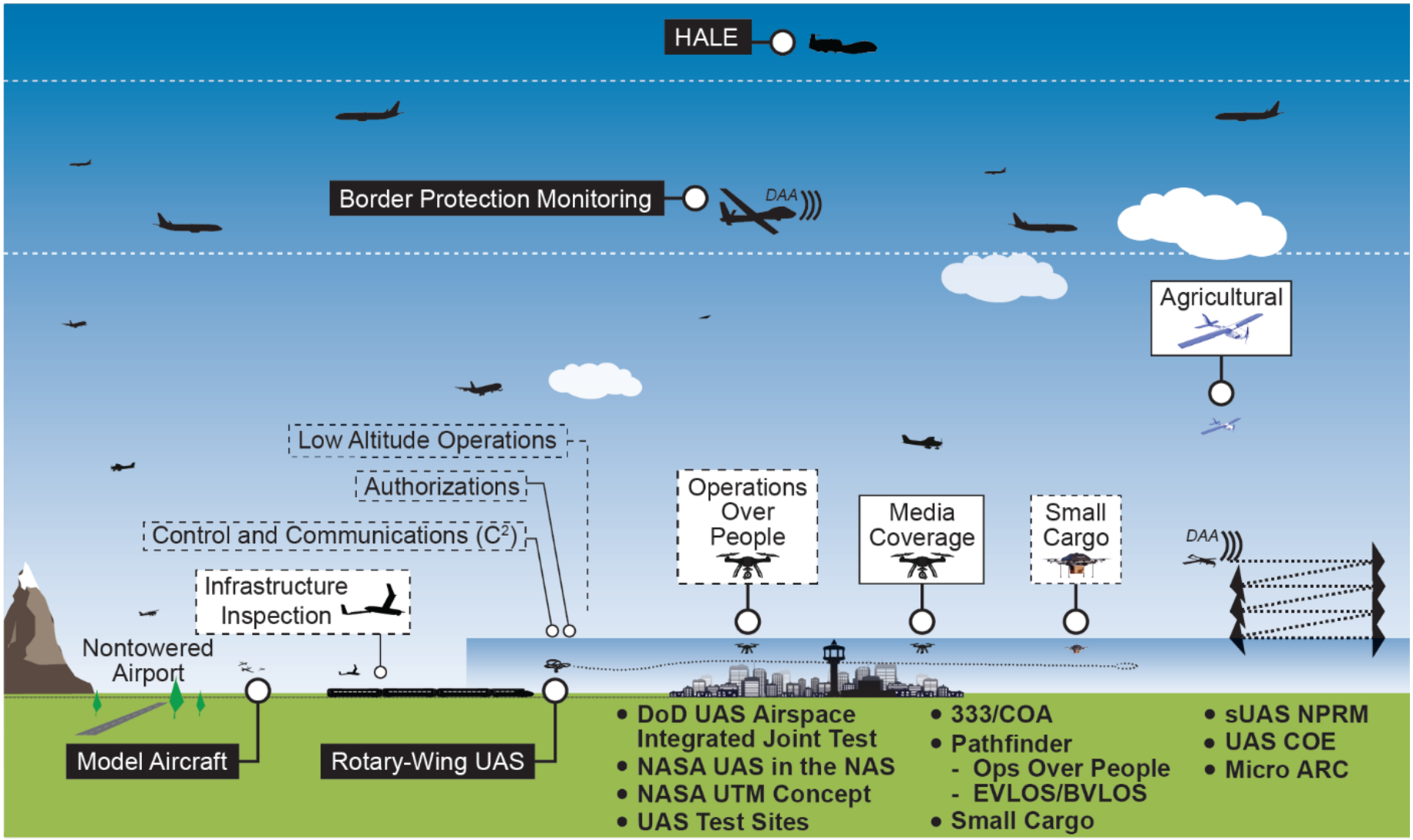
UAS Symposium
Research & Development Panel

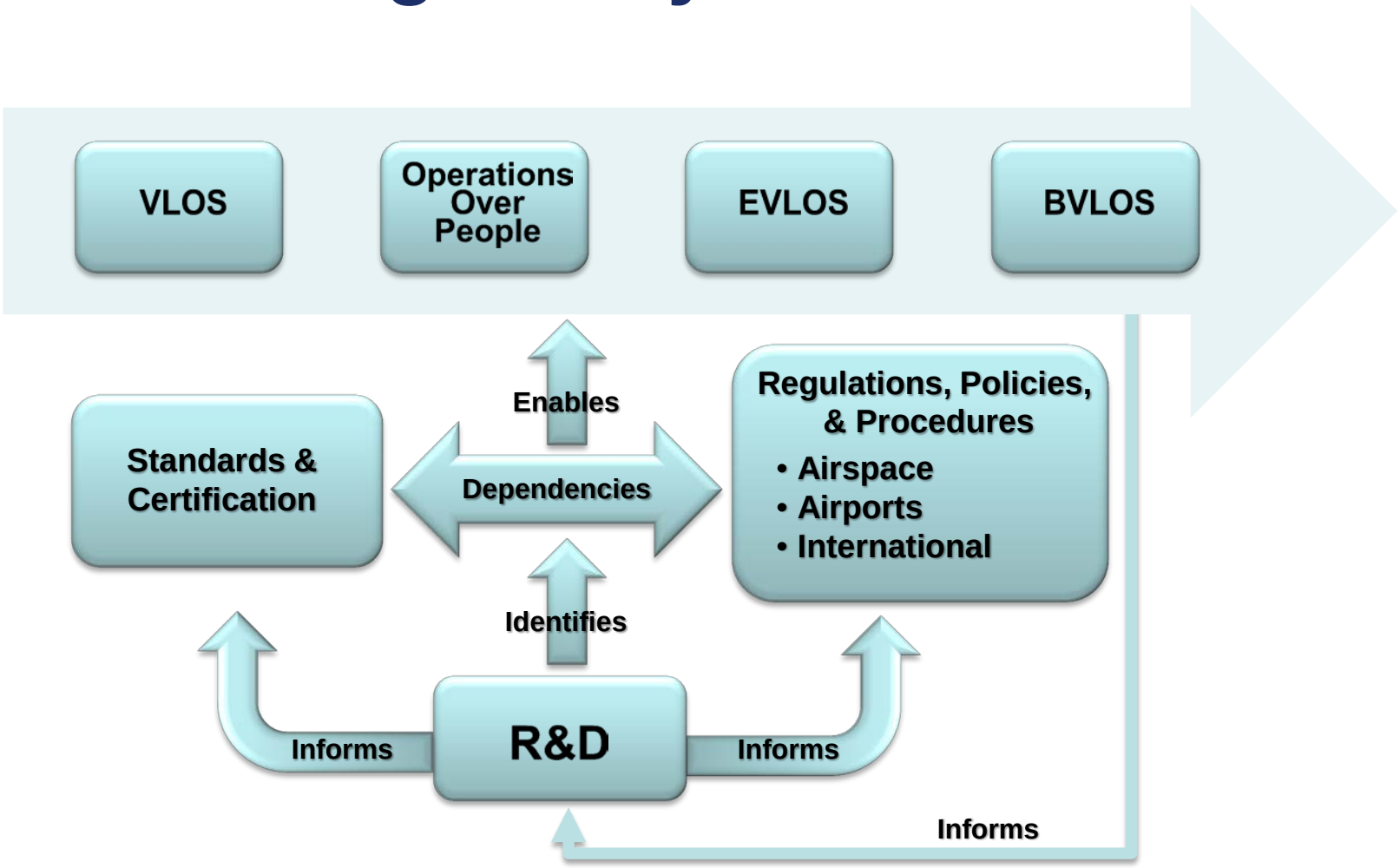
- **Dr. Ed Waggoner, Director, NASA Integrated Aviation Systems Program, Aeronautics Research Mission Directorate**
- **Dallas Brooks, Director, Raspet Flight Research Lab, Mississippi State University**
- **Dr. R. John Hansman, Director of the MIT International Center of Air Transportation and Professor of Aeronautics & Astronautics**

2013 and Beyond

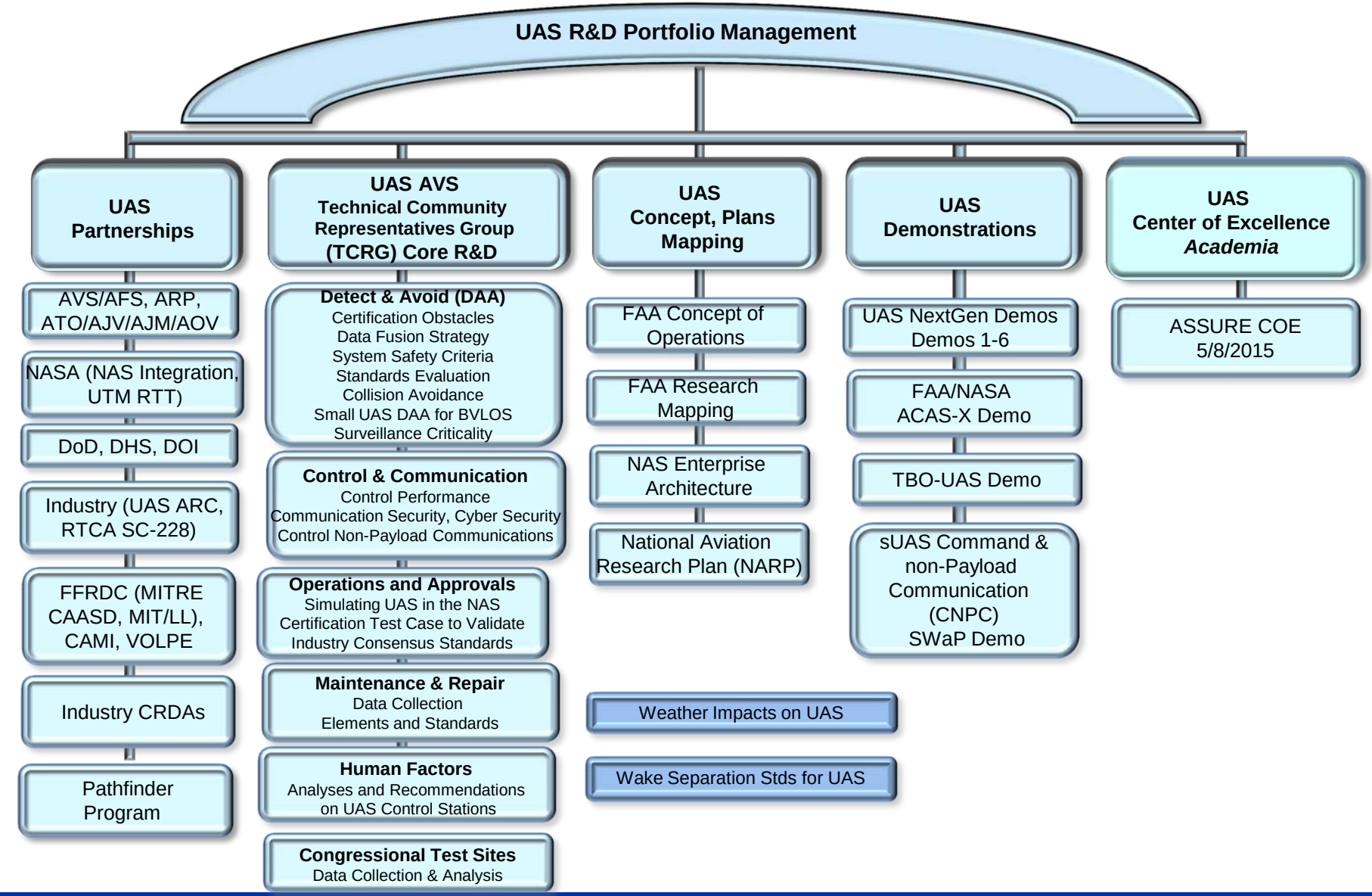
UAS Integrated Options with Manned Aircraft Operations



UAS Regulatory Framework



UAS R&D Portfolio



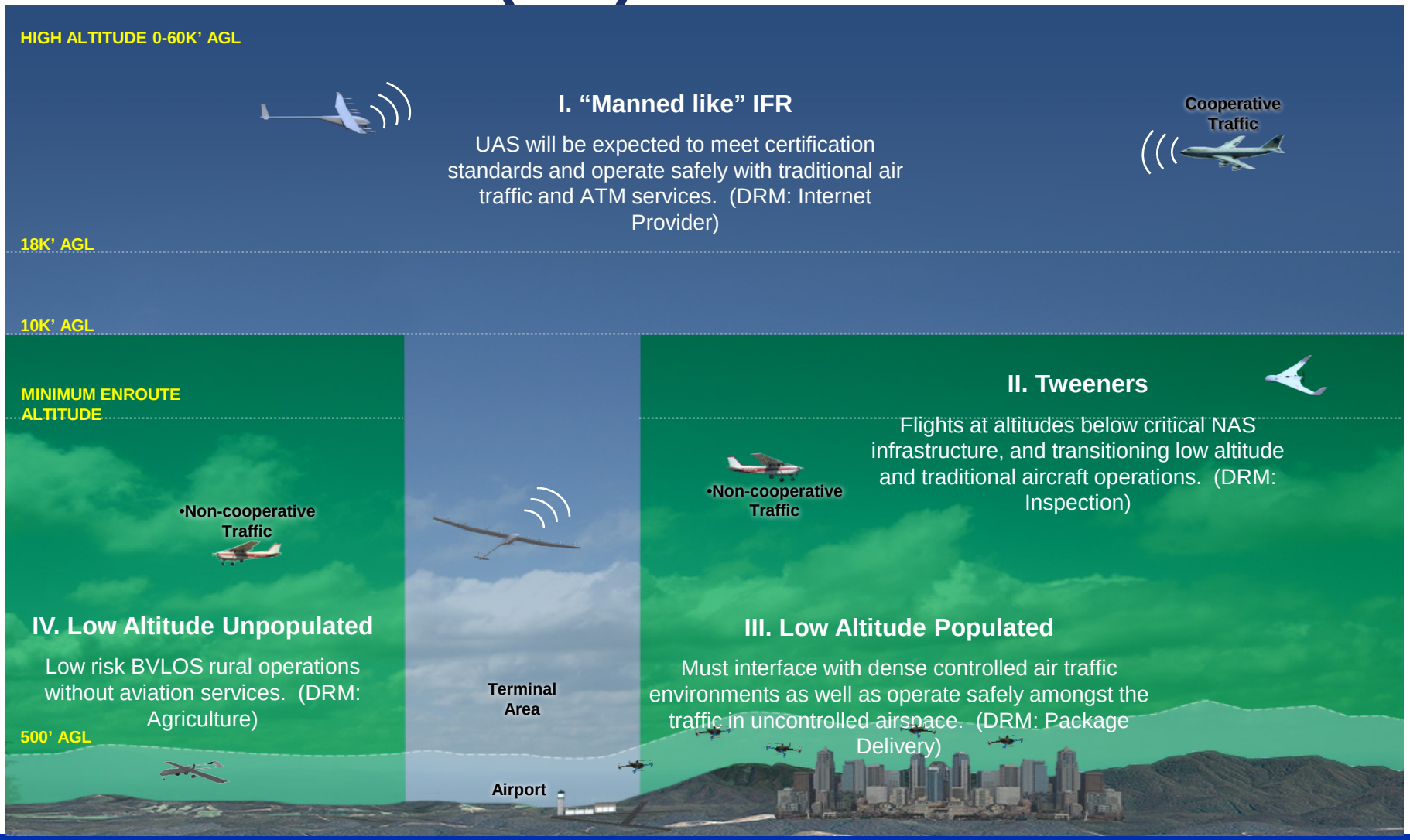
FAA UAS R&D Timeline

2004	✓	FAA/NASA/DoD/DHS/Industry Access 5 for High Altitude Long Endurance
2008	✓	Establishment of initial WJHTC UAS Modeling and Simulation Capability
	✓	RQ-7B Shadow, MQ-9 Predator B Performance Model Verifications/Demo
	✓	RQ-7B Shadow UAS Operational Assessment: Cherry Point, NC
	✓	Multi-UAS Operational Assessment: Class D Airspace
	✓	Initial NAS Integration Simulation-1
	✓	UAS NAS Integration: RQ-7B Shadow with FMS Simulation
	✓	UAS NextGen Demonstrations – NASA, DHS/CBP, USAF, ERAU
	✓	ScanEagle Performance Model Verification – Boeing/Insitu
2010	✓	NASA UAS in the NAS Project (In progress)
	✓	UAS R&D organized within a Portfolio
2012	✓	FAA UAS Integration Concept of Operations V2.0 (Maturation underway)
2013	✓	DoD UAS Airspace Integration Joint Test (2012-2015)
	✓	UAS Test Sites (AK, NV, NY, ND, TX, VA)
	✓	Integration of UAS into the FAA NAS Enterprise Architecture
	✓	NASA UAS Traffic Management Research Transition Team
2015	✓	UAS Center of Excellence (MSU - ASSURE)
Present	→	UAS FY15 - FY16 R&D Initiatives in Progress

Present FAA Sponsored Research

- DAA System Certification Obstacles
- Integration of ACAS-Xu into DAA
- UAS C2 Link Compatibility
- UAS Human Factors Considerations
- UAS Enroute Contingency Operations (pilot & ATC procedures)
- Analysis of Test Site Safety Data
- sUAS Well Clear Definition
- sUAS DAA required for BVLOS (Limited portions of NAS)
- sUAS Control & Non-Payload Communications (SWaP)
- Validation of sUAS Industry Consensus Standards for airworthiness
- UAS Airborne Collision Severity Thresholds
- UAS Ground Collision Severity Thresholds
- UAS Noise Certification

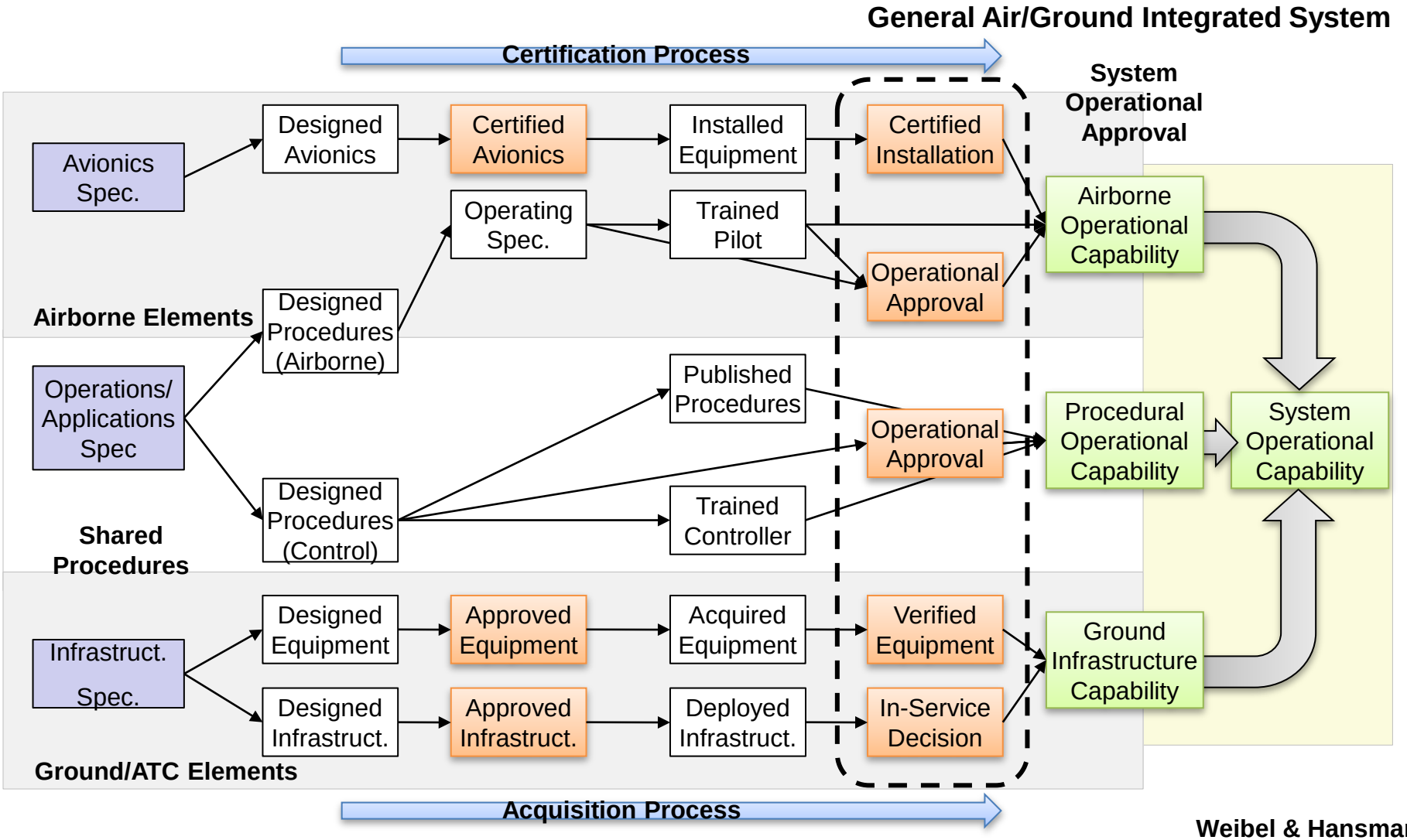
Emerging Commercial UAS Operational Environments (OE)



R&D Concerns for UAS Integration

- **Lack of Clear Research Questions to Support Policy Decisions**
- **Ambiguity of Architecture, Technology Levels and Con-Ops**
  - CNS, Level of Automation, Vehicle Performance, Data Structures
  - Dynamic Environment
  - Need for Reference Placeholders (Architecture, Con-Ops)
- **Diversity of UAS Operating Environments and Platforms**
  - Segregated (Low Altitude, High Altitude)
  - Integrated (Mid Altitudes)
- **Urgency Driving Piecemeal Approach**
- **Need to Leverage Initial Efforts**
  - Operating Statistics and Pathfinder Efforts
- **Role of NASA, DOD, International**
  - NAS Integration
  - Vehicle Technologies

Simplified Set of States Required to Achieve Operational Capability



Weibel & Hansman

Breakout Discussion
Application of Research

- **What are the key and emerging challenges to:**
  - Enabling
  - Enhancing
  - Reducing restrictions on

  your current and desired public & commercial UAS operations?

- **What research is required to address these challenges?**