Unmanned Aircraft Systems (UAS) and NASA Armstrong Flight Research Center

SER Jobs for Progress National, Inc.
Santa Fe, New Mexico

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NASA’s Vision

To discover and expand knowledge for the benefit of humanity.
What does NASA do?

- Exploration of Earth
- Exploration of the solar system and beyond
- Conduct aeronautics and aerospace research
NASA Research Centers and Facilities
Grand Challenge
2001 - Helios Prototype 100k ft Mission
2003 - Helios Prototype Fuel Cell
Pathfinder+ Aeroelastic Research
X-56 – Aeroelastic and Flutter Suppression Research
Certification Approach

Functional Decomposition of Piloting

Aviate
- A/C Control
  - Stability
  - Structural limits
  - Flightpath control
  - Stall
  - Etc.
- Observe Airmanship Rules
  - Well clear
  - Minimum flight levels
  - Airspace boundaries
  - Etc.
- Contingency Management
  - Tactical
    - Air Traffic
    - Ground
    - Obstacles
  - Strategic
    - Onboard failures
    - Weather

Navigate
- Plan Mission
  - Interpret mission objectives
  - Path finding
  - AI
- Follow Mission Plan
  - Pilot commands
  - Waypoint following
  - Intelligent routing
  - Etc.
- Coordinate Mission with other Agents
  - Formation flying
  - Interactive re-routing
  - Surveillance/tracking
  - Etc.

Communicate
- Aircraft Controlling Entity
  - Pilot in control
  - Company operations center
  - Etc.
- Agents in Near Vicinity
  - Nearby aircraft
  - Launch & recovery operator
  - Others?
- Airspace Control Authority
  - ATM
  - UTM
  - Etc.

EVAA (Expandable Variable-Autonomy Architecture) Resilient Autonomy

EVAA (Expandable Variable-Autonomy Architecture)

Piloting

- A/C Safety
  - Well clear
  - Minimum flight levels
  - Airspace boundaries
  - Etc.
NCC - Well Clear in the NAS

Air to Air Radar

ADS-B 1090ES
- Extended Hybrid Surveillance
- Active Coordination

ADS-B / TCAS II / Mode S Equipped

Active Surveillance

Mode A/C/S Transponder Equipped

Non-cooperative No Transponder

CPDS DAA Well Clear (DWC) Alerts and Maneuver Guidance:
- Horizontal & Vertical Maneuvers
- Pilot-in-the-Loop
TCAS II Resolution Advisory (RA) Alerts and Maneuver Guidance:
- Vertical Maneuvers
- Auto-response with Pilot Override
FT6 – Well Clear in the NAS
Resilient Autonomy

• Joint NASA / FAA / OSD / Industry Project
• Benefits
  – NASA
    • Pathfinder for Autonomy in Advanced Air Mobility
  – FAA
    • Findings to Inform the Development of Certification for Autonomy
  – DoD
    • Increasing Use of Autonomy
  – Industry’s Safe Urban use of Autonomy
    • Urban Air Mobility
    • Drone Package Delivery
    • Search and Rescue Operations
    • Infrastructure Surveys
Operational Considerations

- Search Mission Over Ocean
  - Rendezvous and land

- Long-Distance Low-Altitude Rural Delivery
  - Transit below 400’ above ground level
Unmanned Aircraft Systems Traffic Management (UTM) Demo
Questions?