

Integration of Large Remotely Piloted Aircraft into Non-Segregated Airspace



Presented To:

ICAO's 2nd RPAS Symposium

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Aircraft Growth and Evolution



Global effort to Integrate UAS/RPAS into the Aviation System

- **Unmanned Aircraft System (UAS)**
 - Globally accepted term for small UAS, i.e. 25 kgs, VLOS
- **Remotely Piloted Aircraft System (RPAS)**
 - Globally accepted term for large aircraft
 - RPA and RPS with Qualified Remote Pilot
 - C2 Link (i.e. Control and Non-Payload Communication)
- **ICAO RPAS Panel**
 - SARPS and PANS for International Operations under IFR
- **National and Regional Regulations**
 - FAA's DAC and "UAS in Controlled Airspace ARC"
 - JARUS (Joint Aviation Regulators of Unmanned Systems)
- **Technical Standards Organizations**
 - RTCA, EUROCAE, ISO, ARINC

RPA = Remotely Piloted Aircraft

RPS = Remote Pilot Station

PANS = Procedures for Air Navigation Services

SARPS = Standards and Recommended Practices

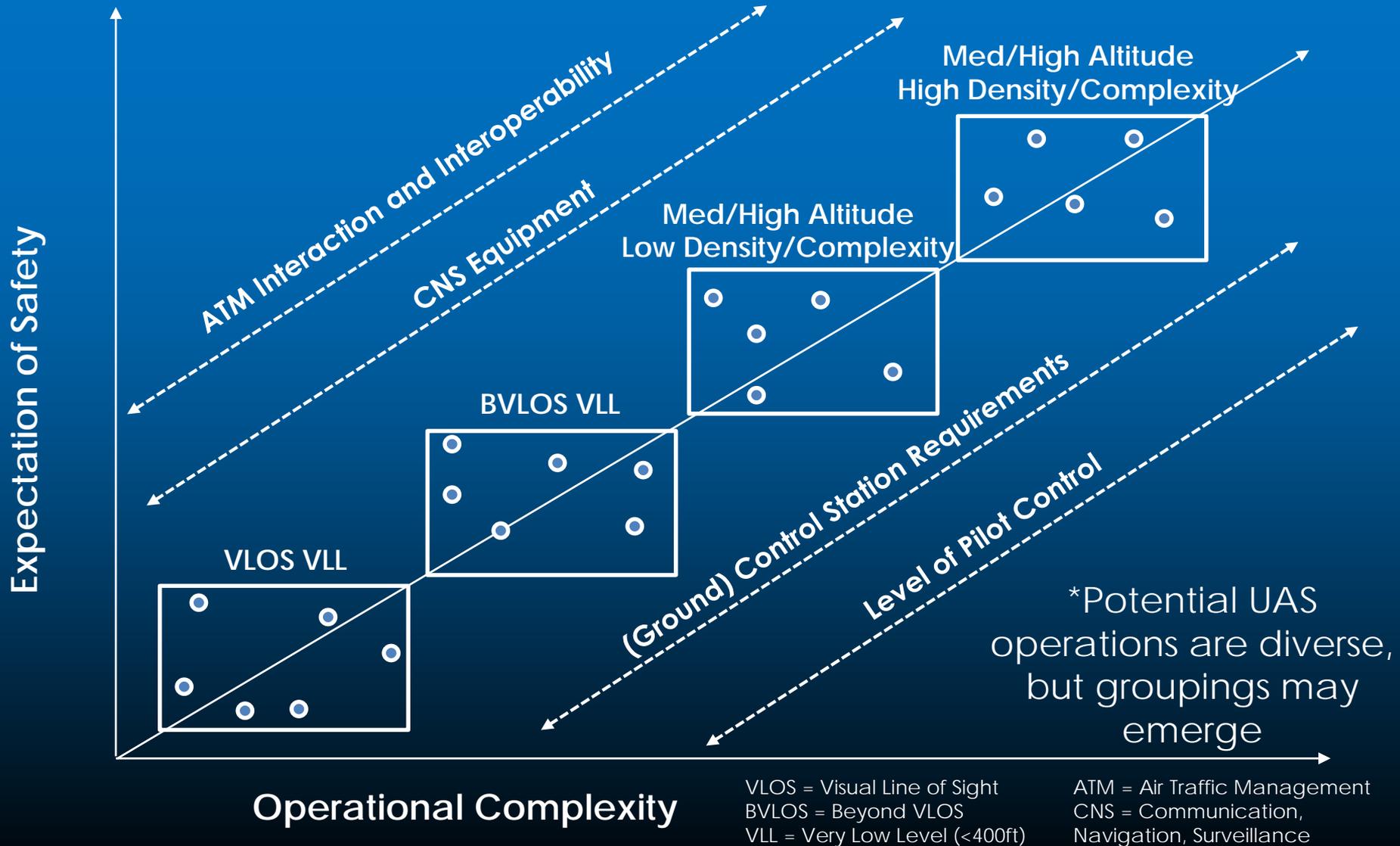
IFR = Instrument Flight Rules

DAC = Drone Advisory Committee

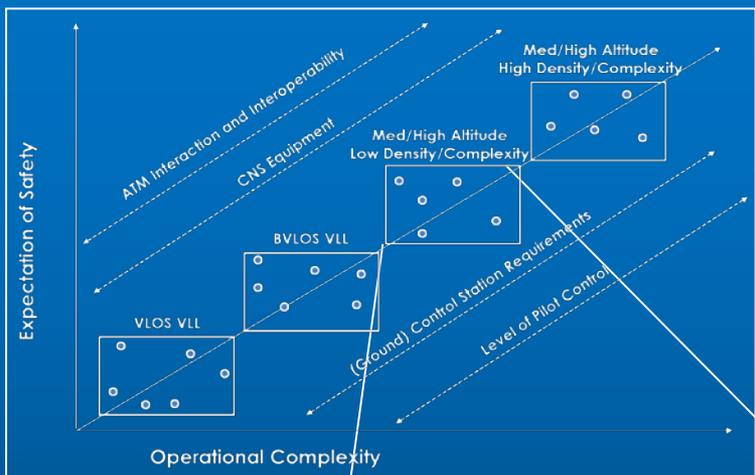
ARC = Aviation Rulemaking Committee

VLOS = Visual Line of Sight

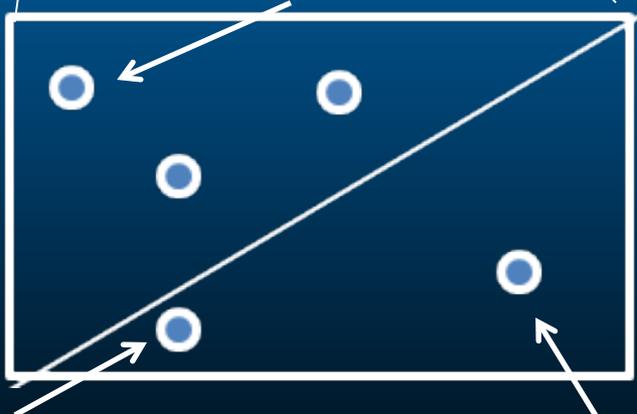
UAS/RPAS will perform a wide variety of operations



CNS/ATM Performance: Med/High Altitude, Low Airspace Density/Complexity



Large Cargo Delivery



Large Area Surveillance

Class D Terminal

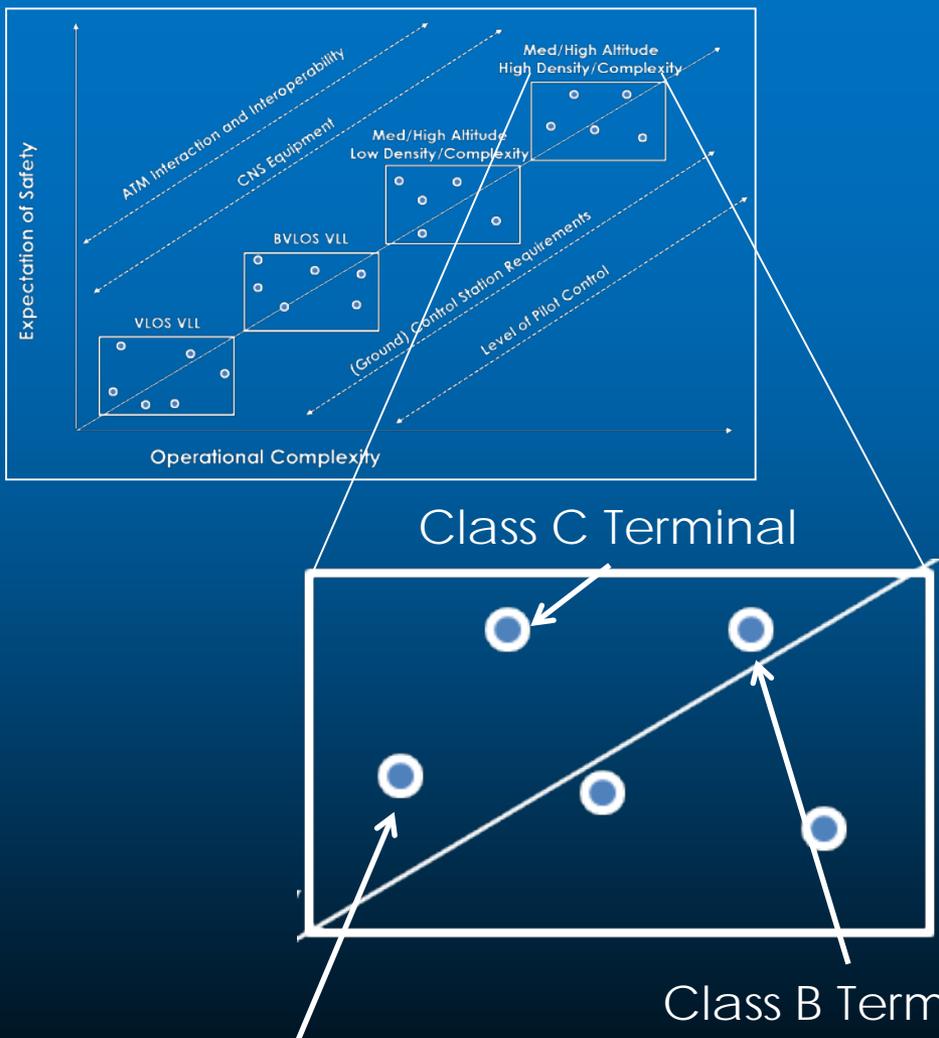
- **ATM**
 - Flight Plan
 - Dynamic Clearance Changes
 - Separation Services
- **CNS**
 - Airborne Voice Communication
 - Performance Based Navigation
 - ADS-B
- **Control Station**
 - General Aviation "Glass Cockpit"
- **Pilot Control**
 - Autopilot Hold Modes
 - Waypoint

ADS-B = Automatic
Dependent Surveillance -
Broadcast
ATM = Air Traffic

Management
CNS = Communication,
Navigation, Surveillance

CNS/ATM Performance

Med/High Altitude, High Airspace Density/Complexity



- **ATM**
 - Flight Plan
 - Dynamic Clearance Changes
 - Delegated Separation
- **CNS**
 - Digital Communication
 - RNP-X
 - ADS-B
- **Control Station**
 - Transport Category "Glass Cockpit"
- **Pilot Control**
 - Direct Flight Path Control
 - Autopilot Hold Modes
 - Waypoint

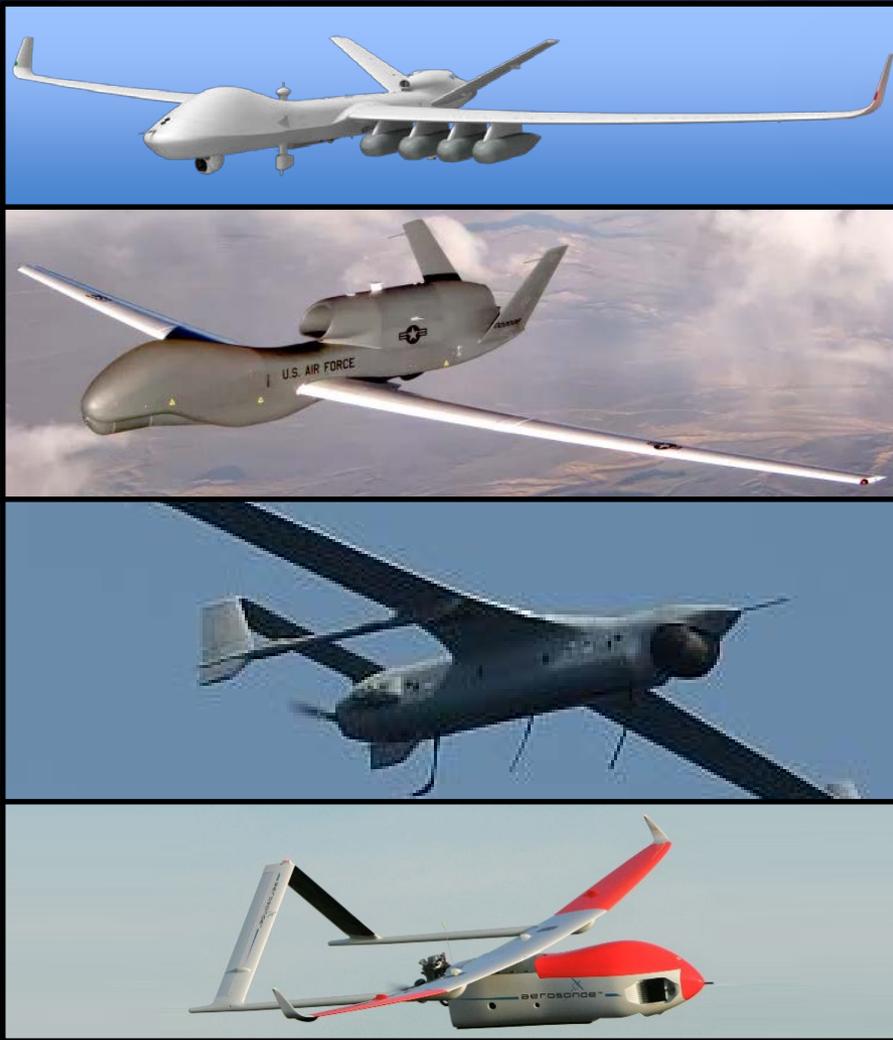
RNP = Required Navigation Performance
 ADS-B = Automatic Dependent Surveillance - Broadcast

ATM = Air Traffic Management
 CNS = Communication, Navigation, Surveillance

Metropolitan Comm. Relay

International IFR RPAS Use Cases

Existing UAS/RPAS Concepts



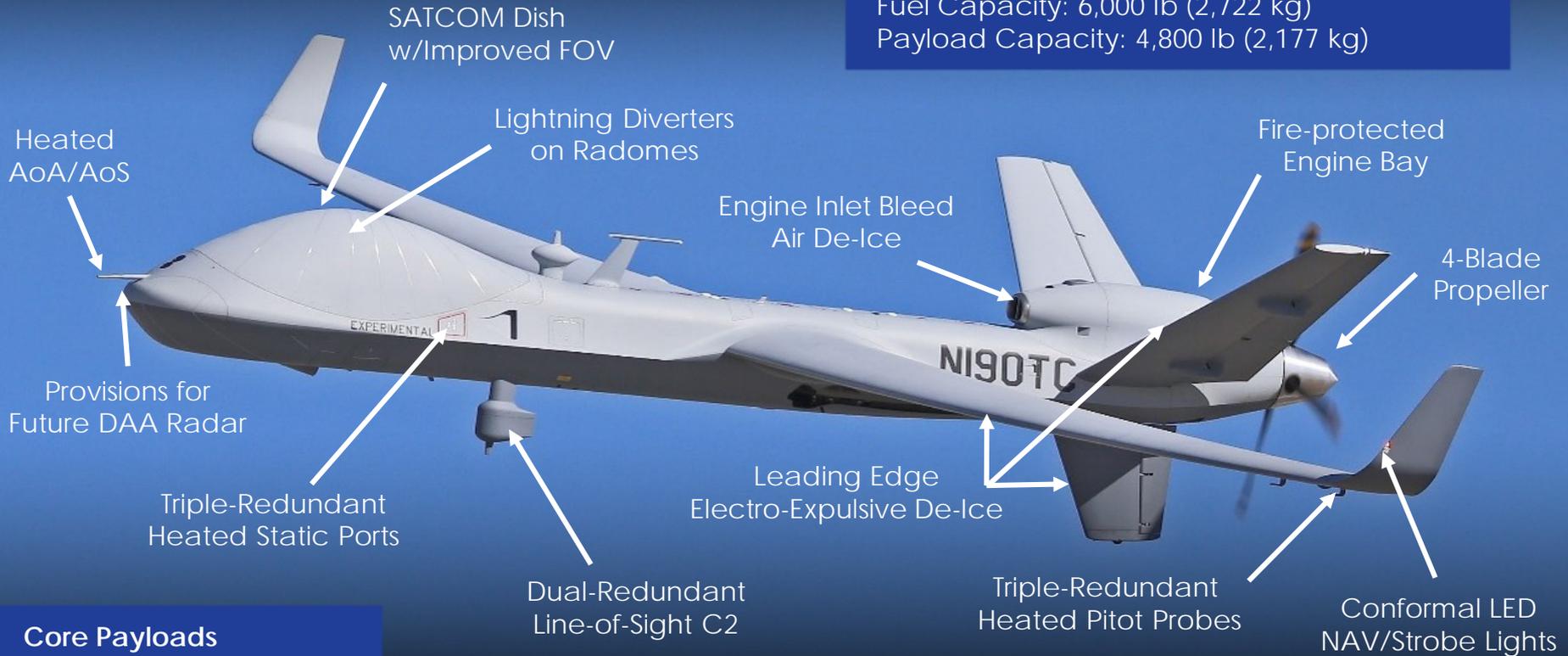
New Concepts



MQ-9B SkyGuardian RPAS

Airworthiness Certification IAW STANAG 4671
All-Weather Capability

Wing Span: 79 ft (24 m) with winglets
Length: 38 ft (11.7m)
Max Gross Takeoff Weight: 12,500 lb (5,670 kg)
Fuel Capacity: 6,000 lb (2,722 kg)
Payload Capacity: 4,800 lb (2,177 kg)



Core Payloads

- Gimballed EO/IR Turret
- Lynx Multi-mode Radar

Lightning and Fire Zone
Separation Requirements

Auto Takeoff/Landing
via SATCOM

SkyGuardian Ground Control Station Concept

- Builds on 10+ year effort to develop RPAS Control Station “from the ground up”
- Integrates the Rockwell Collins Proline Fusion System
- Enables advanced IFR operations with Flight Management System (FMS) capability
- Leverages ARINC 661



NASA's Ikhana RPAS



NASA's Ikhana is a flying testbed for UAS/RPAS technology

RPAS Non-Segregated Airspace Integration



- Adopt legacy and emerging aviation concepts and drive towards RPAS evolution
- Adopt existing technology when applicable and develop new technology when needed to solve RPAS challenges
- Global standards in unmanned aviation
- New regulation and policy to unleash full potential of unmanned aviation



Conclusion

- UAS/RPAS are operating in the U.S. National Airspace System (NAS) today on limited basis
- Normalized Commercial Operations are close
- Operations under IFR will enable the Safe and Efficient integration of UAS/RPAS into the Global Aviation System
- UAS/RPAS will leverage existing and advanced CNS/ATM concepts and equipment both to enable operations and perform new use cases

Questions?



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