33rd DASC Digital Avionics Systems Conference

Designing an Air Transportation System with Multi-Level Resilience

Antlers Hilton, Colorado Springs, CO - October 5-9, 2014

IEEE AESS AIAA

NASA Aeronautics Research Mission Directorate

New Vision & Strategy for Aeronautics Research: How will it Support Resilience?

Digital Avionics Systems Conference

5-9 October 2014

Robert A Pearce

Director – Strategy, Architecture & Analysis

NASA Aeronautics Research Mission Directorate

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3 Mega Drivers

NASA Aeronautics Six Strategic Thrusts

6 Strategic Research and 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 an integrated prototype of a real-time safety monitoring and assurance system

Assured Autonomy for Aviation Transformation
- Develop high impact aviation autonomy applications

NASA ARMD has developed three Strategic Research Thrusts that will contribute to Air Transportation Resilience

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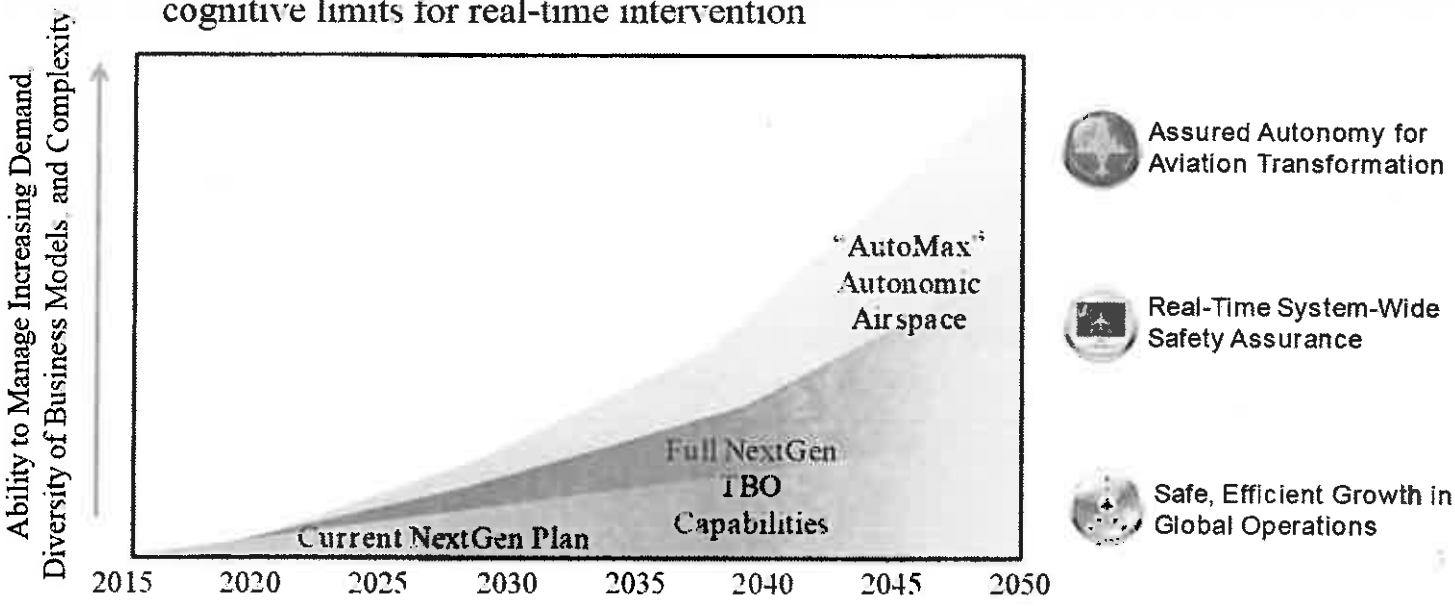
- Thrusts 1, 5 and 6 build upon each other over time
  - Manage increasing global demand
  - Manage increased diversity of business models, as represented initially by UAS, but ultimately including an expanded range of possibilities that more highly autonomous systems will enable, such as new modes of On-Demand Aviation
  - Manage the resulting increased complexity of operations that will be beyond human cognitive limits for real-time intervention



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Fundamental Requirements

User Access & Mobility

Environmental Sustainability

System-Wide Efficiency

System-Wide Safety

System Applications

Transport

Persistence

Emergency Ops

System Self Management

System Characteristics

Robustness

Agility

Resilience

Reliability

Flexibility

Scalability

Lifecycle "Cradle to Cradle"

Design

Recycle/Reuse

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Properties and Capabilities of Autonomy-Enhanced Aviation

Adaptable | Collaborative | Informative | Interactive

System Capabilities

- System-Wide Purview: Aviation system-wide self-awareness enables proactive decisions and actions
- Airspace Systems: Airspace fulfills users' goals in context of system-wide objectives and ubiquitous access
- Vehicle Systems: Vehicle adapts to mission, user expertise, and operational conditions
- Infrastructure: Physical and cyber infrastructure reconfigures to support integrated system-wide operations

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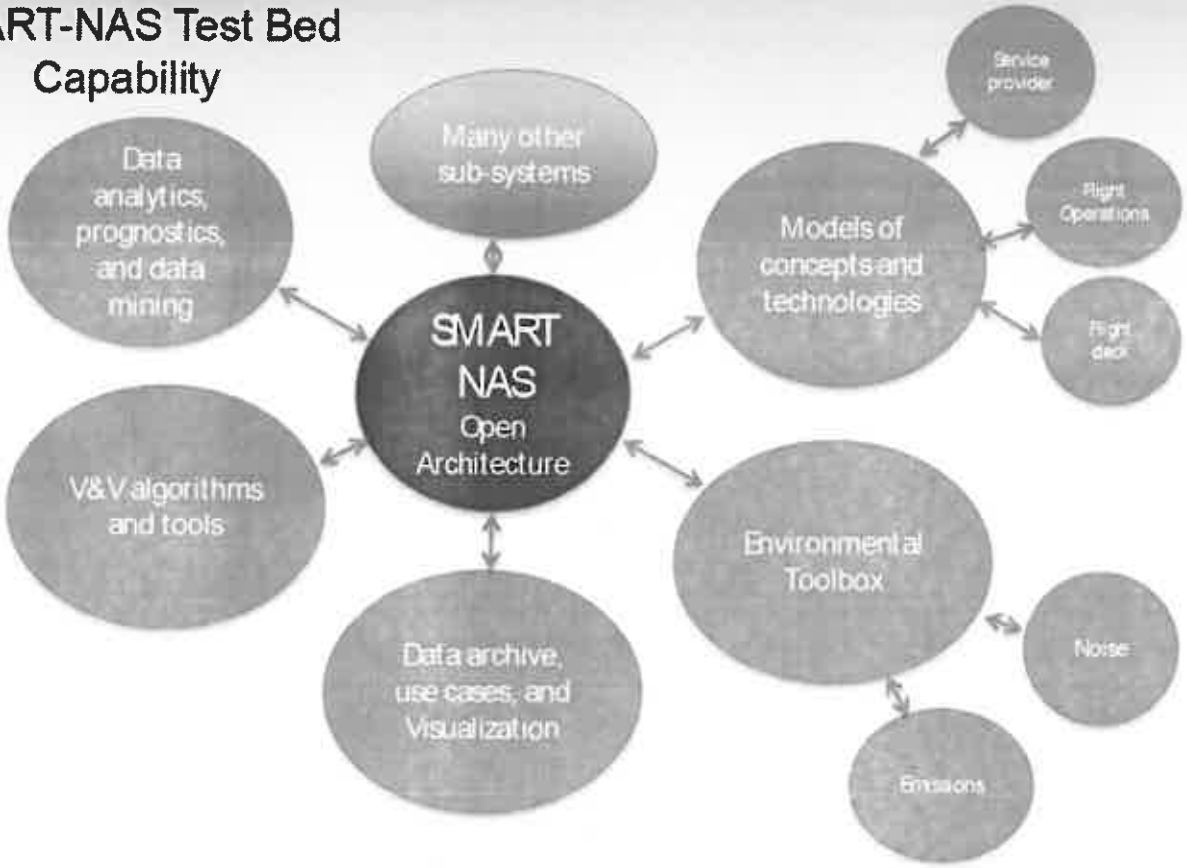
SMART-NAS Test Bed Capability

LVC-DE Capability



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NASA ARMD Vision & Strategy Supports a More Capable and Resilient Air Transportation System

- Working closely with FAA on NextGen development
- Pursuing a New Strategy of Real-Time System-Wide Safety Assurance to Support Better Understanding and Management of System Conditions and Set the Stage for Higher Levels of Autonomy
- Support Fundamental Research in Key Autonomy Technical Challenge Areas and Innovate on High Impact Solutions