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