



33rd **DASC**  Digital Avionics Systems Conference

Designing an Air Transportation System with Multi-Level Resilience

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



Resilience in the Air Traffic Management Arena

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Objectives

- Provide a perspective of how “resilience” relates to air traffic management
- Provide a perspective of the role of research in system recovery



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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”



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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



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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



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Resilience as Matter of Perspective

- User (airlines, general aviation, military)
- Air Traffic Service Provider (controller, traffic manager, ...)
- Airport operators
- Pilots
- Passengers



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Resilience as Matter of Scale

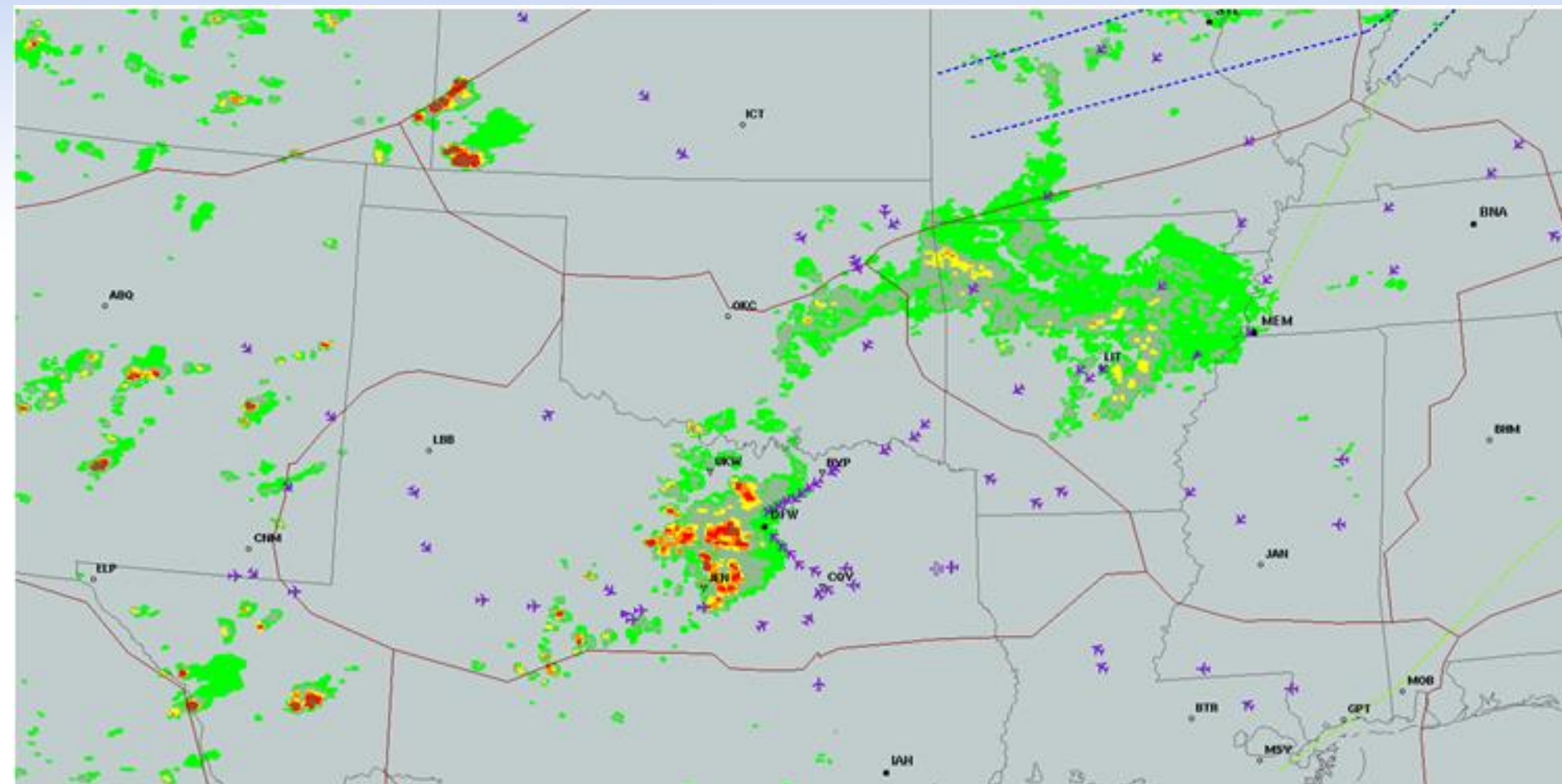
- Airport surface
- Local (terminal) Airspace
- Airspace (enroute) – national level



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Factors Affecting Resiliency in ATM

- Traffic Flow Management
- Constraints
- Competing interests
- Changing landscape (e.g., FAR 117)
- System capabilities



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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



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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.



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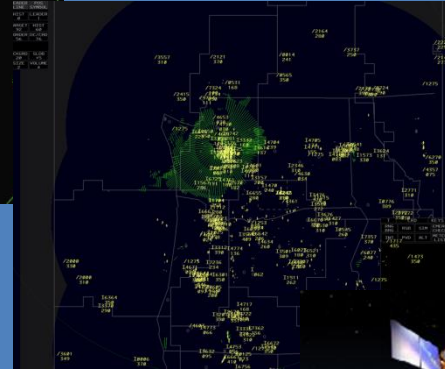
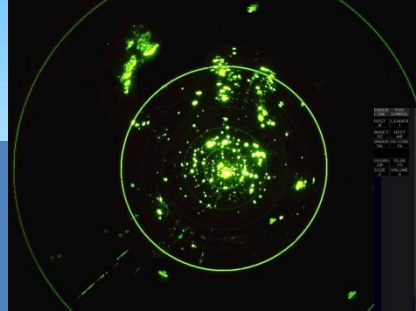
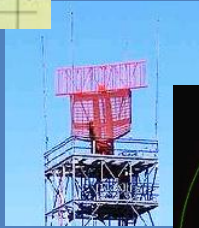
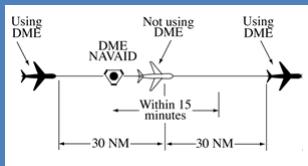
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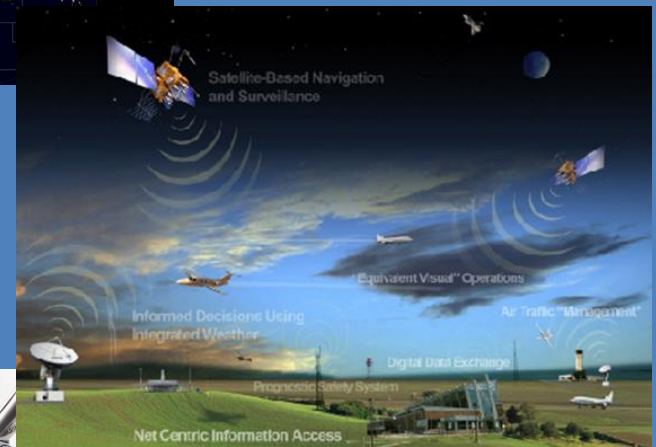
Examples of Research Affecting System Resilience

- Wake vortex
- Dynamic Airspace Configuration
- Precision Release of Departures
- Traffic Flow Management Enhancements

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Resiliency in an evolving landscape of capabilities





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Summary

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



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Questions