Name of Program: Flight Deck, Maintenance, System Integration ("Core Flight Deck HF")

BLI Number: A11G (8AA)

Presenter Name: Chuck Perala

Office: NextGen Human Factors Div. (ANG-C1)

Date: September 1, 2021

Review of FY 2021 - 2024 Proposed Portfolio
Flight Deck, Maintenance, System Integration Overview

Program Scope

• This program addresses research, engineering, and development requirements defined by technical sponsors in the Aviation Safety Organization (AVS). Requirements are driven by the human factors needs of FAA Aircraft Certification (AIR) and Flight Standards (AFS) personnel (field, Headquarters)

• This program also considers rapid changes to current-day technologies, procedures, and emerging issues

FAA Benefits

• Program outputs are transferred to AVS technical sponsors to develop and maintain, as appropriate, human factors-related rules, guidance, procedures, Orders, standards, job aids, and other materials

• Work products benefit AIR and AFS personnel responsible for the evaluation, certification, approval, and continued airworthiness of aircraft; and the certification of pilots and mechanics

Measures of Success

1. Sponsor Satisfaction – did the research meet AVS’s needs?
2. Access to Research – is there sufficient awareness/access to results?
3. Application of Results – did the research support or inform a data-driven decision?
4. Contribution to Safety – how did the research support improvements to human and system performance?
Flight Deck, Maintenance, System Integration
Program Managers and Performers

Program Managers
• Tara (Holmes) Gibson, Division Manager (Tara.M.Gibson@faa.gov)
• Chuck Perala, Program Manager (Chuck.Perala@faa.gov)

Performers and Laboratories
• FAA Civil Aerospace Medical Institute (CAMI)
• Volpe National Transportation Systems Center, DOT
• FAA Center of Excellence for Technical Training and Human Performance (COE TTHP)
  • Auburn University
  • Wichita State University
  • PEGASUS Consortium
• University of Central Florida
• University of Michigan
Objective
• Provide research data to support human factors needs of FAA personnel who evaluate, approve, and oversee the use of advanced vision systems during new low visibility concepts of operation.

How Results are Used
• Research informs FAA equivalent level of safety decisions and policy changes that can increase the number of viable airports/runways for low visibility approach, landing, rollout, and takeoff operations (expand operational credit). It also informs FAA personnel who develop evaluation criteria for use of advanced vision system technologies and incorporate this information into human factors – related regulations, guidance material, and other FAA work products.

Current Research Portfolio Topics
• Head Up Display (HUD) Operational Criteria Research
• Performance and Operational Impacts of Approach Lighting Conditions
• Development of Pilot Evaluation Tools
## Advanced Vision Systems

### On-going research in FY22+

<table>
<thead>
<tr>
<th>Project</th>
<th>Description/Product</th>
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<tbody>
<tr>
<td>Quantifying the contribution of HUD to Pilot Performance on Approaches Where HUD is Used, But Not Required, to Transition to Landing (visual segment of SA CAT I approach)</td>
<td>Evaluate pilot performance and human factors considerations when using a HUD (flight information only) during the visual segment of an SA CAT I ILS approach or during the visual segment of approaches that have a high DA and long visual segment</td>
<td>CAMI</td>
<td>FY2023 Q1</td>
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| Evaluation of HF & Crew Coordination Aspects of Dual HUD CAT III Operations Compared to Single HUD CAT III Operations. Evaluate Whether Active Monitoring Improves Crew Performance Over a Baseline Condition | – Evaluate human factors and crew coordination impacts when using dual HUD during CAT III approach, landing, and rollout operations vs. single HUD CAT III flight operations  
– Examine whether dual HUD provide the pilot monitoring with active monitoring capabilities (e.g. early detection of flightpath changes) | CAMI   | FY2022 Q4       |
| Pilot Performance Using HUD, SVGS, and Flight Director During the Instrument Segment of an Approach | – Evaluate the implementation of SVGS technology and flight director information on a head-up display (HUD)  
– Examine pilot performance and human factors considerations when SVGS-HUD with flight director is used during the instrument segment of a CAT I ILS approach | CAMI   | FY2022 Q3       |
| Pilot Performance and Operational Impacts Associated with using a HUD to Conduct CAT II and CAT III Approaches Using Other than ALSF I or ALSF II Approach Lighting Systems | Examine pilot performance and human factors considerations when using a HUD (flight information only) to conduct CAT II and CAT III approaches to a runway with using alternate approach lighting systems (other than ALSF I, ALSF II) | CAMI   | FY2022 Q3       |
| Pilot Performance and Human Factors Considerations using SVGS on an SA CAT I Approach with Less than a MALSR Approach Lighting System | Examine pilot performance and human factors considerations when using SVGS-HDD to conduct an SA CAT I ILS approach to a runway with an approach lighting systems that has fewer visual characteristics than a MALSR approach lighting system | CAMI   | FY2022 Q4       |
### Advanced Vision Systems
#### On-going research in FY22+

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<tr>
<td>Development of Aircraft Evaluation Group (AEG) Pilot Evaluation Tools for new <strong>EFVS</strong> Systems</td>
<td>Develop AEG pilot evaluation tools for new enhanced flight vision systems (EFVS) and synthetic vision guidance systems (SVGS) to support core AEG responsibilities, including evaluation of: 1) Aircraft and associated systems for operational suitability, 2) Flightcrew training requirements (Flight Standardization Board), 3) Minimum equipment required for dispatch (Flight Operations Evaluation Board), 4) Continued Airworthiness (Maintenance Review Board), and 5) Review and acceptance of Instructions for Continued Airworthiness (ICA).</td>
<td>CAMI</td>
<td>FY2023 Q3</td>
</tr>
<tr>
<td>Development of Aircraft Evaluation Group (AEG) Pilot Evaluation Tools for new <strong>SVGS</strong> Systems</td>
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<tr>
<td>Establish an Empirical Basis for the Minimum Visual Features &amp; Visual Aids a Pilot Must See to Safely Takeoff During Lower than Standard Takeoff Minima Operations Using Natural Vision (HUD, no HUD) or Advanced Vision Systems</td>
<td>Examine whether the visual aids currently required for low visibility takeoff operations are necessary, whether these operations could be implemented on narrower runways with fewer visual aids, &amp; whether the use of advanced vision systems, which have limited fields of view but increased forward sight distance, impact what a pilot must see in any substantive way over that of natural vision</td>
<td>CAMI</td>
<td>FY2023 Q4</td>
</tr>
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Planned Research Portfolio Topics

- Synthetic Vision Guidance Systems (SVGS) for Lower than Standard Takeoff Minima Operations*
- SVGS for Lower than Standard Localizer Performance with Vertical Guidance (LPV) Minima*
- Use of SVGS as a CAT III Rollout Aid
- Use of an Enhanced Flight Vision System (EFVS) on a Head-down display (HDD) for Operations to 100 feet Above Touchdown Zone Elevation

* Indicates research builds upon a project within the current portfolio
Objective
• Provide research data to support the human factors needs of FAA personnel who evaluate, approve, and oversee pilot training and qualification programs, flight deck operations, and pilot procedures.

How Results are Used
• Research informs FAA personnel who develop evaluation criteria for pilot tasks, skills, and training and incorporate this information into regulatory and documents.

Current Research Portfolio Topics
• Training the Emerging Pilot Workforce
• Distance Learning
• Crew Resource Management (CRM)
### Pilot Training and Checking Methods
#### On-going research in FY22+

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<tr>
<td>Training the Emerging Pilot Workforce</td>
<td>Provide scientific and technical efficacy data on potential FAA training and checking methods for the current and projected pilot workforce; areas of emphasis include information management, decision-making, and command judgment</td>
<td>Auburn University</td>
<td>FY2023 Q1</td>
</tr>
<tr>
<td>Modern Training Practices: Methods and Assessment in the Air Carrier Industry (Distance Learning)</td>
<td>Provide recommendations to help decide which topics, skills, and knowledge in aviation training are appropriate for modern training practices, and which are better suited for other learning methods</td>
<td>University of Central Florida</td>
<td>FY2022 Q4</td>
</tr>
<tr>
<td>Crew Resource Management (CRM) section of the Reference Document for Flight Standards Human Factors (RDFSHF)</td>
<td>Develop a single-source reference document for human factors-related rules and guidance that pertain to CRM, including relevant issues to consider when AFS personnel evaluate CRM aspects of proposed operations, procedures, and training</td>
<td>University of Central Florida</td>
<td>FY2022 Q4</td>
</tr>
</tbody>
</table>
Planned Research Portfolio Topics

- Pilot Training for Responses to Failures
- Reference Document for Flight Standards Human Factors (RDFSHF)*
- Crew Resource Management (CRM) Performance Indicators*
- Adapting Training and Flight Operations to Emerging Risks

* Indicates research builds upon on a project within the current portfolio
Objective

- Provide research data to support the human factors needs of FAA personnel who evaluate, approve, and oversee aviation maintenance related training, operations, and procedures.

How Results are Used

- Research informs FAA personnel who develop evaluation criteria for maintenance technician tasks, skills, procedures, and operations and incorporate this information into regulatory and documents.

Current Research Portfolio Topics

- Safety Culture
- Failure to Follow Procedures
## Maintenance Human Factors

### On-going research in FY22+

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<td>Maintenance Human Factors - Safety Culture</td>
<td>Understand the current state of maintenance safety risk management, and examine the effectiveness of applied tools to verify and address potential human factors vulnerabilities</td>
<td>CAMI</td>
<td>FY2022 Q1</td>
</tr>
<tr>
<td>Maintenance Human Factors – Failure to Follow Procedures</td>
<td>Propose and test the effectiveness of human factors countermeasures for failure to follow procedures (FFP)</td>
<td>CAMI</td>
<td>FY2022 Q2</td>
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Planned Research Portfolio Topics

• Analysis of Data to help FAA Assess Adequacy of Policy, Guidance, and Assumptions Related Maintenance Training Requirements (includes differences training)
Fatigue Mitigation in Flight Operations
Research Requirement Overview

Objective
• Provide research data to support effective implementation of recent changes to 14 CFR Part 117 which introduces scientific concepts, performance-based concepts, and procedures for industry to safely conduct flight operations within and outside the table limits of 14 CFR Part 117.

How Results are Used
• Informs FAA personnel who refine operational standards for fatigue risk management systems and incorporate evidence-based criteria into regulations, guidance, training, and other FAA work products.

Current Research Portfolio Topics
• Fatigue Risk Management System (FRMS) Database
• Short Haul Longitudinal Study
## Fatigue Mitigation in Flight Operations

On-going research in FY22+

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<tr>
<td>Fatigue Risk Management System (FRMS) Database</td>
<td>Analyze operational data to assess and monitor the reported pilot performance impact(s) of flight operations conducted outside the table limits of 14 CFR Part 117 (Flight and Duty Limitations and Rest Requirements for Flightcrew Members).</td>
<td>CAMI</td>
<td>FY2022 Q4</td>
</tr>
<tr>
<td>Short Haul Longitudinal Study</td>
<td>Collect objective data to characterize the impact of high frequency multiple segment flight operations, including early start times, nighttime arrivals, etc., to pilot fatigue and cumulative sleep loss across trips pairings.</td>
<td>CAMI</td>
<td>FY2023 Q4</td>
</tr>
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Fatigue Mitigation in Flight Operations
Potential Program Plans (FY22 – FY23+)

* Indicates research builds upon on a project within the current portfolio

Planned Research Portfolio Topics

- Fatigue Risk Management System (FRMS) Database*
- Short Haul Fatigue Study*
- Long range / ultra long-range (LR/ULR) Study*
Objective
• Provide research data to support human factors needs of FAA personnel who evaluate and approve aircraft systems, displays, and controls, including their intended function and operation.

How Results are Used
• Research results inform FAA personnel who develop evaluation criteria for aircraft systems, displays, and controls and incorporate this information into human factors – related regulations, guidance material, and other FAA work products.

Current Research Portfolio Topics
• Electronic Flight Bag (EFB) Research
• Updates to General Guidance Document
• Visual Scanning Research
## Avionics and New Technologies
### On-going research in FY22+

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<tr>
<td>Electronic Flight Bag Survey and Additional Survey Data Analysis</td>
<td>Gather human factors data to understand how pilots access and manage information used for EFB functions</td>
<td>Volpe</td>
<td>FY2021 Q3</td>
</tr>
<tr>
<td>Visual Scanning Techniques in Transport Category Aircraft</td>
<td>Understand the visual scanning techniques used by pilots in transport category aircraft to provide the FAA with a data-driven foundation for identifying the acceptability of design assumptions and mitigations for new flight deck layouts/designs</td>
<td>University of Michigan</td>
<td>FY2023 Q2</td>
</tr>
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Avionics and New Technologies
Potential Program Plans (FY22 – FY23+)

* Indicates research builds upon on a project within the current portfolio

Planned Research Portfolio Topics

• Pilot Interaction with Advanced Technologies
• Pilot Visual Scanning Techniques – Rotorcraft*
• Human Factors General Guidance Document*
• Reduced Crew Operations
• Control Automation and Information Automation
Thank you