



NASA Aviation Safety Program

NASA's Aviation Safety Program



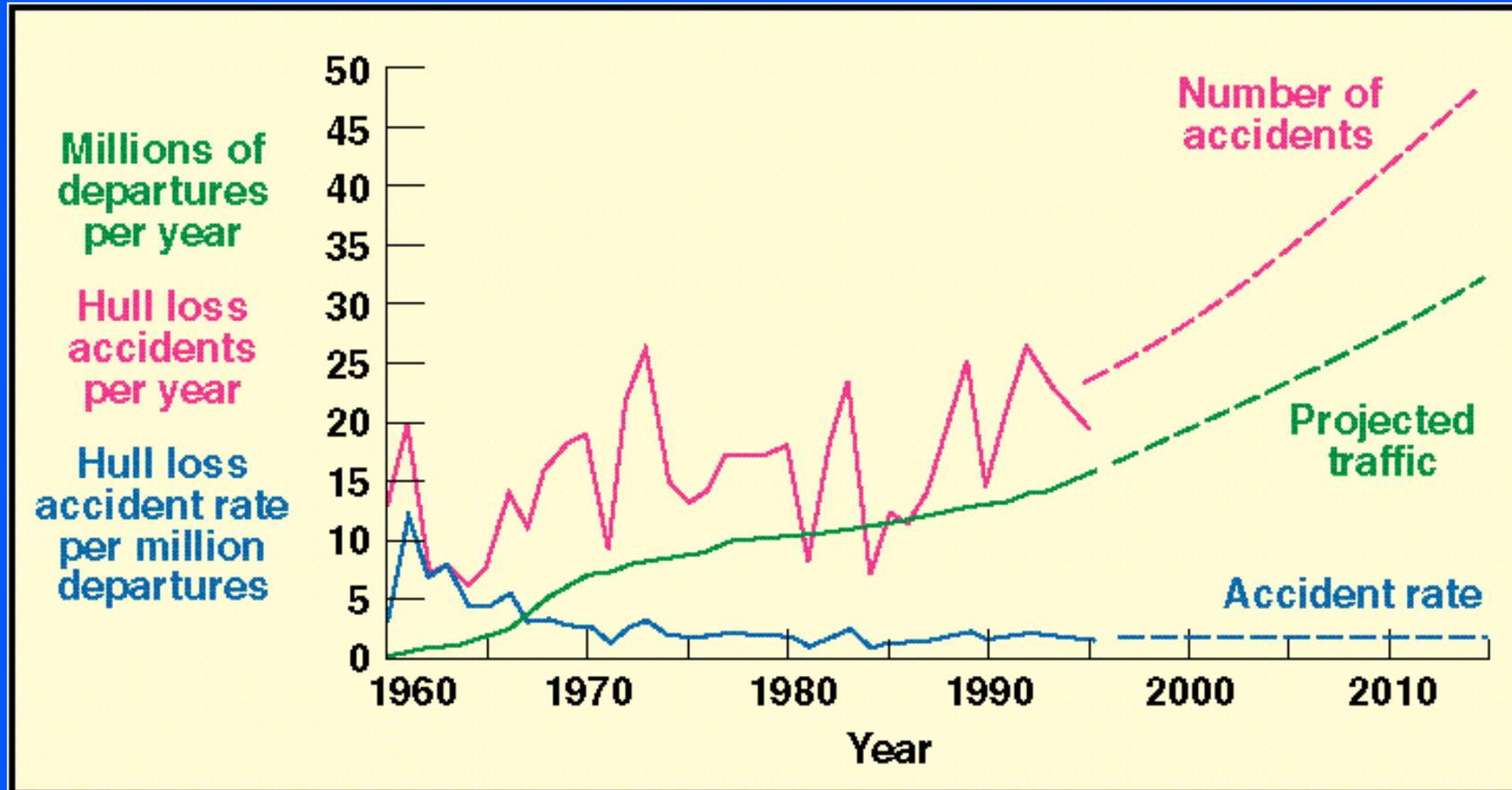
Samuel A. Morello
Director



National Challenge

NASA Aviation Safety Program

If Current Accident Rate Does Not Decline And Traffic Increases as Forecast . . .



(Boeing Data)



NASA's Aviation Safety Initiative

NASA Aviation Safety Program

- Research to enable an 80% reduction in the fatal accident rate by 2007 and a 90% reduction by 2022 can be categorized into one of three investment areas:
 - accident prevention
 - accident mitigation
 - aviation system monitoring and modeling
- Langley Research Center (Lead Center)
 - Ames, Glenn, and Dryden Centers play important roles in this work
- Close coordination with FAA & industry

NASA's Aerospace Technology Enterprise

NASA Aviation Safety Program



Goal 1: Revolutionize Aviation
Enable a safe environmentally-friendly expansion of aviation

Aeronautics Technology Objectives:

1. Increase Safety

Reduce the aircraft accident rate by a factor of five within 10 years, and by a factor of ten within 25 years

2. Reduce Emissions
3. Reduce Noise
4. Increase Capacity
5. Increase Mobility



NASA's strategies for reducing the accident rate are:

- **Aviation System Modeling**-Use the vast amounts of data available within the aviation system to identify and correct aircraft system problems before they lead to accidents.
- **Accident Prevention**-Identify interventions and develop technologies to eliminate the types of accidents that can be categorized as "recurring."
- **Accident Mitigation**-Reduce the risk of injury in the unlikely event of an accident.

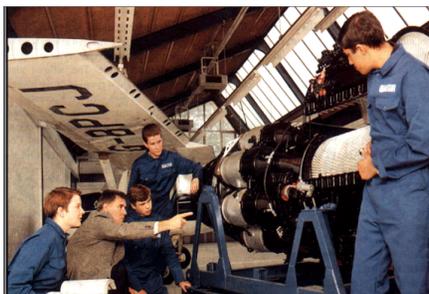
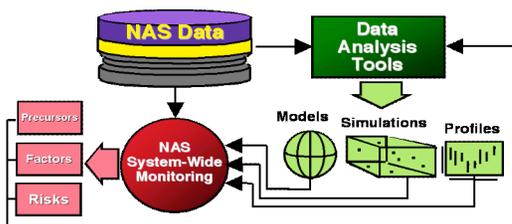
Revolutionize Aviation – Aviation Safety

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System Safety Technologies

Aviation System Monitoring & Modeling

Monitors and assesses data from every flight for known & unknown issues



System-Wide Accident Prevention

Improves human/machine integration in design, operations, & maintenance

Weather Safety Technologies



Icing Research

Icing detection and protection systems, training aids, tools for design and certification of aircraft systems



Weather Accident Prevention

Brings intelligent weather decision-making to every cockpit

Vehicle Safety Technologies

Synthetic Vision

Provides commercial & general aviation pilots with clear-day operations all of the time



Accident Mitigation

Increases survivability when accidents occur

Single Aircraft Accident Prevention

Develops health management & robust control technologies to enable aircraft that are “self healing” & “refuse to crash”



Clear-Day Operations

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Airport moving map on nav display

- Ownship location
- Approved route
- Incursion alerting



Results to Date

- SVS improves Situation Awareness
- Runway conflict alerts effective
- International aviation database requirements defined



SVS proven effective on head-up display (HUD above) and primary flight display (PFD below)

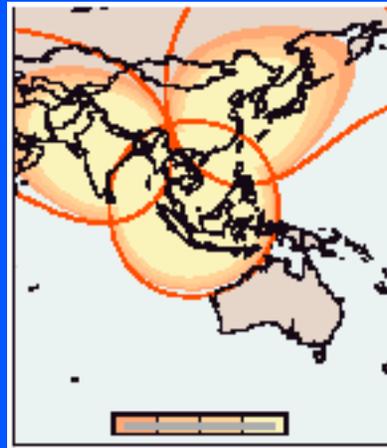


Intelligent Weather Decision Making

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- Honeywell system used in UAL In-Service Evaluation
 - time savings and turbulence mitigation



- AA in-service satellite information
 - excellent SATCOM performance at low elevation angles



- Rockwell weather radar system
 - uplinked NEXRAD data combined with on-board radar data



- ARNAV Weather Hazard Information system
 - display of GA weather products



- Honeywell GA tethered weather information display:
 - pilot confidence same as “out the window”
 - data time delay not always understood
 - contributed to RTCA performance standards

Eliminate Severe Turbulence Hazard

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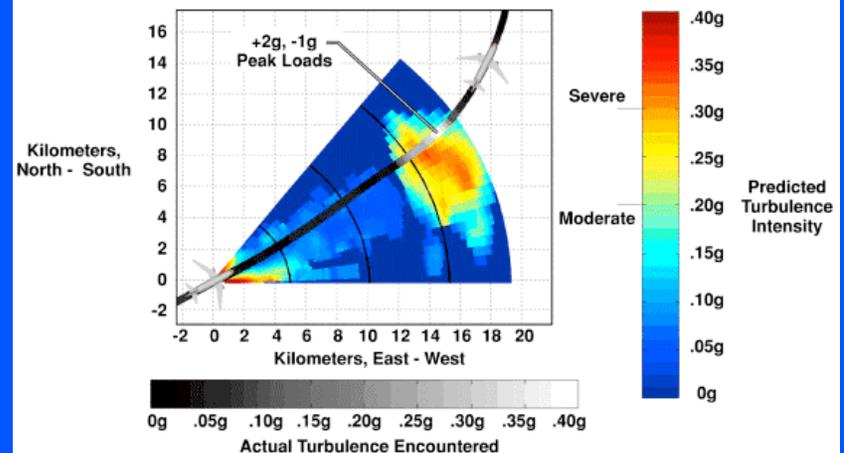
Predicting and Avoiding Turbulence

- Working with industry and the FAA, NASA researchers are conducting flight experiments with radar and lidar systems for predicting turbulent airspace ahead of the aircraft.
- NASA researchers are exploring wind shear radar as possible turbulence alert system, allowing pilots enough time to warn flight attendants and passengers to buckle up.



Severe Turbulence Successfully Detected

12/10/00



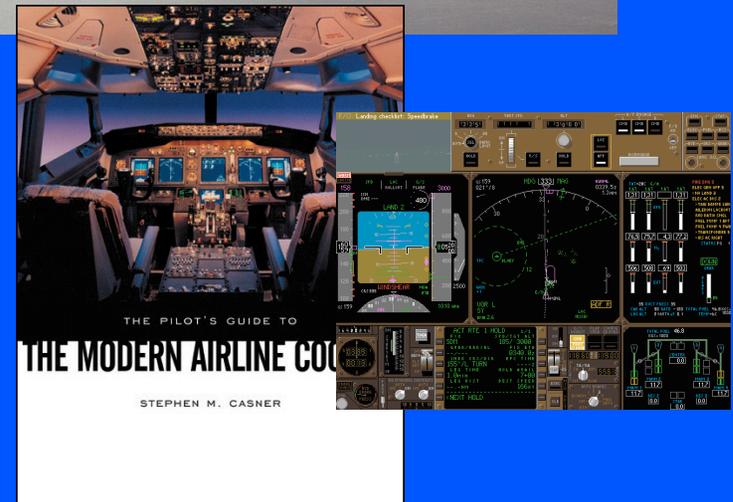
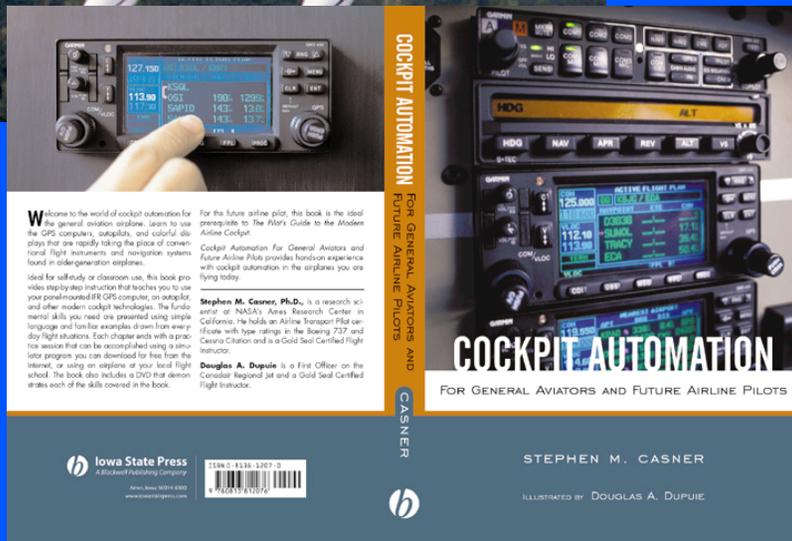
Human/Machine Integration

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- Starts student learning about cockpit automation in small training airplane



- Advanced portion of the training program for future airline pilots
 - Transitions student from small training airplane to commercial jet airliner



Iowa State University Press

Iowa State University Press (June 2001)

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Flight Systems Management

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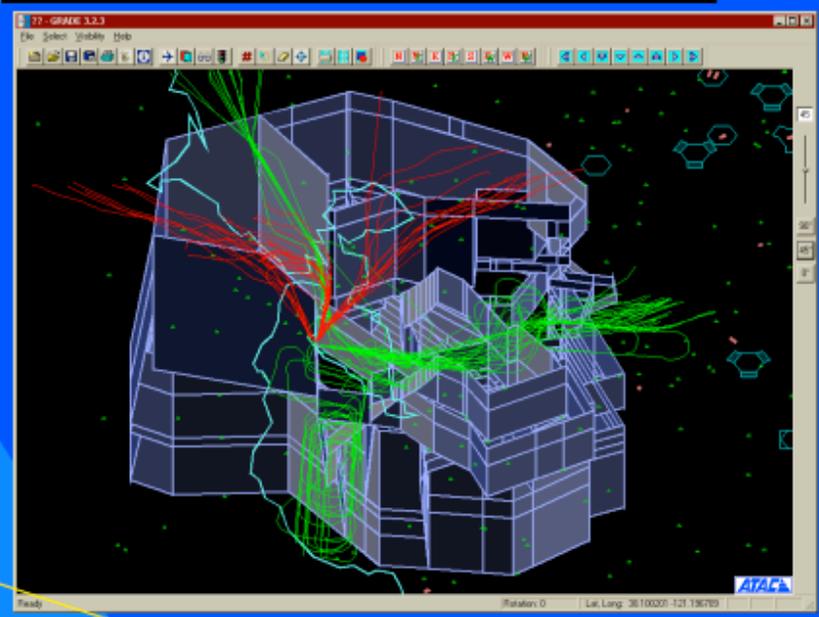
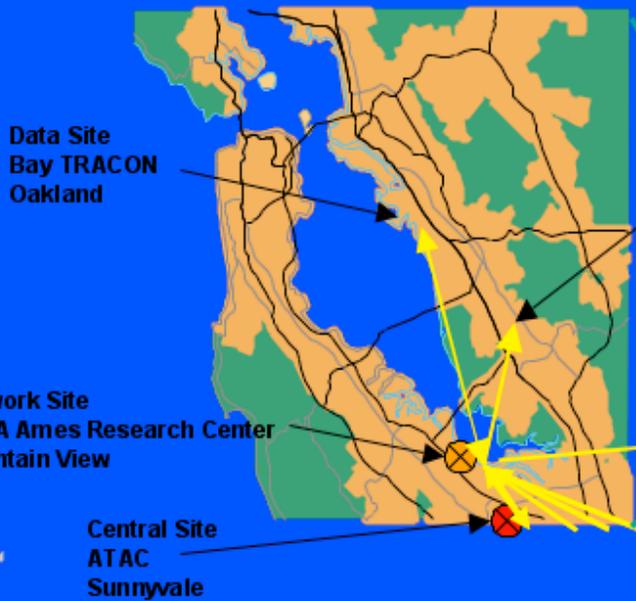
- **NASA and BF Goodrich conducted joint flight tests of a Non-Intrusive Fuel Measuring System on NASA B-757 research aircraft**
- **Fuel Measurement Concept using Neural Nets**
 - **Joint activity between NASA, BF Goodrich, and Barron Associates used neural network process to integrate data from multiple sonic sensors**
 - **Wiring external to tanks**
 - **Improved accuracy**
 - **Reduced on-board data requirements**
 - **Neural network technology was applied to define nonlinear characteristics of fuel sensor readings**
- **Technology Transfer**
 - **New fuel system being incorporated in Dornier 728**
 - **Barron Associates and BF Goodrich team developing approach to comply with FAA certification requirements**



NASA, BFG, and BA developed neural network fuel management system scheduled for JAA certification in 2002

Monitor and Assess All Data From Every Flight

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- PDARS (Performance Data Analysis and Reporting System) tools are in daily use at FAA ATC facilities in southern CA
- Evaluating safety, flexibility, access, predictability, and delay
- FAA expanding PDARS to the entire Southwest Region

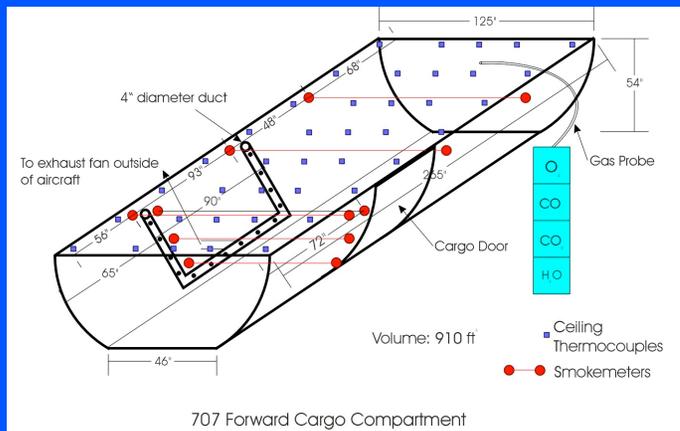


Increase Survivability

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Improved structural modeling/prediction codes



Validated low false alarm fire detection design concepts through testing and analytical modeling of cargo compartment fire signatures.



Validated energy absorbing structures - subfloor and seats reduced occupant loads by 7 to 20%

Plan for the Future

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- Program continues to produce safety-enabling research products in cooperation with FAA and industry partners
- Program now includes Aircraft Icing Research and Search and Rescue Projects
- Moving to risk-based assessment strategy
- Taking pro-active steps to assure technology transfer
 - Creating joint roadmaps with FAA
 - Refining/creating technology implementation plans
- Initiating a structured interaction with Capacity and SATS Programs to identify areas of synergy and opportunities for leveraging

