Human Factors and Automation Interaction

Kathy Abbott, PhD, FRAeS
Chief Scientific and Technical Advisor, Flight Deck Human Factors
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.
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 one-to-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

Designer Error

Pilot Error

Design Engineer

Envelope Protection

TCAS/ACAS

Flight Director

Flexibility/Adaptability

Pilot

Cat III Autoland

Circling Approaches
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