



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



SW-2, 14 JAN 2010 to 11 FEB 2010

MODESTO THREE ARRIVAL
(MOD.MOD3) 09295

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....

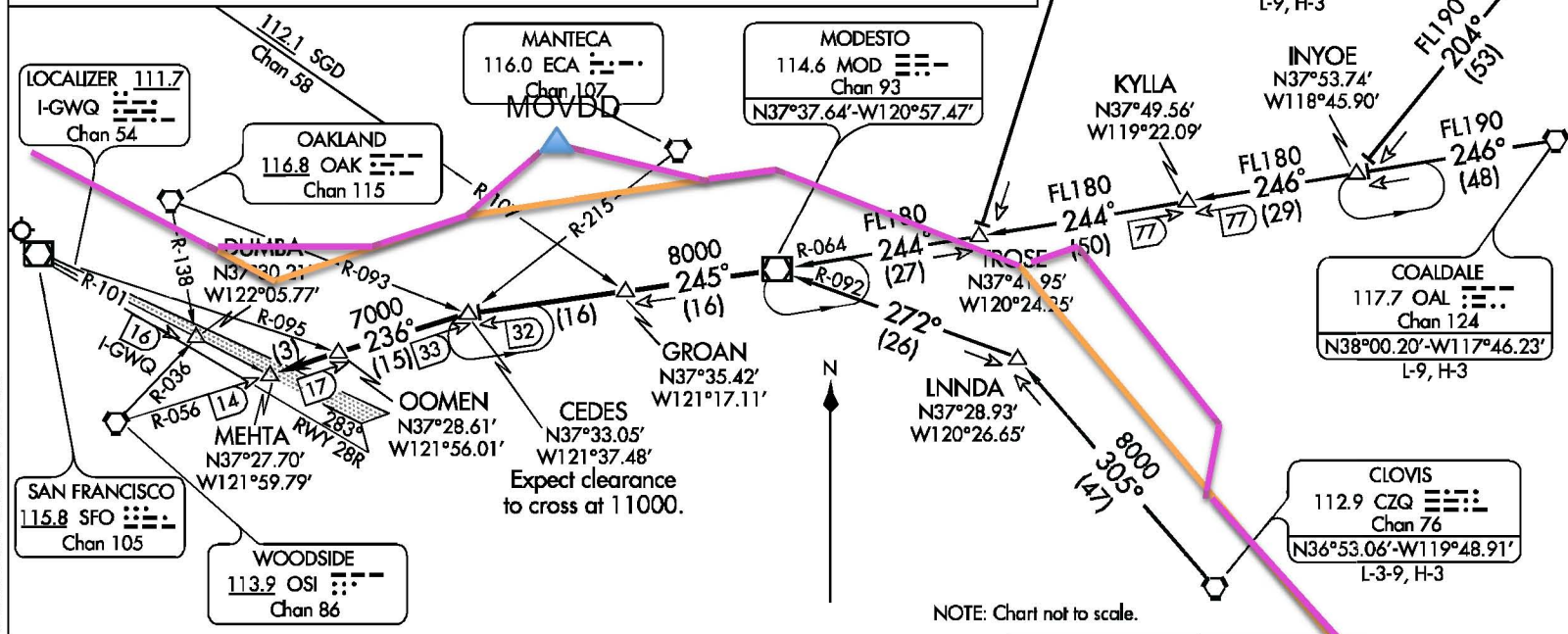
MINA TRANSITION (MVA.MOD3): From over MVA VORTAC via MVA R-204, OAL R-246 and MOD R-064 to MOD VOR/DME. Thence....

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.

MODESTO THREE ARRIVAL
ST-375 (FAA)



SAN FRANCISCO, CALIFORNIA
SAN FRANCISCO INTL

SAN FRANCISCO, CALIFORNIA
SAN FRANCISCO INTL

SW-2, 14 JAN 2010 to 11 FEB 2010

start point, just before CZQ

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