Overview of NASA's Fire Protection Research

Presentation to Fire & Cabin Safety Research Conference

23 October 01

Atlantic City, New Jersey

Robert McKnight

Acting Manager

Accident Mitigation Project

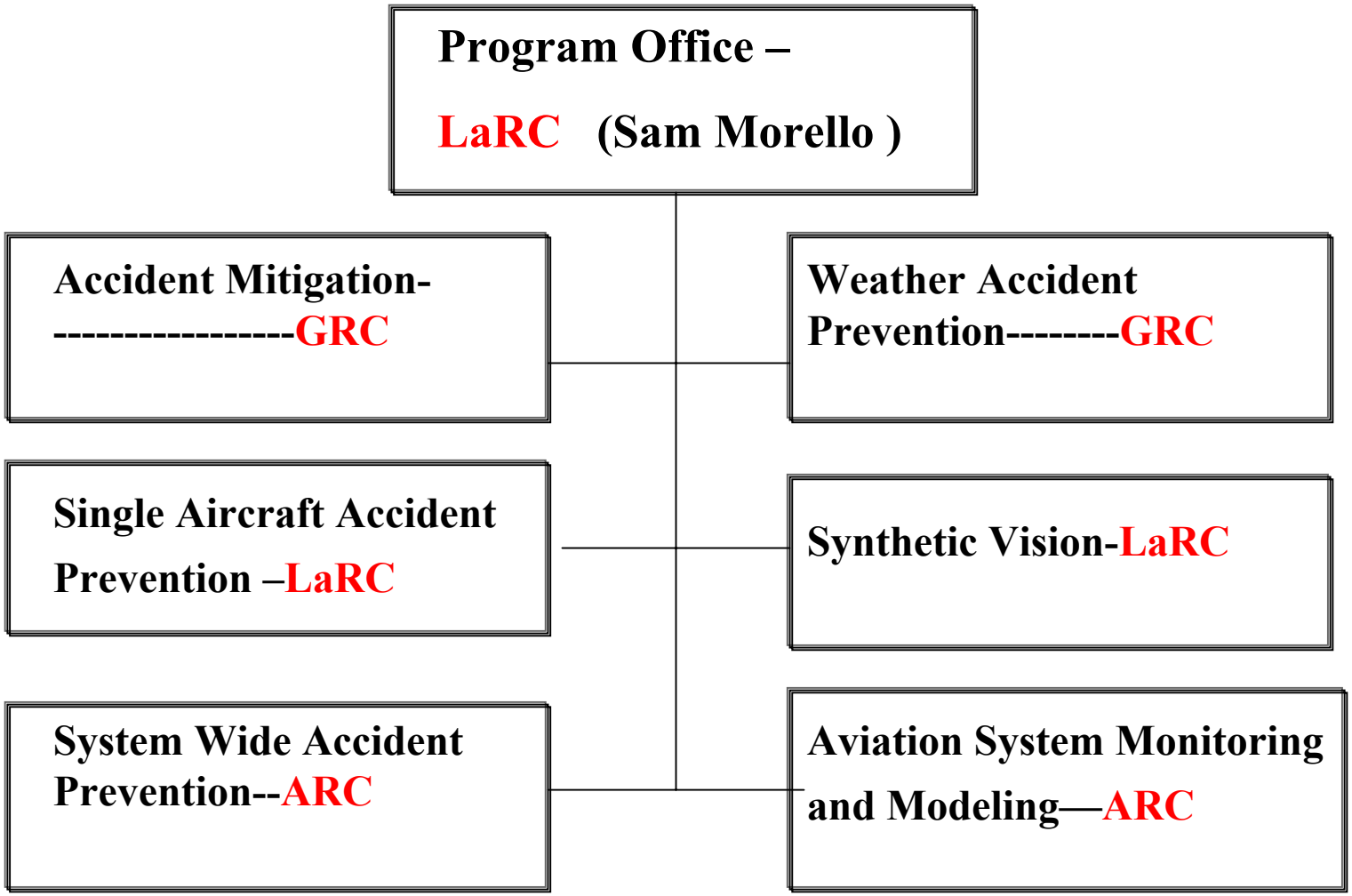
NASA Aerospace Technology Enterprise------ Goal 1

Enable a Safe, Environmentally Friendly Expansion of Aviation

10 Year Objectives

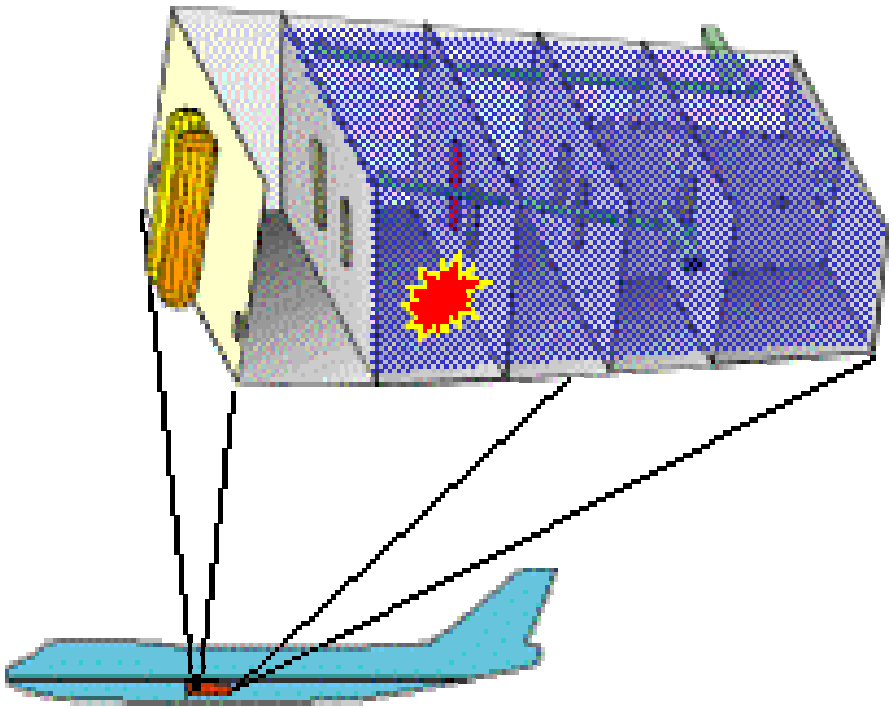
- *Increase airspace capacity*
  Double capacity
- *Reduce Emissions*
  1/3 NOX, 3/4 CO2
- *Increase Safety*
  1/5 accident rate
- *Increase mobility*
  1/2 door-to-door time
- *Reduce Noise*
  1/2 ground noise

NASA Aviation Safety Program Organization



General Accident Mitigation Goals:

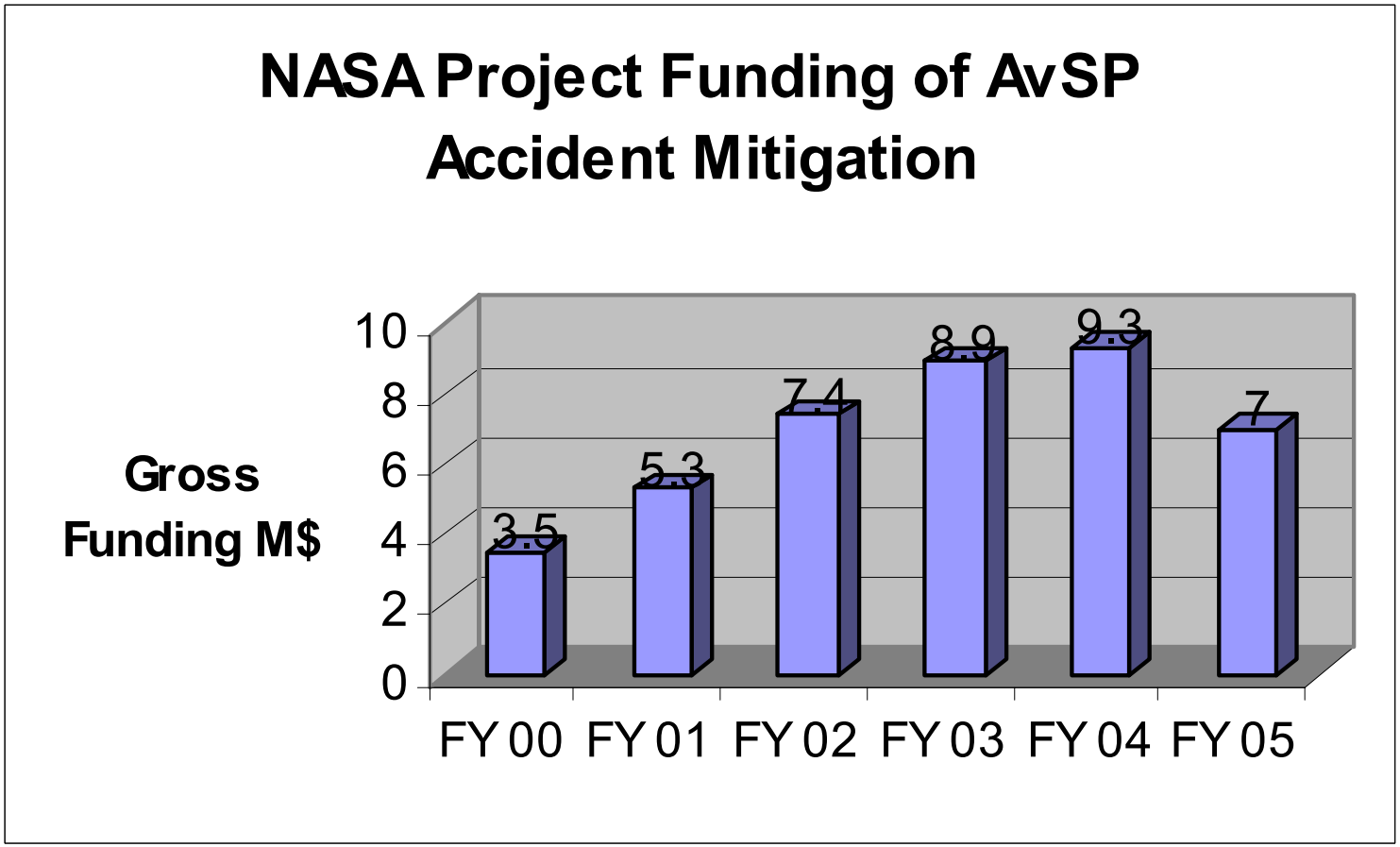
- *Prevent, detect, and suppress in-flight fires*
- *Technology application by 2007, 2022*



General Accident Mitigation Goals:

- *Increase human survivability of crash impact and post-crash fires*
- *Technology application by 2007, 2022*

NASA Funding



Collaborations (partial list)

- *FAA Technical Center Fire Safety Section*
- *Intl AC Systems Fire Protection WG*
- *ARAC Fuel Tank Inerting Harmonization WG*
- *Boeing Phantom Works*
- *OBIGGS / OBOGS equipment manufacturers*
- *Sandia National Laboratories*
- *NIST*
- *Makel Engineering Inc*
- *Glennan Microsystems Initiative*

Implementation Challenges

- *Regulatory uncertainty*
- *Cost impact*
  - *–Increases in cost, weight, maintenance*
  - *–Few or no side effects from implementation that will produce :*
    - o *Increases in operating efficiency, such as with Weather Accident Prevention technology*
    - o *New profit opportunities , such as with Synthetic Vision System technology*

Status

2.5.2.3 Fuel Tank Inerting / Fire Suppression / Oxygen

- *Boeing study of system requirements completed*
- *Boeing study of OBIGGS / OBOGS technology*
- *state-of-the –art completed*
- *Emerging Technologies (partial list) -*

OBIGGS	OBOGS
Cryogenic Distillation (N2)	Cryogenic Distillation
Pressure Swing Absorbtion (N2)	Ceramic Membrane
Hollow Fiber Membrane (N2)	
Combustion Generation of C02	

- *Requests for Proposal (RFP) being prepared for design phase. Downselects from design phase will enter fabrication and test phase. .*

Major Milestones

2.5.2.3 Fuel Tank Inerting / Fire Suppression / Oxygen

FY 02	FY 03	FY 04	FY 05
		FEP Systems Test & Eval △	
			FEP Systems Demo △
2Q02- OBIGGS / OBOGS Design Contracts			
	4Q02- OBIGGS / OBOGS Fab & Test Contracts		
		4Q03 OBIGGS / OBOGS Task Progress Eval	
Ground Testing of OBIGGS / OBIGS Demo Systems 4Q04			
	Ground Demo of OBIGGS Cargo Fire Suppression 1Q05-		
		TRL 6 Demo of OBIGGS / OBOGS 3Q05	

Status

2.5.2.1 Cargo Fire Detection

- *Microfabricated fire gas sensors developed. SnO2, NASICON*
- *FAA development of "resin block" standard smoke & fire source*
- *FAA initial fire tests for development of analytical model completed.*
- *Sandia completed first version of cargo compartment fire smoke, heat, gases analytic model.*
- *Testing of microfabricated sensors in FAA Fire Test Facility this fall.*

Major Milestones

2.5.2.1 Cargo Fire Detection

FY 02	FY 03	FY 04	FY 05
	FEP Systems Test & Eval △		
		FEP Systems Demo △	
4Q02- **2ND Generation Gas Sensors Tests**			
		4Q03- **Integration of Gas Sensors / Signal Processing**	
Fire Detection System Test & Eval **2Q04**			
		TRL 6 Fire Detection System Demo **1Q05-**	

Status

2.5.2.4 Fire –Safe-Fuels / 2.5.1.3 Crash Resistant Fuel Systems

•Data mining of post AMK research completed. Three research focus areas were identified:

—Surfactants -- to decrease the vapor pressure of current commercial jet fuels
—Gelling agents -- to reduce the vaporization rate of atomized fuel
—Chemical composition changes -- to decrease the fuel's vapor pressure

•NASA GRC fuel flammability test rig nearing completion

•Robertson Aviation completed its report on crash resistant fuel systems (CRFS). Several research focus areas were identified:

—Systematic method of evaluating the crashworthiness of designs

—Frangible, breakaway fuel system fittings and tubing.

—Breakaway auto shut off valves

—Fuel tank reinforcement

•NRA's for crash resistant fuel system research are in preparation.

Major Milestones

2.5.2.4 Fire –Safe-Fuels / 2.5.1.3 Crash Resistant Fuel Systems

FY 02	FY 03	FY 04	FY 05
4Q02- Baseline Flammability Testing of Existing Fuels	FEP Systems Test & Eval △ 2Q03- Fuel Modification Concepts Designed	FEP Systems Demo △ Advanced Testing of Fuel Modifications -3Q05	
	CEP Systems Test & Eval △ 1Q03 Fuel System Concepts Designed Commuter Crash Test 3Q04	CEP Systems Demo △ 2Q04 Fuel System Tests Crashworthiness Design Guidelines 3Q05	

Aircraft Security Proposals

Submitted to NASA Hq's aircraft security planning group----

- ***Fuel Tank Inerting*** :
  - ***–Development of civil transport inerting technology to inert all fuel tanks for low – slow flight during approaches to airports as well as during departures.***
  - ***–Provides protection from incendiary projectiles directed from terrorists at unsecure urban / rural / oceanic areas under arrival and departure corridors.***
- ***Cargo Compartment Chemical Sensors*** :
  - ***–Development of civil transport microsensor systems which can be networked throughout aircraft cargo compartments and ventilation ducts to detect outgassing from explosive materials or from chemical / biological agents placed in the aircraft.***

Web Sites

NASA Hq Aerospace Technology site-

www.aero-space.nasa.gov/goals/safety.htm

NASA Langley Lead Center AvSP site –

avsp.larc.nasa.gov/

NASA Glenn AvSP site-

www.grc.nasa.gov/WWW/grcavsp/index.html

FAA Tech Center Fire Safety Section site-

http://www.fire.tc.faa.gov/index.html?top.html&0