Subcommittee on Human Factors Fall 2013 Review

Flightdeck/ Maintenance/ Systems Integration Human Factors

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Date: July 30, 2013

Presentation Outline

- **TCRG/BLI Overview**
  - Emerging FY 16 focal areas
- **Requirements Review**
  - FY 13 requirements
    - HF-13-01: Flight Training Methods for Jet Upset Prevention, Detection and Recovery
    - HF-13-02: ADS-B Human Factors – AIR & AFS Equipment Design, Evaluation, and Operational Approval Guidance
    - HF-13-03: A Multi-Disciplinary Approach to Fatigue Risk Management in Maintenance
  - Primary focal areas FY 14-15

BLI Portfolio Overview

- ***Purpose:*** Provide data to support evaluation criteria and methods, regulatory material, and recommended practices related to human factors for flight deck systems and applications/functions, flightcrew procedures, training, and operational use. Establish data to support risk management programs to address hazards in the maintenance environment.
- ***Benefits:*** To reduce risks associated with human performance while ensuring safety in aviation operations and maintenance activities.
- ***Success:*** Results of research support development of standards, procedures, training, policy and other regulatory and guidance material as well as human factors assessments of technologies and procedures.

Core vs. NextGen

	Core Projects	NextGen Projects
Timeline	Near-term	Mid-term (- 2020)
Research focus	In the field *today*	*Anticipated* in the field
Documentation	Not in NextGen documents	In NextGen documents
Example topics	• Fatigue • Maintenance • Avionics -Today	• DataComm • Instrument Procedures • Avionics- Future
Project example (ADS-B)	• Industry survey (consumer reports) • Symbology- ground vehicles • ADS-B color-coding	• CDTI operational evaluation for merging and spacing (with US Airways) • In-trail procedure/FIM literature review

FY13-FY16 Core Flight Deck Research Requirements Prioritization

	FY 2013	FY 2014	FY 2015	FY 2016
Enhancing Aviation Safety Through Advanced Procedures, Training & Checking Methods, to include Jet Upset	50	22	36	◆
Human Factors Maintenance Risk Management	56	23	31	◆
Avionics & New Technologies: Certification and Operational Approval Criteria	57 - ADS-B 60 - Avionics	44	26	◆
Advanced Vision Systems (EFVS, EVS, SVS, and CVS), Head Up Displays (HUD), Head Mounted Displays (HMD): Certification and Operational Approval Criteria		36	29	◆
Unmanned Aircraft Systems (UAS) Human Factors Considerations		34	23	◆
General Aviation Safety Improvement Research – A Multi-Method Approach to Accident Reduction			10	
Human Factors R&D for Improved Rotorcraft Operational Safety			46	◆
Fatigue Mitigation in Flight Operations				◆

Why is Human Factors Important?

2/3 to 3/4 of all accidents continue to have pilot error as a primary factor…

- Complex Systems/ Automation
- Human Error
- Avionics (Software & Hardware)
- Instrument Procedures
- Training
- Crew Resource Management
- Fatigue
- Maintenance

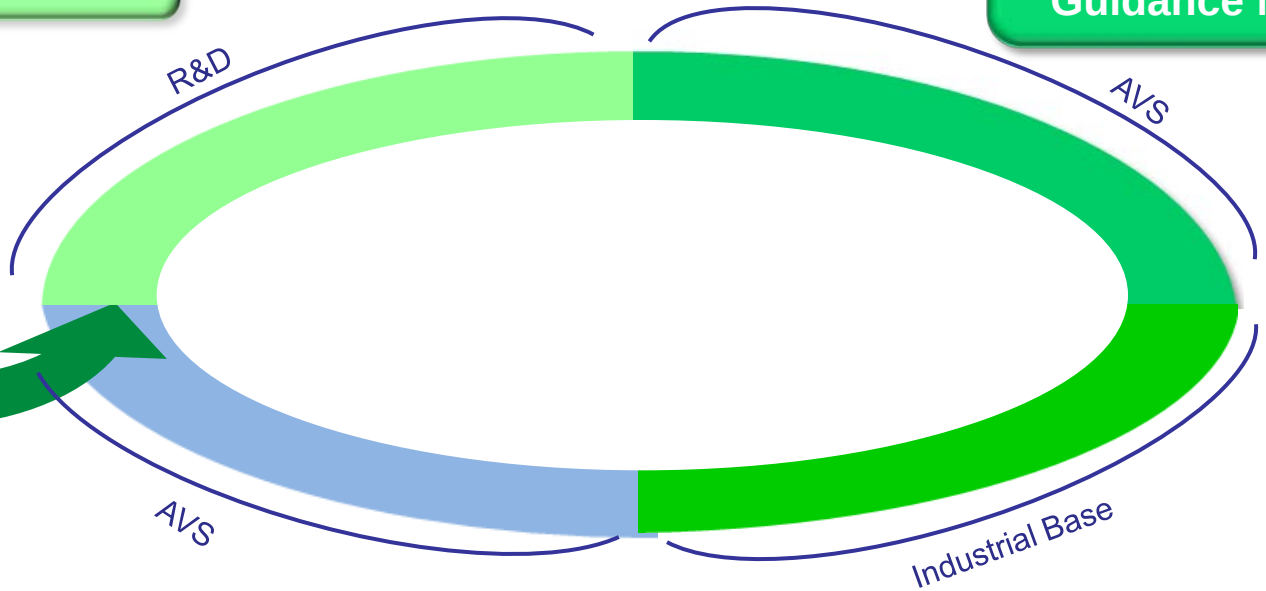
Miracle on the Hudson


Asiana Airlines Flt. 214

Human Factors Research Needs

Conduct Research

Develop/Update Regulatory & Guidance Material



Research Needs

Identify Issues:
- ACO Issue Papers
- Special Conditions
- Accident & Incidents

Applicants Develop New:
1. Aircraft
2. Aircraft Systems
3. Procedures
4. Training
5. Maintenance

When Will the Research be Completed?

As long as technology continues to evolve…

Wright Flyer (en.wikipedia.org)

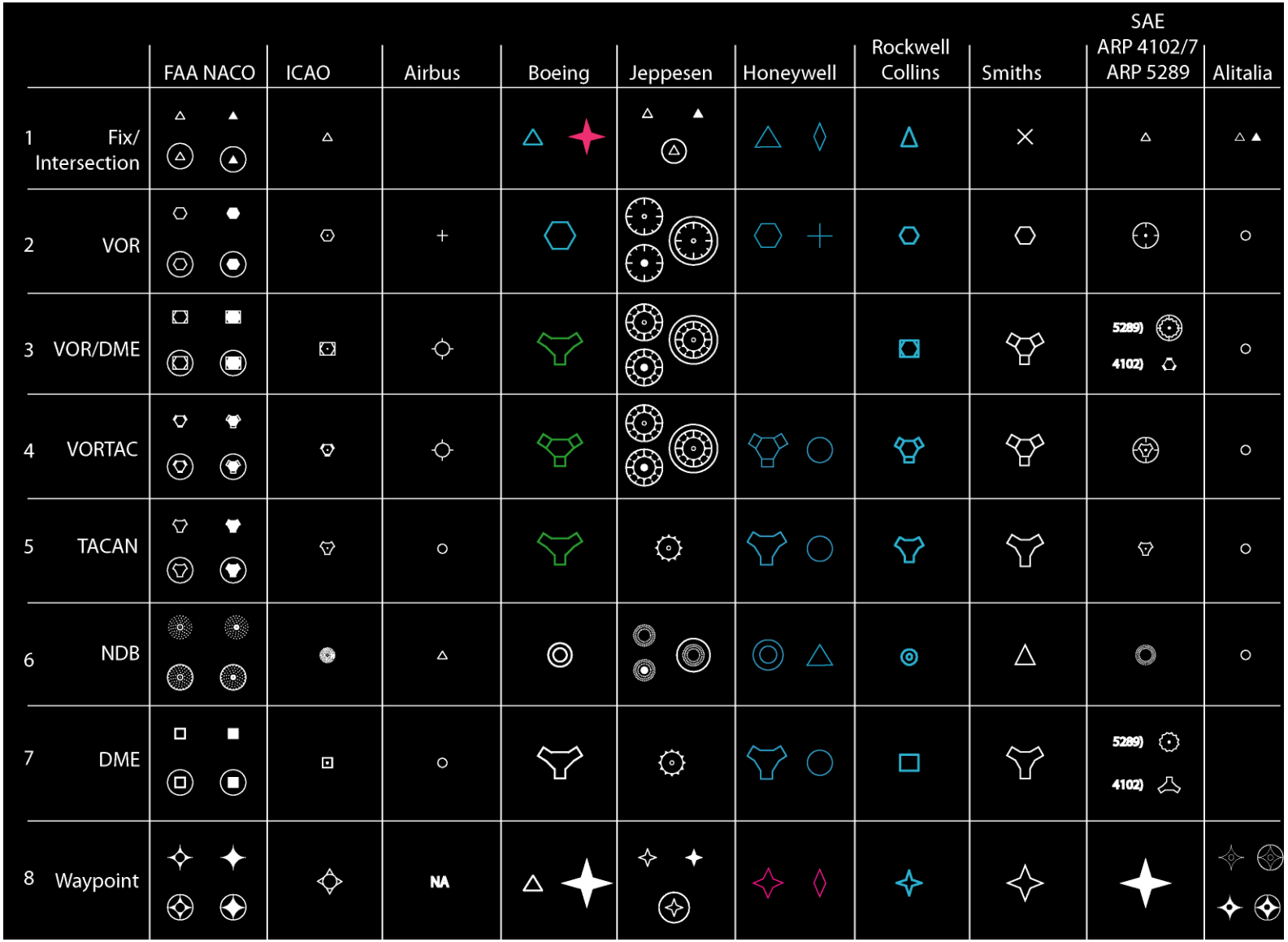
Rockwell Shrike Commander

Cessna Mustang

Beechcraft Starship

…there will be human factors issues.

Why Are We Still Studying Symbology?



Symbology Research

Research

TCAS II Mandate

SAE G10 NAVAID Symbols Published

1950 1986 1993 1997 2005 2007 2011 2013+

Initial Collision Avoidance Research

Aeromexico 498 Midair Collision 1986

Initial ADS-B Symbology Research

Fly-Over Fly-By Symbology Research

NAVAID Symbology Research

Advanced Applications ADS-B Symbology Research

Why Are We Still Studying Symbology?

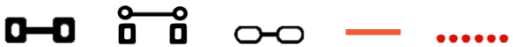
	US Symbols (NOAA)	*ICAO Symbols*
Fly-Over		
Fly-By		

Why Are We Still Studying Symbology?

- **ADS-B**

Information Type	Symbols In Use
Traffic Aircraft	
Ground Vehicles	

- **Low Visibility Operatoins (LVO)**

Information Type	Symbols In Use
Clearance Bar	
Geographic Position Marker (GPM)	
ILS Hold Line	
Non-Movement Area	

HF FY2013 Approved Requirements

HF-13-01: **Flight Training Methods for Jet Upset Prevention, Detection and Recovery**

HF-13-02: **ADS-B Human Factors – AIR & AFS Equipment Design, Evaluation, and Operational Approval Guidance**

HF-13-03: **A Multi-Disciplinary Approach to Fatigue Risk Management in Maintenance**

HF-13-01: Flight Training Methods for Jet Upset Prevention, Detection and Recovery

Research Requirement

- To develop recommendations for the content, strategy and training interval for jet upset training so pilots can interpret the signs of the onset of jet upset and respond before upset occurs
- Identify mitigations for startle, surprise, and distraction
- Output: Input to LOC Aviation Rulemaking Committee
- Sponsor: Sponsor: Kathy Abbott (AVS), Rob Burke (AFS-210), Doug Farrow, (AFS-230)

Execution of the Requirement

- Performer: MIT Lincoln Labs/University of Central Florida
- Start Date: Research ongoing from FY12 requirement (initiated June 2012)
- Current status: **Green**

FY 2013 Accomplishment/Issues

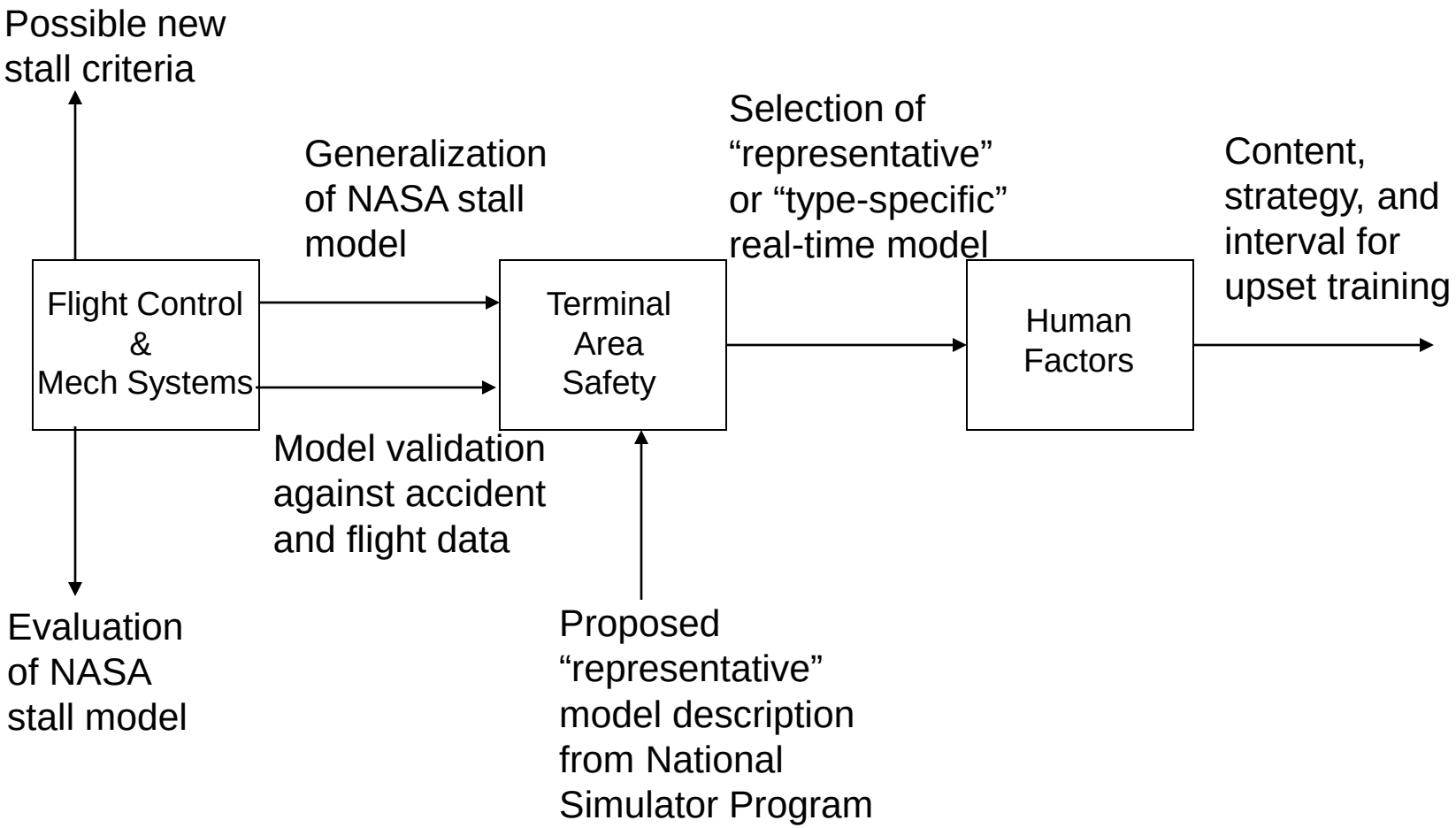
- Review of the learning objectives proposed by ICATEE and ARC and identify the minimum set of maneuvers required for teaching the learning objectives proposed.
- Complete literature review on surprise, startle, and distraction for unexpected events

Out Year Funding Requirements

FY 13	FY 14	FY 15	FY 16	FY 17
$ 360	$ 1,000	$ 500	TBD	TBD

Note: Funding for outyears (FY15+) is for planning purposes only.

Upset Recovery Research – Relationship Among TCRGs



Courtesy Dr. Jeffery Schroeder

HF-13-01: Flight Training Methods for Jet Upset Prevention, Detection and Recovery

Jet Upset Prevention, Detection, and Recovery/Loss of Control

	FY 2013	FY 2014	FY 2015	FY2016
Identify learning objectives for jet upset detection and recovery	◆			
Define training scenarios and performance standards	◆			
Support development and testing of new models to increase the flight envelope that can be simulated with current technologies (with AFS-400)	◆	◆		
Identify a set of tasks for teaching learning objectives for upset recovery training		◆		
Develop and validate specific performance standards for these tasks			◆	
Develop recommendations and training guidelines from results of AFS-400 simulator model research for use by the FAA and industry				◆

HF-13-01: Flight Training Methods for Jet Upset Prevention, Detection and Recovery

Mitigations for Startle, Surprise, and Distraction

	FY 2013	FY 2014	FY 2015	FY2016
Literature review with definitions and on state-of-the-art of mitigations for surprise, startle, and distraction (1st draft)	◆	◆		
Research plan identifying research gaps		◆		
Conduct research			◆	
Develop recommendations for mitigations				◆

Other activities

	FY 2013	FY 2014	FY 2015	FY2016
Analyze training systems (traditional and AQP training) to identify strengths and weaknesses. Consider training for crew resource management.		◆		
Gather data on the lessons learned with the implementation of the ICAO MPL standards and identify strengths and weaknesses		◆		
Conduct literature review to identify training issues and to determine whether guidance is needed to train when pilots need to override or intervene in aircraft systems with hard protection.				◆

HF-13-02: ADS-B Human Factors – AIR & AFS Equipment Design, Evaluation, and Operational Approval Guidance

Research Requirement

- To provide a capability for FAA Certification and Flight Standards personnel to evaluate traffic displays and traffic applications/ operations that use ADS-B technology.
- Output: State of knowledge for current CDTI design and use; key safety-related design issues and tradeoffs; shortcomings of current guidance; current ADS-B display systems (avionics inventory)
- Sponsor: C. Swider, AIR-120; D. Walker, AIR-130; P. Zelechoski, AFS-400

Execution of the Requirement

- Performer: US DOT Volpe Center
- Start Date: Research ongoing from requirement HF-11-05, Avionics & New Technologies: Certification and Operational Approval Criteria
- Current status: **Green**

FY 2013 Accomplishment/Issues

- Reports will be provided to the AVS sponsor who will extract key information, issues, and guidance for inclusion in the appropriate regulatory and guidance material for the specific avionics system
  - Summary of CDTI operational evaluation support and lessons learned from operational trials
  - Draft ADS-B industry survey

Out Year Funding Requirements

FY13	FY14	FY15	FY16	FY17
$ 523	--	$ 880	TBD	TBD

Note: Funding for outyears (FY15+) is for planning purposes only.

In FY15, ADS-B Human Factors project is combined with the Avionics research requirement.

HF-13-02: ADS-B Human Factors – AIR & AFS Equipment Design, Evaluation, and Operational Approval Guidance

ADS-B/CDTI

	FY 2013	FY 2014	FY 2015	FY2016
Conduct symbolology research for airport surface moving maps, ADS-B/CDTI	◆	◆	◆	
Summary of CDTI operational evaluation support and lessons learned from operational trials	◆			
Develop guidance for AVS to evaluate human factors/pilot interface issues with ADS-B alerting		◆		
CDTI Industry Survey		◆		
Issues paper & Incident/accident analysis				◆

Other Avionics Projects

Airport Surface Moving Maps, EFBs

	FY 2013	FY 2014	FY 2015	FY 2016
Conduct analysis of incident/ accident data for airport surface moving maps and EFBs	◆			
Conduct analysis of taxiway distances to identify map/database accuracy requirements.		◆		
Update to Volpe document “Human Factors Considerations for the Design and Evaluation of Electronic Flight Bags, Version 3”		◆	◆	
Report on HF integration issues with tablet (e.g., iPad) technology in the flight deck				◆

Glass Flight Deck

	FY 2013	FY 2014	FY 2015	FY 2016
Glass flight deck industry product report			◆	

General Guidance that cuts across Avionics/Aircraft Types

	FY 2013	FY 2014	FY 2015	FY 2016
Review & update General Guidance document	◆	◆		
Continue to develop an evaluation guide that complements the General Guidance document for Part 23, 25, 27, and 29 aircraft	◆	◆	◆	

HF-13-03: A Multi-Disciplinary Approach to Fatigue Risk Management in Maintenance

Research Requirement

- Review and develop specialized tools for fatigue risk management
- Explore utility of operationally usable sensor technology and integration with existing Fatigue Risk Management Systems
- Collect data from workgroup members to assess changes as a result of FRMS implementation
- Sponsor: Bill Johnson/Ken Kerzner, AFS-300

Execution of the Requirement

- Performer: CAMI
- Start Date: Research ongoing from FY11 research requirement
- Current status: **Green**

FY 2013 Accomplishment/Issues

- Supplemental report with specialized guidelines for fatigue risk management
- Report on practical viability and costs associated with emerging fatigue assessment technologies
- Report on the effectiveness of FRMS operations
- All research will contribute to development of Advisory Circulars and other formal FAA documents available not only to FAA inspectors and organizations but also to operators, manufacturers, maintenance service providers and others

Out Year Funding Requirements

FY 13	FY 14	FY 15	FY 16	FY 17
$ 257	$ 296	$ 1,200	TBD	TBD

Note: Funding for outyears (FY15+) is for planning purposes only.

HF-13-03: A Multi-Disciplinary Approach to Fatigue Risk Management in Maintenance

	FY 2013	FY 2014	FY 2015	FY2016
Review and develop specialized tools for fatigue risk management	◆	◆	◆	◆
Explore utility of operationally usable sensor technology and integration with existing Fatigue Risk Management Systems	◆	◆		
Collect data from workgroup members to assess changes as a result of FRMS implementation	◆	◆	◆	
Determine contributing factors related to “failure to use technical documentation.”		◆	◆	◆
Line Oriented Safety Assessment		◆	◆	◆

FY 13 - FY 16 Core Flight Deck Research Requirements: Focal Areas

	FY 2013	FY 2014	FY 2015	FY 2016
Enhancing Aviation Safety Through Advanced Procedures, Training & Checking Methods, to include Jet Upset	◆	◆	◆	◆
Human Factors Maintenance Risk Management	◆	◆	◆	◆
Avionics & New Technologies: Certification and Operational Approval Criteria	◆		◆	◆
Advanced Vision Systems (EFVS, EVS, SVS, and CVS), Head Up Displays (HUD), Head Mounted Displays (HMD): Certification and Operational Approval Criteria			◆	◆
Unmanned Aircraft Systems (UAS) Human Factors Considerations			◆	◆
General Aviation Safety Improvement Research – A Multi-Method Approach to Accident Reduction			◆	
Human Factors R&D for Improved Rotorcraft Operational Safety			◆	◆
Fatigue Mitigation in Flight Operations				◆