

UAS Symposium Key Research Challenges and Opportunities



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UAS Symposium

Date: April 20, 2016



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UAS Symposium

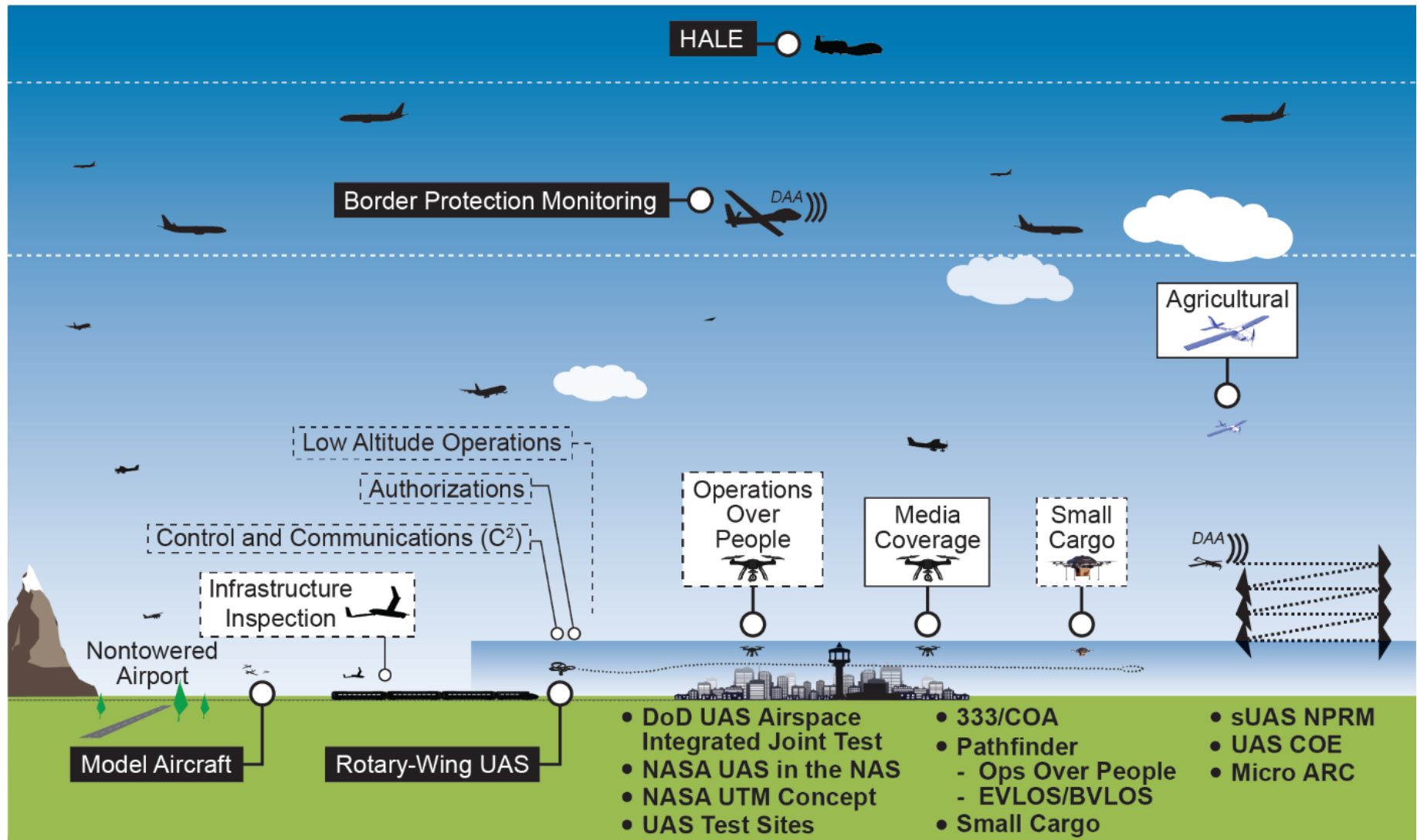
Research & Development Panel

- **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

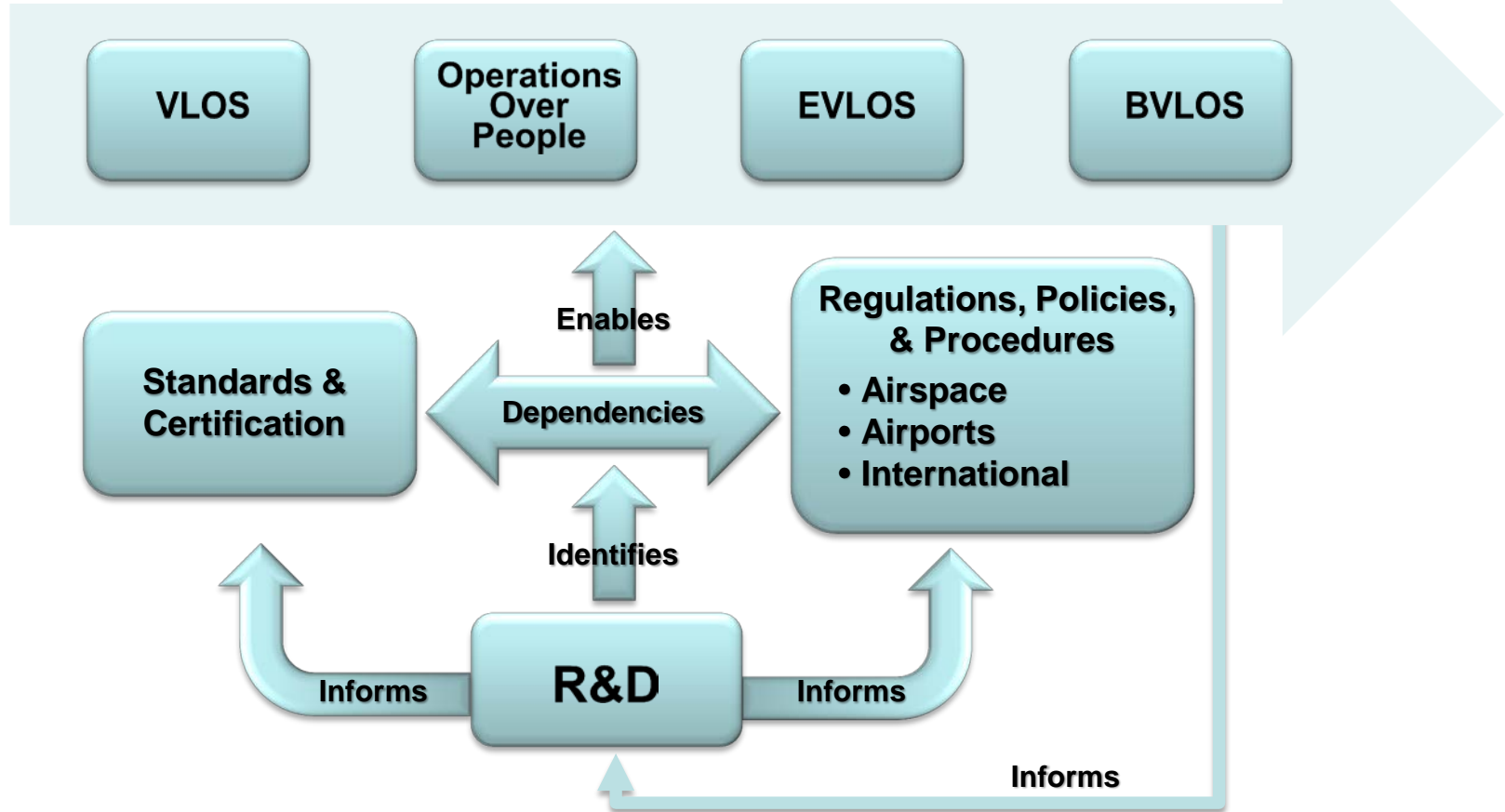


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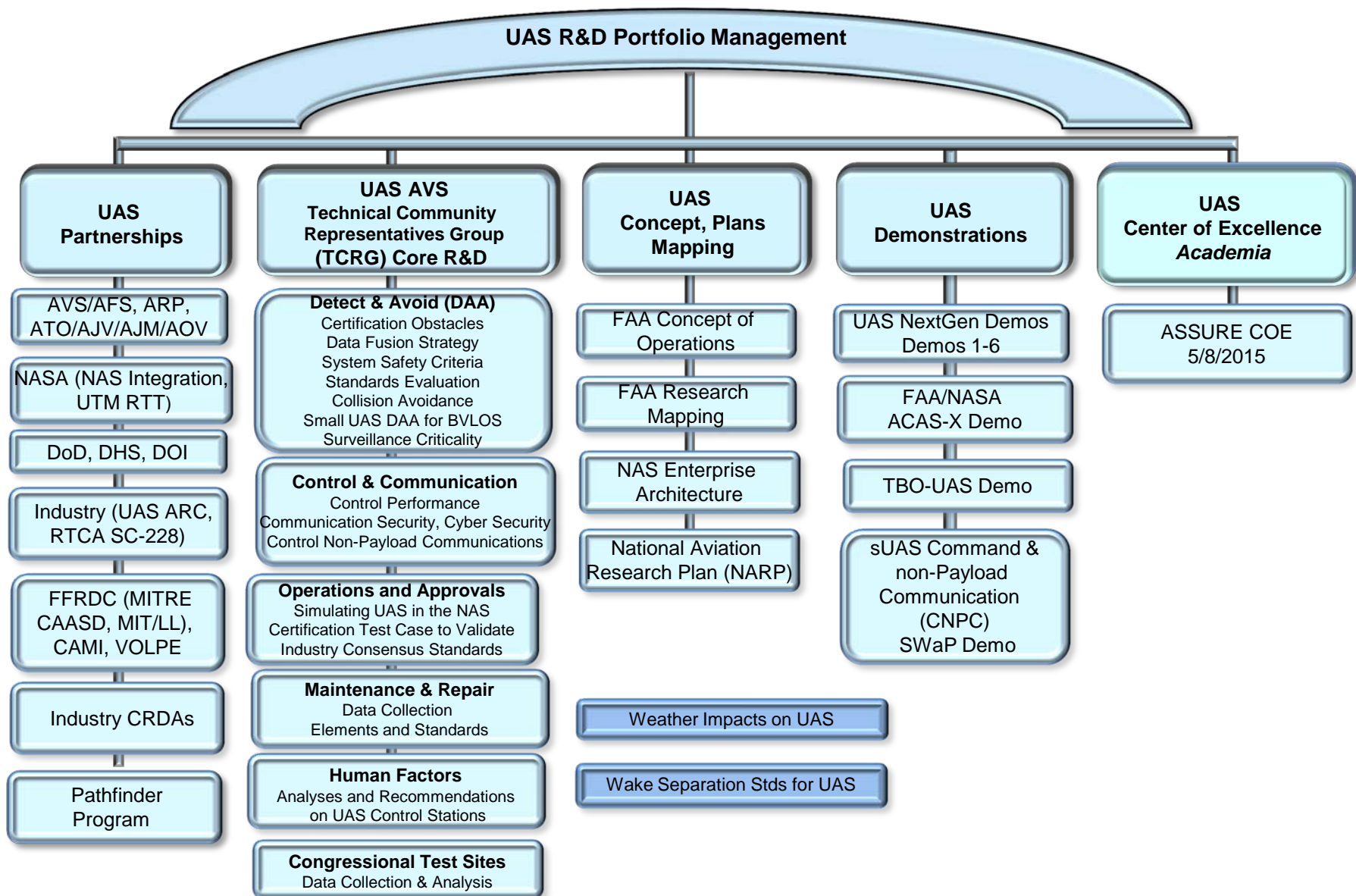
FAA UAS SYMPOSIUM

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UAS Regulatory Framework



UAS R&D Portfolio



FAA UAS R&D Timeline

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- 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)

HIGH ALTITUDE 0-60K' AGL



I. "Manned like" IFR

UAS will be expected to meet certification standards and operate safely with traditional air traffic and ATM services. (DRM: Internet Provider)



18K' AGL

10K' AGL

MINIMUM ENROUTE ALTITUDE

•Non-cooperative Traffic



•Non-cooperative Traffic



IV. Low Altitude Unpopulated

Low risk BVLOS rural operations without aviation services. (DRM: Agriculture)

500' AGL



Terminal Area

Airport

III. Low Altitude Populated

Must interface with dense controlled air traffic environments as well as operate safely amongst the traffic in uncontrolled airspace. (DRM: Package Delivery)

II. Tweeners

Flights at altitudes below critical NAS infrastructure, and transitioning low altitude and traditional aircraft operations. (DRM: Inspection)



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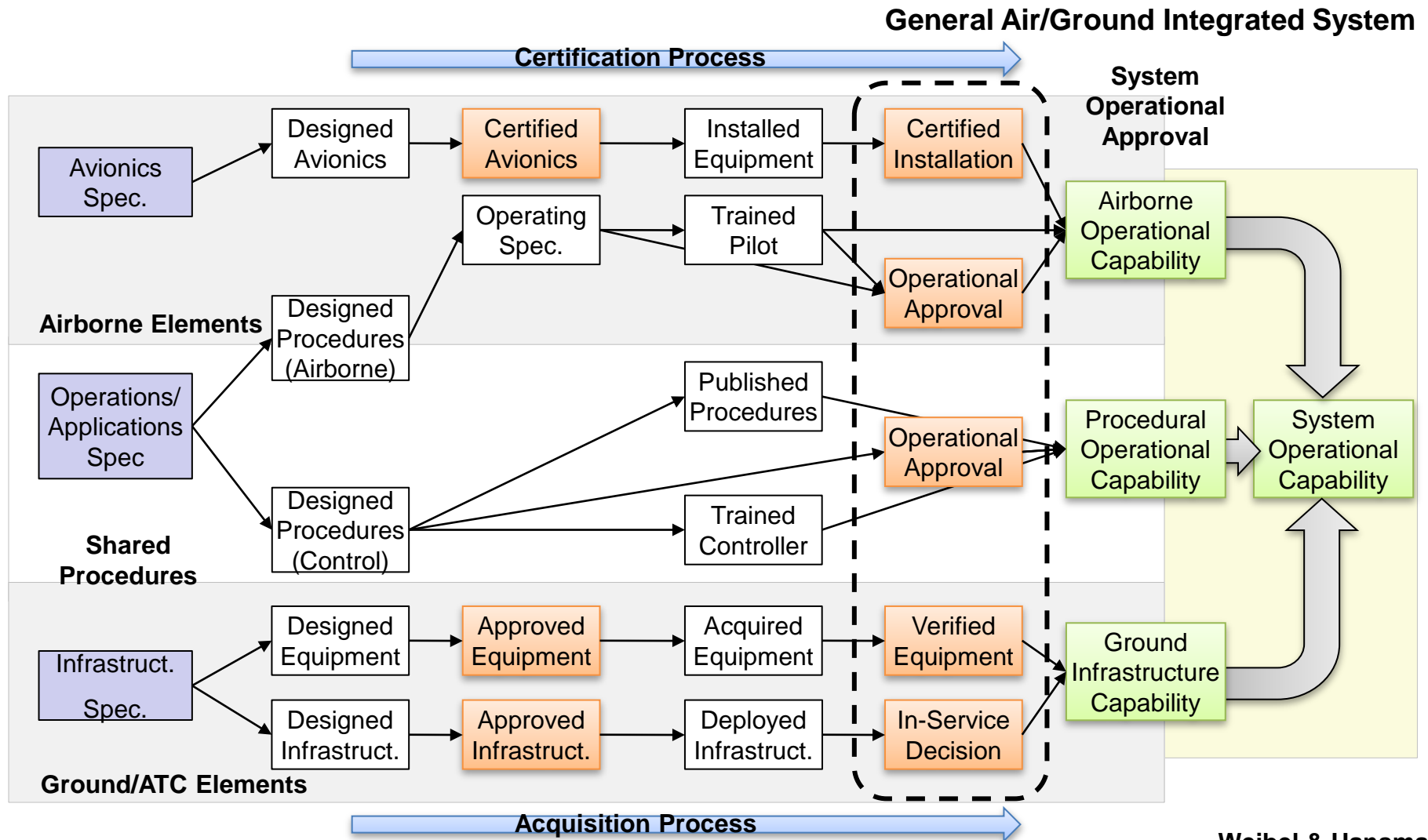
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R&D Concerns for UAS Integration

- **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



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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?**

