Resilience in the Air Traffic Management Arena

Gary Lohr
NASA Langley
Objectives

• Provide a perspective of how “resilience” relates to air traffic management
• Provide a perspective of the role of research in system recovery
Conference and Plenary Theme – “Resilience”

Resilience is…

“Graceful and expected degradation with planned and achievable recovery such that no one component drives the “health” of the overall system unless required”
A degradation of capabilities within the NAS occurs on a daily basis at varying levels of severity.

• As an “expected” event, black and white often times morphs to shades of gray

• Notion of “components” casts a wide net
Human Factors Viewpoint of Resilient Systems

• Systems that-
  – Know what to do – addresses the actual
  – Know what to look for – addresses the critical
  – Know what to expect – addresses the potential
  – Know what has happened – addresses the factual, learning from past

• What they look like-
  – Appropriate information provided to allow humans SA of above
  – Clearly defined and communicated roles and authority levels (including back-ups)
  – Supported communication among agents
  – Flexible function allocation among human and automated agents
Resilience as Matter of Perspective

- User (airlines, general aviation, military)
- Air Traffic Service Provider (controller, traffic manager, …)
- Airport operators
- Pilots
- Passengers
Resilience as Matter of Scale

• Airport surface
• Local (terminal) Airspace
• Airspace (enroute) – national level
Designing an Air Transportation System with Multi-Level Resilience

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

IEEE AESS IAA" AA DASC
Factors Affecting Resiliency in ATM

• Traffic Flow Management
• Constraints
• Competing interests
• Changing landscape (e.g., FAR 117)
• System capabilities
Bridging the Gap…

• Convergence of differing objectives
• More effective avenues for exchange of these objectives
• More effective tools (?automation/processing?) for processing options
• Longer planning horizons
• Research to address the recovery process
Relationship Between Research and Resilience

Research plays a vital role in improving resilience in air traffic management although tools/concepts are not normally investigated with a resilience focus. However, research is the key to development/refinement of requisite NAS capabilities that will serve, by their inherent objectives, to improve resiliency in the System.
Examples of Research Affecting System Resilience

- Wake vortex
- Dynamic Airspace Configuration
- Precision Release of Departures
- Traffic Flow Management Enhancements
Resiliency in an evolving landscape of capabilities
Summary

• Resilience defined
• Nature of resilient systems
• The NAS: “players”, scope/environment
• Key factors affecting system resilience
• Role of research in enhancing resiliency
Questions