

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

Breakout Group 4



Overview

- Single Pilot Operations (SPO) can be managed by a team consisting of:
 - Pilot on flight deck
 - Flight deck automation
 - Cabin manager
 - Airborne support
 - Ground support team
 - Ground automation
- We will review:
 - SPO strategy
 - Operational issues and questions
 - Research topics



Strategy

- Aircraft will be able to fly themselves
- Single pilot on board (PoB) with flight deck automation (FDA) could handle normal operations
 - Aviating, navigating, communicating, and monitoring tasks
 - Following air traffic control instructions
 - Managing departure and arrival
- PoB and FDA could also handle some non-normal conditions
 - Engine out
 - See and avoid
 - Tactical weather situations



Strategy

- Flight would be monitored by an “Enhanced” Airline Operations Center (EAOC)
- EAOC includes ground and airborne personnel and automation (decision support and data)
- More extreme non-normal events could be managed by the PoB, FDA, “Cabin Commander,” and EAOC
 - Air interruptions (extreme weather, flight mechanical, FDA problems, security issues)
 - Pilot and/or FDA may need help in high workload situations
 - May be FDA failure states to cope with
 - Specialize skills or information may be required



Strategy

- Aircraft crew and EAOC would be a dynamic, distributed team comprised of required expertise
 - PoB and FDA
 - Cabin Commander
 - “Wing Man,” pilot(s), technicians, dispatchers, and others in the EAOC
 - Automation and data resources in EAOC
- EAOC would come into play on an as needed, flexible basis
- Information would be exchanged between team members to support problem solving



Strategy

- Wingman concept
 - PoB would communicate with pilot on other, nearby flight
 - Would be pre-identified to assist
 - Would provide operational support
 - Run checklists
 - Program Flight Management System
 - Navigate around weather
 - Ship to ship Crew Resource Management (CRM)
 - Monitoring and alertness function
 - Decision-making support
 - Resources are readily available in the system
 - EAOC could coordinate this



Mercedes



“Attention Assist System”



Strategy

- Could train a Cabin Commander to manage in-flight problems in cabin (people or mechanical)
- Might also need resources and communications/data sharing with ground (checklists, ground assistance)
- Would be part of the operational team
- Relieve PoB of monitoring and managing cabin/passenger matters
- Could also be airport specialists who could assist with arrival/departure questions/problems



Strategy

Flight
(PoB, FDA, Cabin Commander)



Wing Man



EAOC



Questions and Issues

- Automation
 - What are the tasks/responsibilities that should be allocated/traded back and forth between PoB, FDA, and EAOC?
 - What are the best tasks for automation, human, or both?
 - Automation may not relieve workload as much as expected; when does this happen?
 - Automation may need to be transparent and interactive , and sometimes not
 - How to structure CRM with temporary, distributed teams and automation (air & ground)?



Questions and Issues

- Radio bandwidth, delays, and security issues
- Coordination with air traffic control (ground gets involved?)
- How to handle mixed equippage operations?
- Ensure “graceful” degradation of automation and personnel
- PoB oxygen above FL350



Questions and Issues

- Resources
 - Displays/controls on ground to mirror flight deck
 - Mirror relevant information
 - Wing Man flight deck could mirror displays from flight
 - Video link, radar links, etc.
 - Voice interaction systems to call out air traffic control DataComm instructions, verbalize checklists, input to on board systems
 - EAOC would need to make resources available quickly
 - Get into “loop” rapidly



Pilot Incapacitation



One solution: Autopilot (Otto) and stewardess take over...



Questions and Issues

- PoB incapacitation
 - Spectrum of problems (asleep, sick, crazy, dead, etc.)
 - Affects flight controls or not
 - How do predict or detect any and all conditions?
- Would also need to cover normal breaks or absences from flight deck
- Cabin Commander could handle cabin/passenger problems
- Pilot malice
 - Intentional, dangerous intervention in flight



Questions and Issues

- Response to incapacitation
 - Warnings (“wake up!”)
 - Takeovers (FDA or ground staff/systems)
 - FDA/EAOC could take over in case of incapacitation
 - How to give control back? How much to give back?
 - Who is commander of airplane?
 - When would this shift?
 - Cabin Commander could be useful in evaluating PoB



Questions and Issues

- Incapacitation could be FDA or EAOC automation
 - Fails in different way from PoB
 - May be in the form of errors or bugs
 - Also could be failure, or multiple (unexpected) failures of systems
 - PoB or EAOC could take over in case of problems



Research Topics

- How to form/train/manage temporary, distributed teams that can work under pressure?
 - How to measure/evaluate performance?
- How to build good CRM in these teams
- Methods for ensuring graceful degradation of automation or human
- How to define and measure thresholds for workload for PoB and EAOC to govern when to allocate tasks
 - Workload monitoring part of pilot monitoring?
- Transitions in levels of support (PoB and EAOC)
 - What help and how much?
- Independent vs. collaborative automation
- How to monitor team and individuals (and monitor the monitor)



Research Topics

- What and how much data/video/displays to share with remote location (EAOC)?
- Radio bandwidth: how much will be needed for audio, video, flight data, etc?
- How to handle mixed equipage?
- Location of authority, does it shift (flight, cabin, EAOC commanders)?
- Methods for Validation and Verification of automation
- What are regulatory issues? (size, number passengers, Part 95 vs. 121, operational environment, freight vs. passengers, risk to ground)
- Consider spinoffs from SPO research for NextGen and near term



Research Topics

- Harbor pilot model? (Local expert at airport)
 - Due to problems with transmission delays at remote facilities
 - Work for FAA and not airline?
- Develop criteria and measures through which SPO concepts/technology can be evaluated and affect FAA standards
- Validate standards using concept development and simulation
- Conduct evaluation of second pilot for error trapping
 - Human can be instrumental in overcoming problems
 - Use ASRS?

