Design of a Single Cockpit Pilot for Airline Operations
Jonathan Graham, Chris Hopkins, Soham Trivedi, Andrew Loebler
System Engineering & Operations Research, George Mason University

Context
- Commercial air carriers have experienced poor financial performance over the past thirteen years
- Financial volatility is caused by rising operating expenses
- Rising variable costs such as fuel are driving operating expenses up
- FAA has predicted a pilot shortage in the next 10 years
- Historically, the cockpit has decreased in size as a way to mitigate labor costs as technology became available to assume the roles of the replaced pilots. Could removing the co-pilot be the next step in this devolution?

Need Statement & Alternative Con-Ops
Need: A single pilot cockpit is needed to decrease labor expenses and mitigate the effects of a pilot shortage

Alternatives:

<table>
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<tr>
<th>Two Pilot Cockpit (Baseline)</th>
<th>Single Pilot (No Additional Support)</th>
<th>Single Pilot (With Onboard Procedural Support System)</th>
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<tbody>
<tr>
<td>No change from system in place today</td>
<td>All tasks transferred to pilot</td>
<td>Co-pilot is replaced with hypothetical black box avionics system that is integrated into the cockpit.</td>
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<tr>
<td>Procedural breakdown does not change from FCOM</td>
<td>Callouts between pilot and co-pilot removed</td>
<td>System can give intelligent suggestions to pilot, but has no control over the plane.</td>
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designed single cockpit, as expected

Procedure Model Results
- Unsupported single pilot had smallest processing time
- The unsupported single pilot showed a fourfold increase in workload over the baseline
- The onboard-supported single pilot, however, saw a 15% reduction in workload from the baseline
- Predicted reduced processing times due to reduction in task count
- Both single pilot cockpit designs have average procedure times significantly smaller than the two pilot cockpit, as expected

Reliability and Business Model Results
- Required system reliability at 1 million flight hours is 0.94
- An unsupported single pilot would require aircraft reliability to be at an unachievable level, making it an unfeasible option
- Single pilot with onboard support would be feasible as long as an emergency auto-landing feature could be implemented
- Avionics would have to be certified above 1 in 1 million flight hour failure

Conclusions & Future Work
- Single pilot with onboard support alternative gave best utility to cost ratio
- Recommend keeping two pilot cockpit with the procedure support system to be phased in and evaluated for the eventual change to the single pilot cockpit pending further future analysis
- Extend procedure simulation to a live pilot simulator to validate and/or recalibrate models
- Tie in ATC procedures to test their workloads
- Incorporate dynamics feedback loop
- Conduct focus groups with stakeholders to establish win-win scenario
- Begin development of Single Pilot with Onboard Support requirements baseline