Data Comm Flight Deck Human-in-the-Loop Simulation

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Previous Data Comm Tasks:
NASA & Volpe

• Compile flight deck and air-ground Data Comm human factors issues
• Indicate methodologies that might be most appropriate to address issue
• Provide a prioritization of those issues
• Get feedback regarding prioritization of those issues from the FAA’s Data Comm Office
• Consider HITL to address flight deck human factors issues
Previous Research/Operational Concerns

• Terminal area use of Data Comm may be required for NextGen clearance types
• Terminal area creates flight crew challenges when using Data Comm
  – Timing concerns for busy phase of flight
  – Heads-down issues
• Message length has been an issue for flight crews in voice and data comm (Lozito et. al, 2004)
• Autoload of data comm messages has indicated some loss of situation awareness (Logsdon et al., 1996)
Research Questions

• What are the acknowledgment times and transaction times for the terminal area?

• What is the impact on message timing when comparing two small messages v. a longer concatenated message?

• What is the impact on crew errors (spoken errors and data entry errors) when comparing two small messages v. a longer concatenated message?

• What is the impact on the autoloading of message components when comparing two small messages v. a longer concatenated message?
Methods

• Boeing 747-400 Level D Certified Simulator
• SFO Terminal Airspace
• Current message set
• Participants will be current line pilots (CAs and F/Os)
• Controller as confederate
• Pseudopilot for background chatter
• Data Comm/Voice mix
• Short v. Long messages
• Subset of messages will be autoloadable (mostly route messages)
Example Scenario: Modesto 3 Arrival

CLOVIS TRANSITION (CZQ MOD3): From over CZQ VORTAC via CZQ R-305 and MOD R-092 to MOD VOR/DME. Thence....

COALDALE TRANSITION (OAL MOD3): From over OAL VORTAC via OAL R-246 and MOD R-064 to MOD VOR/DME. Thence....

MINA TRANSITION (MVA MOD3): From over MVA VORTAC via MVA R-204, OAL R-246 and MOD R-064 to MOD VOR/DME. Thence....

MUSTANG TRANSITION (FMG MOD3): From over FMG VORTAC via FMG R-182 and MOD R-064 to MOD VOR/DME. Thence....

....From over MOD VOR/DME via MOD R-245 to CEDES INT, then via OSI R-056 to OOMEN INT, then via OSI R-056 to MEHTA INT. Expect vectors to the final approach course.

LOST COMMUNICATIONS: Intercept and proceed via SFO RWY 28R localizer to DUMBA INT.
Study Metrics

- Crew acknowledgment time
- Total transaction time
- Errors
  - Acceptance of erroneous clearance
  - Additional crew errors
- ATC queries
  - Voice
  - Data Comm (use of downlink or message log)
- Workload
  - NASA TLX
  - WAK
- Situation Awareness