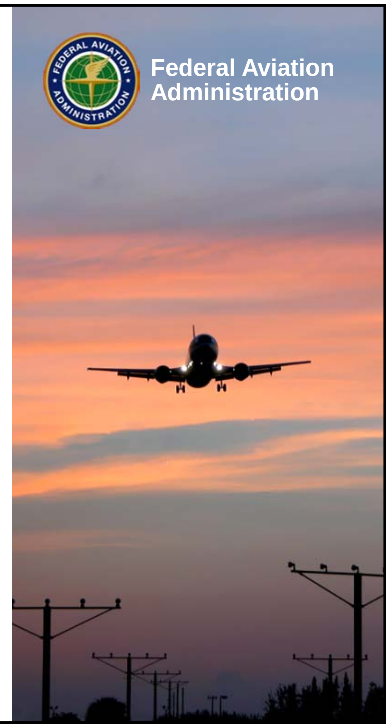
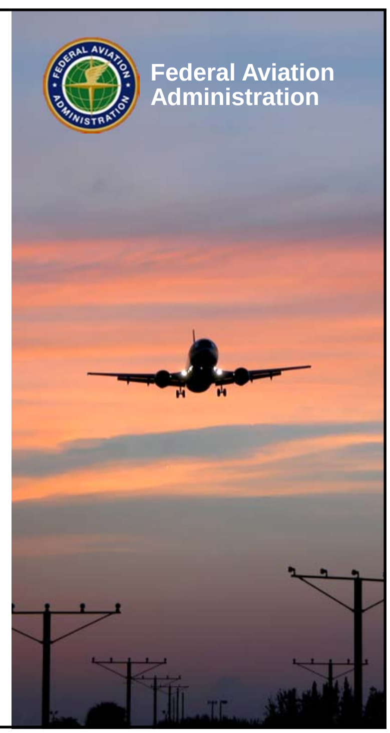
Summer/Fall Human Factors REDAC Subcommittee Sep 16-18th 2014

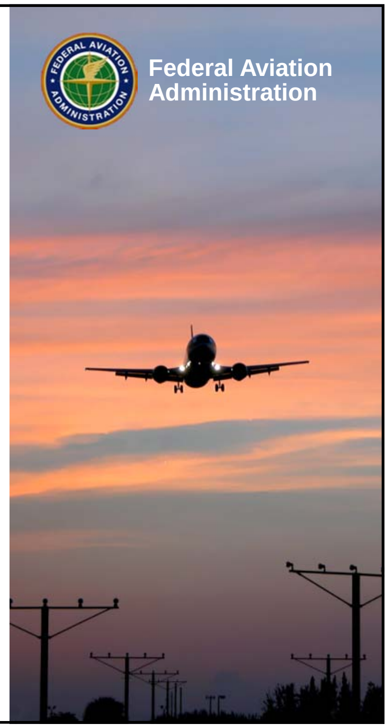


Welcome and Opening Remarks

Jack Blackhurst Chair HF REDAC Subcommittee

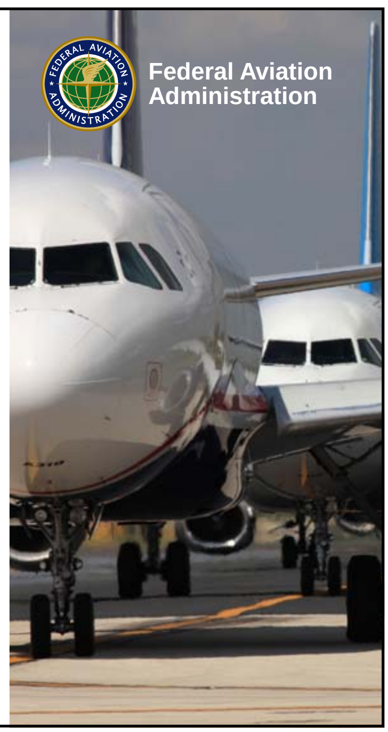


FAA DFO Opening Items



Jason Demagalski
Human Factors Manager
ATO Safety and Technical Training
AJI-1200

Introductions



Developing Strategic R&D Plan for the FAA

Presented by: Cathy Bigelow, Research and Development Management Division, ANG-E4

Date: Summer 2014

Background

- FAA needs to think more strategically about the future
- Opportune time to think ahead more and develop plan that could support Administrator's Strategic Initiatives
- Developing more effective R&D portfolio may lead to increase in value of our R&D budget

New Tasking for REDAC and Subcommittees for Fall meetings

- **Asking subcommittees to look at broader, longer-term perspective, 10+ years**
- **Provide FAA advice to support development of R&D portfolio that is**
  - Strategic
  - Responsive
  - Addressing future R&D needs

Approach

- **At Summer/Fall meeting, develop two lists**
  - Emerging issues, things FAA should get ahead of
  - Future opportunities, areas where FAA could benefit
- **Refine the lists to the top 4-5 issues**
- **Explain why it is important for FAA to consider each one**

Output

- **Subcommittee produce a written report and brief their results at Fall REDAC**
  - Report their top 4-5 emerging issues and future opportunities
  - Describe why each one should be consider by the FAA

REDAC and the Subcommittee: Roles and Responsibilities

Presented by: Cathy Bigelow, ANG-E4

Date: Summer 2014

Basis for REDAC

- **49 USC § 44508 - Research advisory committee**
- **Established a research advisory committee in the FAA, which shall**
  A. Provide advice and recommendations to the Administrator of the Federal Aviation Administration about needs, objectives, plans, approaches, content, and accomplishments of the aviation research program;
  B. Assist in ensuring that the research is coordinated with similar research being conducted outside the Administration;

Basis for REDAC, cont'd

C. Review the operations of the regional centers of air transportation excellence; and
D. Annually review the allocation made by the Administrator of the amounts authorized among the major categories of research and development activities carried out by the Administration and provide advice and recommendations to the Administrator on whether such allocation is appropriate to meet the needs and objectives identified under subparagraph (A).

Basis for REDAC, cont'd

- **The Administrator may establish subordinate committees to provide advice on specific areas of research.**
- **FAA established the following:**
  - Aircraft Safety
  - Airports
  - Environment and Energy
  - Human Factors
  - NAS Operations

Operation of REDAC and Subcommittees

- **Two sets of meetings (full committee and subcommittees) held annually**
- **First meeting in summer/fall timeframe**
  - Purpose is to provide strategic guidance to the FAA to develop the upcoming FY+3 research portfolio
  - FAA informs the subcommittee so they can provide the strategic guidance
    - Review of past year activities and accomplishments
    - Selected deep dives
    - Proposed FY+3 focal areas

Operation of REDAC and Subcommittees

- **Two sets of meetings (full committee and subcommittees) held annually**
- **Second meeting in winter/spring timeframe**
  – Purpose is to review the R&D portfolio developed based on their strategic guidance from fall meeting
  – FAA briefs the proposed R&D FY+2 portfolio
  – Subcommittee provides recommendations on the proposed portfolio

Purpose of Subcommittees

- **Formed by FAA to assist REDAC**
  – Provide advice to REDAC on specific areas of research
  – Assist in identifying overarching issues that could affect R&D portfolio
  – Help the FAA establish the best possible R&D portfolio within the constraints of FAA's available resources

REDAC and the Subcommittee: Writing Good Recommendations

Presented by: Cathy Bigelow, ANG-E4

Date: Summer 2014

Subcommittee Recommendations

- Key outputs of the REDAC to fulfill their R&R
- Needed to help FAA ensure best possible R&D portfolio within the constraints of FAA's available resources
- Best recommendations are clear and actionable

Good Recommendation Example

- The SAS recommends that the FAA collate the results of its Unleaded Fuels program and that the FAA transfer these results to the aviation and petroleum industry for the private sector's use in any additional efforts aimed at developing alternatives to 100LL aviation gas and modifications to piston engines to accept lower octane fuels.

Opposite of Good Example

- The Subcommittee applauds the CAASD NextCAS IRAD effort, but modifying TCAS or creating a new collision avoidance system to achieve compatibility with NextGen would be a particularly complex problem, and that work would need to be based on a clear understanding of changed requirements and be a mainstream activity within CAASD's FAA-funded work program, to be done in concert with existing TCAS experts at FAA, MIT/LL and other organizations.

Current Two Part Format

- **Finding**
  - – Provides some context for the recommendation
  - – Background so reader can better understand recommendation
  - – FAA response does not address the Finding or any information contained in the Finding
- **Recommendation**
  - – Should giving advice to the FAA to do something
  - – Should be clear to the reader what that something is
  - – Assume reader is non-technical

REDAC Human Factors Subcommittee

R&D Budget Status

Mike Gallivan

September 16, 2014

R,E&D FY 14 Budget

- **R,E&D FY 14 Budget Request - $166.0M**
- **FY 14 Appropriation $158.792**
  - Signed Jan. 17, 2014
  - Safety - $87.244
  - Improve Efficiency - $24.329
  - Reduce Environmental Impacts - $41.579
  - Mission Support - $5.640

FY 15 R,E&D Request

Program	FY 2015 Request ($000)	FY 15 House Mark ($000)	FY 15 Request/FY 15 House +/-	FY 2015 Senate Mark ($000)	FY 15 Request/FY15 Senate +/-	2015 Conference Mark ($000)	FY 15 Request/FY15 Draft Conference +/-
Fire Research and Safety	6,929	6,929	-	6,000	(929)		(6,929)
Propulsion and Fuel Systems	2,413	2,413	-	2,000	(413)		(2,413)
Advanced Materials/Structural Safety	2,909	2,909	-	2,909	-		(2,909)
Aircraft Icing /Digital System Safety	5,889	5,889	-	5,500	(389)		(5,889)
Continued Airworthiness	9,619	9,619	-	9,619	-		(9,619)
Aircraft Catastrophic Failure Prevention Research	1,567	1,567	-	1,500	(67)		(1,567)
Flightdeck/Maintenance/System Integration Human Factors	9,897	6,000	(3,897)	8,500	(1,397)		(9,897)
System Safety Management	7,970	7,970	-	7,970	-		(7,970)
Air Traffic Control/Technical Operations Human Factors	5,898	5,898	-	5,400	(498)		(5,898)
Aeromedical Research	8,919	8,919	-	8,300	(619)		(8,919)
Weather Program	17,800	15,897	(1,903)	15,847	(1,953)		(17,800)
Unmanned Aircraft Systems Research	8,974	10,974	2,000	12,974	4,000		(8,974)
NextGen - Alternative Fuels for General Aviation	5,700	6,000	300	6,000	300		(5,700)
NextGen - Advanced Systems and Software Valida	-		-		-		-
Joint Planning and Development Office	-		-		-		-
NextGen - Wake Turbulence	8,541	8,541	-	8,541	-		(8,541)
NextGen - Air Ground Integration Human Factors	9,697	9,697	-	9,697	-		(9,697)
NextGen - Self Separation Human Factors			-		-		-
NextGen - Weather Technology in the Cockpit	4,048	4,048	-	4,048	-		(4,048)
Environment and Energy	14,921	14,921	-	14,921	-		(14,921)
NextGen - Environmental Research - Aircraft Technologies, Fuels, and Metrics	19,514	23,014	3,500	21,514	2,000		(19,514)
System Planning and Resource Management	2,135	2,135	-	2,100	(35)		(2,135)
William J. Hughes Technical Center Laboratory Facility	3,410	3,410	-	3,410	-		(3,410)
TOTAL	156,750	156,750	-	156,750	-	-	(156,750)

FY 2015 House Language

- ***Unmanned aerial systems (UAS) research*.—The FAA has established six UAS test sites, which are expected to provide valuable information for developing the regulatory framework for UAS integration. However, the FAA will need to develop a comprehensive plan to identify research priorities, including how data from test site operations will be gathered, analyzed, and used. The Committee recognizes these challenges and provides $10,974,000 for UAS research, which is $2,000,000 above the budget request. These additional funds are provided to help meet the FAA's UAS research goals of system safety and data gathering, aircraft certification, command and control link challenges, control station layout and certification, sense and avoid, and environmental impacts.**

- ***Unmanned aerial systems data sharing*.—Issues with defining the safety data the FAA needs from the Department of Defense (DoD) remain a barrier in its efforts to develop safety standards. The Committee directs the FAA to develop a plan to resolve these data-sharing issues with the DoD and to identify what data is needed, why it is needed, and how it will be used.**

FY 2015 House Language

- ***NextGen—Alternative fuels for general aviation.*—The Committee provides $6,000,000 for alternative fuels research for general aviation, which is $300,000 above the budget request. During the complex transition of the general aviation piston fleet to an unleaded fuel, an increase in funding above last year is merited to move from research to a phase focused on coordinating and facilitating the fleet-wide evaluation, certification and deployment of an unleaded fuel and to help overcome any market issues that prevent it from moving forward. The Committee recognizes this is a multi-year effort and looks forward to updates on the continued progress on this initiative as it effectively balances environmental improvement with aviation safety, technical challenges, and economic impact.**

- ***NextGen environmental research—aircraft technologies, fuels and metrics.*—The Committee provides $23,014,000 for the FAA's NextGen environmental research aircraft technologies, fuels and metrics program, which is $3,500,000 above the budget request. Over the last few years, the Committee has provided additional resources for the FAA's environmental research program in an effort to expedite the development of viable alternative fuels that can be used in aircraft. Recognizing that fuel costs continue to consume the largest portion of airline operating budgets and in an effort to reduce the aviation sector's emissions footprint, the Committee provides additional resources to continue the research, development and testing of alternative fuels. Now that the United States Air Force Research Laboratory is no longer able to support alternative fuels testing, it is expected that the FAA will use some of these resources to produce fit for purpose chemical-analytical, fuel-property and material compatibility testing for many of the new chemical processes that produce alternative jet fuel. In addition, the Committee provides resources to continue the FAA's Continuous, Lower Energy Emission, and Noise Program.**

FY 2015 Senate Language

- ***Unmanned Aerial Systems Research—Center of Excellence***.—The Committee recommendation includes $12,974,000 for unmanned aircraft systems research, an increase of $4,000,000 above the budget request and $4,330,000 above the fiscal year 2014 enacted level. The administration's request includes $1,000,000 for a new center of excellence on unmanned aircraft systems [UAS], but given its importance, the Committee directs the FAA to dedicate the full funding increase to the center, which would receive a total of $5,000,000 under the Committee recommendation.

  The Committee is pleased with the Department's progress in establishing a UAS center of excellence to address a host of research challenges associated with integration of UAS into the national airspace. The formation of a UAS center of excellence is essential to meet the requirements enacted as part of the FAA Modernization and Reform Act of 2012. The Committee directs that when the FAA selects candidates for the center, the agency shall consider a geographically and climatically diverse team of academic institutions with proven track records in unmanned aircraft systems engineering and certification, airspace integration, aviation modeling and simulation, UAS policy, UAS training and pilot certification, and collaboration with partners in the UAS industry. As cyber security is of paramount importance to safe UAS operations, the FAA should pay particular attention to teams with National Security Administration and Department of Homeland Security cyber education, research and operations certifications. Candidates should be well integrated with the FAA UAS test sites, with emphasis on teams that have the capacity to research beyond line of sight small UAS operations. Candidates should have close relations with disaster response agencies, the Department of Homeland Security and the Department of Agriculture in order to facilitate research into key UAS mission areas, such as environmental monitoring, weather and hydrologic prediction, precision agriculture, law enforcement, disaster response and oil transportation systems monitoring.

FY 2015 Senate Language

- ***Unmanned Aerial Systems Research—Strategic Plan for Research***.— In order to support the integration of UAS into the national airspace, the FAA Modernization and Reform Act of 2012 required the FAA to work with other Federal agencies and representatives from the aviation industry on a comprehensive plan that would include a timeline for the necessary research and regulations. The law also required the FAA to write its own roadmap for integrating UAS into the national airspace, to update this roadmap each year, and to designate six test sites that will collect data and conduct research.

  Although the FAA has completed each of these requirements, the Committee remains concerned that the FAA has not yet shown details on how its research will directly lead to better UAS integration. The first edition of FAA's roadmap, entitled the ''Integration of Civil Unmanned Aircraft Systems [UAS] in the National Airspace System [NAS] Roadmap,'' contains no discussion on what specific questions need to be answered before integrating UAS into the national airspace, what research projects would answer those questions, or which data are necessary to support that research. Importantly, the roadmap does not provide a strategy on how the test sites will participate in these efforts.

  The Committee understands that the new UAS center of excellence can perform a vital role in coordinating with each of the test sites and filling research gaps for the FAA. However, the Committee believes that the FAA must direct the strategy itself. The Committee therefore directs the FAA to include a strategic plan on research efforts as part of its next edition of the roadmap. The roadmap shall include a section that discusses the specific research needs to safely integrate UAS into the NAS, including an examination of the research goals that the FAA must reach in order to successfully and safety advance NAS integration; FAA's strategy to obtain the identified research through partnerships with other Federal agencies, the UAS center of excellence, participants in the UAS and aviation industry, and the UAS test sites; and an evaluation of the ability of the UAS test sites to coordinate with the FAA and its center of excellence, and participate in the FAA's strategy, and help achieve the research goals identified in the roadmap.

FY 2015 Senate Language

- ***Unmanned Aerial Systems Research—Coordination with Other Agencies*.—Both the U.S. Customs and Border Protection [CBP] and the National Aeronautics and Space Administration [NASA] research and develop UAS technologies. The Committee therefore encourages the FAA to leverage these research and development efforts as it integrates UAS into the national airspace. The Committee expects the FAA to use the resources provided for UAS research under the Committee recommendation to collect and evaluate data and information from CBP and NASA UAS projects, and to collaborate with these partners on research efforts necessary to integrate UAS into the national airspace. The Committee also encourages the FAA to study how the Air Force conducts routine UAS operations, including the safe takeoff and landing of multiple platforms in a short period of time, as part of its airspace integration efforts.**

- ***Alternative Fuels for General Aviation*.—The Committee recommendation includes $6,000,000 for research that supports alternative fuels for general aviation. This funding level is $300,000 above the budget request and equal to the fiscal year 2014 enacted level**

FY 2015 Senate Language

- ***NextGen—Environmental Research—Aircraft Technologies, Fuels, and Metrics*.—The Committee recommendation includes $21,514,000 for NextGen environmental research. This funding level is $2,000,000 above the budget request and $5,465,000 below the fiscal year 2014 enacted level. The Committee recommendation provides funding above the budget request to support the Continuous Low Energy, Emissions and Noise [CLEEN] program. Under the CLEEN program, the FAA partners with the aviation industry to develop and test aircraft technologies that reduce noise, emissions and fuel burn. The Committee recommendation also includes an additional $3,000,000 above the budget request for the CLEEN program in the appropriation for FAA's facilities and equipment. In total, the Committee recommendation provides $21,200,000 for the CLEEN program, an increase of $5,000,000 above the budget request.**

- ***National Center for Advanced Materials Performance*.—The FAA has effectively partnered with the National Center for Advanced Materials Performance [NCAMP] on mutually beneficial initiatives that reduce Federal spending and improve FAA standardization for aviation oversight. The Committee believes that NCAMP will similarly contribute to future initiatives within the National Network for Manufacturing Innovation [NNMI] enterprise, and as such, the Committee encourages the FAA to recommend adding NCAMP to the NNMI framework.**

FAA FY 2015 Budget Request

Account	FY 15 Request	FY 15 House Mark	Difference (+/-)	Fy 15 Senate Mark	Difference (+/-)
Operations	$ 9,750,000,000	$ 9,750,000,000	$ -	$ 9,750,000,000	$ -
Facilites & Equipment	$ 2,603,700,000	$ 2,600,000,000	$ (3,700,000)	$ 2,473,700,000	$ (130,000,000)
Research, Engineering & Development	$ 156,750,000	$ 156,750,000	$ -	$ 156,750,000	$ -
Airports	$ 2,770,000,000	$ 3,350,000,000	$ 580,000,000	$ 3,480,000,000	$ 710,000,000
Total	$ 15,280,450,000	$ 15,856,750,000	$ 576,300,000	$ 15,860,450,000	$ 580,000,000

Federal Aviation Administration

FY 15 R,E&D Request

	FEDERAL AVIATION ADMINISTRATION	FY 2014 Enacted	FY 2015 Pres. Bud. Request
A. Research, Engineering and Development		**158,792**	**156,750**
A11	**Improve Aviation Safety**	**87,244**	**94,484**
a.	Fire Research and Safety	8,000	6,929
b.	Propulsion and Fuel Systems	1,800	2,413
c.	Advanced Materials/Structural Safety	2,600	2,909
d.	Aircraft Icing/Digital System Safety	7,500	5,889
e.	Continued Airworthiness	8,000	9,619
f.	Aircraft Catastrophic Failure Prevention Research	1,500	1,567
g.	Flightdeck/Maintenance/System Integration Human Factc	5,000	9,897
h.	System Safety Management	11,000	7,970
I.	Air Traffic Control/Technical Operations Human Factors	5,000	5,898
j.	Aeromedical Research	7,000	8,919
k.	Weather Program	14,200	17,800
l.	Unmanned Aircraft Systems Research	8,644	8,974
m.	NextGen - Alternative Fuels for General Aviation	6,000	5,700
n	NextGen - Advanced Systems and Software Validation	1,000	-
A12	**Improve Efficiency**	**24,329**	**22,286**
a.	Joint Planning and Development Office	-	-
b.	NextGen - Wake Turbulence	9,000	8,541
c.	NextGen - Air Ground Integration Human Factors	11,329	9,697
d.	NextGen - Self-Separation Human Factors		
e.	NextGen - Weather Technology in the Cockpit	4,000	4,048
A13	**Reduce Environmental Impact**	**41,579**	**34,435**
a.	Environment and Energy	14,600	14,921
b.	NextGen - Environmental Research - Aircraft Technologie	26,979	19,514
A14	**Mission Support**	**5,640**	**5,545**
a.	System Planning and Resource Management	2,200	2,135
b.	William J. Hughes Technical Center Laboratory Facility	3,440	3,410

Federal Aviation Administration

F&E Portfolio FY 15

Program	Appropriation Account	2014 Enacted ($000)	2015 Request ($000)	FY 15 House Mark	FY 15 Senate Mark
NextGen - ATC/Tech Ops Human Factors - Controller Efficiency/Air Ground Integration	F&E	4,722	-		
NextGen - Environment & Energy - Environmental Management Systems and Advanced Noise and Emissions Reduction	F&E	9,443	2,500		
NextGen - New ATM Requirements	F&E	20,775	4,980		
NextGen - Operations Concept Development Validation Modeling	F&E	4,722	-		
NextGen - System Safety Management Transformation	F&E	7,555	5,700		
NextGen - Wake Turbulence Re-categorization	F&E	1,416	-		
NextGen - Operational Assessments	F&E	7,555	-		
NextGen Staffed NextGen Towers (SNT)	F&E	1,889	-		-
Total NextGen Transportation system - System Development		**58,077**	**13,180**	**-**	

FY 15 Congressional Issues

- **House and Senate working from the same base**
  - $1,013,628,000,000 Base
    - $492,000,000,000 Discretionary Funding
- **Debt Ceiling not an issue for FY 15 Budget Request**
- **Sequestration not an issue for FY 15 Budget Request**
- **Election for House and Senate seats**
- **Sequestration may/will be an issue in FY 16**

R,E&D FY 16 Budget Status

- **FY 16 R,E&D OST Submission June 4, 2014**
- **FY 16 R,E&D OMB Submission early Sept. 2014**
- **Scheduled date of FY 16 budget presented to Congress February 2, 2015**

Federal Aviation Administration

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Out Year Targets

- **Targets established February 2014**
  - FY 16 - $160M
  - FY 17 - $164M
  - FY 18 - $167M
  - FY 19 - $171M
  - FY 20 - $175M
- **Expect targets to change**

Federal Aviation Administration

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FAA Reauthorization

- **Current Authorization thru FY 2015**
- **FAA has started work on its proposed reauthorized bill**
  – Will have to go thru OST and OMB

Federal Aviation Administration

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Budget Future

•It is unclear regarding funding levels after FY 15

Federal Aviation Administration

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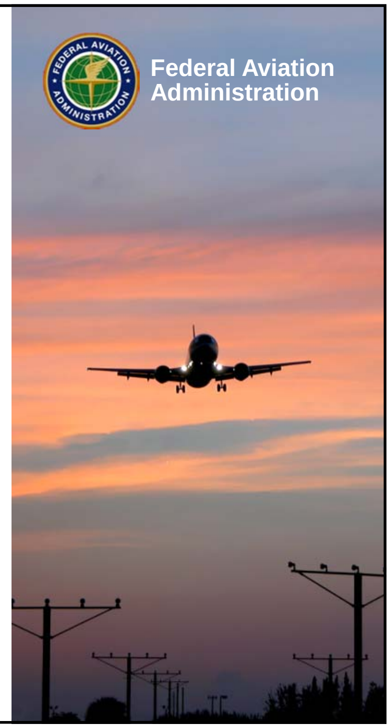
Review of FAA Human Factors Research Processes



Rachel Seely
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Jason Demagalski
Human Factors Manager
ATO Safety and Technical Training
AJI-1200

Key Phases in Budget Process

- Formulation Phase
- Presentation/Justification Phase
- Execution Phase

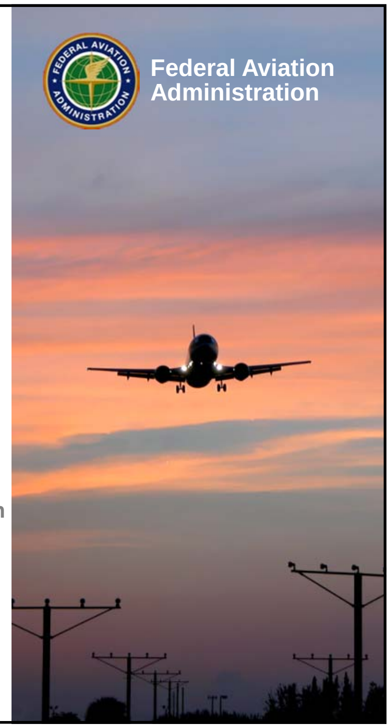
- Phases occur simultaneously within a fiscal year. When the approved operating budget for the current fiscal year is in execution phase (FY15), the proposed budget for the following fiscal year is in the presentation/justification phase (FY 16), and the request for two years out is in the formulation phase (FY17).

Budget Process

- **Purpose of Budgeting Process: To estimate, justify, and obtain/execute the necessary funds to carry out the Agency RE&D Mission.**
- **The Budget Process and its schedule is dependent upon the political climate of the Executive and Legislative Branches of Government.**
- **Two bills are key to budget process: Authorization Bill – which clears the way for money to be spent but does not actually fund a program or agency and Appropriation Bill – which provides an agency the legal authority to incur obligations and provides Dept of Treasury authority to make payments.**

	Formulation Phase Current Yr + 2 *Planning for FY17*	Presentation Phase Current Yr +1 *Presenting FY16*	Execution Phase Current Yr *Spending FY15 funds*
October 2014	Research, Engineering and Development (RE&D) and Facilities and Equipment (F&E) determine priorities for research requirements through varied processes.	FAA RE&D FY16 Budget Estimates Submitted to OMB.	FAA submits RE&D FY15 apportionment request to OMB. FAA receives funds and distributes.
November 2014	The following Lines of Business (LOB)- AVS, ANG, ATO each develop a research portfolio.	OMB Pass Back Received.	RE&D Obligates funds per execution plans; e.g. PLAs, PREPS, PDs.
December 2014	AVS reviews/coordinates safety research portfolio with sponsors and ANG. ATO reviews and coordinates its portfolio among its sponsors.	OMB Appeal Process.	RE&D Obligates funds per execution plans; e.g. PLAs, PREPS, PDs.
January 2015	Portfolios are agreed to among sponsors and organizations	OMB Appeal Process.	RE&D Obligates funds per execution plans; e.g. PLAs, PREPS, PDs.
February 2015	Research Executive Board and REDAC subcommittees review portfolios.	President's Budget Submitted to Congress. NARP Submission to Congress.	First Quarter Review
March 2015	Portfolios are finalized.	Congress Develops Budget Resolution.	RE&D continues to Obligate funds per execution plans; e.g. PLAs, PREPS, PDs.
April 2015	REDAC Board reviews Agency research portfolios.	Congress Passes Budget Resolution.	RE&D continues to Obligate funds per execution plans; e.g. PLAs, PREPS, PDs.
May 2015	JRC approves Agency research portfolios.	House and Senate Budget Mark-Ups.	Second Quarter Review
June 2015	FAA submits combined research budgets from the portfolios to OST.	House Appropriations Bill.	RE&D continues obligating funds per execution plans.
July 2015	OST Reviews FAA submission.	Senate Appropriations Bill.	RE&D continues obligating funds per execution plans.
August 2015	OST Mark is "passed back" to FAA and FAA may appeal.	House/Senate Conference resolves differences between Bills.	Third Quarter Review
September 2015	FAA Budget Estimates submitted to OMB.	Consolidated Bill Passes Congress and President Signs.	**Begin FY15 End of Year Activities**

Human Factors Action Items



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Human Factors in ANG-C1

Paul Fontaine
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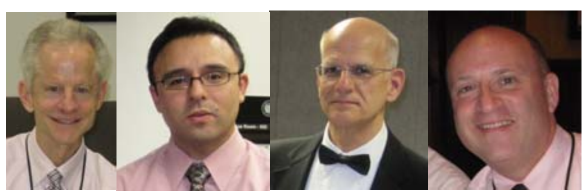
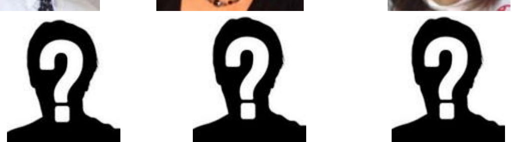
Dr. Paul Krois
Human Factors
Division Manager

Rachel Seely
Acting Branch Manager





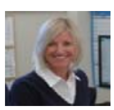
Aviation Research Division

Human Factors Branch - ANG-E25

Dennis L. Filler, Director
William J. Hughes Technical Center
FAA Director of Research

Eric C. Neiderman, Ph.D.
Aviation Research Division,
ANG-E2

Aerospace Human Factors Research Division



Dr. Carla Hackworth AAM-500 Division Manager (Acting)

Dr. Carol Manning AAM-520 Branch Manager

Dr. Katrina Avers AAM-510 Branch Manager (Acting)

Organized into two branches….

- NAS Human Factors Safety Research Branch, AAM-520
- Flight Deck Human Factors Research Branch, AAM-510

Human Factors Action Items

1. **Define the role of human factors**
   a) Within the FAA
   b) Within ANG
2. **Define a lexicon of key human factors terms**
3. **Define and document the "Human Factors Integration Lead" (a.k.a the "Bill Kaliardos job)**
4. **Institutionalization of human factors: better leverage talent, laboratories, and funding within ANG, focusing on ANG-C1 and ANG-E25**

Define the role of human factors – within the FAA

- **FAA Human Factors researchers seek to understand the physical, behavioral, cognitive, and social characteristics of aviation professionals such as pilots, air traffic controllers, technical operations specialists, and aircraft maintenance technicians and the systems that they use**
- **FAA human factors engineers and practitioners apply human factors knowledge to improve safety, efficiency, performance, and reliability of the National Airspace System through focus on human performance of air traffic control and technical operations personnel as impacted by new and modified systems, procedures, and training**
- **FAA human factors specialists working in the Aviation Safety office apply human factors knowledge to develop regulatory guidance for aircraft certification and operational approvals for advanced flight deck technologies, procedures, and training**

Define the role of human factors – within the FAA

- **Goals**
  - To maintain and when possible, improve aviation safety by reducing the impact of human error
  - To increase the efficiency and performance of the NAS by improving the quality of operational decisions and facilitating operational actions
  - To ensure that proposed changes to the NAS address operational needs and achieve required performance levels
  - To increase the utilization of new capabilities
  - To reduce programmatic risks
- **Personnel and Resources**
- **Customers and sponsors**

Federal Aviation Administration 49

Define the role of human factors – within ANG

- **Human Factors personnel work in and for many parts of ANG as FAA employees or contractors but most ANG human factors personnel work in two offices, the Human Factors Research and Engineering Division (ANG-C1), located at FAA Headquarters, and the Human Factors Branch (ANG-E25), and located at the William J. Hughes Technical Center. The offices share five main responsibilities:**
  - To manage FAA human factors research, engineering, and development programs across organizations and domains
  - To conduct human factors research, engineering, and development projects, including human-in-the-loop simulations, field studies, task analyses, rapid prototyping, guidelines and standards, and usability tests
  - To serve as human factors expert consultants to FAA programs, initiatives, working groups, and teams
  - To maintain and develop FAA human factors technical infrastructure, including laboratories, instruments, simulators, data collection equipment, and associated personnel
  - To promote and grow the field of human factors across the nation and the world, especially in the aviation and transportation domains.

Federal Aviation Administration 50

Define a lexicon of key human factors terms

- **Human Factors**
  - Ergonomics
  - Cognitive Ergonomics
  - Human Factors Engineering
  - Human System Integration (HSI)
  - Human-Computer Interaction (HCI)
  - Engineering Psychology
  - Personnel Psychology
  - Usability / User Experience

Define a lexicon of key human factors terms

- **Human-in-the-Loop (HITL) Simulation**
  - Risk Reduction/Issue Identification Simulation
  - Verification/Testing Simulation
  - Validation Simulation
  - Simulation Experiment
  - Training simulation
- **Human-Machine Interface (HMI)**
  - Computer-Human Interface (CHI)
  - User Interface (UI)

Define and document the “Human Factors Integration Lead”

- Key GAO Recommendation - The Secretary of Transportation should direct the FAA Administrator to assign a high priority to filling the vacancy of human factors integration lead and structure that position and the program director of Human Factors Research and Engineering Group (HFREG) position in a manner that provides the authority to ensure that human factors research and development is coordinated, considered, and prioritized in all phases of NextGen development. In response to this, a NextGen Human Factors Integration Lead (HFIL) was appointed in October 2010

Federal Aviation Administration

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Define and document the “Human Factors Integration Lead”

- **HFIL Job Description.**
  1. collecting and analyzing data on human factors research and engineering requirements, synthesis, validation, and interface management
  2. identifying and assessing existing or potential issues, risks, and solutions that involve human factors and human performance in civil aviation operations
  3. working with the operational Service Units, other organizations, and the user community to understand their concerns and ensure that they are addressed in integration issues
  4. presenting concepts, study results, and conclusions in a manner that fosters an atmosphere of collaboration
  5. developing and managing project schedules and budget requests
- **Proposed Role Changes**
  - Research liaison
  - Human Factors matrix support
  - AMS changes
  - Involvement in technical program planning.

Federal Aviation Administration

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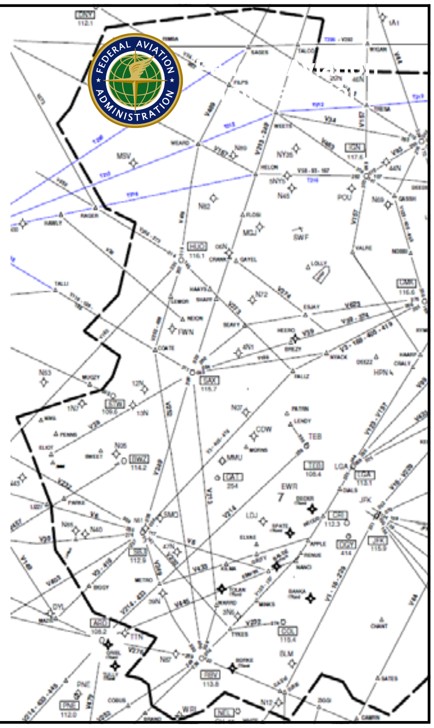
Institutionalization of human factors: better leverage talent, laboratories, and funding within ANG, focusing on ANG-C1 and ANG-E25

- **Human Factors Round Table**
  - To ensure that all human factors projects managed and performed by ANG are high-quality, cost-effective, and impactful
  - To ensure that the knowledge, skills, and expertise of all human factors staff members in ANG-C11, ANG-E25, and AAM-500 are used to their full potential
  - To ensure that FAA human factors laboratories, equipment, and other technical capabilities are maintained, sustained, improved, and used appropriately
  - To ensure consistent processes and messages about human factors across the Agency

Institutionalization of human factors: better leverage talent, laboratories, and funding within ANG, focusing on ANG-C1 and ANG-E25

1. Details, exchanges, and growth
2. Publications and peer review
3. Common websites
4. New positions and hiring
5. Strategic plan alignment
6. Revise FAA Order 9550.8
7. Attend each other's meetings

ATC-Tech Ops Human Factors Research Program Strategy



Presented to: REDAC HF Subcommittee

By: Dino Piccione

Date: September 16, 2014

Where Are We Now?

- **Emphasis of the program has shifted more toward ATC/TO Safety and Training**
  - Research sponsor community now includes operational elements
  - Emphasis on how we can help operations -includes training
- **We are part of the Top 5 Corrective Action community**
- **SUPCOM and selected facilities briefed - HF**
- **NATCA is recommending HF to facilities**
- **Spin-off is new HF office in ATO Safety**

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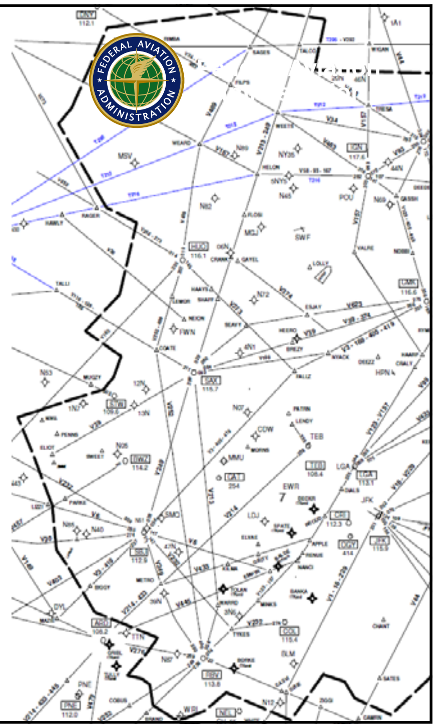
ATO HF Research Strategy

- **Continue HF support in AMS and HF Acquisition Working Group**
  - Includes "automation philosophy"
- **Establish working relationship with new HF Safety office**
- **Apply research on high-impact problems**
- **HF research focused on the workforce to address operational issues**
  - Safety and Training

Strategic Focus Areas

- **Top 5 Hazards in the NAS**
- **HF research for ops**
  - Safety (e.g., tool for facility-level human perf. risks)
  - Training (e.g., trainee success at large TRACONS (N90))
- **HF in major safety initiatives and Risk Based Decision Making**
  - SI-RAP for tech ops
  - RAP, ATSAP, etc. for ATC
- **HF in policy decisions (tower services, automation, service analysis, concepts, investment decisions, safety risk management)**
- **HF in training effectiveness (cost, time, and safety impact)**

Questions?



NextGen HF ATC/Tech Ops Program

Integrated Control Structures Briefing

NextGEN

Rachel Seely, PhD.
Human Factors and Engineering Research Division
Federal Aviation Administration

16 September 2014

Control Structures - HF NextGen

- The NextGen HF ATC/Tech Ops program has the unique mission to translate the effects of NextGen on Air Traffic Controllers and Technical Operations Specialists
- Control Structures – One way of demonstrating the effect of NextGen on Actors

FAA NextGEN

Proactive Human Performance Assessment

Goal of Control Structures: Proactively identify potential human performance hazards introduced by new systems or procedures

- Human-centered approach to identify the impacts of proposed NextGen changes on human performance
- Effort documents impact of planned changes on controller performance and assesses potential hazards to human performance and human error modes
- Current assessment focuses on Segment Bravo increments included in NSIP 2014

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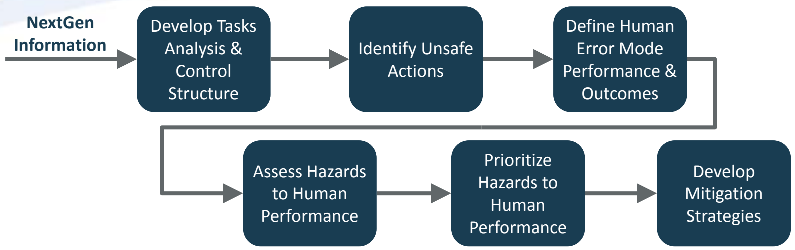
Control Structures – Safety Analysis



Output of Human Factors Analysis

- Comparison of Increment to Current Operations
- Tasks Impacted by Changes proposed in Increment
- Control Structure showing Interactions Impacted by change
- Potential Human Performance Hazards associated with change

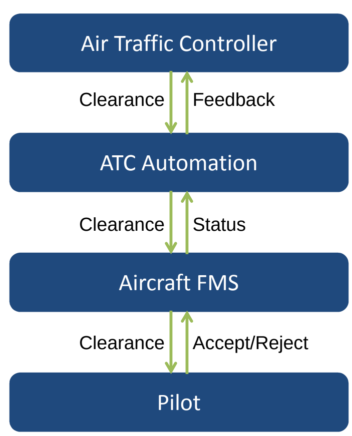
FAA NextGEN

Simplified Data Comm Example

Task Analysis

1. Controller determines clearance.
2. Controller inputs clearance into data comm automation.
3. Automation sends data comm message to aircraft FMS.
4. FMS display clearance to pilots.
5. Pilots reviews clearance.
6. Pilots accept or reject clearance.

Control Structure



FAA NextGEN

Example NextGen Segment Bravo Application

102118-21: IM-S Cruise (Interval Management – Spacing)

This increment expands the use and aircraft efficiency benefits of Interval Management operations to the cruise environment by enabling en route controllers to identify, initiate, and monitor Interval Management operations, with the aid of ground automation.

Upon receipt of an ATC clearance, a trailing aircraft during cruise will achieve and maintain a specified interval behind a target aircraft. This increment also enables flight deck avionics to formulate and, when approved by ATC, to execute a lateral maneuver to maintain a specified interval behind the target aircraft.

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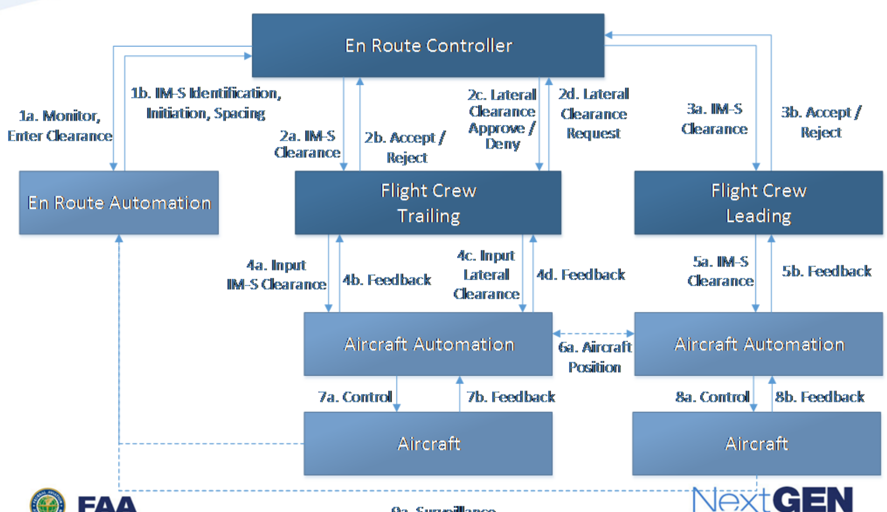
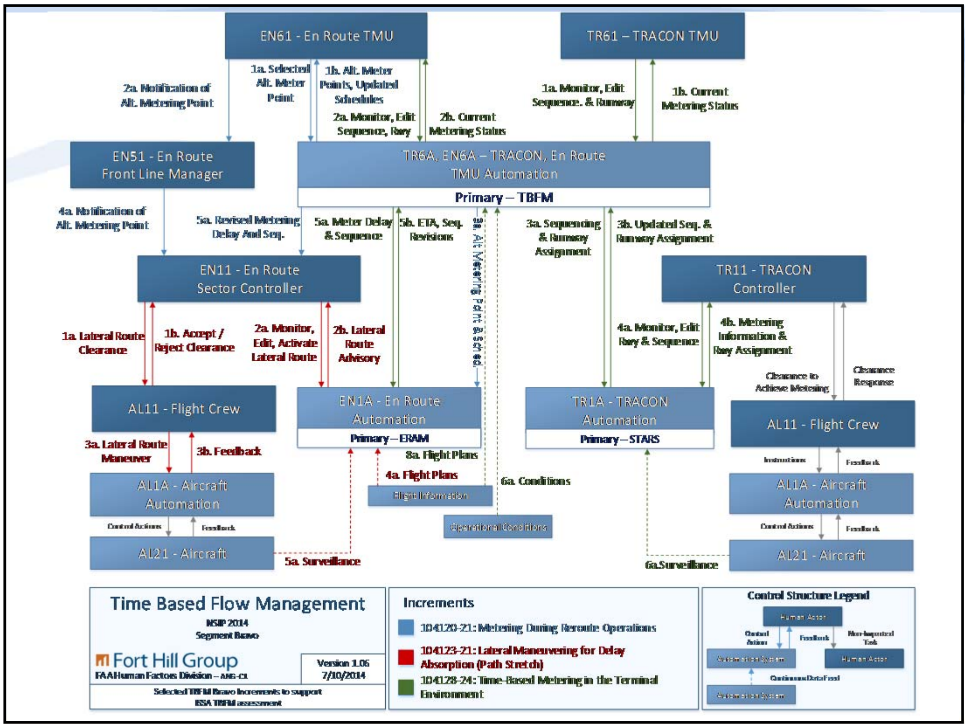
102118-21: IM-S Cruise Human Factors Control Structure



FAA NextGEN



NextGEN

TBFM PORTFOLIO INCREMENTS

DETAILED EXAMPLES

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104128-24:
Time-Based Metering in the Terminal Environment

104128-24: Time-Based Metering in the Terminal Environment

Increment Description

This increment provides for optimal flow into the terminal domain by facilitating the use of Performance-Based Navigation (PBN), expanded metering, and the capability to merge multiple streams when metering for closely spaced parallel runway operations. By synchronizing with en route metering, this capability reduces the aircrafts time and distance flown by allowing runway assignments and sequencing information to be displayed to terminal controllers. Real-time updates consider factors such as meter points inside terminal airspace, previous arrival runway and sequence assignment, and user preferences for runway assignment, traffic, weather conditions, and runway spacing constraints.

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104128-24: Time-Based Metering in the Terminal Environment

Comparison to Current Operations

Currently all time-based metering is done outside the terminal environment. The ultimate metering points for TMA are the arrival fixes on the boundary between En Route and Terminal airspace.

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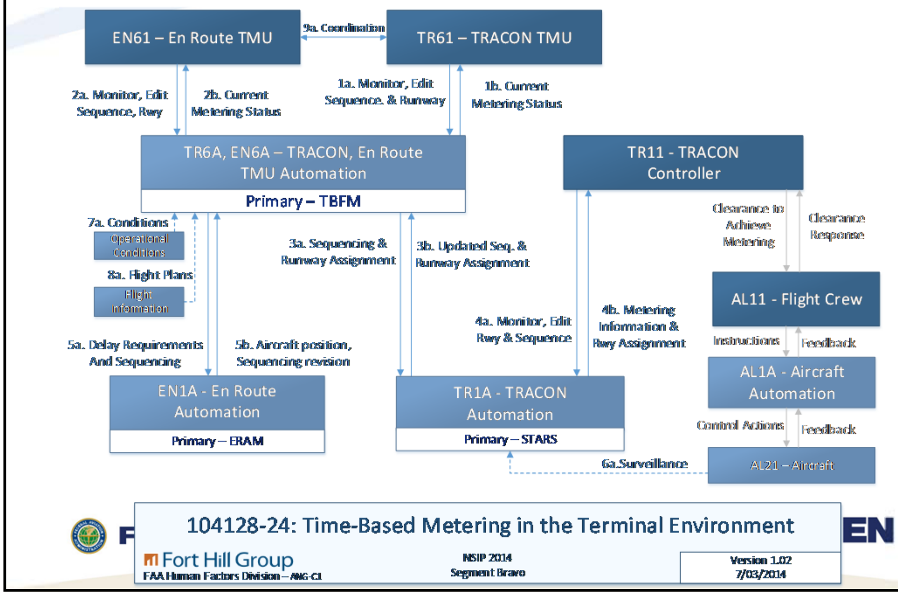
104128-24: Time-Based Metering in the Terminal Environment

Step	Interaction	Description
1a	TR61:TR6A	TRACON TMU monitors TBFM Automation and makes both strategic and tactical changes to sequence and runway assignment
1b	TR6A:TR61	TBFM Automation displays STA and ETA information and runway assignment on timeline to TRACON TMU
2a	EN61:EN6A	En Route TMU monitors TBFM Automation and makes both strategic and tactical changes to sequence and runway assignment
2b	EN6A:EN61	TBFM Automation displays STA and ETA information and runway assignment on timeline to En Route TMU
3a	TR6A:TR61	TBFM Automation sends sequencing information and runway assignments to TRACON Automation
3b	TR1A:TR6A	TRACON Automation sends manually updated sequencing and runway assignments to TBFM Automation
4a	TR11:TR1A	TRACON Controller monitors sequencing information and runway assignments on display, manually overrides sequencing and runway assignments when operationally beneficial
4b	TR1A:TR11	TRACON Automation displays sequencing information and runway assignments to TRACON Controller
5a	EN6A:EN1A	Aircraft surveillance provides aircraft position to TRACON Automation
5b	EN1A:EN6A	TRACON Automation send aircraft position information to support for initial squencing and updates to TBFM Automation
6a	AL21:TR1A	TRACON Automation gathers information on flight plans
7a	TR1A:TR1A	TBFM Automation sends sequencing information and delay times based on STA to En Route Automation
8a	AL21:TR1A	En Route Automation sends ETA to TBFM automation for initial sequencing and updates regularly
9a	EN61:TR61	En Route TMU and TRACON TMU coordinate changes to the sequence/schedule

104128-24: Time-Based Metering in the Terminal Environment



104128-24: Time-Based Metering in the Terminal Environment

Hazard ID	Hazard Condition	Human Error Mode	Worst Credible Outcome	Severity, Likelihood, Recovery	Risk Priority Category
TBFM/104128-24/01	TRACON TMU monitors TBFM display and makes both strategic and tactical changes to sequence and runway assignment	TMC fails to update sequence / schedule / runway when necessary	TBFM schedule/sequence is inadequate resulting in over-delivery of aircraft. Controllers must tactically manage traffic. Potential for holding / airborne delays.	(5, 3, 3)	Moderate
TBFM/104128-24/02	TRACON TMU monitors TBFM display and makes both strategic and tactical changes to sequence and runway assignment	TMC assigns inadequate runway to aircraft	Controller tactically manages aircraft with inadequate runway assignment, reallocates aircraft in to arrival flow for correct runway.	(5, 4, 4)	Low
TBFM/104128-24/03	TRACON TMU monitors TBFM display and makes both strategic and tactical changes to sequence and runway assignment	TMC changes aircraft STA before coordinating with controller; Change conflicts with controller plan.	TRACON Controller is unable to meet new STA times. Controller temporarily discontinues metering. Tactically manages traffic until able to resume metering.	(5, 4, 3.5)	Low

FAA NextGEN

104128-24: Time-Based Metering in the Terminal Environment

Hazard ID	Hazard Condition	Human Error Mode	Worst Credible Outcome	Severity, Likelihood, Recovery	Risk Priority Category
TBFM/104 128-24/04	TRACON TMU monitors TBFM display and makes both strategic and tactical changes to sequence and runway assignment	TMC issued runway change too late; difficult for flight crew to update FMS/Execute	Flight crew accepts runway change. Flight crew is unable to input clearance in sufficient time to execute landing on new runway. Flight crew executes missed approach, TRACON controller re-sequences aircraft into arrival flow.	(4, 4, 3.5)	Moderate
TBFM/104 128-24/05	TRACON Controller monitors sequencing information and runway assignments on display, manually overrides sequencing and runway assignments when operationally beneficial	TRACON Controller fails to monitor schedule; aircraft arrives early/late to meter point	Controller tactically manages aircraft to work back into arrival flow. Potential for holding or airborne delay.	(5, 3, 4.5)	Low
TBFM/104 128-24/06	TRACON Controller monitors sequencing information and runway assignments on display, manually overrides sequencing and runway assignments when operationally beneficial	Over-reliance on automation for sequencing/spacing	Potential for skill-degradation related to merging flows. Controller unable to adequately manage spacing at merge point if TBFM is unavailable. Potential for loss of separation.	(4, 4.5, 3)	Moderate
TBFM/104 128-24/07	TRACON Automation displays sequencing information and runway assignments to TRACON Controller	TRACON Automation fails to display sequence/runway assignment for aircraft	Controller tactically manages aircraft to work back into arrival flow. Potential for holding or airborne delay.	(5, 4, 4)	Low

NextGEN

104123-21: Lateral Maneuvering for Delay Absorption (Path Stretch)

104123-21: Lateral Maneuvering for Delay Absorption (Path Stretch)

Increment Description

This capability provides automation that will enable en route controllers to maneuver aircraft laterally to meet metering times while providing the opportunity for aircraft to fly optimized descents to the meter fix (e. g. TRACON boundary). If lateral maneuvering is required to meet the scheduled time of arrival (STA), the lateral route contained in the advisory would consist of information defining the route to be flown, which includes the turn-out (starting) point, a Place-Bearing-Distance (PBD) defined waypoint to fly to, and a return point on the original trajectory to turn back to once the PBD waypoint has been reached. This capability leverages existing Lateral Navigation (LNAV) and Vertical Navigation (VNAV) capabilities of an aircraft's FMS, to compute a preferred descent trajectory for the aircraft, subject to the clearance given and the speed and altitude constraints at the meter fix. The DST then updates the aircraft's flight plan information to reflect the clearance issued.

FAA NextGEN

104123-21: Lateral Maneuvering for Delay Absorption (Path Stretch)

Comparison to Current Operations

Currently controllers use either speed control or vectoring (lateral movement) to achieve delays to meet TBFM meter times. Speed control by itself is only effective for losing one or two minutes. If a controller needs to lose more time they will use significant of course vectors (turns of 60°or greater), possibly combined with speed control. Delays of 7 minutes or more can generally only be achieved through a 360°turn.

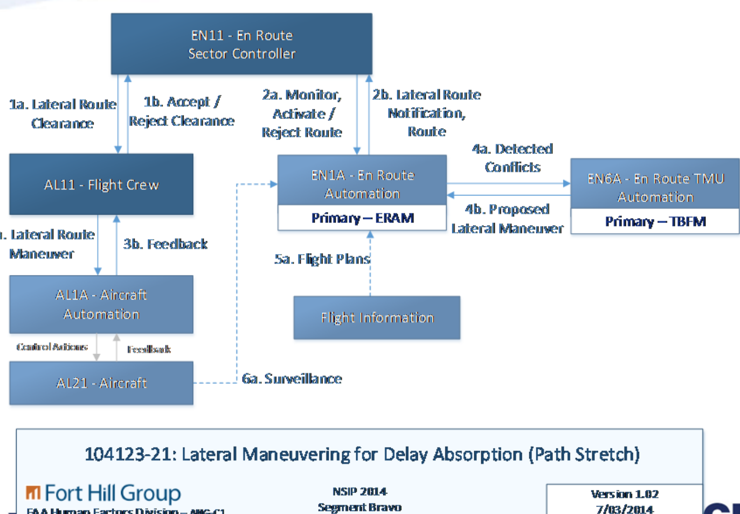
Vectoring is an imprecise art, i.e. the controller usually doesn't know exactly how long the vector will last, and he or she just waits until the required delay time for the aircraft is eliminated before turning the aircraft back on course. This means the pilot will have even less of an idea of the duration of the off-course lateral movement, making any use of optimized descent irrelevant until they are turned back on course.

FAA NextGEN

104123-21: Lateral Maneuvering for Delay Absorption (Path Stretch)

Step	Interaction	Description
1a	EN11:AL11	En Route Sector Controller issues lateral route clearance including the turn-out (starting) point, a Place-Bearing-Distance (PBD) defined waypoint to fly to, and a return point to Flight Crew
1b	AL11:EN11	Flight Crew accepts or rejects lateral route clearance
2a	EN11:EN1A	Controller reviews En Route Controller updates automation with accepted Path Stretch instruction including potential conflicts and monitors execution
2b	EN1A:EN11	En Route Automation provides controller with lateral route instruction generated to help aircraft meet meter time
3a	AL11:AL1A	Flight Crew enters lateral route clearance including the turn-out (starting) point, a Place-Bearing-Distance (PBD) defined waypoint to fly to, and a return point into Aircraft Automation
3b	AL1A:AL11	Aircraft Automation provides feedback on the execution of the lateral route clearance to the Flight Crew
4a	EN1A:EN6A	The En Route Automation probes the suggested lateral route clearance for conflicts and advises TBFM Automation if the route isn't viable.
4b	EN6A:EN1A	TBFM Automation provides suggested lateral route clearance to En Route Automation
5a	AL1A:EN1A AL31:EN1A	The En Route Automation gathers information on aircraft flight plans
6a	AL21:EN1A	The En Route Automation gathers aircraft position information via surveillance

104123-21: Lateral Maneuvering for Delay Absorption (Path Stretch)



104123-21: Lateral Maneuvering for Delay Absorption (Path Stretch)

Hazard ID	Hazard Condition	Human Error Mode	Worst Credible Outcome	Severity, Likelihood, Recovery	Risk Priority Category
TBFM/ 104123-23/01	This capability provides automation that will enable en route controllers to maneuver aircraft using path stretching to meet metering times while providing the opportunity for aircraft to fly optimized descents to the meter fix.	Automation fails to identify aircraft needing path stretching	Aircraft arrives at meter fix too early. Downstream controller tactically manages traffic and flow.	(5, 3, 4)	Low
TBFM/ 104123-23/02	If path stretching is required to meet the scheduled time of arrival, the lateral route contained in the advisory would consist of information defining the path stretch maneuver, which includes the turn-out point, a Place-Bearing-Distance (PBD) defined waypoint to fly to, and a return point on the original procedure to turn back to once the PBD waypoint has been reached.	Automation provides controller with path stretching instruction with inadequate turn-out point.	Aircraft does not meet meter fix time. Sector controller tactically manages traffic and flow.	(5, 3, 4)	Low
TBFM/ 104123-23/03	If path stretching is required to meet the scheduled time of arrival, the lateral route contained in the advisory would consist of information defining the path stretch maneuver, which includes the turn-out point, a Place-Bearing-Distance (PBD) defined waypoint to fly to, and a return point on the original procedure to turn back to once the PBD waypoint has been reached.	Automation provides controller with path stretching instruction with inadequate PBD waypoint.	Aircraft does not meet meter fix time. Sector controller tactically manages traffic and flow.	(5, 3, 4)	Low

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104123-21: Lateral Maneuvering for Delay Absorption (Path Stretch)

Hazard ID	Hazard Condition	Human Error Mode	Worst Credible Outcome	Severity, Likelihood, Recovery	Risk Priority Category
TBFM/ 104123-23/04	If path stretching is required to meet the scheduled time of arrival, the lateral route contained in the advisory would consist of information defining the path stretch maneuver, which includes the turn-out point, a Place-Bearing-Distance (PBD) defined waypoint to fly to, and a return point on the original procedure to turn back to once the PBD waypoint has been reached.	Automation provides controller with path stretching instruction with inadequate return point	During path stretching operation, actual aircraft performance and airspace conditions differ from predicted traffic flow and conditions. Return point no longer provides required separation minima for path stretching aircraft.	(4, 3.5, 3.5)	Moderate
TBFM/ 104123-23/05	This capability provides automation that will enable en route controllers to maneuver aircraft using path stretching to meet metering times while providing the opportunity for aircraft to fly optimized descents to the meter fix.	Sector controller incorrectly edits path stretching instruction provided by automation	During path stretching operation, actual aircraft performance and airspace conditions differ from predicted traffic flow and conditions. Return point no longer provides required separation minima for path stretching aircraft.	(4, 4, 4)	Low
TBFM/ 104123-23/06	This capability provides automation that will enable en route controllers to maneuver aircraft using path stretching to meet metering times while providing the opportunity for aircraft to fly optimized descents to the meter fix.	Sector controller delays issuance of path stretching instructions to aircraft.	During path stretching operation, actual aircraft performance and airspace conditions differ from predicted traffic flow and conditions. Return point no longer provides required separation minima for path stretching aircraft.	(4, 3.5, 4)	Moderate

FAA NextGEN

104123-21: Lateral Maneuvering for Delay Absorption (Path Stretch)

Hazard ID	Hazard Condition	Human Error Mode	Worst Credible Outcome	Severity, Likelihood, Recovery	Risk Priority Category
TBFM/ 104123-23/07	The DST then updates the aircraft's flight plan information to reflect the clearance issued.	Automation fails to update flight plan information with path stretching clearance	Conformance alert notifies controller with nuisance alert. Sector controller manually updates flight plan with path stretching clearance.	(5, 4, 4.5)	Extremely Low
TBFM/ 104123-23/08	This capability provides automation that will enable en route controllers to maneuver aircraft using path stretching to meet metering times while providing the opportunity for aircraft to fly optimized descents to the meter fix.	Flight crew delays acceptance of path stretching clearance	During path stretching operation, actual aircraft performance and airspace conditions differ from predicted traffic flow and conditions. Return point no longer provides required separation minima for path stretching aircraft.	(4, 3.5, 3.5)	Moderate
TBFM/ 104123-23/09	This capability provides automation that will enable en route controllers to maneuver aircraft using path stretching to meet metering times while providing the opportunity for aircraft to fly optimized descents to the meter fix.	Flight crew fails to initiate turn at PBD waypoint.	Potential for aircraft to conflict with other airspace traffic or for airspace violation.	(3, 4, 3)	Moderate
TBFM/ 104123-23/10	This capability provides automation that will enable en route controllers to maneuver aircraft using path stretching to meet metering times while providing the opportunity for aircraft to fly optimized descents to the meter fix.	Flight crew inadequately executes return to original path.	Actual return time differs from predicted return time. Return point and time no longer provides required separation minima for path stretching aircraft.	(4, 3.5, 3.5)	Moderate

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NextGEN

July 31 Cross-Agency Panel Discussion on Human Factors: Overview for REDAC

Bill Kaliardos

Sept 16, 2014

FAA

Why the Panel Discussion?

- Many HF-related problems affect multiple organizations in FAA
- HF problem definitions and solutions often require collaboration across stovepipes
  - E.g., air/ground; operations/acquisitions; research/practice; early/late-AMS…
  - Example Problem: REDAC Recommendation
    - ATO/AVS/ANG should develop a consensus Top 5 assessment of human performance issues with NextGen air/ground integration to drive appropriate research.
- FAA is not organized to handle such cross-cutting problems
  - Cross-stovepipe incentives are weak
- Panel was assembled at bi-annual HF Coordination meeting to explore this topic

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Panel Participants

- NextGen
  - Steve Bradford
- ATO – Program Management / Acquisitions
  - Gary Burke, Pam Dellarocco
- ATO – Safety
  - Mike Hawrysko, Angel Luna
- ATO – Ops Concepts and Ops Requirements
  - David Toms
- AVS
  - Kathy Abbott, Lou Volchansky

FAA NextGEN

Panel Participants

FAA

NextGEN

Discussion Points

- Very interesting and worthwhile, although no tangible outcomes
- Discussions included:
  - Role of human factors in operational data
  - Effect of NextGen tools on the controller’s job
  - Misc
    - Deskilling concerns
    - Increased automation
    - Enterprise level requirements

FAA

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Discussion: HF and Ops Data

- Much data collected related to human performance, yet HF specialists are rarely involved in analysis (e.g., reading ATSAP reports and categorizing)
- Anecdotally, most panelists have not experienced the thread from HF operational data to:
  - New designs (e.g., NextGen)
  - Previously fielded designs
  - Training
- Example ops feedback: Effect of ATC clearance mods on pilot reprogramming of flight plan
- ATO Safety:
  - Interested in improving HF involvement (e.g., Jason)

FAA NextGEN

Discussion: NextGen Effects on the Job of Operators

- Program-based culture makes it difficult to consider overall effects of NextGen on operator's job (discussion focused on ATC)
- Difficult to test integrated/cumulative effects
- Need to look beyond errors, workload, fatigue, etc.
  - Is work engaging?
  - Is work challenging?
  - Is work meaningful?
- AJV addressing NextGen effects on operator, but not coordinated with ANG-C1

FAA NextGEN

Bill’s Assessment of Discussion

- No clear path to effective agency-level human factors
  - Hard for one part of an organization to be responsible
  - Current integration efforts are, ironically, still stovepiped within one line of business
  - Need non-HF to lead agency-level integration, with HF support
- Such discussions are very beneficial and need to continue
  - Ad hoc for now
  - Hopefully formalized in the future

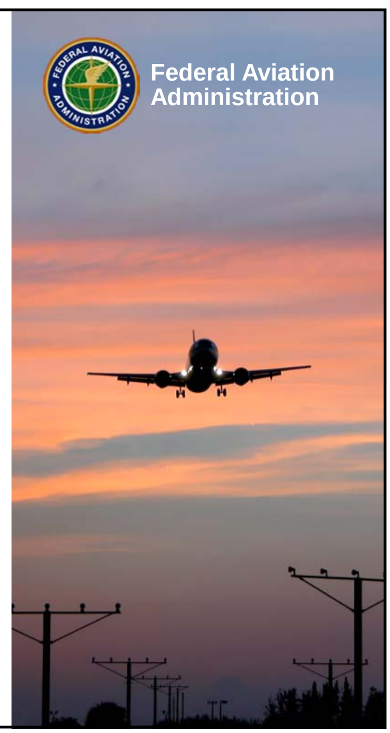
FAA NextGEN

Questions?

Bill.Kaliardos@faa.gov

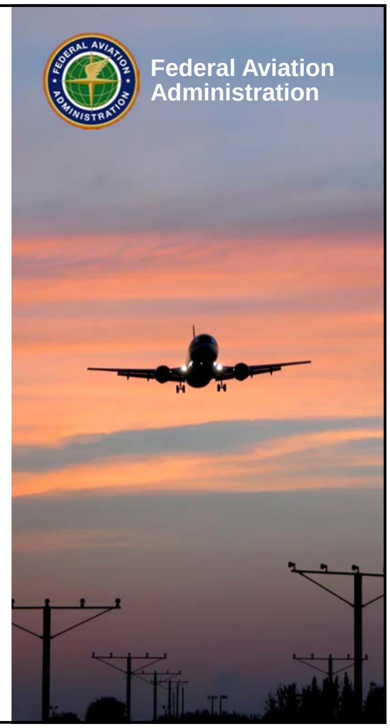
FAA NextGEN

Review of Findings & Recommendations and Action Items



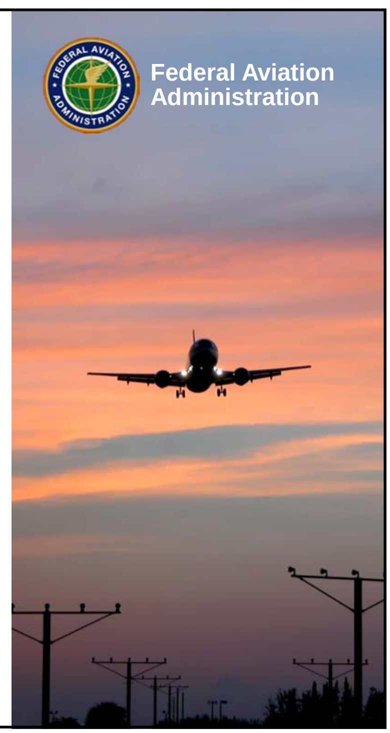
REDAC Member Presentation and Discussion

Jack Blackhurst



REDAC Member Presentation and Discussion

Chris Desenti



optics

Observation Platform for Technical and Institutional Consolidation of Safety research

OPTICS - Observation Platform for Technical and Institutional Consolidation of Safety research

Barry Kirwan (EUROCONTROL) & Paul Krois (FAA)

Presented to the FAA Research, Engineering and Development Advisory Committee (REDAC)
Human Factors Subcommitee
Washington 16th September 2014

OPTICS is a Coordinated Action funded by the European Commission under the
Seventh Framework Programme (FP7-AAT-2013_RTD-1). Grant Agreement n° ACS3-GA-2013-605426

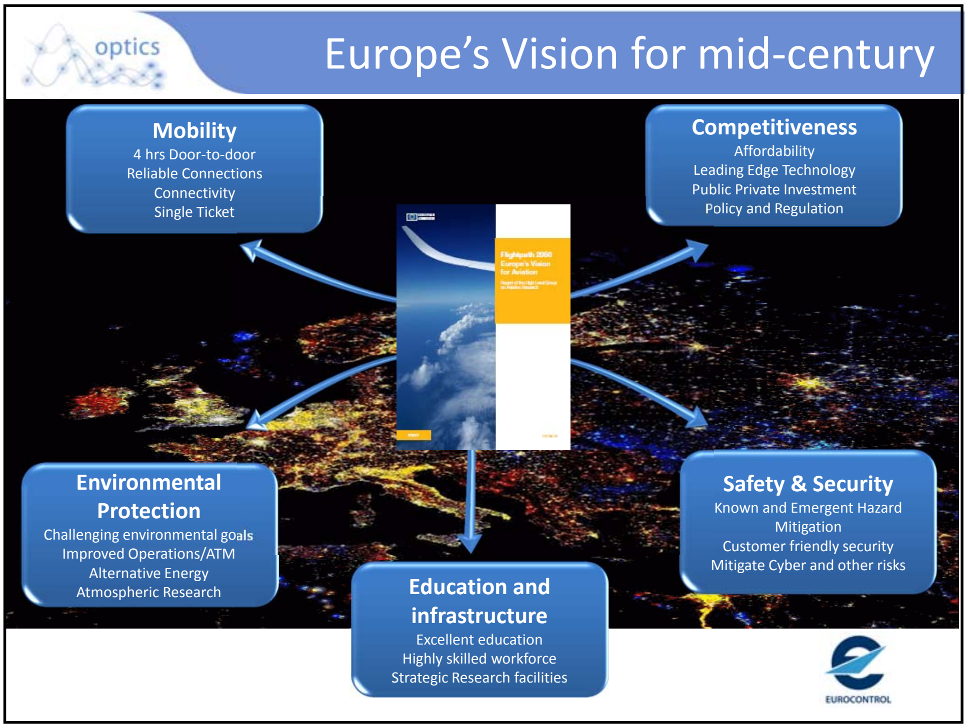
optics

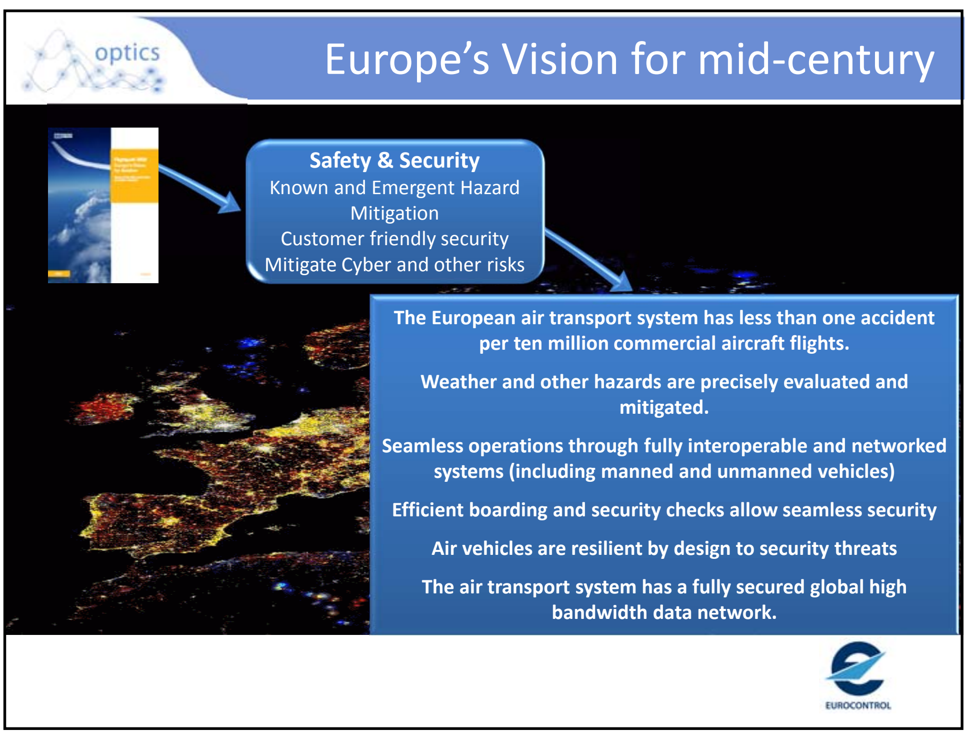
Flightpath 2050

Flightpath 2050 sets vision of European aviation transport

- » **Advisory Council for Aviation Research in Europe (ACARE)**: Engaged hundreds of experts across the entire Aviation Transport System
- » **Strategic Research and Innovation Agenda (SRIA)**: Roadmap of what needs to be done in three time frames – 2020, 2035, and 2050.
- » **Vision includes five principal pillars**: OPTICS is a European Commission-funded project that monitors the safety part of the SRIA

EUROCONTROL


optics
Europe’s Vision for mid-century
Mobility
4 hrs Door-to-door
Reliable Connections
Connectivity
Single Ticket
Competitiveness
Affordability
Leading Edge Technology
Public Private Investment
Policy and Regulation
Environmental Protection
Challenging environmental goals
Improved Operations/ATM
Alternative Energy
Atmospheric Research
Safety & Security
Known and Emergent Hazard Mitigation
Customer friendly security
Mitigate Cyber and other risks
Education and infrastructure
Excellent education
Highly skilled workforce
Strategic Research facilities
EUROCONTROL


optics
Europe’s Vision for mid-century
Safety & Security
Known and Emergent Hazard Mitigation
Customer friendly security
Mitigate Cyber and other risks
The European air transport system has less than one accident per ten million commercial aircraft flights.
Weather and other hazards are precisely evaluated and mitigated.
Seamless operations through fully interoperable and networked systems (including manned and unmanned vehicles)
Efficient boarding and security checks allow seamless security
Air vehicles are resilient by design to security threats
The air transport system has a fully secured global high bandwidth data network.
EUROCONTROL

OPTICS

OPTICS asks two simple questions

- » Are we doing the right research for aviation safety?
- » Are we doing the research right?

Series of 4 safety workshops including HF, vehicle operations

EUROCONTROL

SRIA Landscape Map
Safety Capabilities - Human Factors

	INDIVIDUAL	TEAM	ORGANIZATIONAL
TECHNOLOGIES	ADAPTIVE AUTOMATION AUTOMATION SUPPORT HF IN DESIGN AND MANUFACTURING	CREW MANAGEMENT SYSTEMS MONITORING OF CREW/TEAM CAPACITY SYSTEMS FOR HAZARD AVOIDANCE INTEGRATED TECHNOLOGIES FOR TURNAROUND INFORMATION SYSTEMS SUPPORT FOR HUMAN COLLABORATION	TOOLS AND METHODS FOR EMERGENT RISKS INTEGRATED SEARCH AND RESCUE CAPABILITIES PREVENTIVE MAINTENANCE AND SYSTEM UPGRADES COMMON FRAMEWORK FOR CERTIFICATION
METHODS	HP ENVELOPE	CISM FOR TEAMS AND ORGANISATIONS NEW TEAM CONCEPTS UNDERSTANDING MULTICULTURAL INTERACTION BTWN CREW AND PASSENGERS UNDERSTANDING CULTURAL ASPECTS OF PASSENGERS	MANAGING HUMAN BEHAVIOUR IN EMERGENCIES BEHAVIOURAL ANALYSIS TO IDENTIFY HAZARDS SAFETY PERFORMANCE INDICATORS OPERATIONAL RISK MONITORING SAFETY DATA SYSTEMATIC ANALYSIS SAFETY CULTURE SAFETY INFLUENCES

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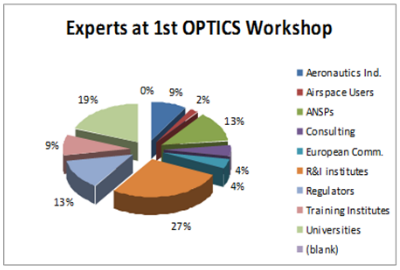

1st Expert Workshop: Human Factors

Initial Priorities Sorted Into Six Categories

DESIGN FOR HUMAN USE	OPERATIONAL SAFETY
Human Factors in the Design Life Cycle Human Factors Guidance Human Factors Standards and Regulations Human Systems Integration Usability	Helping pilots avoid and recover from adverse events Understanding pilot performance in unsafe scenarios Online measurement and forewarning Human performance data collection and usage SAFURITY – Security impacting on safety

1st Expert Workshop: Human Factors

AUTOMATION	RISK MANAGEMENT
A framework for incorporating automation Adaptive automation using better cognitive models Tools for pilot training and selection Human-Machine Interactions Human/Automation System Roles	More integrated risk management Integrating HF into risk management Broader safety assessment (e.g., including ground operations, and safety culture) Integration of HF into Safety Management Systems Quantitative human performance prediction
HUMAN RESOURCES	**HUMAN PERFORMANCE**
Advanced training concepts Advanced selection testing Better understanding of organizational culture A focus on the role of social dialogue in facilitating the acceptance of technological and social change	Better measurement of: fatigue, situation awareness, workload, complexity, cognition, physiological measures Team performance monitoring and assessment Understanding/management of human variability Human Performance Envelope development and implementation More use of prototyping simulations Skill retention and degradation

Overarching Issues

Design for Human Use: After decades of research, the uptake of Human Factors into system designs is still low and uneven.

Are we getting Human Factors into the design life cycle at the right stage, or at all? Where are the HF standards and guidance materials that can be applied across the entire aviation transport system?

Automation: We have challenging goals for automation, but in practice, despite decades of experience in the cockpit, it is difficult tog et it right and acceptable to the user.

Where is the over-riding framework for incorporating automation into new systems, and for making the human-automation partnership effective?

Operational Safety: Pilots need more support for those rare emergency scenarios when they can find themselves suddenly in a dangerous situation with little time to recover.

How can we better understand, warn and support the aircrew in sudden emergency situations?

Overarching Issues

Risk Management: Risk management and SMS usage are widespread, but Human Factors stays largely outside of these processes and frameworks, which still largely concern human risks in the system.

How can we get HF better integrated into these processes?

Human Resources: Selection and Training approaches in the industry have not evolved significantly, and organizational culture is treated as largely untouchable. Yet if safety is to improve, standards need to be raised at the individual, team, and organizational culture level.

How can we make better use of new ideas and methods from academia to raise standards in people management and performance in aviation organizations, both at the sharp end (pilots, controllers) and at the blunt end (management, leaders)?

Overarching Issues

Human Performance: Decades of research on individual factors such as fatigue and situation awareness gives the impression that the whole field of human performance in not 'joined-up'.

How can we develop an integrated approach that takes account of multiple factors and their interactions (human performance envelope), so that we can predict and guide the impact of future changes on total human performance?

Conclusions

Four Top Priorities Based on Most Votes

Human Performance Envelope
Research on individual factors (fatigue, methods for assessing complexity, skill degradation) needs to move to understand better how these factors interact and collecting influence human performance. Human Performance Envelope is to an extent a game-changer , as the usual approach is not having sufficient impact.

Human Factors in Design and Manufacturing
To close the shortfall in guidance and good practice for integrating Human Factors to encompass the entire aviation transport system (ATS) and its design life cycle (when to do HF, with what guidance, and against which standards), incentize the ATS with a benchmarking approach with which to rate processes and products for maturity.

Conclusions Continued

Top Priorities Based on Most Votes

Automation:

Adaptive Automation
With limited progress and questions about its viability, consider an intermediate stepping stone such as adaptable automation that is employed at the discretion of the user, so the user remains in the loop and does not lose situation awareness, and can recover if things go wrong and the automation can no longer cope.

Automation Support
As a key enabler for Flightpath 2050, the most inclusive idea at the Workshop was “Develop a framework for the incorporation of automation within complex systems.” This includes a toolkit of approaches and best practices for developing automation.

Additional Conclusions

Items Missing from SRIA

- Training and selection for the pilot and controller of the future
- Security impacts on safety (in particular cyber attacks)
- A common HF education system to teach the basics of HF to all system actors (operational, technical, design, and managers).

Main Game Changing Priority

To evolve an industrial and organizational culture that values Human Factors and uses it in design and management processes

Suggestions, Questions?

optics

www.optics-project.eu

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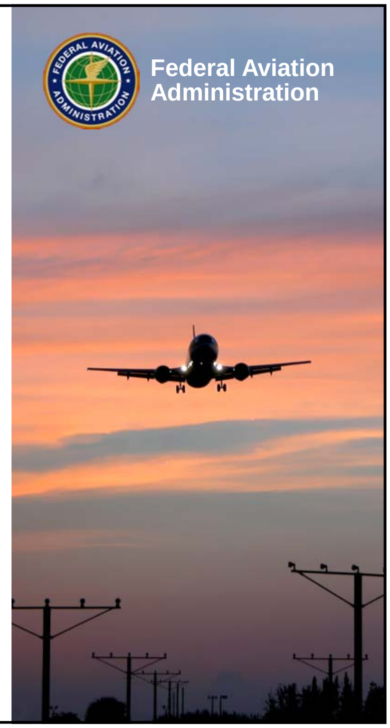
REDAC Member Presentation and Discussion

Phil Smith



Important Research Focus Areas:
The View from OSU
Philip J. Smith

- **Issue 1. Integrated management of airport surface and airspace constraints during convective weather**
- **Issue 2. Collaborative routing to support adaptive air traffic flow management**
- **Issue 3. Human factors issues in the design and use of RNAV/RNP routes**
- **Overarching human factors issue:**

  Assuming Old Human Factors Problems are Still Solved When Introducing New Systems

Smith, P.J. (2014). *Yearly Report: Critical Human Factors Issues for Guiding Advances in the Support and Execution of Collaborative Decision Making.* CSEL Technical Report 2014-12, The Ohio State University. Supported by the FAA Human Factors Division (ANG-C1)

Smith, P.J., Murphy, M., Stellings, E. and the CDM Flow Evaluation Team (2014). *Operating in a CTOP (Collaborative Trajectory Options Program) Environment.* CSEL Technical Report 2014-10, The Ohio State University. Supported by the FAA Collaborative Decision Making Program and the FAA Human Factors Division (ANG-C1)

Smith, P.J., Durham, K. and Evans, M. (2014). *Best Practices and Lessons Learned in the Development and Use of RNAV Routes.* CSEL Technical Report 2014-16, CSEL, The Ohio State University. Supported by the FAA Human Factors Division (ANG-C1).

Issue 1. Integrated Management of Airport Surface and Airspace Constraints During Convective Weather

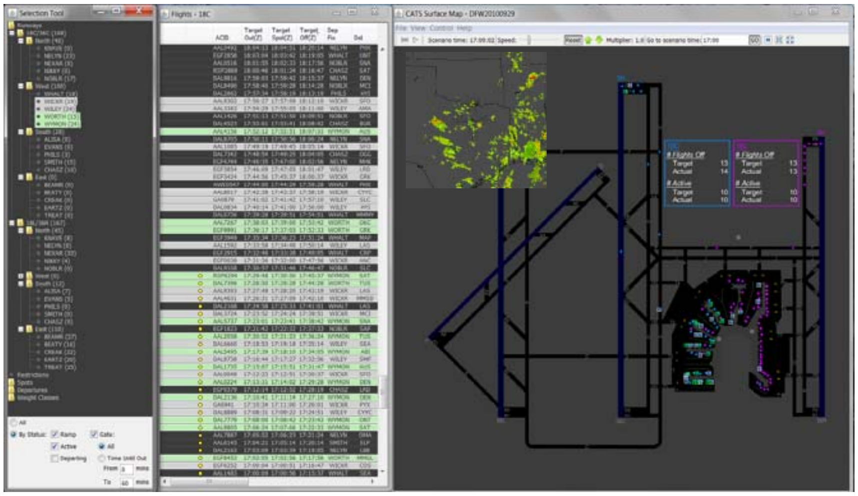


Figure 12. Flights filed to depart via WICKR and WILEY highlighted in gray; flights filed to depart via WORTH and WILEY highlighted in green.

Issue 2. Collaborative Routing: New Strategies and Tools for Adaptive Air Traffic Flow Management

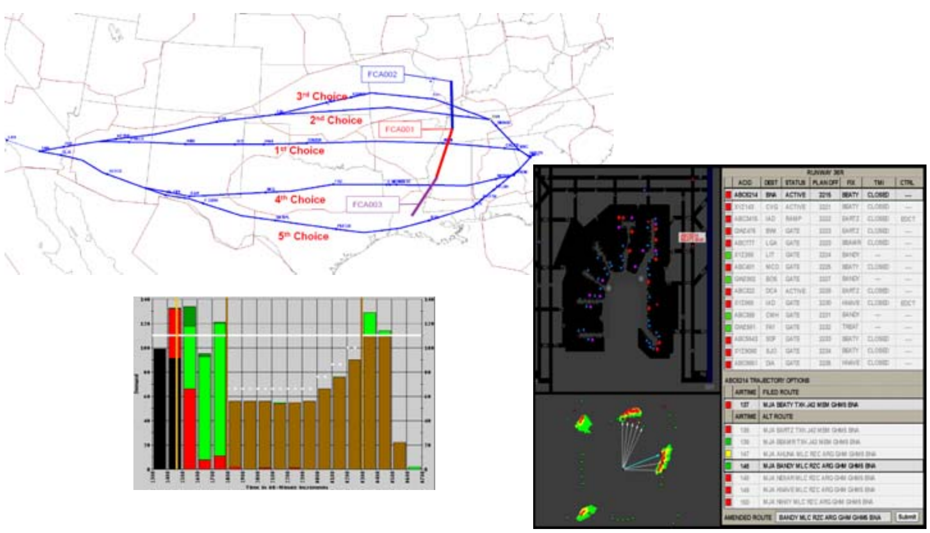


Figure 21. Integration of airspace, airport surface information to support manual reroutes using the information in a TOS

Overarching Human Factors Issue:
Assuming Old Human Factors Problems are Still Solved When Introducing New Systems
(Example: Issue 3. Human factors issues in the design and use of RNAV/RNP routes)

Human-Automation Interaction:
Predicted Accident in the Use of an RNAV Approach –
Overtake on Approach & Missed Approach Conflict (Smith, Rinehart and Spencer)

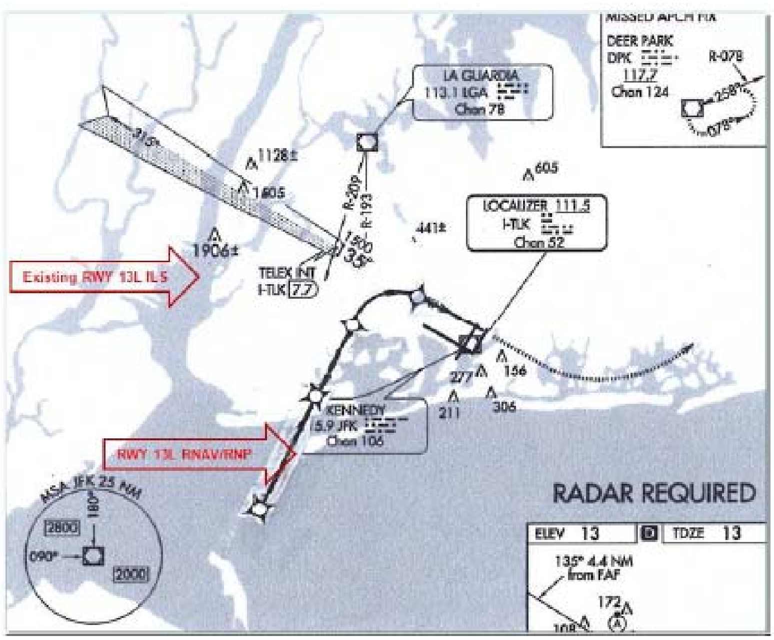
Perspective	What happens or doesn't happen?	What actions are taken or not taken?
Flight Crew	During preparation for takeoff from SVO to JFK, Delta 467 flight crew notes that predicted weather in JFK is calling for excellent visibility and winds from the southeast.	Pilot Flying (PF) is the First Officer. PF loads Parch 1 RNAV arrival and VOR RWY 13L Approach.
Flight Crew	After completing ocean crossing and approaching Top of Descent, Pilot Monitoring (PM) gets updated ATIS via ACARS. ATIS "D" shows VOR RW 13L. Clear skies. Winds 140 at 15 knots. Departing RW13R.	PF transfers control to PM and briefs for a RNAV Visual for RW 13L at JFK. He notes that RNAV Visual must be requested but is normally given when weather is good and that the LNAV and VNAV Guidance works well. As part of the brief he notes that there is no missed approach published as it is a Visual Approach procedure.

Perspective	What happens or doesn't happen?	What actions are taken or not taken?
Flight Crew	New York Center controller clears Delta 467 on Parch arrival to cross TRAIT at FL240.	PF begins descent using VNAV to cross TRAIT at FL240. CCC is programmed for 250/12000 and ROBER at 9000 but altitude window is set for 24000.
Flight Crew	New York Center controller clears Delta 467 to cross CCC at 12000 feet and 250 knots.	PF sets 12000 into altitude window and selects VNAV to continue descent on PARCH arrival profile.
Flight Crew	Approaching CCC, New York Center switches Delta 467 to New York Approach.	PM checks in with NY Approach with ATIS "D". NY Approach states that Delta 467 should expect VOR RW 13L and continue descent to 9000. PM asks for RNAV Visual RW 13L. Controller states that Delta 467 should expect that.
Flight Crew	Approaching ROBER, NY Approach begins giving vectors to Delta 467 with an initial vector of 180 with a descent to 5000'.	PF sets 5000' in altitude window and selects FLCH. PF sets heading 180 in heading window and presses to select Heading Select. He instructs PM to "extend the centerline". PM selects ASALT as the active Waypoint and sets the course to 045 and executes to select an extended line for the approach for 13L.

Perspective	What happens or doesn't happen?	What actions are taken or not taken?
Flight Crew	Controller switches Delta 467 to final controller.	PM checks in with NY Approach "at 5500' descending to 5000'". Check in is acknowledged and a continued descent to 3000' is directed with a vector of 230. Crew is told to expect RNAV Visual RW13L. PF resets altitude window and heading window.
Flight Crew	At approximately 8 miles abeam ASALT, a vector of 280 is given. Speed of 180 knots.	PM acknowledges. PF selects heading of 280, and speed of 180 knots. Flaps are extended to 5 degrees on schedule.
Flight Crew	At approximately 6 miles from ASALT, a vector of 360 is given.	PM acknowledges. PF selects heading of 360 degrees.

Perspective	What happens or doesn't happen?	What actions are taken or not taken?
Flight Crew	At approximately 4 miles from ASALT a vector of 020 is assigned and Delta 467 is cleared for the RNAV Visual RW13L with a switch to tower frequency.	PM acknowledges. PF sets heading to 020 degrees, and calls for flaps to 15. He arms LNAV. Sets altitude window to 100 feet. Arms VNAV and sets speed intervention for 180 knots again. PM checks in with tower. Tower states that Delta 467 is cleared to land following a Regional Jet 4 miles ahead.
Flight Crew	Aircraft crosses ZADUD at 3000' at 180 knots and shortly begins a descent on autopilot.	Flight crew notes that they are on profile.
Flight Crew	Passing 1800'	PF calls for gear down and sets speed window for final approach speed of 147 knots. After gear is down he calls for flaps 25 and landing checklist.
Tower	On radar tower notes a closure rate of 50 knots between Delta 467 and the RJ they are following.	Tower Controller directs Delta 467 to slow to final approach speed and states that they are overtaking the RJ they are following by 50 knots.

Flight Crew	Both pilots begin scanning for RJ. Aircraft is between WIRKO and JEVNI passing 1000' and in a right turn.	They see the RJ ahead and note on their TCAS that they are less than 3 miles behind the RJ.
Flight Crew	Tower controller believes an unsafe situation is developing and directs "Delta 467 cancel landing clearance, go around".	PF hits go around buttons on back of throttle, states "go around, flaps 20". Aircraft rolls wings level heading approximately 090 degrees. Power comes up and aircraft begins climb. PM selects flaps to 20, sees the climb begin and states, "positive rate". PF calls for "gear up". PM selects gear to up position.
Flight Crew	Aircraft is climbing through 1200' in a heading hold mode.	Since nothing has been selected for a roll mode, from an RNAV approach, aircraft reverts to heading hold on the last heading it was passing through.
Tower	Tower controller realizes a police helicopter is just north of the airport at 1500'. The aircraft will not have sufficient separation. He commands Delta 467 to take heading 150.	PF selects heading select of 150. Aircraft begins a right turn.
Flight Crew	TCAS gives "traffic" warning and commands a descent.	To be continued.



Overarching Human Factors Issue:
Assuming Old Human Factors Problems are Still Solved When Introducing New Systems

How do we detect such assumptions?

How do we ensure that such assumptions are dealt with during the design so that either:
- The problem is eliminated so that the critical scenarios cannot arise?
- There are sufficient safety nets so that, if a critical scenario arises, the system is sufficiently resilient to deal with it?

Overarching Human Factors Issue:
Assuming Old Problems are Still Solved When Introducing New Systems
(Example: Issue 2. Collaborative routing to support adaptive air traffic flow management)

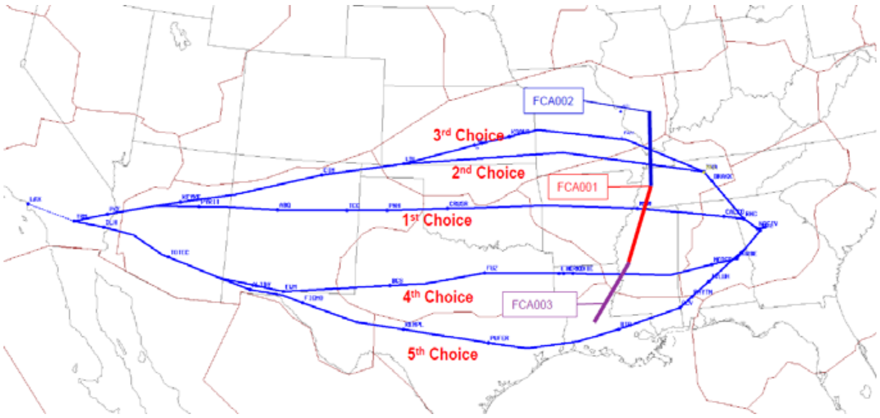
Design of Distributed Work System
Predicted Accident due to predictable performance by software designers, dispatchers, traffic managers and controllers

CTOP (Collaborative Trajectory Options Program)

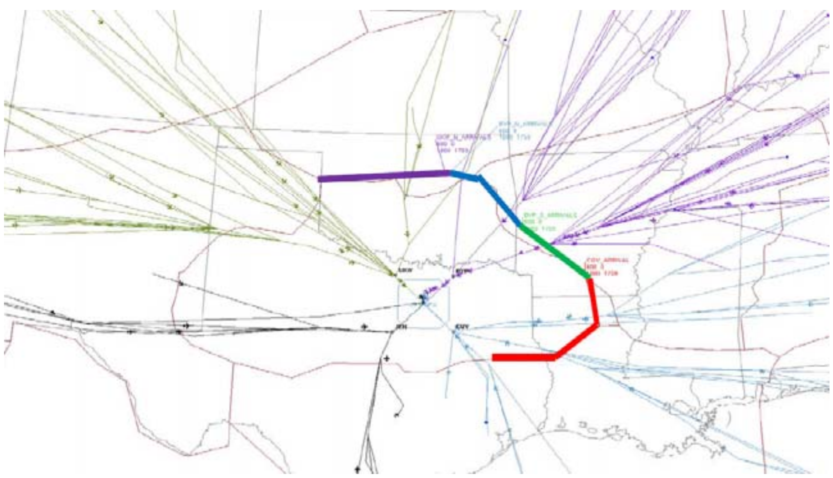
Historical problem (2001): Dispatcher filing CDRs with "unusual" turns

Example: CDR EWRBNA36 (KEWR COATE Q436 HERBA JHW J29 DJB J29 ROD FLM HYK DREFT PASLY2 KBNA)

CTOP Review



CTOP Review



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Example: CDR EWRBNA36 (KEWR COATE Q436 HERBA JHW J29 DJB J29 ROD FLM HYK DREFT PASLY2 KBNA)

Historical safety nets to this unanticipated issue (2001): Departure Center TMU (weak solution); Display of route on strip (weak solution); Controller detecting unexpected trajectory; Pilots; TCAS

Historical solution (2002): Procedures, training and airline automation (in response to actual occurrences)

Overarching Human Factors Issue:
Assuming Old Problems are Still Solved When Introducing New Systems
(Example: Issue 2. Collaborative routing to support adaptive air traffic flow management)

Design of Distributed Work System
Predicted Accident due to predictable performance by software designers, dispatchers, traffic managers and controllers

CTOP (Collaborative Trajectory Options Program)

New issue (2014): Flight operator software submitting TOS including "unusual" CDR; FAA software selecting this route

Safety nets(?):

- Automation Developers
  - Flight operators
  - FAA
- Dispatcher
- Departure center traffic manager (weak solution)
- Display of route on strip (weak solution)
- Controller detecting unexpected trajectory
- Pilots detecting potential loss of separation
- TCAS detecting potential loss of separation

Solution(?)

Overarching Human Factors Issue:
Assuming Old Human Factors Problems are Still Solved When Introducing New Systems

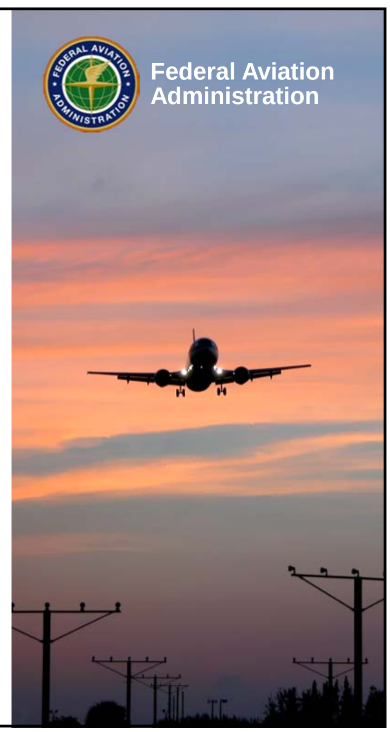
How do we detect such assumptions?

How do we ensure that such assumptions are dealt with during the design so that either:

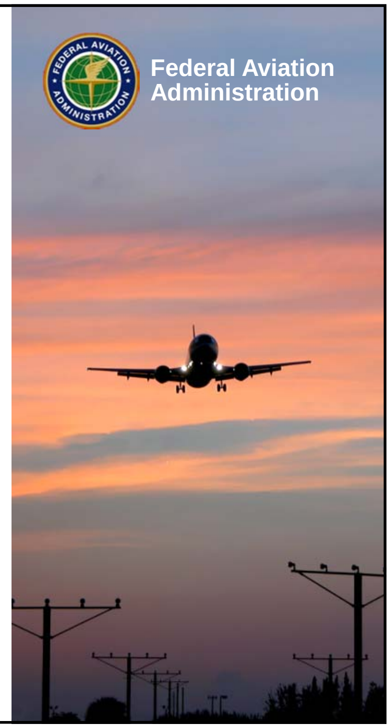
- The problem is eliminated so that the critical scenarios cannot arise?
- There are sufficient safety nets so that, if a critical scenario arises, the system is sufficiently resilient to deal with it?

REDAC Member Presentation and Discussion

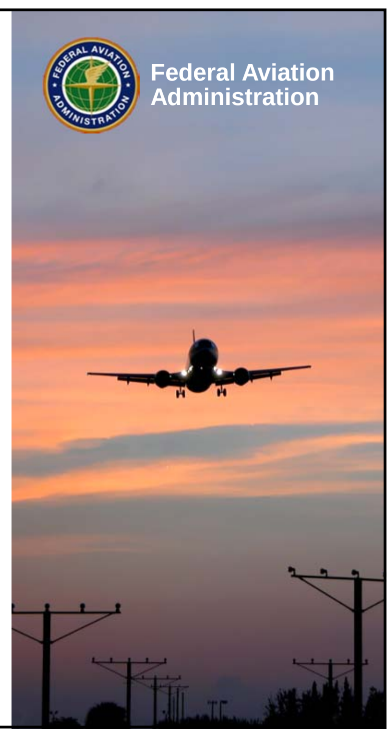
Bill Rogers



Wrap Up & Homework

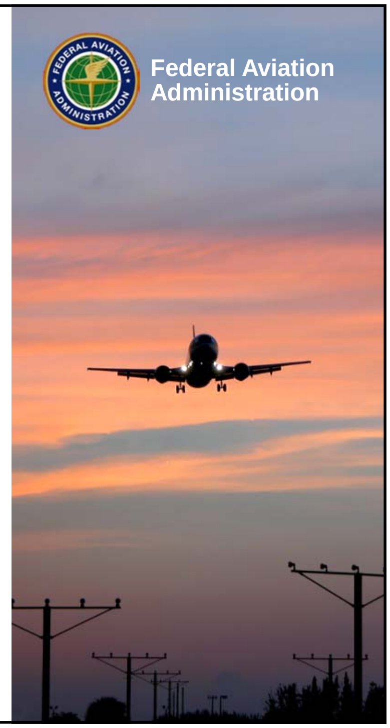


Review



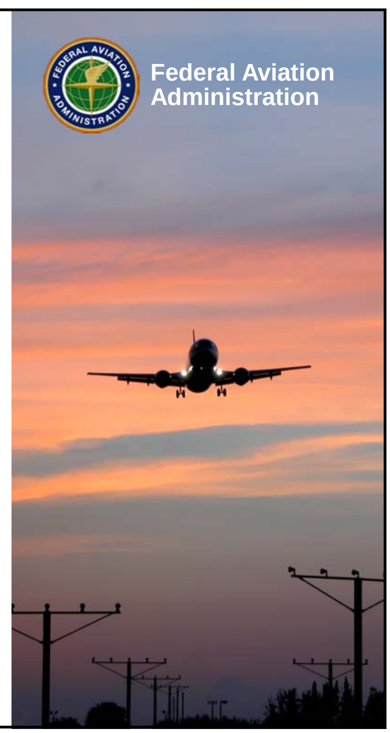
NASA Presentation

John Cavolowsky



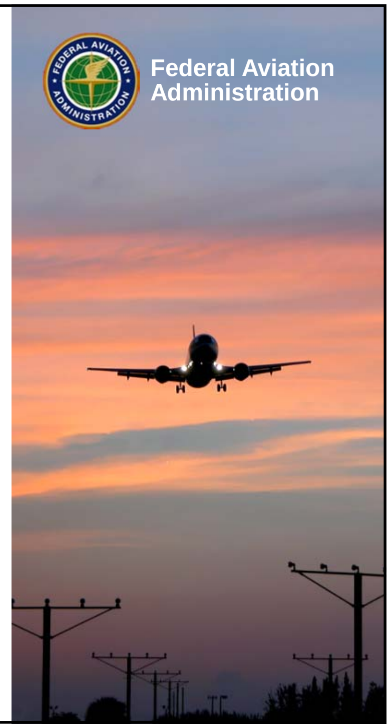
REDAC Member Presentation and Discussion

Tom Prevot



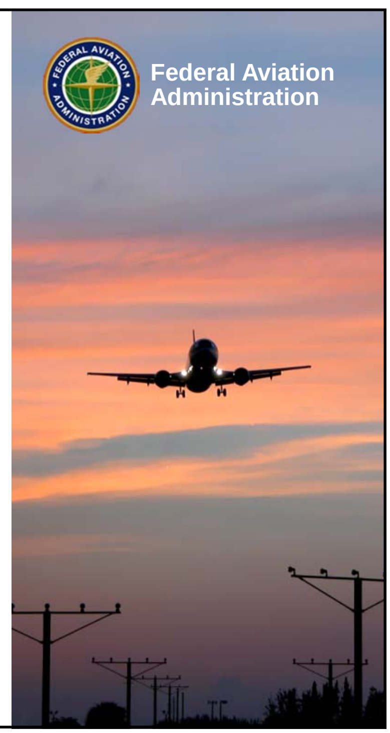
REDAC Member Presentation and Discussion

John Hansman



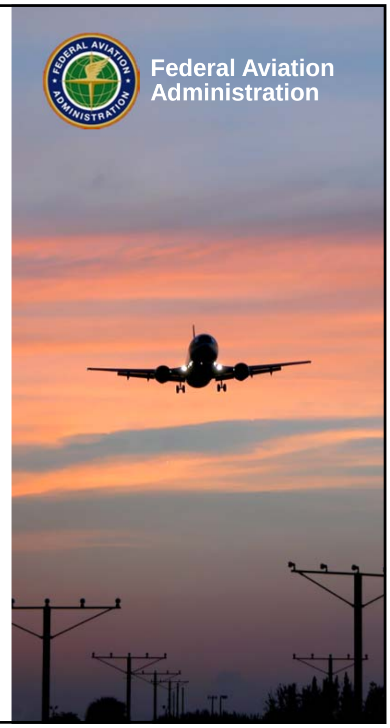
Presentation from AVS HFCC

Kathy Abbott



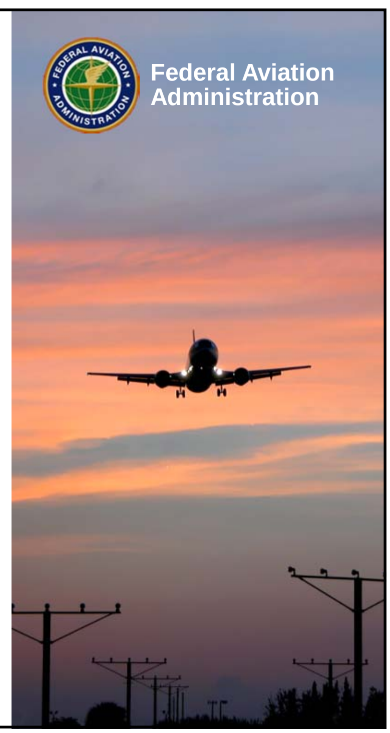
Gulfstream Human Factors Presentation

Susan Taylor



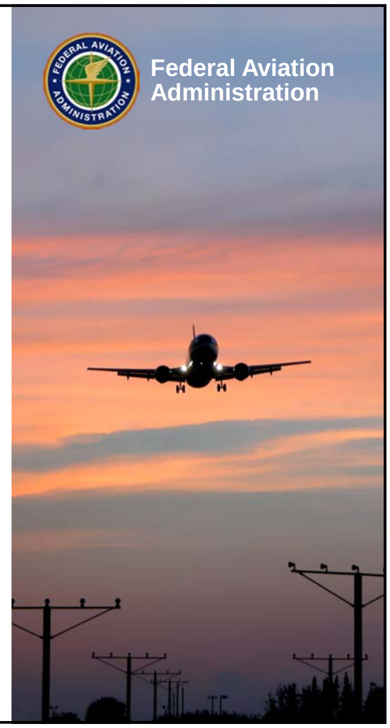
REDAC Member Presentation and Discussion

Alan Jacobsen

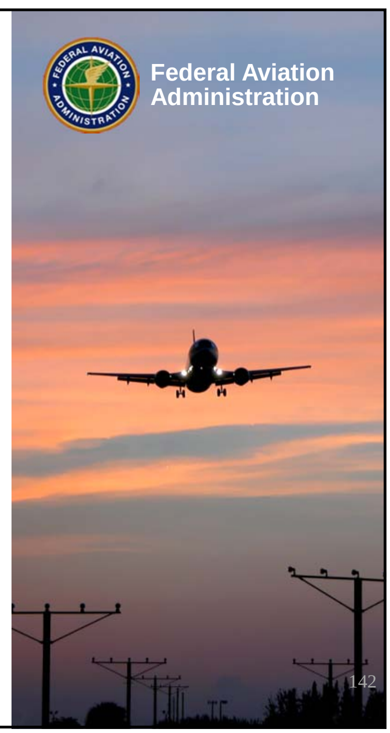


REDAC Member Presentation and Discussion

Dave McKenney

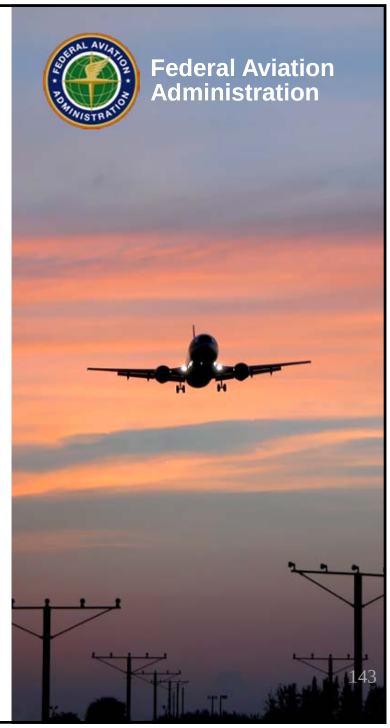


Discussion to identify Top 5 Future Research Issues



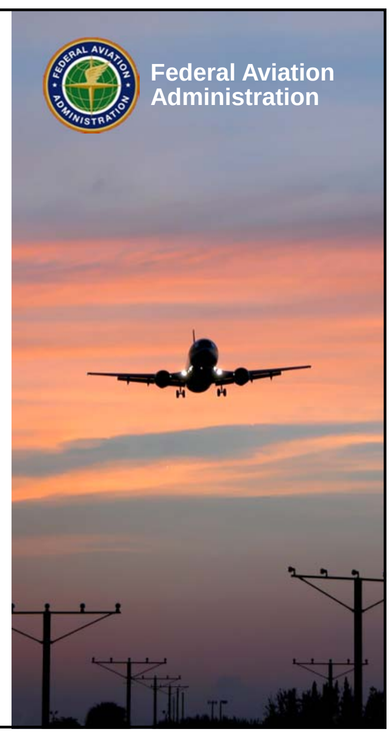
Assignments and Next Steps

Jack Blackhurst



FAA DFO Closing Items

Jason Demagalski
Human Factors Manager
ATO Safety and Technical Training
AJI-1200



Fall 2014 Human Factors REDAC Subcommittee

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