NextGen Air/Ground Integration Research Areas

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NextGen Air/Ground Integration Research Areas

Area	Requirement Number	Requirement Title
Procedures	A12B.HFNG.2	Human Factors Guidelines for Advanced Instrument Procedure Design and Use
	A12B.HFNG.4	Flight deck systems: flightcrew interfaces, installation, integration and operations
Training	A12B.HFNG.3	Procedures, Tasks, Skills and Training for NextGen Air Carrier Pilots and Dispatchers
	A12B.HFNG.6	Human Error and Complex Systems
Flightcrew Interfaces	A12B.HFNG.3	Procedures, Tasks, Skills and Training for NextGen Air Carrier Pilots and Dispatchers
	A12B.HFNG.4	Flight deck systems: flightcrew interfaces, installation, integration and operations
Advanced Controls	A12B.HFNG.4	Flight deck systems: flightcrew interfaces, installation, integration and operations
	A11E.FCMS.5	Flightcrew Strength and Anthropometric Design Assurance (FSADA)

NextGen Air/Ground Integration Research Areas

Area	Requirement Number	Requirement Title
Advanced Vision	A12B.HFNG.4	Flight deck systems: flightcrew interfaces, installation, integration and operations
	A11H.TAS.5	Helicopter operational safety improvements using advanced vision systems
Data Comm	A12B.HFNG.5	DataComm Human Factors R&D
Human Error	A12B.HFNG.6	Human Error and Complex Systems
Flight Path Management	A12B.HFNG.6	Human Error and Complex Systems
System State	A11E.FCMS.11	Displays and Alerting for Airplane Systems State Awareness
	A11E.FCMS.9	Low Energy Alerting and Awareness Systems
UAS	A12B.UASNG.1	Minimum Detect and Avoid (DAA) Display and Flight Path Information
	A11L.UAS.16	UAS Operational Assessment: Contingency Operations (ENROUTE)

NextGen Air/Ground Integration Research Areas – Procedures

Requirement	Performers	Past	FY 2018	Future	Transition
Flight deck systems: flightcrew interfaces, installation, integration and operations (A12B.HFNG.4)			Human-in-the-Loop Simulation Draft Report for Interval Management/Time Sequencing and Spacing (FY14 01.07.00) Report evaluating the Integration of terminal time based metering concepts with interval management concepts (FY16A 03.04.00)	Strategic Flightcrew Integration Needs in a Time-Based Control Environment, Terminal (FY17 07.00.00) [Complete in FY20] Strategic Flightcrew Integration Needs in a Time-Based Control Environment, En Route (FY18 03.01.00-03.04.00) [Complete in FY20]	Provide input to RTCA SC-186, who is developing the minimum operational performance standards for ADS-B Data-driven recommendations to mitigate en route human factors TBO risks and operational integration issues; Recommendations regarding future time-based ATM/TBO research needs

NextGen Air/Ground Integration Research Areas – Procedures (cont.)

Requirement	Performers	Past	FY 2018	Future	Transition
Human Factors Guidelines for Advanced Instrument Procedure Design and Use (A12B.HFNG.2)	MITRE, Volpe	Report summarizing need for an alternate visual depiction for RNAV/RNP arrival/departure procedures (FY14 03.02.00) [Completed in FY17]	Final report on briefing strips for RNAV/RNP Arrivals and Departures to update AFS charting standards (FY16B 02.01.00)		Order 8260.19G, Flight Procedures and Airspace Order 8260.46E, Departure Procedure Program Order 8260.58A, US Standard for PBN Instrument Procedure Design AC 90-113A, Flight Procedures (IFPs) AC 90-112A, Development and Submission of Special Instrument Procedures to the FAA AC 90-110A, Instrument Flight Procedure Service Provider Authorization Guidance for Required Navigation Performance Authorization Required Procedures

NextGen Air/Ground Integration Research Areas – Procedures (cont.)

Requirement	Performers	Past	FY 2018	Future	Transition
Human Factors Guidelines for Advanced Instrument Procedure Design and Use (A12B.HFNG.2)	MITRE, Volpe	Report on human factors issues for instrument procedures complexity (FY13 03.11.00) [Completed in FY16]		NextGen HF Recommendations to Address the Impact of NAS Complexity Factors on Flightcrew Compliance with NextGen Terminal Procedures (FY17 12.00.00) [Complete in FY20]	This research will identify: 1) Leading causal factors of FD PBN procedure non-compliance issues in transition and terminal airspace, and 2) data-driven recommendations to mitigate those causal factors

NextGen Air/Ground Integration Research Areas – Training

Requirement	Performers	Past	FY 2018	Future	Transition
Procedures, Tasks, Skills and Training for NextGen Air Carrier Pilots and Dispatchers (A12B.HFNG.3)	CAMI, NASA, University of Michigan		Report recommending training and checking requirements, annotated with the results of the training simulations and small group tryout activities. (FY16A 02.01.00)		14 CFR Part 121, Subparts N, O & Y, Air Carrier Certification AC 120-54, Advanced Qualification Program AC 120-90, Line Operations Safety Audits AC 120-51, Crew Resource Management Training
Procedures, Tasks, Skills and Training for NextGen Air Carrier Pilots and Dispatchers (A12B.HFNG.3)				Report that Examines Pilot Training Using a Problem Solving and Decision-Making Approach (FY16A 02.02.00) [Complete in FY19]	14 CFR Parts 65, Certification: Airmen Other than Flightcrew Members 14 CFR Parts 119, Certification: Air Carriers and Commercial Operators 14 CFR Parts 121, Air Carrier Certification 14 CFR Parts 135, Air Carrier and Operator Certification 14 CFR Parts 142, Training Centers FAA Order 8900.1, Flight Standards Information Systems (FSIMS)

NextGen Air/Ground Integration Research Areas – Training (cont.)

Requirement	Performers	Past	FY 2018	Future	Transition
Human Error and Complex Systems (A12B.HFNG.6)	CAMI, NASA, University of Michigan		Cognitive Skill Degradation Mitigation Study and Report (FY16A 01.02.00)		The results of this research will contribute to the development of human factors criteria for Flight Standards inspectors when evaluating air carrier training programs to ensure conformance with FAA regulatory and guidance material. 14 CFR Part 65, Certification: Airmen Other than Flightcrew Members 14 CFR Part 119, Certification: Air Carriers and Commercial Operators 14 CFR Part 121, Advanced Qualification Program 14 CFR Part 135, Air Carrier and Operator Certification 14 CFR Part 142, Training Centers FAA Order 8900.1, Flight Standards Information Systems (FSIMS)

NextGen Air/Ground Integration Research Areas – Flightcrew Interfaces

Requirement	Performers	Past	FY 2018	Future	Transition
Flight deck systems: flightcrew interfaces, installation, integration and operations (A12B.HFNG.4)	CAMI, En Route Computer Solutions, Florida Institute of Technology, University of Michigan, Volpe		Report identifying features that contribute to display compellingness and potential mitigations (FY16A 03.03.00)		AC 120-76C, Guidelines for the Certification, Airworthiness, and Operational Use of Electronic Flight Bags Order 8900.1, Flight Standards Information Systems (FSIMS) EFB/AMM Job Aid
Procedures, Tasks, Skills and Training for NextGen Air Carrier Pilots and Dispatchers (A12B.HFNG.3)		System Complexity Report (FY14 01.04.00) [Complete in FY16]		Final Report on Display Complexity: Definitions, Empirical Findings, and Recommendations for training and design (FY16B 01.01.00) [Complete in FY19]	This research will be used to determine if a new Advisory Circular is required
Flight deck systems: flightcrew interfaces, installation, integration and operations (A12B.HFNG.4)			Report on information integrity, reliability, and security human factors considerations - literature review of cyber security documentation that relates to operations on the flight deck (FY14 02.05.00)	Final report on information integrity, reliability, and security human factors considerations – conduct HITL and complete final report (FY16B 03.05.00) [Complete in FY19]	Support the development of new guidance on information integrity, reliability, and security on the flight deck

NextGen Air/Ground Integration Research Areas – Flightcrew Interfaces (cont.)

Requirement	Performers	Past	FY 2018	Future	Transition
Flight deck systems: flightcrew interfaces, installation, integration and operations (A12B.HFNG.4)	CAMI, En Route Computer Solutions, Florida Institute of Technology, University of Michigan, Volpe		Report on HF Considerations for Electronic Data-Driven Charts (FY16A 03.01.00)	Final report on HF Considerations for Electronic Data-Driven Charts to aid in developing a standard means of compliance for approving DDC applications (FY16B 03.04.00) [Complete in FY20]	Update regulatory and guidance material on the presentation of electronic charting information Update to RTCA DO-257A
Flight deck systems: flightcrew interfaces, installation, integration and operations (A12B.HFNG.4)			Final Report on Electronic Flight Bags Task Management Research (FY16B 01.02.00)		Identify if any training recommendations are needed—this would feed into Flight Standards Information Systems (FSIMS) or EFB AC. AIR would use the information to update guidance relative to shared displays.

NextGen Air/Ground Integration Research Areas – Advanced Controls

Requirement	Performers	Past	FY 2018	Future	Transition
Flight deck systems: flightcrew interfaces, installation, integration and operations (A12B.HFNG.4)	CAMI, Honeywell	Eye Gaze Control Technology Report (FY14 02.12.00) [Completed in FY16]	Report on human factors considerations for advanced flight deck controls (Touch) (FY14 02.04.00)	Report with recommendations for the design and evaluation of voice controls (FY16A 03.02.00) [Complete in FY19] Final report on human factors considerations for displays controlled by touch and/or gaze and those that provide haptic feedback to update the Controls Advisory Circular based on new interfaces. (FY16B 03.02.00) [Complete in FY19] HF Guidance for the Design & Evaluation of Multi-Modal Aircraft/Flight Deck Controls (FY18 01.04.00-01.06.00) [Complete in FY20] Complete analysis and report for Advanced Control Systems (FY19 Budget Narrative) Report with guidance on compliance with the human factors related regulations which will be used by AVS to update regulatory and guidance material (FY19 Budget Narrative)	AC 20-175, Controls for Flight Deck Systems
Flightcrew Strength and Anthropometric Design Assurance (FSADA) (A11E.FCMS.5)			Draft report providing recommendations on updating CFR Part 25.777 (anthropometric rule) on flight control forces, human strength and size (FY16A 03.08.00)	Final report providing recommendations on updating CFR Part 25.777 (anthropometric rule) on flight control forces, human strength and size to update standards for small, transport, and helicopter aircraft (FY16B 03.01.00) [Complete in FY19]	14 CFR 25.777, Cockpit Controls

NextGen Air/Ground Integration Research Areas – Advanced Vision

Requirement	Performers	Past	FY 2018	Future	Transition
Flight deck systems: flightcrew interfaces, installation, integration and operations (A12B.HFNG.4)	CAMI, MITRE, Volpe	Report on LVO/SMGCS supporting technologies and symbology (FY13 03.03.00) [Completed in FY16] Evaluation of LVO SMGCS using EFVS Without Airport Infrastructure (Taxiways) (FY14 02.01.00) [Completed in FY16] Report of human factors research on EFVS for operational credit to 300 ft. RVR (FY13 03.04.00) [Completed in FY16]	Technical report documenting effectiveness of EFVS for effective landing and taxiing (LVO/SMGCS) in low visibility environments with minimal or no airport infrastructure (FY16A 03.07.00) Final Report on Research using EFVS during LVO/SMGCS Taxi (narrow body aircraft) at airports with little or no infrastructure to determine if LVO can be extended to more airports (FY16B 03.09.00) Report on airport infrastructure database for EFVS to support the use of EFVS for operational credit (FY16B 03.08.00)	HF Requirements for the Use of EFVS During Takeoff at Airports with Reduced and/or Degraded NAS Infrastructure (FY17 02.00.00) [Complete in FY20]	14 CFR 91.176 (a) – EFVS Operations Support the use of EFVS for operational credit at airports where aircraft would not be able to land otherwise due to low visibility conditions

NextGen Air/Ground Integration Research Areas – Advanced Vision (cont.)

Requirement	Performers	Past	FY 2018	Future	Transition
Flight deck systems: flightcrew interfaces, installation, integration and operations (A12B.HFNG.4)	CAMI, MITRE, Volpe	Combined Vision Systems - An Industry/Product review of CVS systems (FY14 02.07.00, 02.08.00, 02.09.00) [Completed in FY16]		Final Report for Addressing Research Gaps for CVS (FY16B 03.07.00) [Complete in FY19]	Develop operational criteria, evaluation tools and job aids, means of compliance documents, operational guidance for applicants, inspector guidance material for approving CVS operations, authorizations for conducting CVS operations, and training, recent flight experience, and proficiency requirements.
Flight deck systems: flightcrew interfaces, installation, integration and operations (A12B.HFNG.4)			Report comparing synthetic vision in HMD with HUD for 100 ft. and 150 ft. DH to evaluate minimum for both general aviation, Part 121, and 135 (FY14 02.11.00) Test script detailing simulation scenario for SVGS HUD and SVGS HDD with 150-ft DH /1200 RVR and 1400 RVR at selected airports (FY16A 03.06.00)	Human Factors Recommendations for Conducting Low Visibility Flight Operations in Transport Category Aircraft Using SVGS Information on HDDs & HUDs (FY17 01.00.00) [Complete in FY19]	Develop operational standards and approval criteria for specific SVGS operations (e.g., SVGS at 150-ft DH / 1200 RVR and 1400 RVR). Results will also inform as to minimum training, recent flight experience, and proficiency requirements for SVS on SA CAT I approaches.

NextGen Air/Ground Integration Research Areas – Advanced Vision (cont.)

Requirement	Performers	Past	FY 2018	Future	Transition
Helicopter operational safety improvements using advanced vision systems (A11H.TAS.5)	CAMI, MITRE, Volpe, WJHTC			Human Factors Examination of Heads-Up/Head-Worn Display Technologies and Concepts for Enhanced Helicopter Vision Systems (FY17 03.00.00) [Complete in FY19] HF Examination of HWD/HMD Prototypes & Sensor Technologies for Rotorcraft Advanced Vision Systems (FY18 01.01.00-01.03.00) [Complete in FY20]	AC 90-106A, Enhanced Flight Vision Systems AC 20-167A, Airworthiness Approval of EVS, SVS, CVS, and EFVS Equipment AC 90-106H, Unanticipated Right Yaw in Helicopters 14 CFR 91.175, Takeoff and Landing Under IFR FAA Order 8260.42B, Standard for Helicopter Area Navigation (RNAV)

NextGen Air/Ground Integration Research Areas – Data Comm

Requirement	Performers	Past	FY 2018	Future	Transition
DataComm Human Factors R&D (A12B.HFNG.5)	Volpe	Report on Loss of Controller-Pilot Voice Communications in Domestic En Route Airspace (FY14 02.06.00) [Completed in FY16] Report on data communications SC-214 message set human factors considerations for Segment 2 and beyond (FY13 03.06.00) [Completed in FY16]			AC 90-117, Data Link Communications
DataComm Human Factors R&D (A12B.HFNG.5)				Human Factors Mitigations to Address Emerging & Strategic Risks – Oceanic Conditional Clearances and Height Deviations (FY17 04.00.00) [Completed in FY19]	This research is expected to prevent current issues from adversely affecting concepts such as Dynamic Required Navigation Performance (DRNP), 4DT, & precise metering, which will rely on data link to transmit increasingly complex clearances.

NextGen Air/Ground Integration Research Areas – Data Comm (cont.)

Requirement	Performers	Past	FY 2018	Future	Transition
DataComm Human Factors R&D (A12B.HFNG.5)	Volpe			Human Error Prevention and Mitigation Strategies for TBO Concepts that May Rely on Defining Waypoints (Lat./Long.) in ½ Degrees (FY17 05.00.00) [Complete in FY19]	This project will identify the benefits, limitations, & HF implications of alternative ways that flightcrews may respond to aircraft display and FMS ½ degree waypoint limitations (e.g. non-standard use of rounding); Gross navigation errors (GNEs) attributed to using ½ degree waypoints; and HF design, error prevention, and mitigation strategies

NextGen Air/Ground Integration Research Areas – Human Error

Requirement	Performers	Past	FY 2018	Future	Transition
Human Error and Complex Systems (A12B.HFNG.6)	CAMI, MITRE, NASA, University of Central Florida, Volpe		Literature review and research report on Decision Making for unexpected events (FY16A 01.04.00)	Human Factors Gap Analysis of Far-Term NAS Conditions and Flightcrew Procedure Vulnerabilities – Unexpected Events (FY17 09.00.00) [Complete in FY20]	14 CFR Part 65, Certification: Airmen Other than Flightcrew Members 14 CFR Part 119, Certification: Air Carriers and Commercial Operators 14 CFR Part 121, Advanced Qualification Program 14 CFR Part 135, Air Carrier and Operator Certification 14 CFR Part 142, Training Centers FAA Order 8900.1, Flight Standards Information Systems (FSIMS)
Human Error and Complex Systems (A12B.HFNG.6)				FAA System Safety Guidance: Development of Feasible Human Error Assessment Method Alternatives (FY17 11.00.00) [Complete in FY20]	This research will result in a set of repeatable human error assessment methods aimed at clarifying and evaluating applicant compliance with 25.1302

NextGen Air/Ground Integration Research Areas – Human Error (cont.)

Requirement	Performers	Past	FY 2018	Future	Transition
ANG Requirement	CAMI, MITRE, NASA, University of Central Florida, Volpe		Analysis of HF gaps related to NextGen air ground integration in mixed environments (FY16B 01.05.00)		Descriptions of the near-term, medium-term, and further term operational capabilities used by pilots, controllers, traffic flow managers, and front line managers for arrival, departure and surface operations
ANG Requirement				Far-Term Flight Deck Human Factors Strategic Plan (FY17 13.00.00)	Research will drive the identification of strategic human factors research needs, increase FD program coordination with pre implementation programs, and support the development of future NextGen flight deck PLAs

NextGen Air/Ground Integration Research Areas – Flight Path Management

Requirement	Performers	Past	FY 2018	Future	Transition
Human Error and Complex Systems (A12B.HFNG.6)	MITRE		Report on Flight Path Management – Manual Flight Operations (FY14 01.05.00)		Support the development of SOPs for flight-crew interaction
Human Error and Complex Systems (A12B.HFNG.6)			Standard Operating Procedures: Flight Path Management in Air Carrier Operations Final Report (FY14 01.06.00)	Human Factors Recommendations to Address Flightpath Management System Dependencies (FY18 03.05.00-03.07.00) [Complete in FY20]	New Flightpath Management AC 14 CFR Part 121, Subparts N, 0, Y – Advanced Qualification Program

NextGen Air/Ground Integration Research Areas – System State

Requirement	Performers	Past	FY 2018	Future	Transition
Displays and Alerting for Airplane Systems State Awareness (A11E.FCMS.11)	NASA, AFS-440		Final report on Displays and Alerting for Airplane Systems State Awareness (FY16A 01.01.00)		Support the development of specific criteria for evaluating such systems for intended function under 25.1301 and 25.1302 and for failure modes under 25.1309.
Low Energy Alerting and Awareness Systems (A11E.FCMS.9)			Human Factors Methodology and Test Plan to Assess & Select Aircraft Energy State Awareness Prototypes for Further FAA Evaluation (FY16A 03.09.00)	Human Factors for Low Energy State Awareness System Alternatives (FY17 06.00.00) [Complete in FY19] Evaluation of Flight Deck System Alternatives that Aim to Mitigate Aircraft Energy State Awareness Risks (FY18 02.01.00-02.03.00) [Complete in FY21]	Support the development of display and alerting criteria for the evaluation of energy state awareness technologies for intended function under 25.1301, 25.1302, 25.1322, and for failure modes under 25.1309. These criteria would address novel aspects of emerging technologies that current FAA guidance does not cover.

NextGen Air/Ground Integration Research Areas – UAS

Requirement	Performers	Past	FY 2018	Future	Transition
Minimum Detect and Avoid (DAA) Display and Flight Path Information (A12B.UASNG.1)	CAMI, WJHTC	Report documenting: 1) results of literature review and baseline of current procedures (e.g., lost link); 2) SME interviews (ATC and UAS pilots); 3) candidate procedures and technologies; 4) test plan for evaluating candidate procedures/technologies (FY16A 04.01.00) [Completed in FY17]		Final Report recommending standard procedures and possible technological mitigations for UAS during en route contingency operations to mitigate the workload and safety impacts (FY16B 04.01.00) [Complete in FY19]	This research will identify potential risks to the safety of the NAS based on UAS contingency operations, which will inform the standards development.
UAS Operational Assessment: Contingency Operations (ENROUTE) (A11L.UAS.16)		Lab Study: Detect and Avoid Display requirements – 1) Generic Control Station and 2) Manned Aircraft (FY14 04.03.00) [Completed in FY17]		Report documenting: 1) results of literature review of relevant to UAS CDTI/Alerting; 2) experimental method and rationale; 3) results from HITL; 4) Proposed recommendations and requirements for UAS CDTIs in support of self separation systems, including RTCA Detect and Avoid System MOPS (FY16A 04.02.00) [Complete in FY19]	Support development of system requirements for the pilot interface for UAS control stations. These requirements will support the RTCA SC-228 Minimum Operational Performance Standards.