TAPPR (Terminal Area Paired Procedures Research)

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ABSTRACT

Situation awareness is critical for Air Traffic Controllers, as the constant aircraft flow demands their attention. The main goal of Terminal Area Paired Procedures Research (TAPPR) is to increase the number of flights that can land on very closely spaced parallel runways in low-visibility conditions. Currently, the San Francisco International Airport (SFO) can support about 60 landings per hour, but this can be achieved only with parallel approaches, which are allowed only under visual meteorological conditions. In low-visibility situations often encountered at SFO, parallel approaches are no longer allowed and the arrival rate is consequently halved. TAPPR is an advanced concept that introduces automated paired approaches to very closely spaced parallel runways to assure safe separation under low visibility conditions. We aim to bring the follower aircraft in a pair 5–25 seconds in trail of the leader aircraft because that zone is considered safe for wake and traffic. The Air Traffic Controllers in this experiment are provided with tools on their display that assist them in pairing aircraft to land within 5–25 seconds of each other. Two aspects that we will examine are the Air Traffic Controllers' situational awareness and their use and thoughts on the tools provided to them. With this, we will determine the effectiveness of the Air Traffic Controllers' tools and whether they can be used for efficient paired approaches in the future.

Planes preparing for parallel landing at SFO.

Air Traffic Controllers participating in the experiment. Positions from left to right: Boulder sector controller, Area Coordinator, Niles sector controller.

RESULTS

TOOL	NUMBER OF TIMES INDICATED THAT THIS TOOL WAS USED (OUT OF 144 POST-RUN QUESTIONNAIRES)	PERCENTAGE
pairing table	134	93.06%
timeline	112	77.78%
conformance monitoring tool	105	72.92%

	AVERAGE of the 144 post-run responses
What was the demand on your attention? [Situational Demand] (1 = very low, 7 = very high)	3.67
What do you feel your level of understanding of the situation was? [Situational Provision] (1 = very low, 7 = very high)	6.38
How much attention capacity do you feel you had available to apply to the operation? [Personal Resources] (1 = very low, 7 = very high)	5.81
How acceptable do you feel the speed control on the flight deck was? (1 = very unacceptable, 5 = very acceptable)	3.90
How acceptable do you feel the alerts provided by conformance monitoring tools were? (1 = very unacceptable, 5 = very acceptable)	4.00
How much did you have to compensate for the flight deck speed control to make the operation work? (1 = required extensive compensation, 5 = required moderate compensation)	3.76

MATERIALS & METHODS

In this experiment, the following participants were necessary:

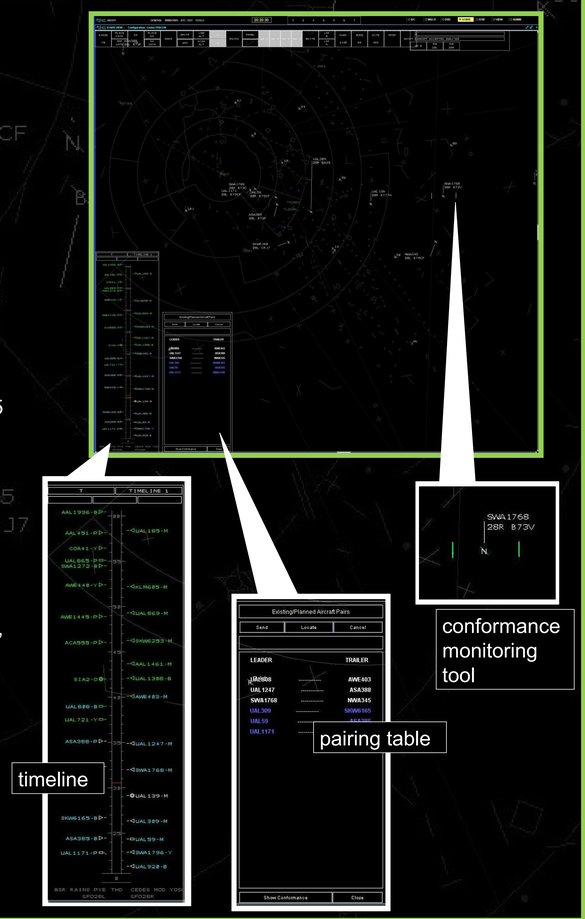
- three sets of three Air Traffic Controllers (one set per week, nine total)
- six sets of two Pilots (two sets per week, twelve total)
- four Pseudo Pilots (same four every week, four total)

In this section, we will discuss the materials and methods relevant strictly to the Air Traffic Controllers' main task: pairing aircraft and maintaining a 5-to-25-second spacing between the two aircraft in each pair. The Air Traffic Controllers were provided with radio for communicating with the pilots in addition to the following tools on their radar display:

- pairing table (displays pairs of aircraft selected by Area Coordinator)
- conformance monitoring tool (displays two green bars to show the range in which the trailing aircraft should be in order to be within 5–25 seconds behind the leading aircraft)
- timeline (displays every flight's call number and updated continuously to show time-wise where each plane is in relation to the coupling point as well as to each other)

Each Air Traffic Controller sat at either the Boulder, Area Coordinator or Niles station and rotated after each 30-minute run. After every run, each controller completed a questionnaire that asked them to rate various aspects of situational awareness, acceptability and their use of the tools, based on their experience.

Situational Awareness Rating Technique (SART) (Durso, 1998) was used to collect data on situational awareness after every run. The post-run questionnaire was also used to collect data on acceptability and usage of tools presented here. Data analysis was done using Microsoft Excel.



CONCLUDING REMARKS

Situational Awareness:

- The rating for the demand on the controllers' attention [situational demand] (3.67 out of 7) tells us that even with the new tools provided, the simulations did not require an overwhelming level of focus.
- The high rating of understanding of the situation (6.38 out of 7) allows us to conclude that the controllers were very comfortable with the task as well as with using the new tools [situational provision].
- With an average rating of 5.81 out of 7 for attention capacity that controllers felt they had available to apply to the operation, we conclude that the controllers were able to focus fairly well on their task [personal resources].

Acceptability:

- The rating for the acceptability of the speed control on the flight deck (3.9 out of 5) leads us to conclude that the controllers found the speed control to be fairly acceptable in this experiment.
- With an average rating of 4 out of 5 for the acceptability of the alerts provided by conformance monitoring tools, we conclude that the alerts are fairly acceptable.
- The rating of 3.76 out of 5 for need of compensation due to flight deck speed control leads us to conclude that controllers had to compensate for the function.

Usage of tools:

- The pairing table, timeline and conformance monitoring tool were all used in a great majority of the runs.
- In particular, the 93.06% usage of the pairing table allows us to determine that it is an essential asset to the success of this experiment.

SUGGESTION FOR FUTURE WORK

Improve the speed control functions on the flight deck and the alerts provided by conformance monitoring tools to further improve acceptability.

REFERENCES

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ACKNOWLEDGEMENTS

The first author thanks Savita Verma, Sandra Lozito, Deborah Ballinger, Diane Carpenter, Jacob Pfeiffer and all the Air Traffic Controllers who participated.