



CDA Procedures at SDF

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Background

- **MIT led team conducted the successful and widely publicized flight test of a Continuous Descent Approach (CDA) procedure at Louisville International Airport (SDF) in 2002.**
 - Two B767-300 aircraft at the tail end of the UPS arrival bank were selected each night for the test.
 - First aircraft flew a conventional approach.
 - Second aircraft flew the CDA approach.
 - Lateral path were the same for both.
 - Enabling direct comparison of noise impact.
 - Flight test conducted during two-week period beginning on 29 October 2002.



Key Findings of 2002 Flight Test

□ Significant benefits:

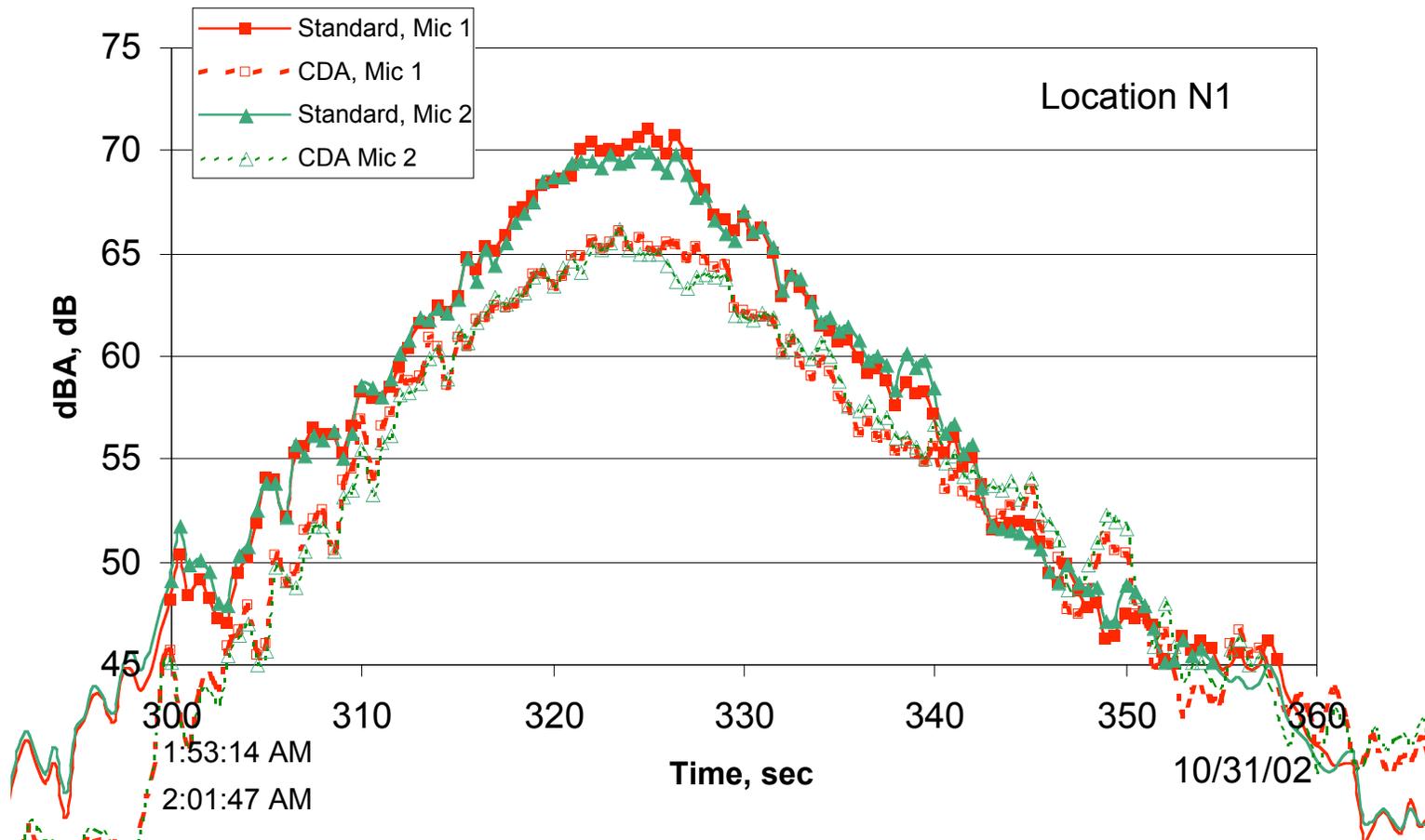
- 4 to 6 dB peak noise reduction in Floyds Knobs, IN;
- 500 lb. per aircraft fuel burn reduction;
- 100 sec. Flight time reduction.

□ Flight Management System (FMS) issues can cause undesirable auto-throttle and auto-pilot behavior:

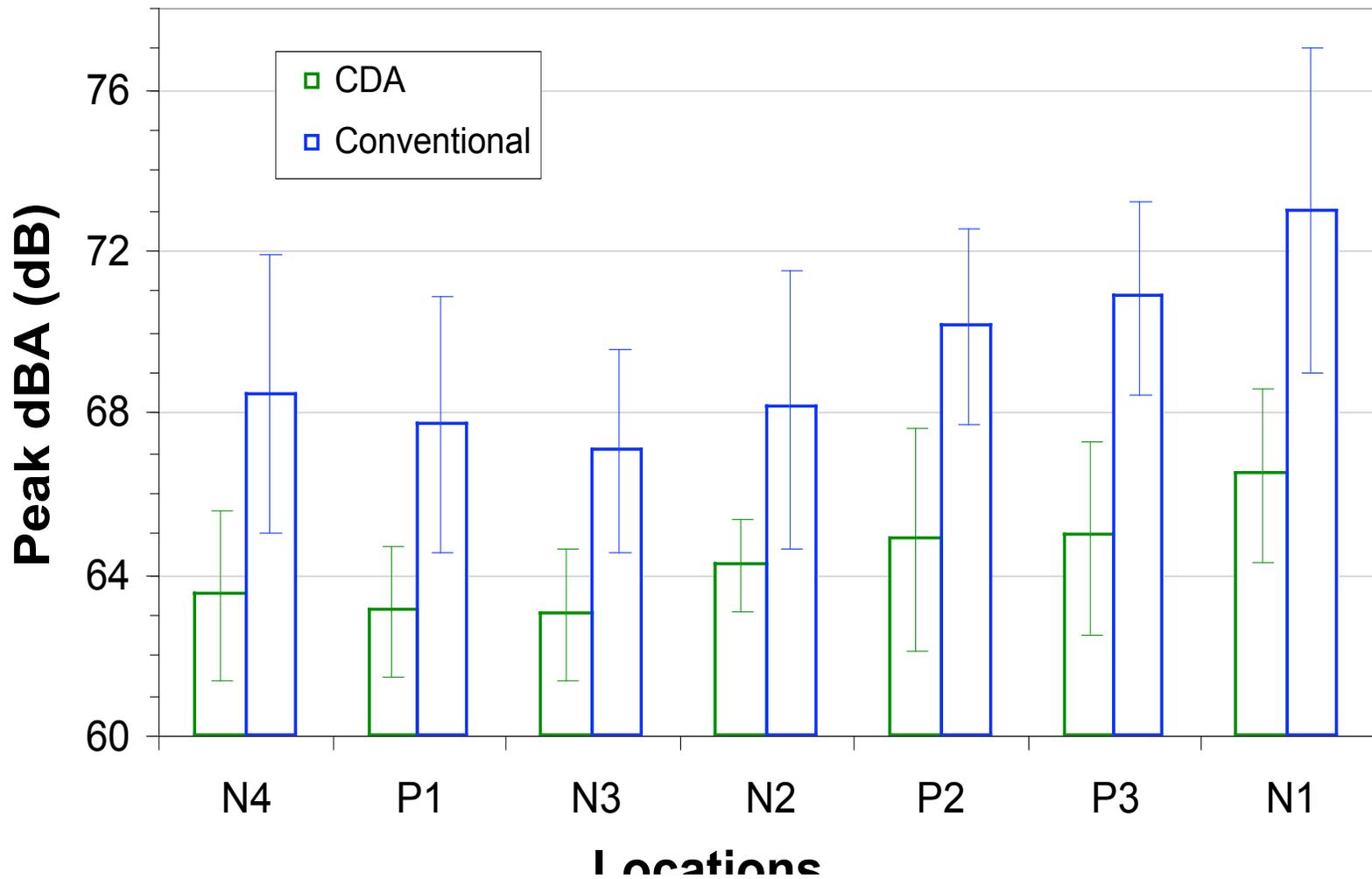
- Auto-throttle engages (with high thrust) if pilots are tardy in extending flaps/gear or if unexpected wind caused aircraft to slow more quickly than expected;
- Auto-pilot decreasing descent rate to arrest acceleration thus taking aircraft off desired path.



Noise Reduction



Noise Reduction (2)





Goals for Current CDA Flight Test

- **Design RNAV CDA procedures for runway 17R and 35L that:**
 - Eliminate FMS issues identified in 2002 flight test;
 - Begin at a higher altitude thus providing more fuel burn and emissions benefits;
 - May be used in daily operation.

- **Conduct flight test with greater number of aircraft (up to 20) each night to:**
 - Demonstrate consistency of procedure in terms of aircraft performance and noise benefits;
 - Provide data required for operational acceptance.



Team

□ Primary Participants:

- MIT (lead)
- Boeing
- FAA
- NASA
- RAA
- UPS

□ Secondary Participants:

- Rannoch
- DOT Volpe Center
- Wyle Labs



Research Approach

- **Determine waypoints and corresponding crossing restrictions and pilot procedures:**
 - Analytical analysis;
 - Simulator studies (at Boeing, NASA and UPS);
 - Beta flight tests (conducted by management pilots).

- **Determine initial separation required to ensure that the minimum separation is never violated:**
 - Monte-Carlo simulation (at MIT).



Research Approach (2)

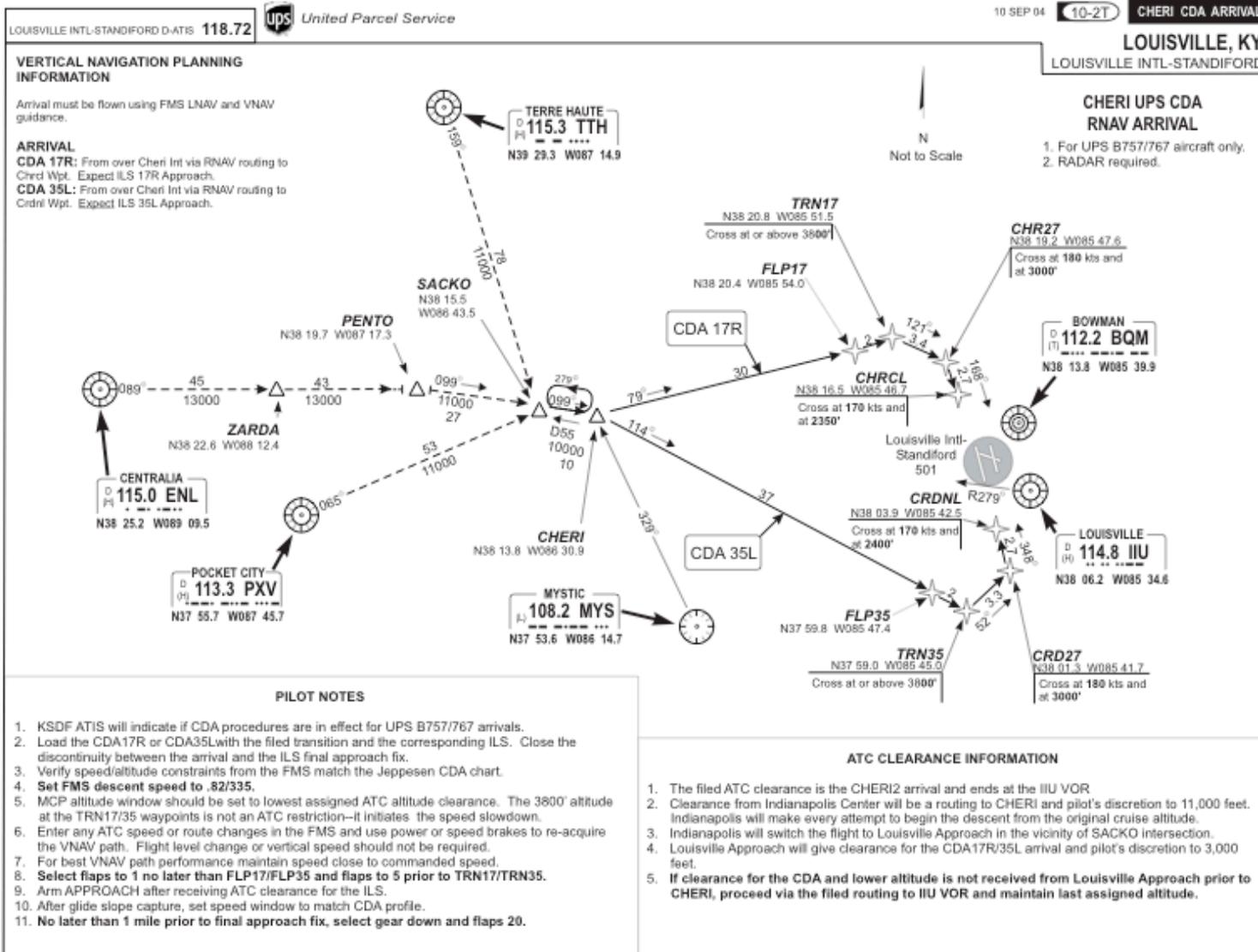
- Develop controller procedures:**
 - Determine procedures that give pilots sufficient flexibility but maintain ability of controller to monitor and intervene if necessary.

- Develop noise monitoring plans:**
 - Determine locations for noise monitoring stations.

- Conduct flight test between September 13 and September 26.**



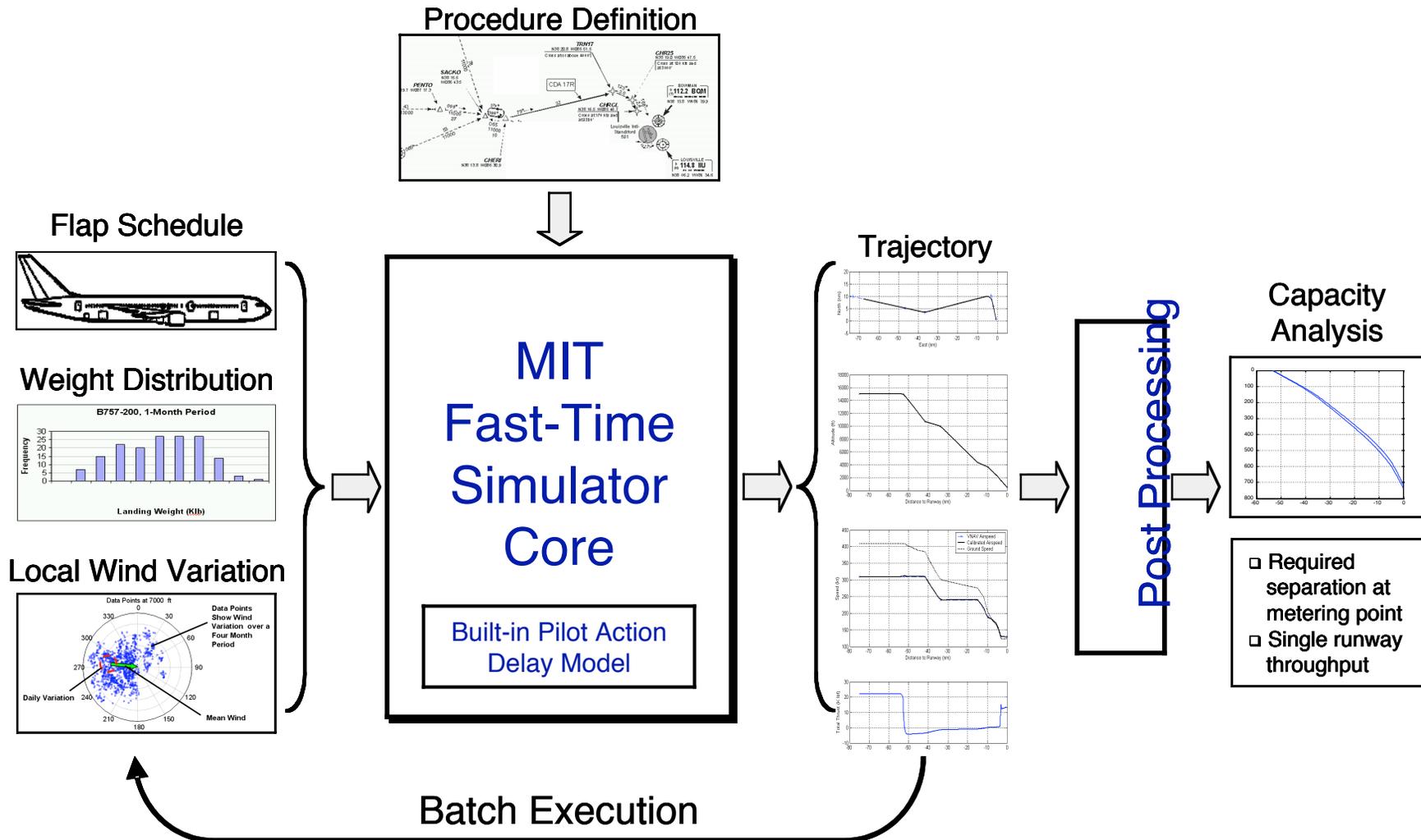
Approach Chart



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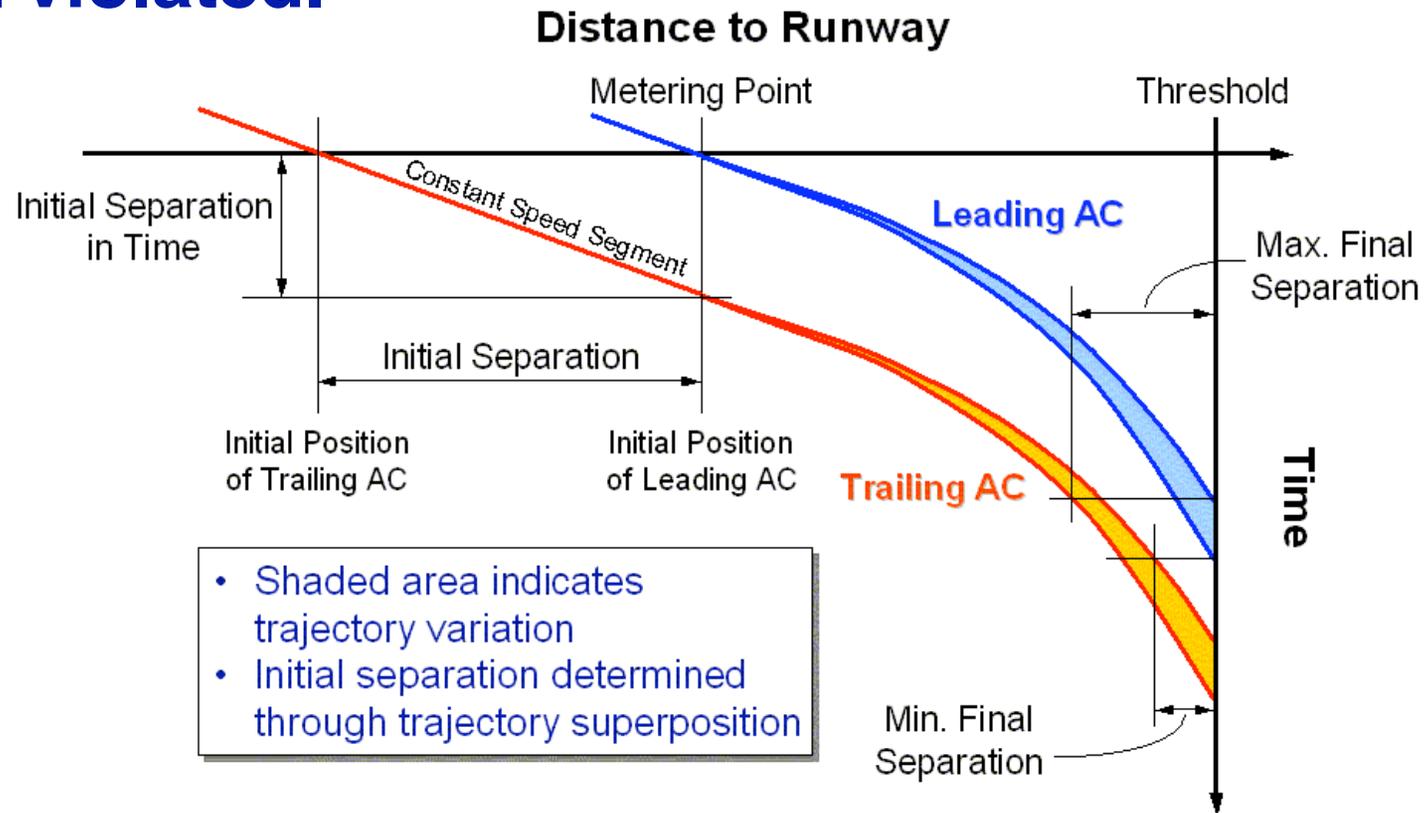
Fast-time Monte Carlo Simulation



Source: Liling Ren (Graduate Student)

Airport Capacity Analysis

- **Determine runway throughput by determining required separation at metering point to ensure that separation minima are not violated.**





Status

□ Flight test successfully completed:

- 126 aircraft planned over 10-nights
 - 123 aircraft performed as expected
 - 2 aircraft were adjusted (due to lower initial separation)
 - 1 captain declined to participate
- Noise data collected on 9 of the 10 nights;
 - Late switch in direction of operation prevented noise measurement team moving to other side of airport.
- CDA and non-CDA aircraft successfully mixed on one night.

□ Data analysis underway

- Report should be completed by November 30.



Goals for Next Phase of Research

□ Provide criteria for implementation of CDA throughout the National Airspace System:

- Many airports are interested in implementing CDA;
- Guidelines required for establishing priority and developing airport specific procedures.

□ Implement CDA at night where beneficial:

- Permanent procedure at SDF will be first to go through 18-step FAA approval process.

□ Develop controller tools for implementation in higher traffic scenarios:

- Design and test systems to help controllers estimate initial separation and future state of CDA aircraft.