

Air Traffic Operations Laboratory

where ideas take flight

LaRC Presentation to Wingnuts Flying Club

January 7, 2013

Roy Roper



Purpose

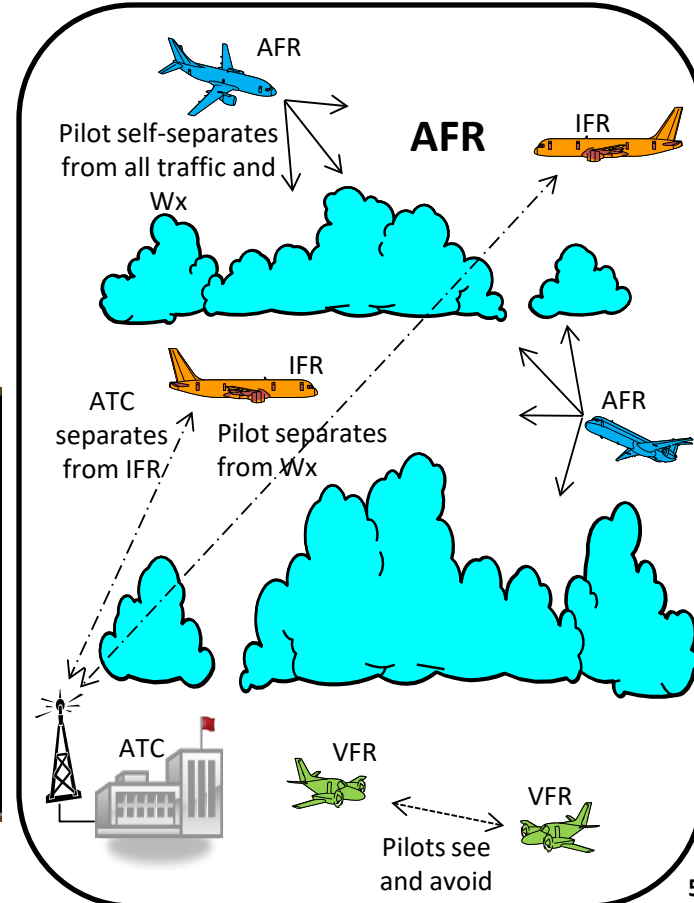
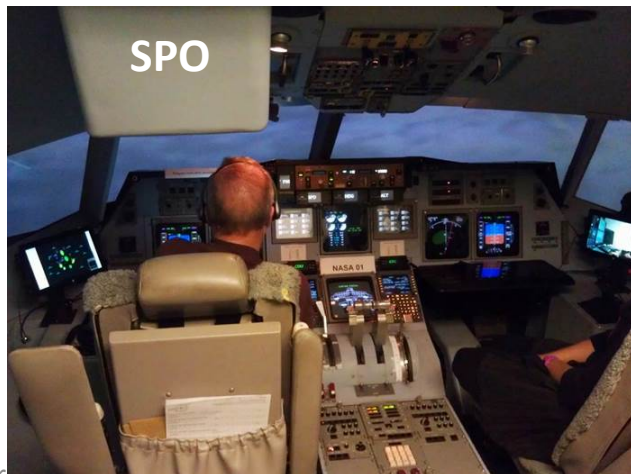
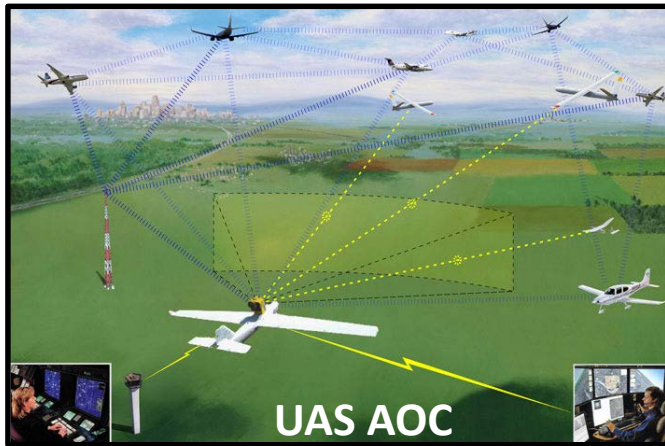
- Introduce the Wingnuts Flying Club to the work CSAOB does at NASA
- Discuss pilot volunteer opportunities
- Questions

What Does NASA Do in Aviation?

- My Branch's work concerns Aviation Operations
- We conceive, explore, test, and deploy new concepts to improve the National Airspace System:
 - Efficiency
 - Safety
- How do we do that?
 - Work with stakeholders to develop concepts
 - Test concepts in relevant conditions, including simulations and flight tests
 - Transfer technology to end-users



Future Contributions to NextGen and beyond



LaRC flight facilities supporting NextGen



SR-22 UAS SURROGATE



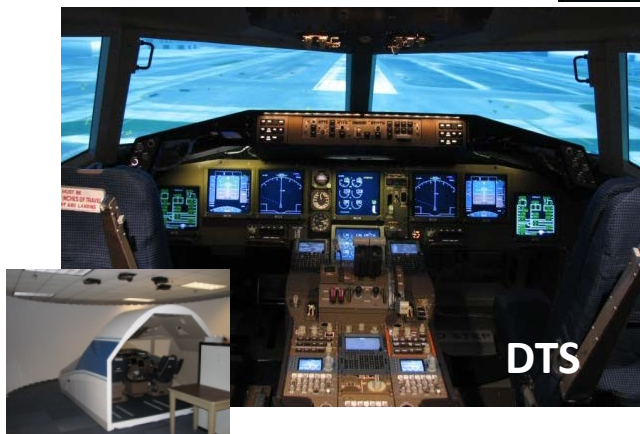
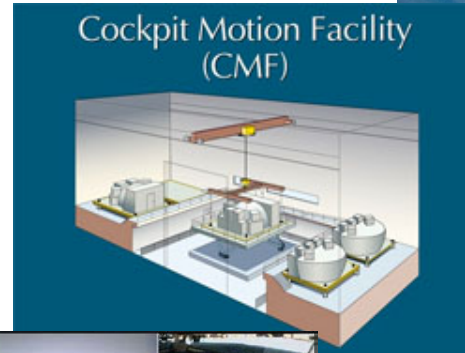
LD-CAP



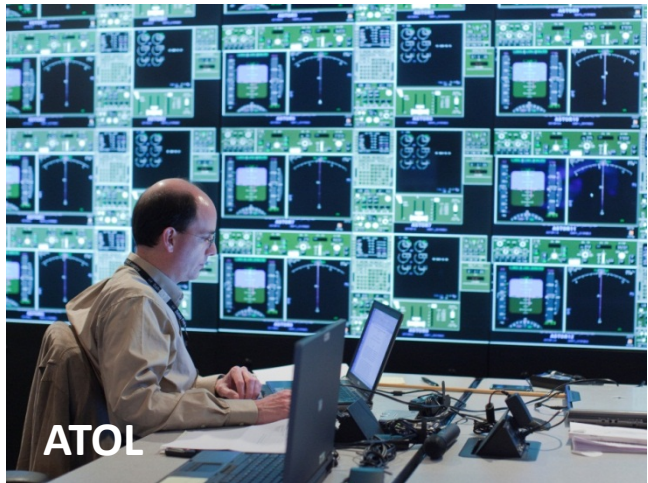
EDGE UAS LAB and TESTBED



LaRC sim facilities supporting NextGen and beyond:



Langley sim facilities supporting NextGen and beyond:



Air Traffic Operations Lab (ATOL)

Multi-fidelity, part-task, aircraft and air traffic simulation environment

Exploration of inter-aircraft, aircraft / airspace, and air / ground interactions in a NextGen environment

- Concept-level operations research (human decision making, situational awareness, transfer of authority and responsibility)
 - Concept-level Safety Assessment
 - Flight deck automation development
 - Initial flight deck interface development (displays, MCDU, EICAS and aural alerts, CPDLC messages, etc.)
- 
- Technology / concept performance assessment
 - Rapid prototyping
 - Requirements evaluation for future communication, navigation, and surveillance infrastructure

ATOL Simulation

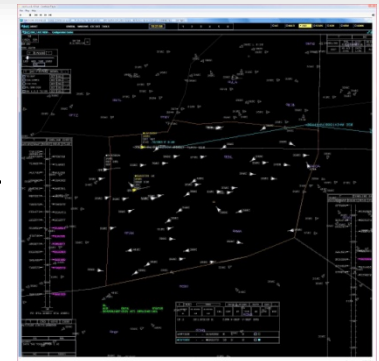
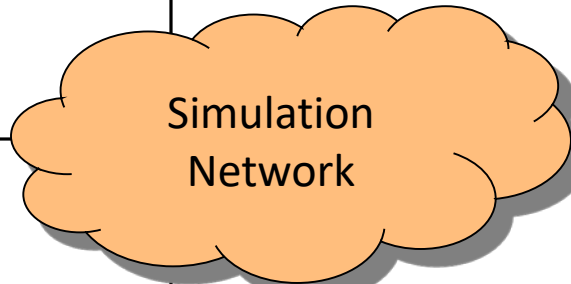


- Boeing Glass Cockpit based on B777
- Flight Management System (FMS)
- AutoFlight and AutoThrottle Systems
- Automatic Dependent Surveillance – Broadcast (ADS-B)
- Controller-Pilot Data Link Communication (CPDLC)
- ARINC 429 Avionics Bus Emulation
- Class III Electronic Flight Bag Emulation
- TCAS II (in development)
- Single or Dual Crew Stations
 - Air Route Traffic Control Center (ARTCC) Station
 - Terminal Radar Approach Control (TRACON) Station



Joint Simulation with Other Labs

Langley Facilities



Outside Facilities

FY14 LaRC Simulation Enhancements

- Expansion of ATOL to double capacity
- ATOL/FSF collaborative development of a Vertical Take Off and Landing simulator to investigate:
 - Human/Machine Interface
 - Decision Aiding
 - Autonomy applications
- Co-locate and Integrate the Unmanned Aircraft Systems Lab with the ATOL
- UAS in the NAS
Live Virtual Constructive – Distributed Environment
- Conversion of FSF Cab from B757 to B737-800



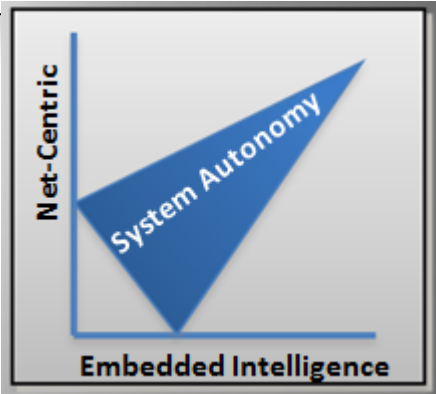
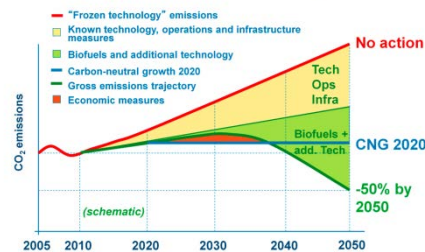
ARMD Strategic Implementation Plan (SIP)

Research is organized into six relevant themes.

3 Mega-Drivers



Emissions reduction roadmap



6 Strategic Research & Technology Thrusts

Safe, Efficient Growth in Global Operations

- Enable full NextGen and develop technologies to substantially reduce aircraft safety risks

Innovation in Commercial Supersonic Aircraft

- Achieve a low-boom standard

Ultra-Efficient Commercial Transports

- Pioneer technologies for big leaps in efficiency and environmental performance

Transition to Low-Carbon Propulsion

- Characterize drop-in alternative fuels and pioneer low-carbon propulsion technology

Real-Time System-Wide Safety Assurance

- Develop tools for use in a prototype of an integrated safety monitoring and assurance system

Assured Autonomy for Aviation Transformation

- Develop high-impact aviation autonomy applications

Contributions to Future Initiatives

- **Safe, Efficient Growth in Global Operations**

- AFR – decentralized control, aircraft autonomy, trajectory optimization, focus on true point to point (P2P) operations
- Networked ATM – decentralized and distributed control and functions
- SPO – adaptive automation, enhanced human-machine interfaces, new flight deck procedures, new ATC procedures
- PTM – leverage surveillance and situational awareness advances to optimize trajectories and air travel, initially Oceanic
- International Collaboration – DLR, NLR, ONERA, ENRI, Air Traffic Services Australia
- UAS in the NAS – Centennial Challenge
- On Demand Mobility – design of flexible NAS architectures, efficient trajectories
- VTOL PAV – human-machine interfaces, automation/autonomy components

- **Innovation in Commercial Supersonic Aircraft**

- Supersonic NAS integration – ATC procedural changes, CD&R algorithms, and enhanced interfaces
- Supersonic cockpit interfaces – XVS

- **Real-Time System-Wide Safety Assurance**

- Assess safety monitoring and assurance systems in gate-to-gate simulations
- Evaluate robustness and reliability of developed flight deck and ATM systems

- **Assured Autonomy for Aviation Transformation**

- Trust in Autonomy/certification of autonomous systems research
- Develop high-impact aviation autonomy applications
- UAS in the NAS Centennial Challenge



Research Opportunities



- We maintain a database of pilots and tap into that list for experiment test subjects.
- Selection is based on reported skills and experience as they apply to a given experiment.
- <https://flight-research.larc.nasa.gov/>

Public Aeronautics Test Assistance Center

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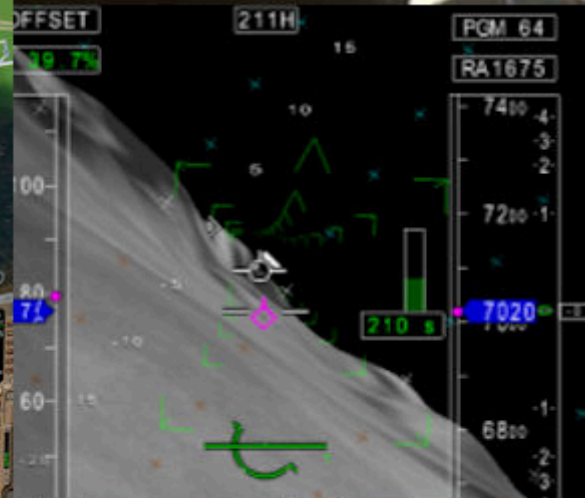
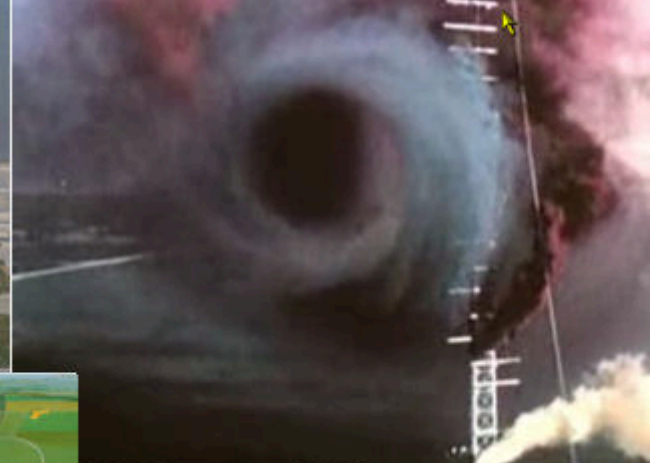
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Researchers at NASA Langley Research Center in Hampton, Virginia are conducting ongoing studies in National Airspace System management, flight deck operations, and human factors. These studies depend on the participation of technical experts in airline, general, corporate, and military aviation, and air traffic control. This collaboration is resulting in technical advances in Airborne Systems, Flight Operating Procedures, Flight Deck Systems Concepts, Synthetic Vision, and Unmanned Aircraft Systems.

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Acronym List

AirSTAR	Airborne Subscale Transport Aircraft Research	NAS	National Airspace System
AFR	Autonomous Flight Rules	PAV	Personal Air Vehicle
AOC	Airspace Operations Challenge	PTM	Pair-wise Trajectory Management
AOP	Autonomous Operations Planner	RFD	Research Flight Deck
ATD-1	ATM Technology Demonstration #1	SEVS	Synthetic and Enhanced Vision Systems
ATM	Air Traffic Management	SPO	Single Pilot Operations
ATOL	Air Traffic Operations Lab	SSI	Separation Assurance/Sense and Avoid Interoperability
CD&R	Conflict Detection & Resolution	TAP	Traffic Aware Planner
CMF	Cockpit Motion Facility	TASAR	Traffic Aware Strategic Aircrew Requests
CMS	Controller Managed Spacing	TES	Test and Evaluation Simulator
CSAOB	Crew Systems and Aviation Operations Branch	TMA	Traffic Management Advisor
DTS	Development and Test Simulator	UAS	Unmanned Aircraft Systems
DMS	Differential Maneuvering Simulator	VTOL	Vertical Take Off and Landing
FIM	Flight Deck Interval Management	XVS	eXternal Vision System
FSF	Flight Simulation Facilities		
GFD	Generic Flight Deck		
HAVS	Human and Autonomous Vehicle Systems		
HSI	Human System Interaction/Integration		
IFD	Integration Flight Deck		
ITP	In Trail Procedure		
LD-CAP	Limited Development - Cooperative Airspace Project		



Thank You!

