

Single Pilot Operations
Technical Interchange Meeting
April 10-12, 2012

Breakout Report
Group 2 (Showroom)



Function Allocation

- In SPO, we need to know who is the backup?
 - Air/ground
 - Human/Automation
 - Pilot 1/Pilot 2
 - Nominal/Off-nominal
 - Dynamic allocation – who has the authority?
- If a human is the “second Pilot,” does s/he needs to be in the cockpit?
 - Preferably Yes
 - Time urgency (response time)
 - Situation awareness
 - Nature of other problem
 - If on plane (not a FO)
 - How does s/he get access to the cockpit?
 - How much training is needed?
 - If on ground
 - Does a ground pilot monitor one flight for entire trip? By phase of flight?
 - How does that affect certification?



Function Allocation

- If the “second pilot” is automation
 - What roles do the single pilot take on from that traditionally assigned to the second pilot?
 - What roles should the automation be assigned?
 - Automation needs to have the ability to do everything
 - The second pilot does (coordination and monitoring)
 - The primary pilot does (incapacitation)
- How adaptive does the automation have to be?
 - Is there an optimal balance?
 - Can it be dynamic? Who determines the level?
 - How accepting are insurance agencies and other stake holders?
- It was consensus of the group, that the most likely “second pilot” would be automation in most situations, although human SMEs can be brought in to consult on particular problems



Automation as the “second” pilot

- Qualities of and Design Considerations for Automation
 - Should *essentially* never be wrong
 - Intuitive to use
 - Decision support tool
 - Trajectory
 - Systems management
 - Coordination
 - Control interface
 - Interact with primary pilot in same manner as a human co-pilot
 - Voice control
 - Respond to human instruction (checklist in 2 mins)
 - Anticipate pilot needs (present relevant information)
 - Trade-off tasks with pilot
 - Cross verification
 - Coordinate with all systems and report to pilot
 - CRM capable
 - Public acceptance



Research Issues: Design

- What are the Ergonomics of a SP cockpit?
 - How to capitalize on ergonomics?
 - Display-control layout
 - Information Display (multimodal?)
 - Menu structure
 - Musculoskeletal disorders
 - Flight deck layout (where would FAA or line-check airmen sit?)
- What Biological considerations need to be taken into account?
 - Autopilot when leaving cockpit: How long can pilot be absent?
 - Boredom
 - Fatigue
 - Social interaction
- What Environmental consideration need to be addressed?
 - Separate cockpit for lost of cabin pressure
 - Interruptions and distractions



Research Issues: Human-Computer Interaction

- Who are we Designing for?
 - Pilots
 - Novices
- What is the basis of the Interaction?
 - Cooperative/Query/Challenge
 - Interruptions
- What is an acceptable System response time?
- How would a Voice interface be implemented?
 - Dialogue component
 - Natural vs. controlled natural language
 - Context
- How often does the Human need interact with the automation?
- What are the best Icons/labels/color coding warnings to use?
- When to alert pilots and how?
- Digital vs. analog (ani-digi) – include trend information in the display?
- What level of automation transparency/level of info being reported by automation to pilot query is ideal?



Research Issues: NextGen Impacts

- Does the level of precision required by NextGen determine the functional allocation?
- What are the limitations of having a human operator in the system?
- Does SPO influence acceptable boundary levels?
- How does the interdependence of systems in NextGen will impact the development of SPO?
- Is SPO even feasible in NextGen, especially in off-nominal situations?



Research Issues: Training

- For the different F/A what are the minimum training regulations?
- How does automation affect awareness?
- What can single pilots do without more automation?
Do we need more automation?
- What should the system do in absence of the pilot?
What is the role of automation in an emergency?
- What should be included in CRM training?
- How do we train pilots for unexpected events
 - Training situation assessment and decision making skills
 - Balance between emergency procedure training vs. creativity
 - Embedded training during flight
- How to prevent skill degradation?
- What are the new teamwork skills required?



Research Issues: Training (con't)

- How do we select and train new pilot?
- Does training differ by flight length?
- Cultural issues – what are the impact of cultural influences on automation acceptance
 - As an example: flying with somebody that you are in an argument with – there is very little interaction, and that makes the trip “miserable” (is that similar to what it would be like flying with just a computer?)
 - Trust in automation by given cultures
- Are there any task combinations that are unmanageable in a single pilot environment? Can we train to mitigate the detrimental impacts of multitasking?



Research Issues: Communication

- There needs to be research on voice controlled automation
- What can technology support?
 - Natural Language vs. Controlled natural language
 - Type of speech (let's start down)
 - Variability of commands
 - Training issues?
- Can voice analyses be used as an indicator of stress?
- Can the system recognize when the pilot does not understand and adapt to the pilot?
- What is the role of dialogue and context?
- Can we use of research from other literature to support development?
 - Space exploration
 - Automobile industry



Research Issues: Trust and Acceptability

- What are the overall benefits of SPO? Does this debate warrant dollars over the money that could be provided to second pilots?
- Do we need to survey the public? Are they accepting of FAA certification?
- Where will the pushback come from?
 - Professional communities
 - Unions
- How would a zero tolerance policy for accidents affect the feasibility of SPO?

