MEMORANDUM

EVALUATION OF DUAL AND TRIPLE SIMULTANEOUS
PARALLEL ILS APPROACHES SPACED 3000 FT APART
USING THE PRECISION RUNWAY MONITOR

April 9, 1996

The objective of this study was to evaluate the operation of simultaneous approaches to two and three parallel runways spaced 3000 ft apart. Controllers used the Precision Runway Monitor (PRM) to monitor approach traffic. The PRM consisted of an electronic scanning radar system with a 1.0 second (s) update rate and 1 milliradian accuracy and a Final Monitor Aid (FMA), a high resolution color display equipped with conflict alerts. The air traffic consisted of both flight simulators and computer generated aircraft which emulated a high density operation of turbojets, turboprops, and reciprocating engine driven aircraft.

To study the safety of the proposed operations, conflict situations were created between aircraft. "Blunders" were generated by having an aircraft deviate from the localizer by either 20 or 30 degrees toward the path of an aircraft on an adjacent approach. To create worst case scenarios, 50 percent of the blundering aircraft simulated a loss of radio communication with the controllers.

The study was designed to answer the following two questions:

1. Can the controllers maintain the test criterion miss distance of 500 ft between aircraft? Simply stated, can controllers prevent conflicts from resulting in a test criterion violation (TCV)?

2. Do the controllers, technical observers, the Multiple Parallel Technical Work Group (TWG), and ATC management observers agree that the proposed simultaneous approach operations are acceptable, achievable, and safe as simulated?

Early simulations in the MPAP (including this one) considered all of the blunders in the analysis of the TCV rate. A simulation was considered successful if less than 2% of all blunders resulted in TCVs. Results indicated that of the 247 conflicts created in the dual approach operation, only 1 resulted in a TCV. Thus, controllers were able to resolve 99.6 percent of the scripted conflicts in the dual approach operation. In the triple approach operation, 373 conflicts occurred between a blundering aircraft and an evading aircraft, 4 of which violated the test criterion miss distance. Consequently, controllers were able to resolve 98.9 percent of the conflicts in the triple approach operation. The overall TCV rates, calculated by the original method, was less than 2%. This result would have met the TCV criteria in use at the time of the simulation.

Procedures for MPAP simulations have been enhanced significantly since the conduct of this simulation. Enhancements enabled the MPAP TWG to determine that a limited number of blunder situations resulted in the severe conflicts. These situations were based upon aircraft alignment on the approach course, blunder degree, and the ability of the blundering aircraft to respond to controller instructions. With this greater understanding of the nature of parallel approaches, the MPAP TWG focused their analyses of proposed operations on the outcome of these severe conflicts.

Development in analytic tools enabled the TWG to restrict their assessment to only those aircraft which were longitudinally aligned at blunder start. This condition was denoted as being “at-risk”. An at-risk blunder would have resulted in a TCV had the controller and/or aircrew response been insufficient. Unfortunately, technical problems were identified in the aircraft track files from this simulation. These data were not retrievable for re-analysis, preventing in-depth examination of the aircraft alignment needed for the identification of at-risk status. As such, the performance data from this simulation could not be analyzed using current techniques and current criteria.

In the controller report, the controllers indicated that the PRM system with a simulated 1.0 s radar update rate significantly improved their performance. They also stated the displays and radar "would reduce stress and greatly enhance safety at any airport operating under current procedures."

Approximately 20 percent of the flight simulators in the dual approach operation and 40 percent of the flight simulators in the triple approach operation entered the No Transgression Zone (NTZ) at least once during an approach. In addition, controllers broke out 78 (3.5 percent) of all aircraft that were not involved in a blunder for the dual configuration and 54 (1.5 percent) of all aircraft that were not involved in a blunder for the triple approach configuration.

The frequent entries into the NTZ caused two separate and distinct problems; (1) the controllers' corrective actions congested the communication frequency to an unacceptable level, and (2) the excessive number of NTZ violations frequently required aircraft to be broken out of the approach. These findings highlight areas of potential safety hazards and reductions in the efficiency of the operation.

The MPAP TWG participated in the design of the simulation and the evaluation of the results in order to make recommendations about the operability of the proposed operations. The TWG was composed of subject experts from various FAA offices, including the Office of System Capacity and Requirements, Flight Standards, Aviation System Standards, Air Traffic, Research and Development, and regional organizations and operations personnel. As a result of the simulation, the TWG could not determine if the PRM System with the simulated 1.0 s radar update rate provided controllers with the ability to effectively resolve blunders for the 3000 ft runway configurations. Additionally, the TWG believed that the congestion on the communication frequency and the high frequency of breakouts would prevent safe and efficient operations.

Based on these results, the TWG determined that dual and triple simultaneous parallel approach operations with 3000 ft runway separation would not be acceptable.