Human Factors and Automation Interaction

Kathy Abbott, PhD, FRAeS

Chief Scientific and Technical Advisor, Flight Deck Human Factors

Federal Aviation Administration



Federal Aviation Administration

Takeaways

- Resurgence of interest in Human Factors and automated systems/autonomy
- We need a more nuanced view of "automation"
- Complexity is a factor, too
- Need to address challenges and emerging issues
- Broad, integrated perspective needed design, training, operations, maintenance, regulatory, etc.

Resurgence of Interest in Human Factors and Automated Systems/Autonomy

Drivers include:

- Increasing use of automated systems/autonomy
- New entrants, technologies and operations
- Recent accidents
- Safety management

New Technologies and Operations



How are things changing for pilots?

- Sometime simpler, sometimes more complexity
- More information
- More tasks
- Different errors
- More use of automated systems



We need a more nuanced view of "automation"

- Many systems, not a single system
- Not all the same type of automated system
- Greatest growth is in automation of information-related tasks



Sometimes the issue is complexity, not automation

- Equipment design, operational complexity, overall integrations
- Vulnerabilities are sometimes related to complexity. Examples: Large amounts of information, Change fatigue







Current/Emerging Issues

- Human contribution to safety and operational effectiveness
- Information automation/management
- Responsibility for safety of flight
- Complexity: of aircraft systems, airspace procedures...
- Failure management
- Knowledge and skill degradation due to lack of practice
- Safety effects of organizational culture

Pilots and controllers mitigate risk on a regular and ongoing basis

Safety Snapshot: Split-second Decision Saved the Day (and more) in Perth

by John Croft in Things With Wings Mar 16, 2016 RBS TWEET COMMENTS 1









EASA	EMERGENCY AIRWORTHINESS DIRECTIVE
	AD No.: 2014-0266-E
****	Date: 09 December 2014 Note: This Emergency Airworthiness Directive (AD) is issued by EASA, acting in accordance with Regulation (EC) No 216/2008 on behalf of the European Community, its Member States and of the European third countries that participate in the activities of EASA under Article 66 of that Regulation.

This AD is issued in accordance with EU 748/2012, Part 21.A.3B. In accordance with EC 2042/2003 Annex I, Part M.A.301, the continuing airworthiness of an aircraft shall be ensured by accomplishing any applicable ADs. Consequently, no person may operate an aircraft to which an AD applies, except in accordance with the requirements of that AD, unless otherwise specified by the Agency [EC 2042/2003 Annex I, Part M.A.301, the ADS applicable ADs. Consequently, no person may operate an aircraft to which an AD applies, except in accordance with the requirements of that AD, unless otherwise specified by the Agency [EC 2042/2003 Annex I, Part M.A.301, the ADS applicable ADS. Consequently, no person may operate an aircraft to which and AD applies, except in accordance with the Authority of the Charles of Bestiver (EC 218/2009, Article 14/4) exception.

Flight Deck Information



Who is Responsible? Who is Liable?

Shift of responsibility/liability



Pilot responsibility/liability

Product liability

Lack of practice can result in degradation of basic knowledge and skills

Degradation of motor *and cognitive* skills and knowledge for manual flight operations

More than 60% of flight path-related accidents from 1996-2009 had a manual flight error



Challenges

- Variable expectations of safety for different segments of aviation
- Cybersecurity
- Dependence on sensors
- Infrastructure
- Change management
- Building on lessons from past experience

Autonomy Issues

- Trust issues (none or too much)
- Understandability Issues
- Training issues

The Autonomy Paradox

(Blackhurst, Gresham & Stone, 2011)



- Why 'unmanned systems' don't shrink manpower needs
- Autonomy doesn't get rid of humans, it changes their roles

As machine intelligence advances, the **need for better human interfaces** increases

Three Myths of Autonomy

- Myth of replacement not a simple oneto-one replacement
- Myth of linear progress
- Myth that autonomy is the highest level of technology.



The highest expression of the technologies are the ones that work most deeply, fluidly, **with** human beings.

Where to put risk mitigation



Questions for Consideration

- What operations?
- What level(s) of safety?
- Who is responsible for the safety of flight?
 - If it is the pilot, then pilot must have the knowledge and skills, and the system design must enable the pilot to intervene as needed
 - If not the pilot, then who? How does that affect the design requirements from a safety perspective?
- If we don't know all the ways pilots bring safety to the operation, how can we automate it?
- What model(s) of human-machine interaction should be used?

Broad perspective needed



Takeaways

- Resurgence of interest in Human Factors and automated systems/autonomy
- We need a more nuanced view of "automation"
- Complexity is a factor, too
- Need to address challenges and emerging issues
- Broad, integrated perspective needed design, training, operations, maintenance, regulatory, etc.

Takeaways

- Resurgence of interest in Human Factors and automated systems/autonomy
- We need a more nuanced view of "automation"
- Complexity is a factor, too
- Need to address challenges and emerging issues
- Broad, integrated perspective needed design, training, operations, maintenance, regulatory, etc.

Kathy Abbott kathy.abbott@faa.gov