



Noise Impact Study of a New 2004 Noise Abatement Procedure at the Louisville Airport

Dr. Natalia Sizov, Professor John-Paul Clarke, Liling Ren, MIT
Kevin R. Elmer, Dr. Belur N. Shivashankara, Boeing



2004 Flight Test: In Action

- September 15th, 2004



Steve Rizzi, NASA and Kevin Elmer, Boeing

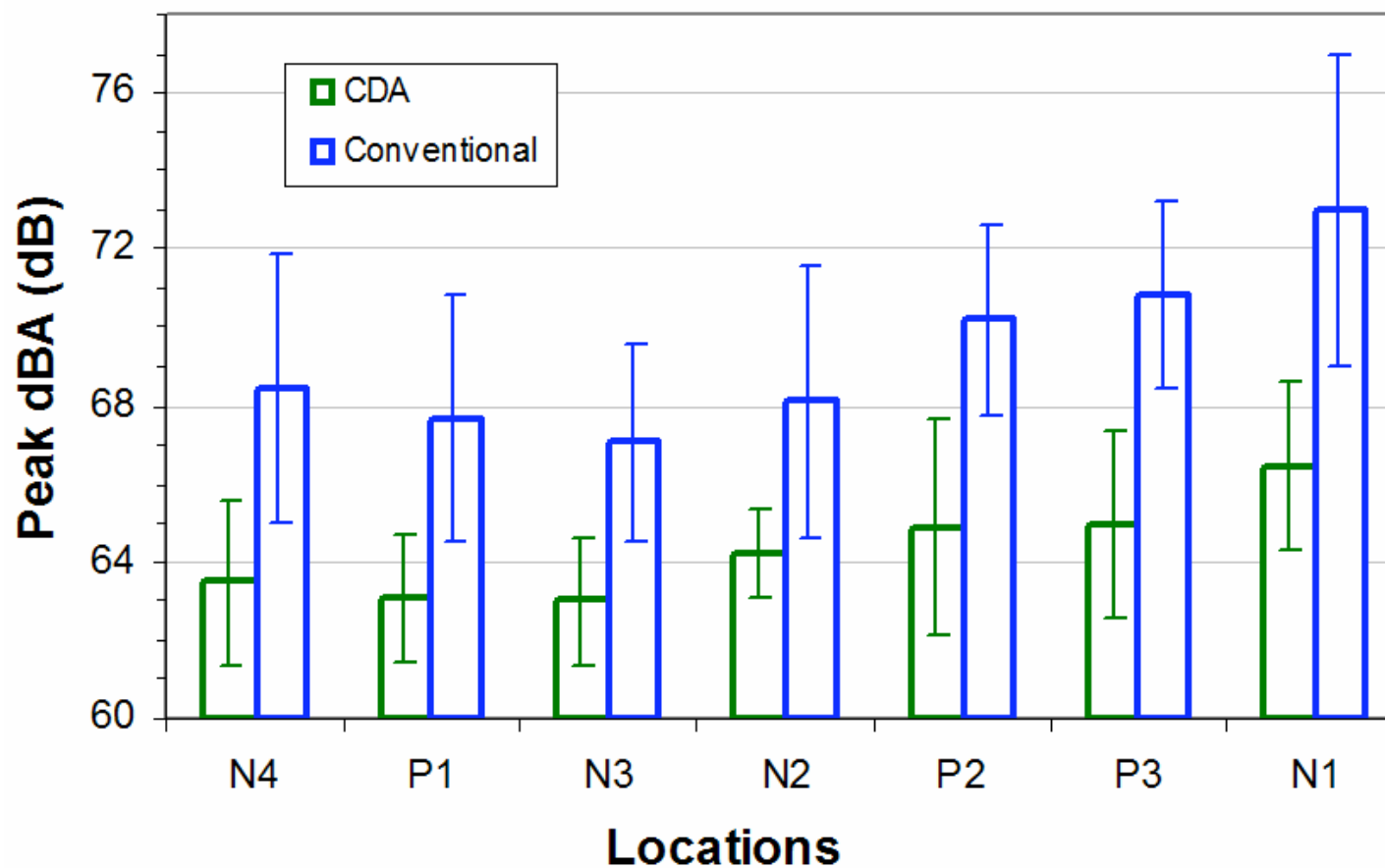


Eric Boeker, Volpe and Natalia Sizov, MIT

- This material is based upon work supported by the Federal Aviation Administration under Grant Number 9550.7A



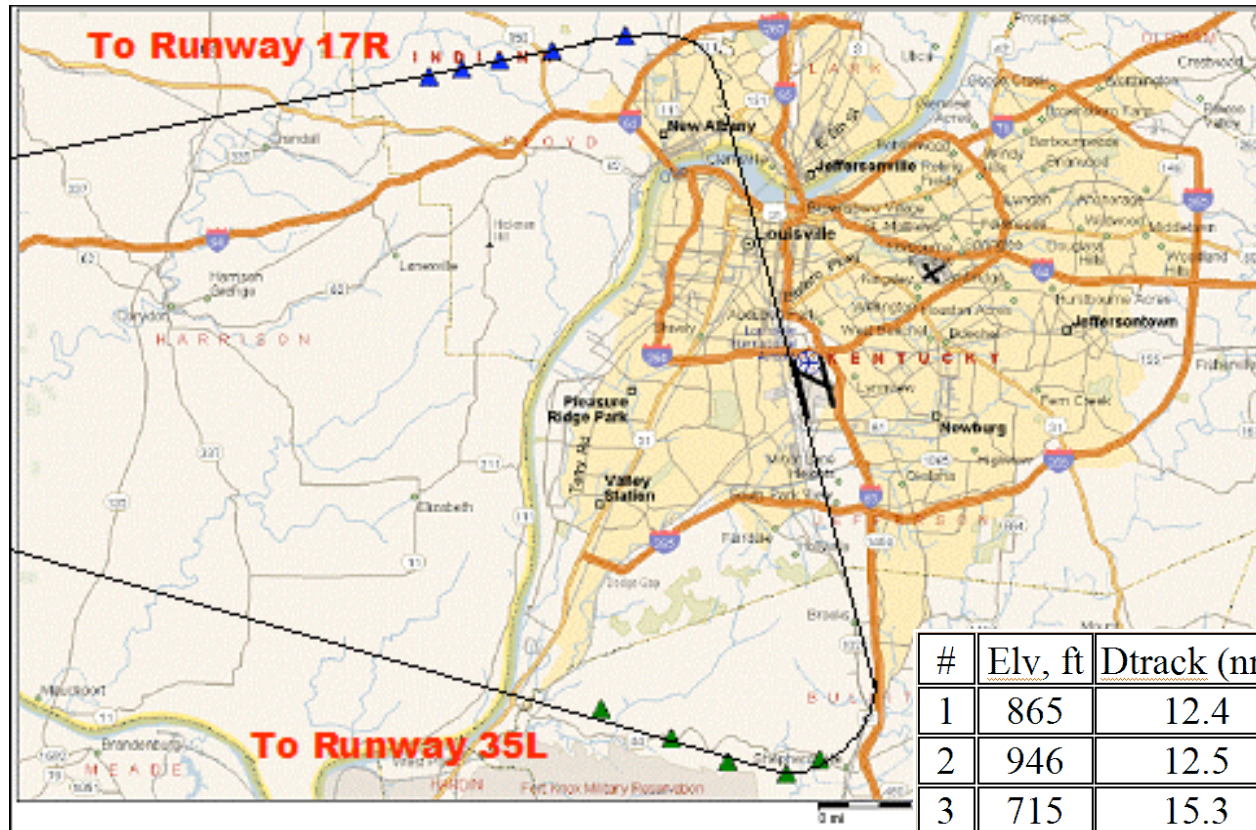
2002 Flight Test: Noise Reduction





2004 Flight Test: Noise Monitors

- The “North Flow” landings conditions occur about 80% of the time



North sites

#	Elv, ft	Dtrack (nm)	AC altitude, ft
1	865	12.4	3870- 4234
2	946	12.5	3878- 4234
3	715	15.3	4173- 4982
4	820	16.0	4262- 5168
5	675	16.7	4393- 5350
6	753	17.4	4559- 5489



2004 Flight Test: Equipment setup

- Site #5 South



- Site #1 South- typical site

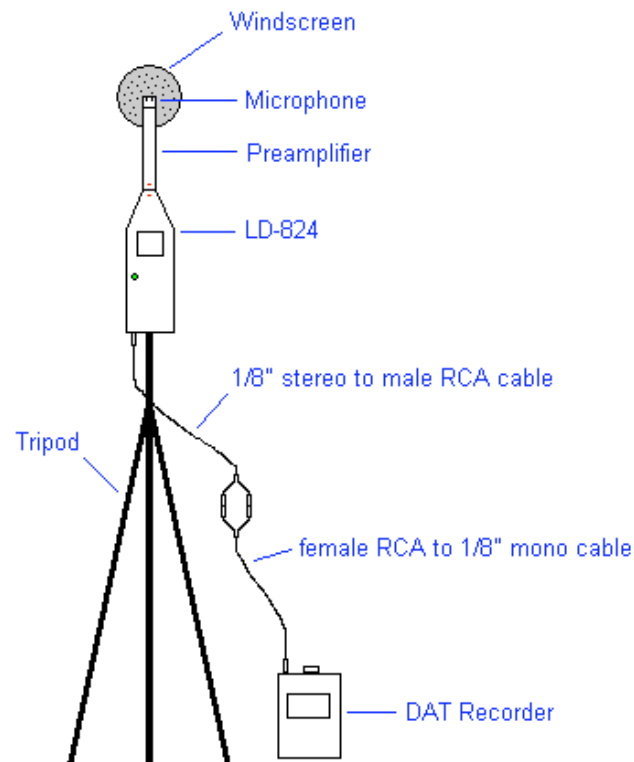


	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
14 September	48.81	47.1	51.19	46.71	47.33	53.78
15 September	48.42	50.04	49.31	49.38	49.6	43.9
18 September	41.14	40.34	43.18	43	N/A	38.19
21 September	38.48	36.42	39.73	41.93	42.19	37.12
22 September	43.6	42.41	44.15	46.54	N/A	38.99
23 September	41.61	40.08	46.95	48.26	46.63	41.46
25 September	49.56	50.93	50.07	40.31	45.32	47.01
Average	44.52	43.90	46.37	45.16	46.21	42.92



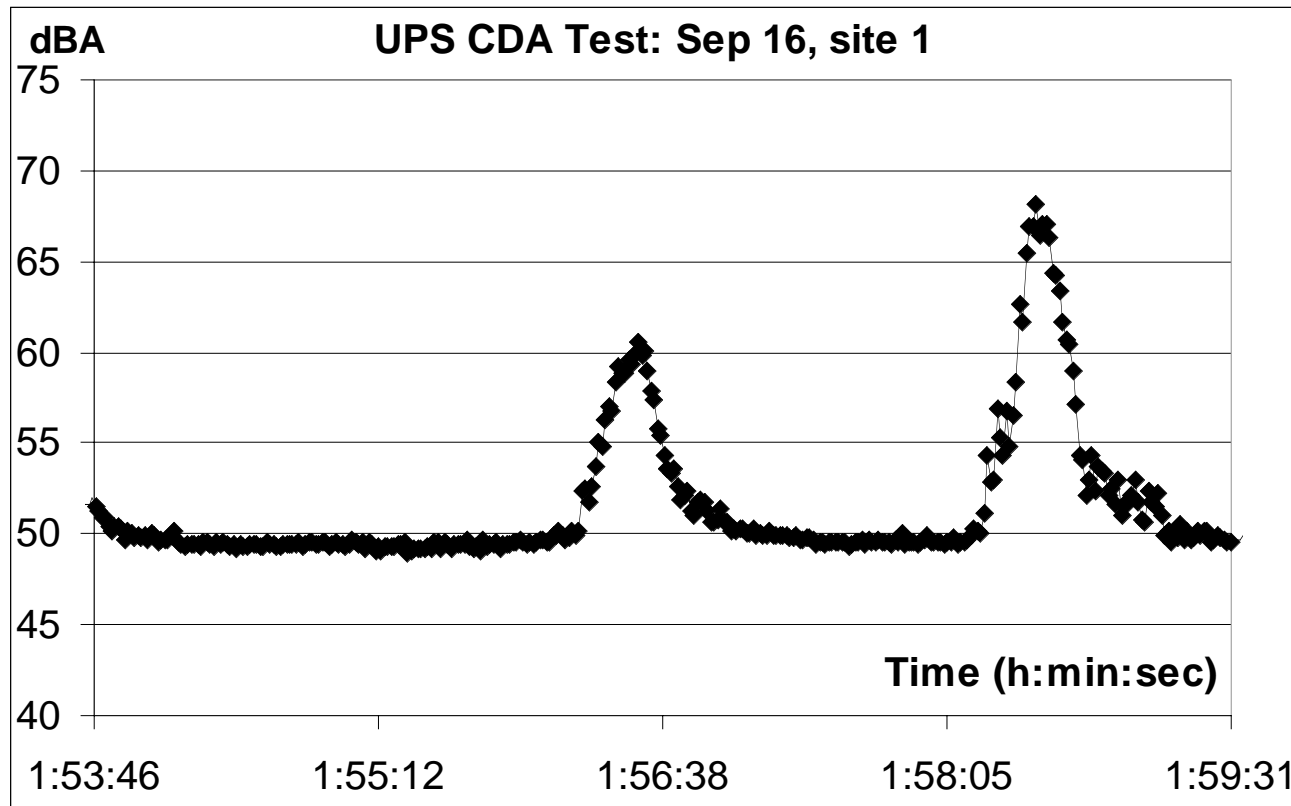
2004 Flight Test: Equipment

- LD-824 meters with an LD-812 connected to DAT, provided by Volpe





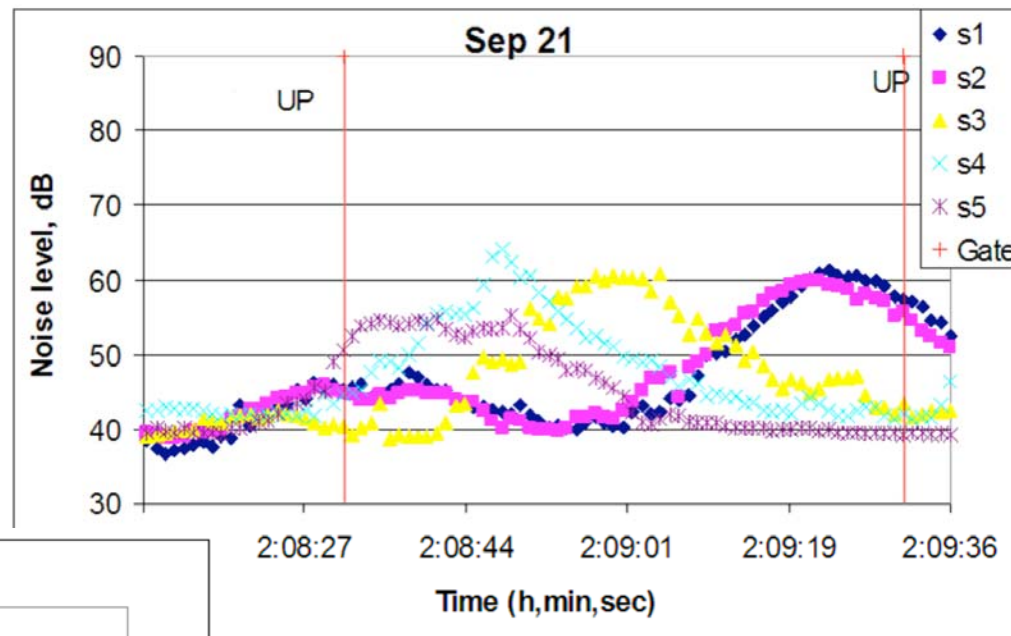
2004 Flight Test: Time History



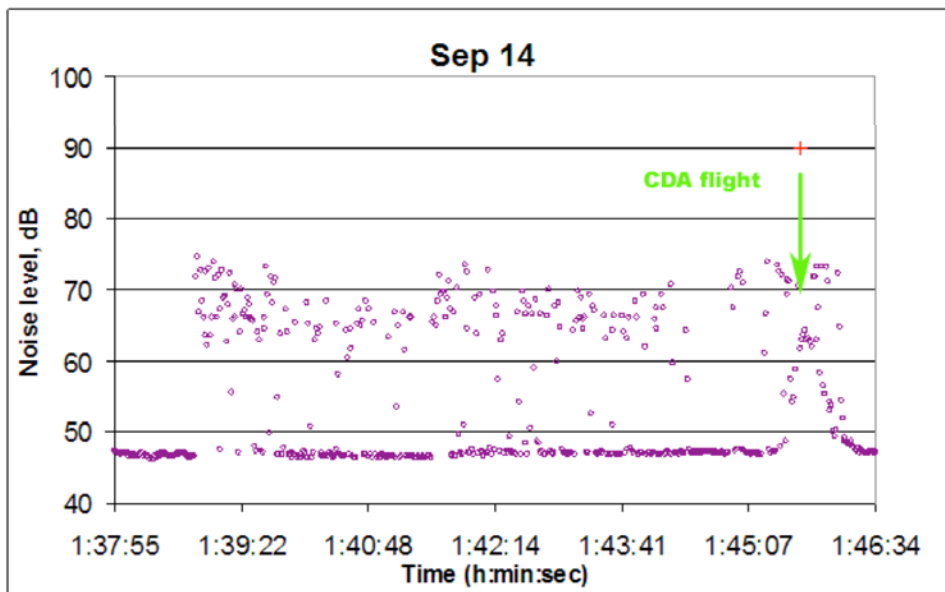
- Ambient noise levels are between 36 and 50 dBA
- Lasted for about 25 seconds, and well distinguished
- Nightly temperatures 60-70 F
- There was no precipitation and wind



2004 Flight Test: Measurements



- Site #5 South, dogs barking

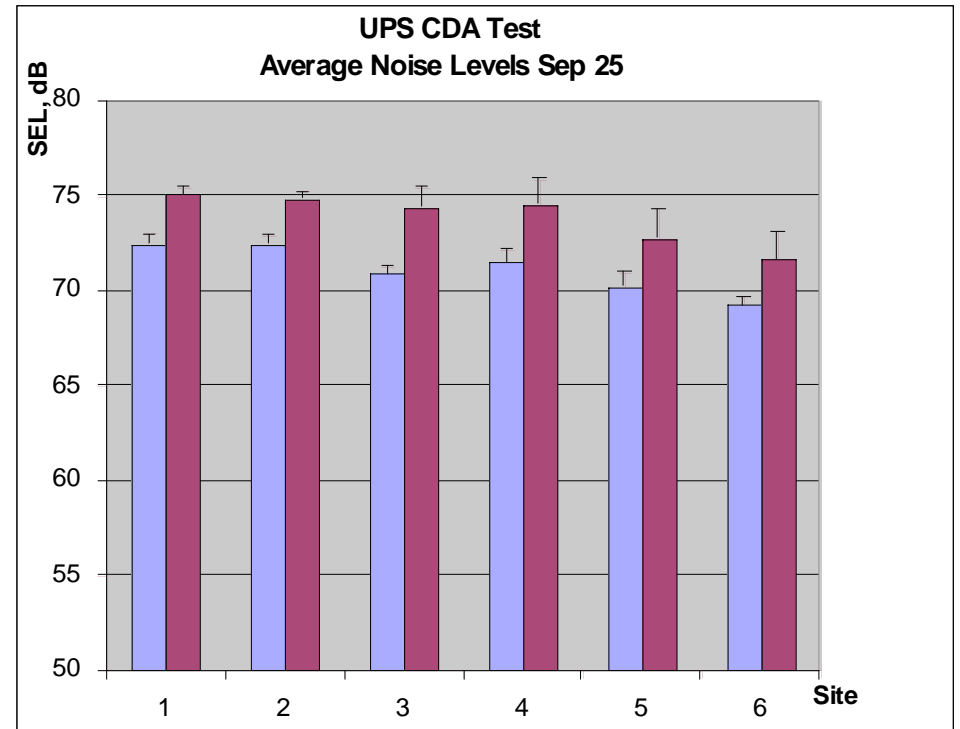
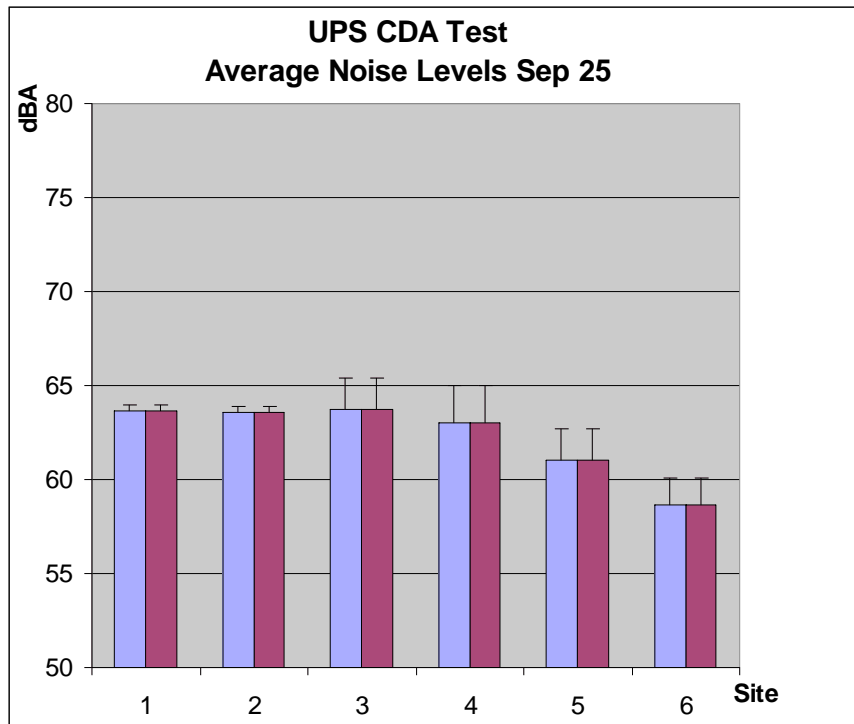


- All South sites, separation time 2 minutes



2004 Flight Test: Noise Levels

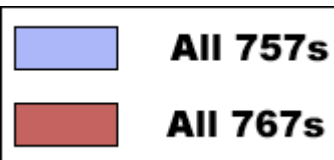
- Typical night noise levels



Average peak noise

B757-200: from 56.5 to 61.4 dBA, ± 1.7 dBA.

B767-300: from 61.8 to 67.8 dBA ± 3.5 dBA.



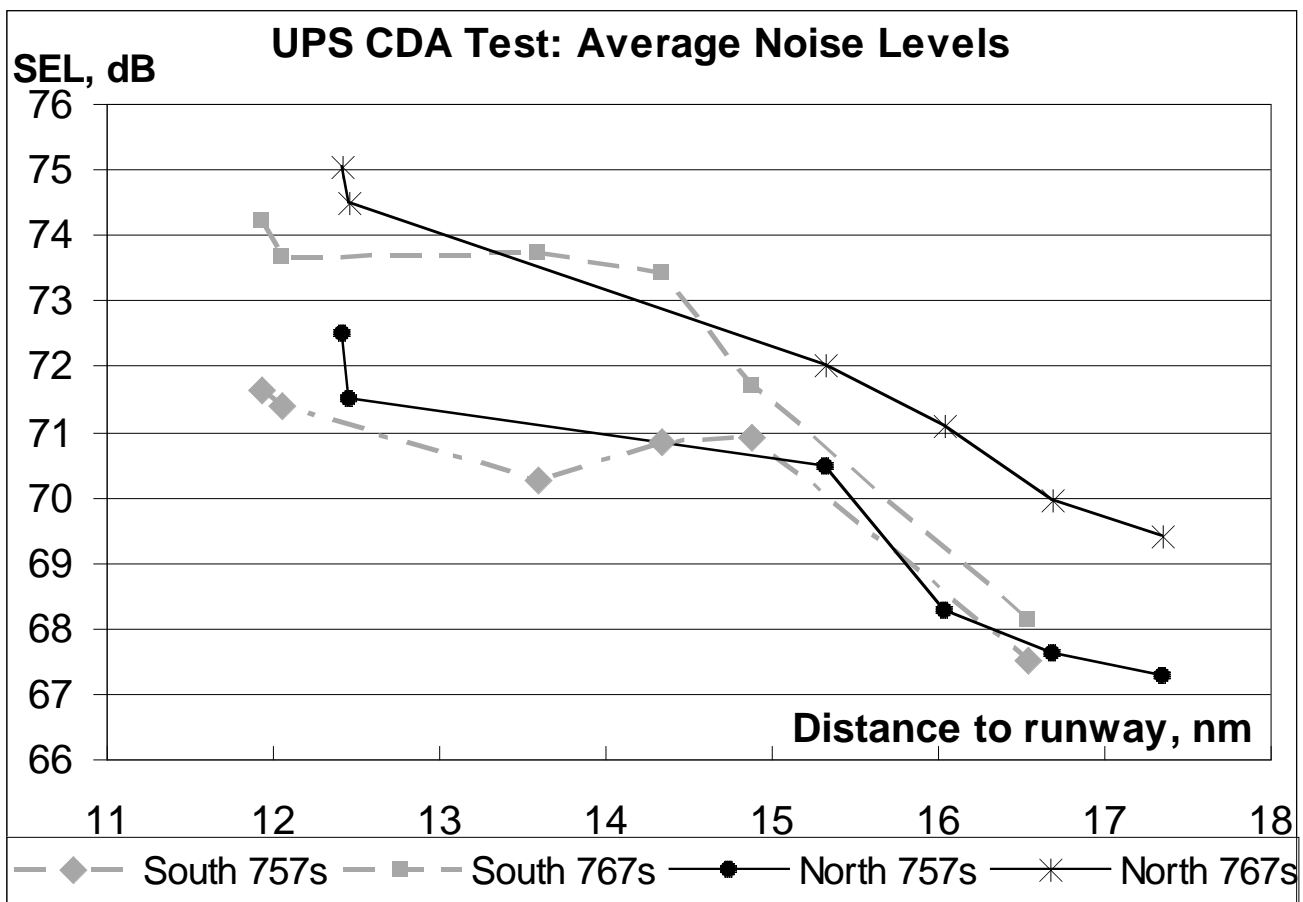
Sound exposure levels

B757-200: from 69 to 72.6 dBA, ± 0.8 dBA.

B767-300: from 73.6 to 76.8 dBA ± 2.5 dBA.

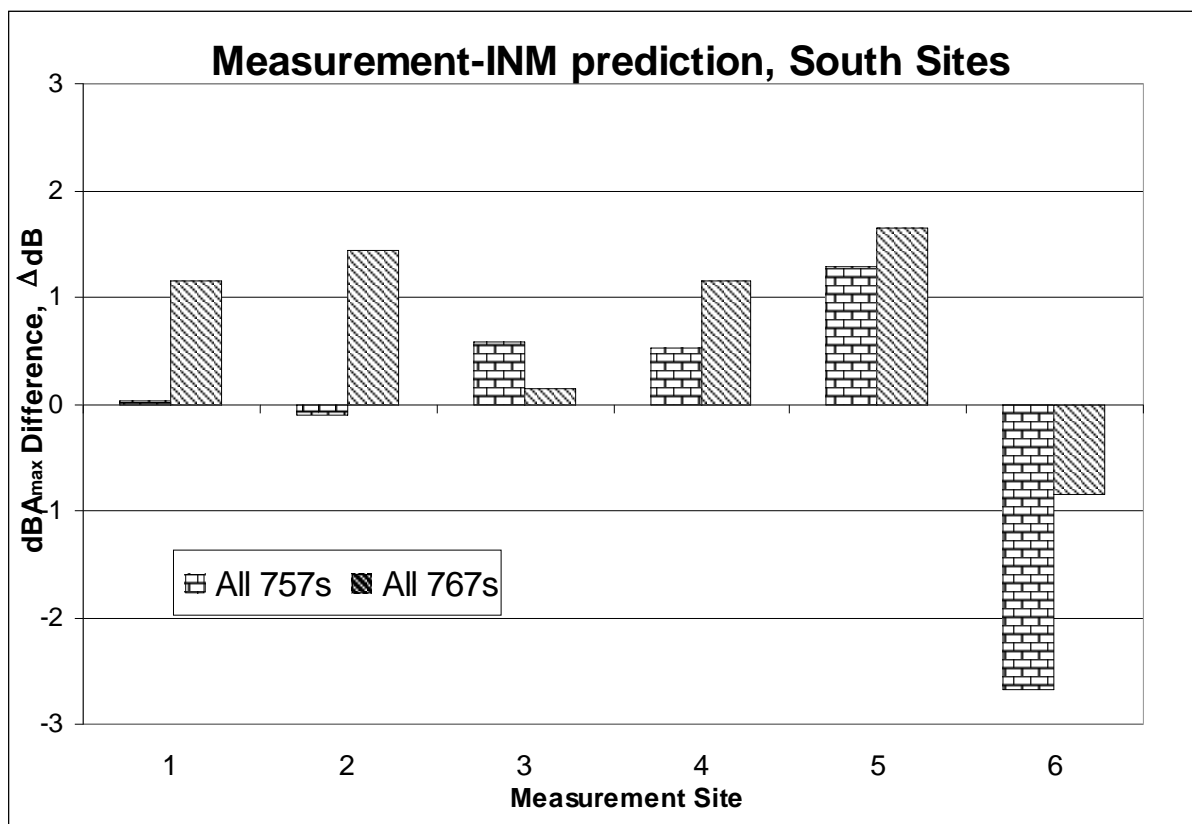


2004 Flight Test: Noise vs Distance





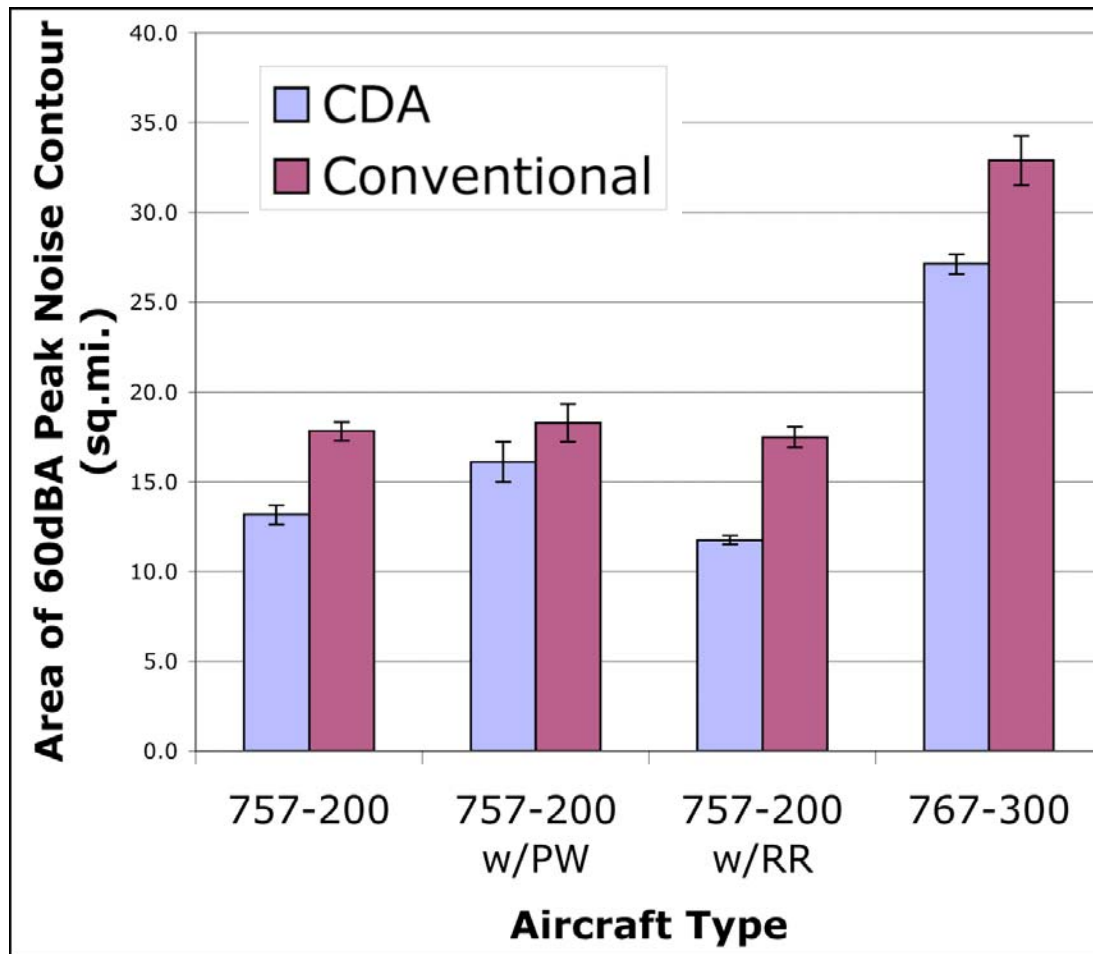
Evaluation of noise prediction accuracy





CDA & STD: Single Event

- **Size of 60dBA contours for CDA and conventional approach**

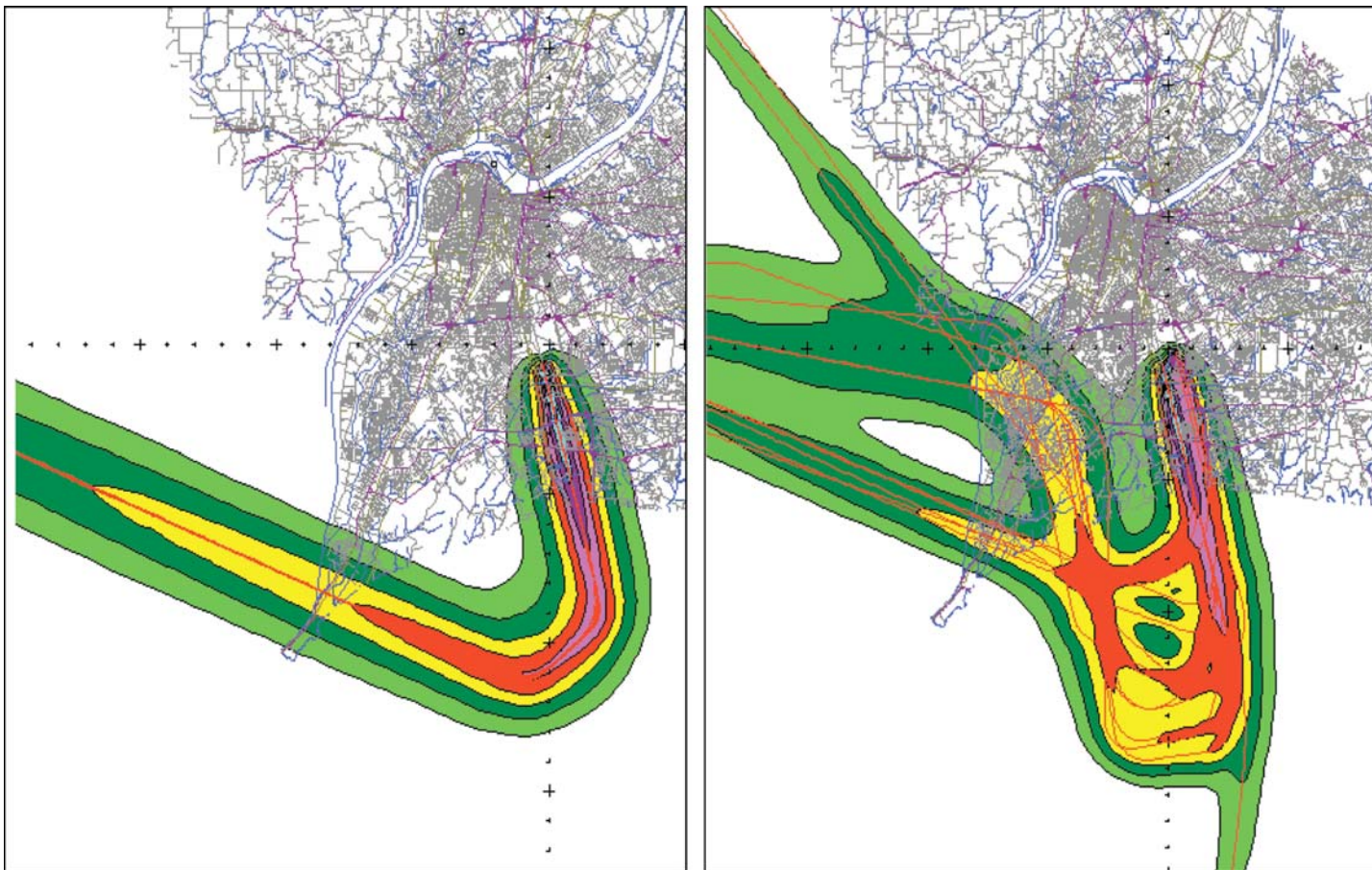


- 31 B757-200: the average size reduction from 17.8 to 13.2 sq. mi., 26%.
- 10 B757-200 with PW PW2056 from 18.3 to 16.1 sq. mi., 12%
- 21 B757-200 with RR 535E from 17.5 to 11.8 sq. mi., 33%.
- B767-300s with GE CF6-50C2 from 32.9 to 27.1 sq. mi., 17%.



CDA & STD: 16 Flights

- **Cumulative noise contours CDA & conventional approach**



	35	40	45	50	55	60	65	70	75
color									
baseline	401.67	249.83	123.88	49.44	14.21	4.66	1.65	0.29	0.03
CDA	188.34	123.79	65.35	28.25	11.67	4.32	1.67	0.26	0.22

- 1 -3 AM
- 7 B757-200 & 9 767-300
- DFDR trajectories



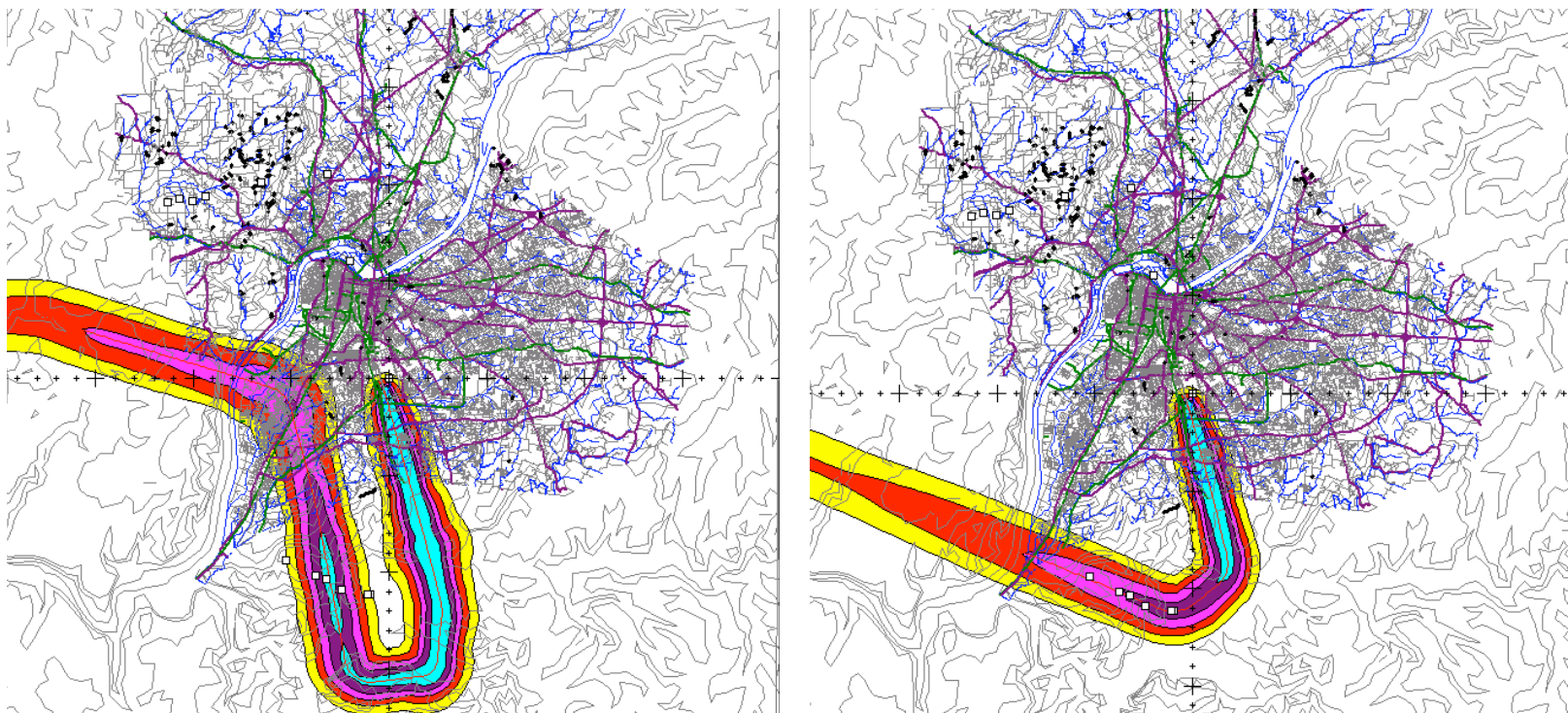
Noise Impact: Summary





- Flight tests were conducted for two week period beginning September 14 with 12 to 14 UPS aircrafts each night. In all, 125 aircrafts performed the new procedure as planned during the test period with very few adjustments
- A great volume of flyover noise measurement was collected during 9 nights of in-service UPS flights at Louisville to check out the CDA procedure
- The noise measurements were generally of high quality and consistency
- The noise measurements matched predicted levels made with the INM using flight data that was collected
- These predictions showed a reduced noise levels under the flight path



Single event noise contour area

- 757: baseline flight- left, CDA-right.



L _A max, dB	45	50	55	60	65
color					
baseline, sq ml	N/A	N/A	36.1	17.8	7.0
CDA, sq ml	N/A	N/A	29.2	13.2	5.5

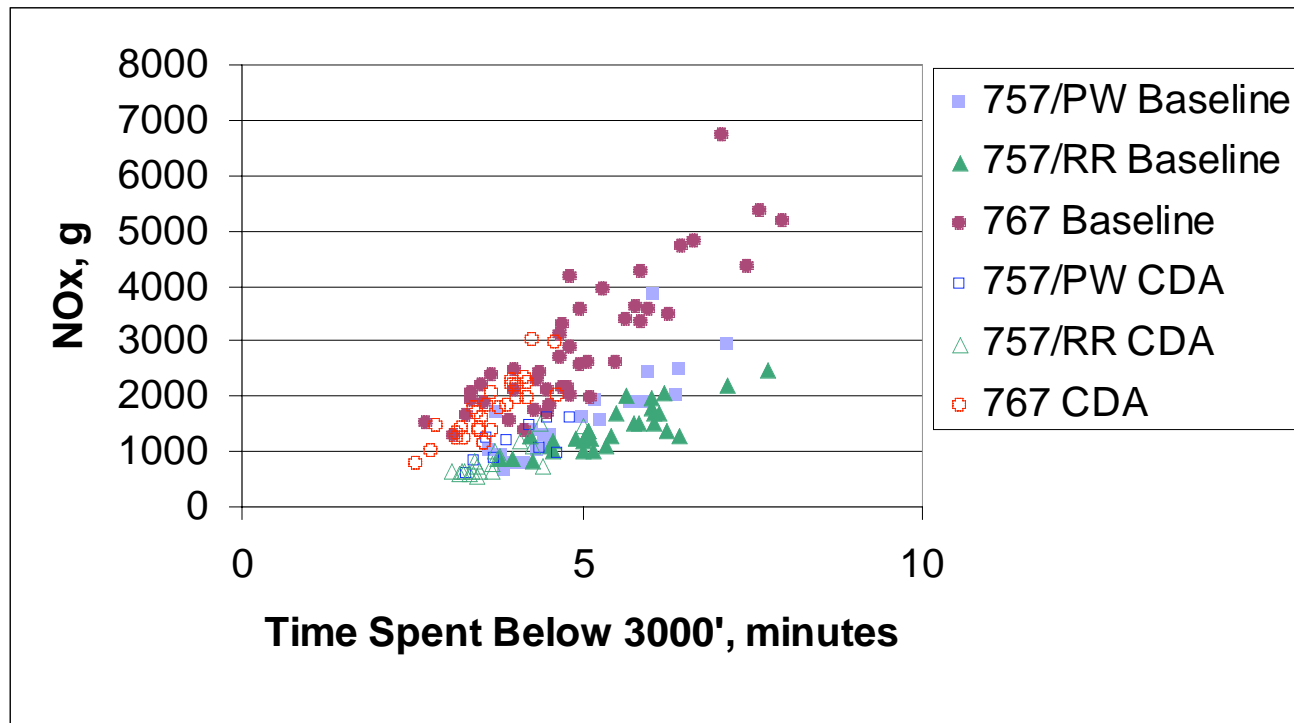


Sample flight data input for emission calculations

Time, sec	Press Alt, ft	Static Air Temp, deg, C	CAS, kts	Eng 1 Fuel flow, lb/hr	Eng 2 Fuel flow, lb/hr
12562	3037	21.8	180	2879	2815
12563	3018	21.8	180.5	2687	2623
12564	2997	21.8	180.5	2496	2431
12565	2976	21.8	181	2336	2240
12566	2957	21.8	181	2144	2080
12567	2939	22	181	2016	1920
12567	2921	22	181	1888	1792
12569	2904	22	181.5	1792	1696
12570	2886	22	181.5	1664	1568

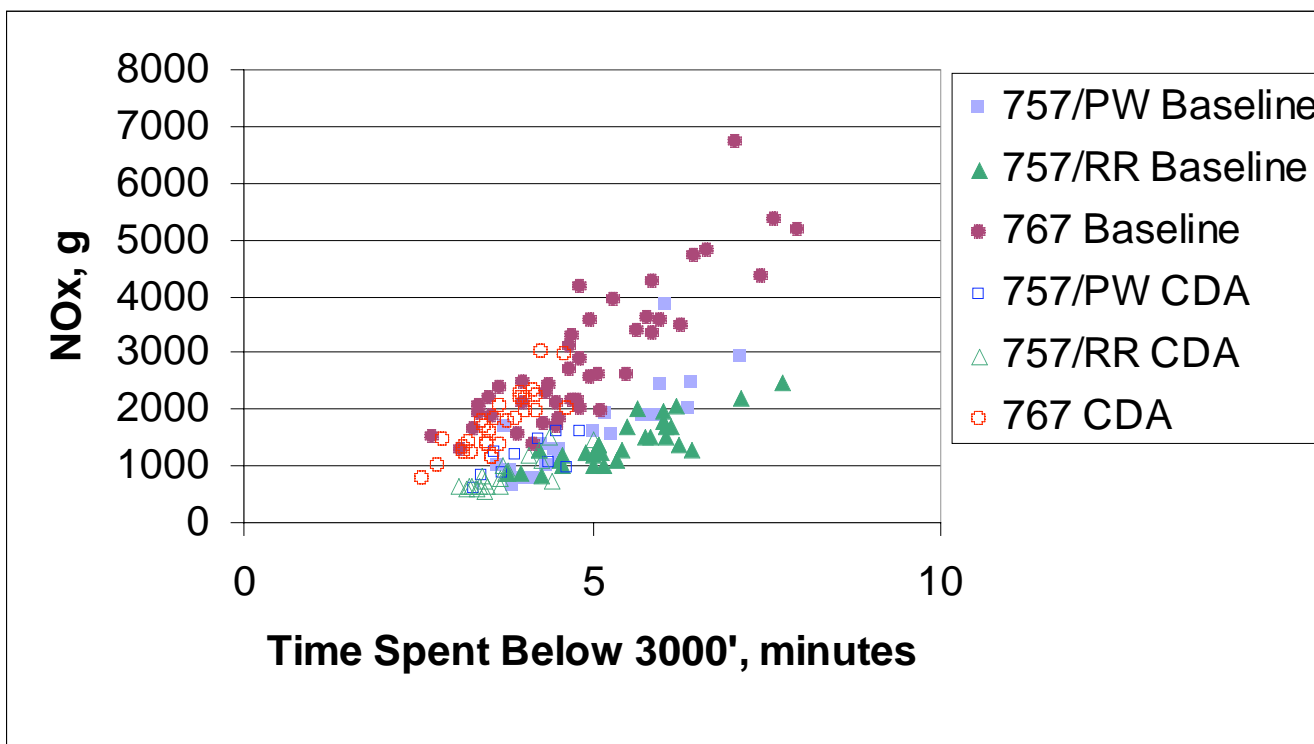


NOx produced by the B757-200 and B767-300 aircraft vs. time



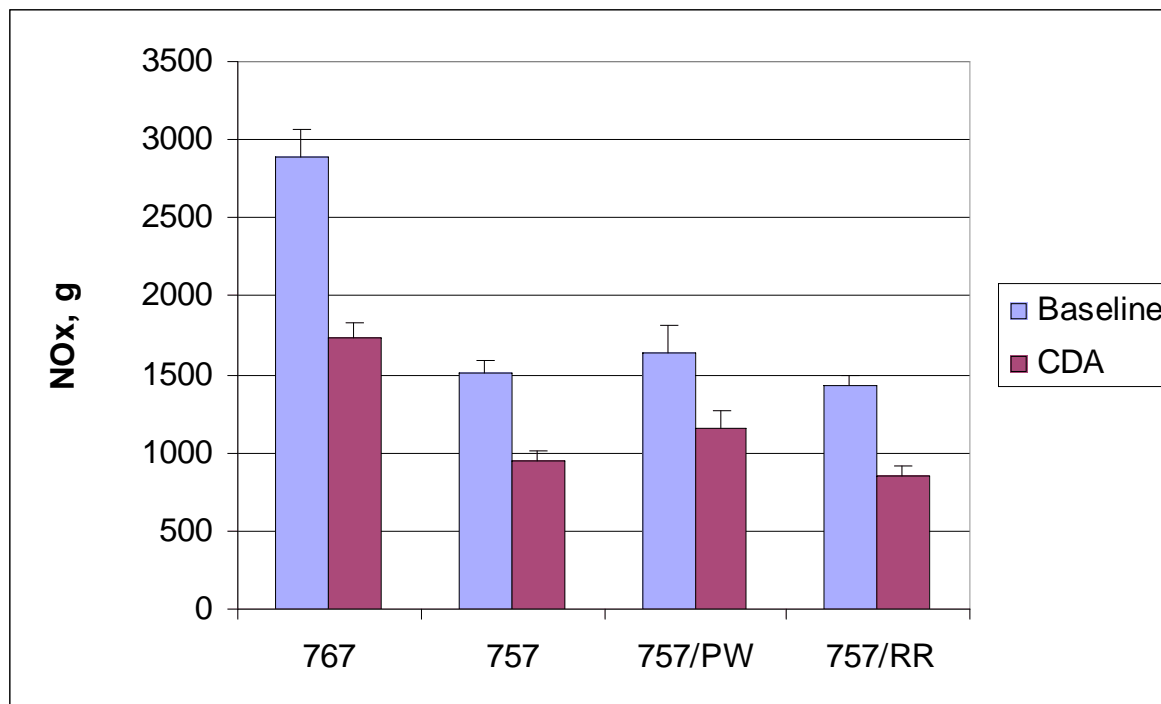


NOx produced by the B757-200 and B767-300 aircraft vs. time



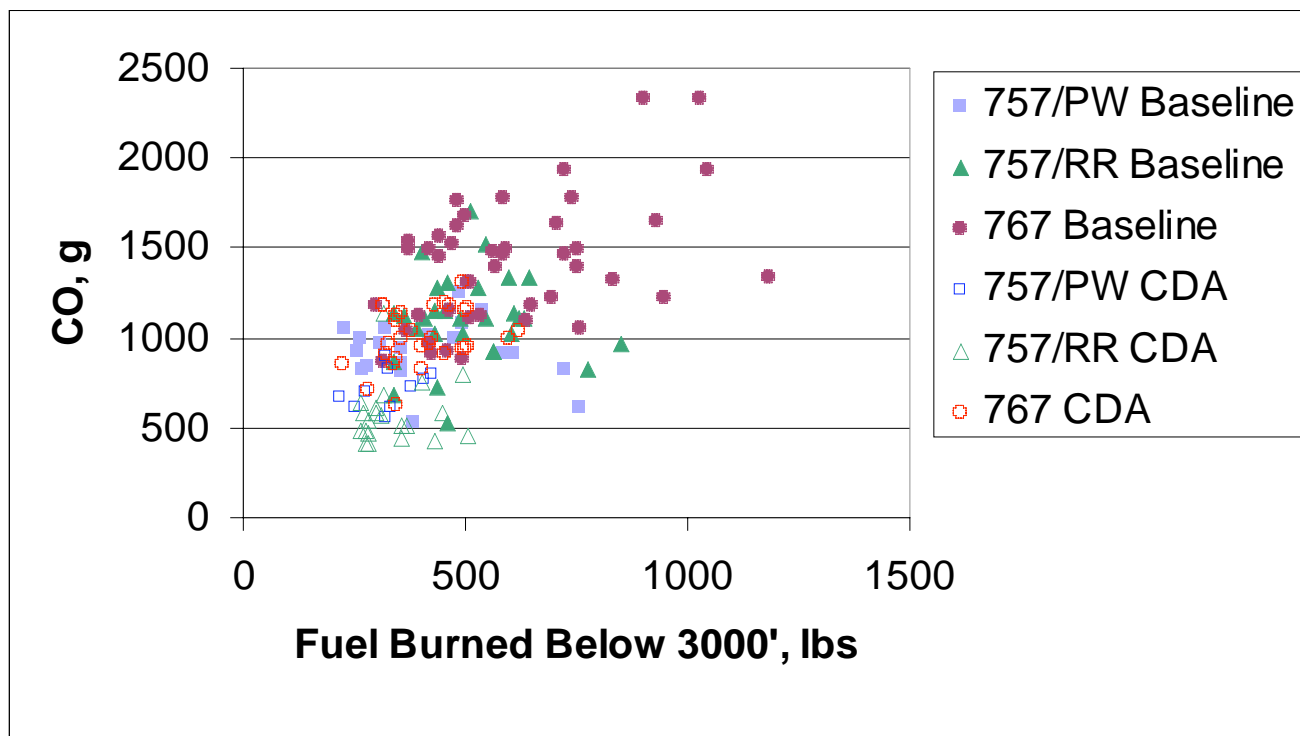


Average NOX produced by the B757-200 and B767-300 aircraft



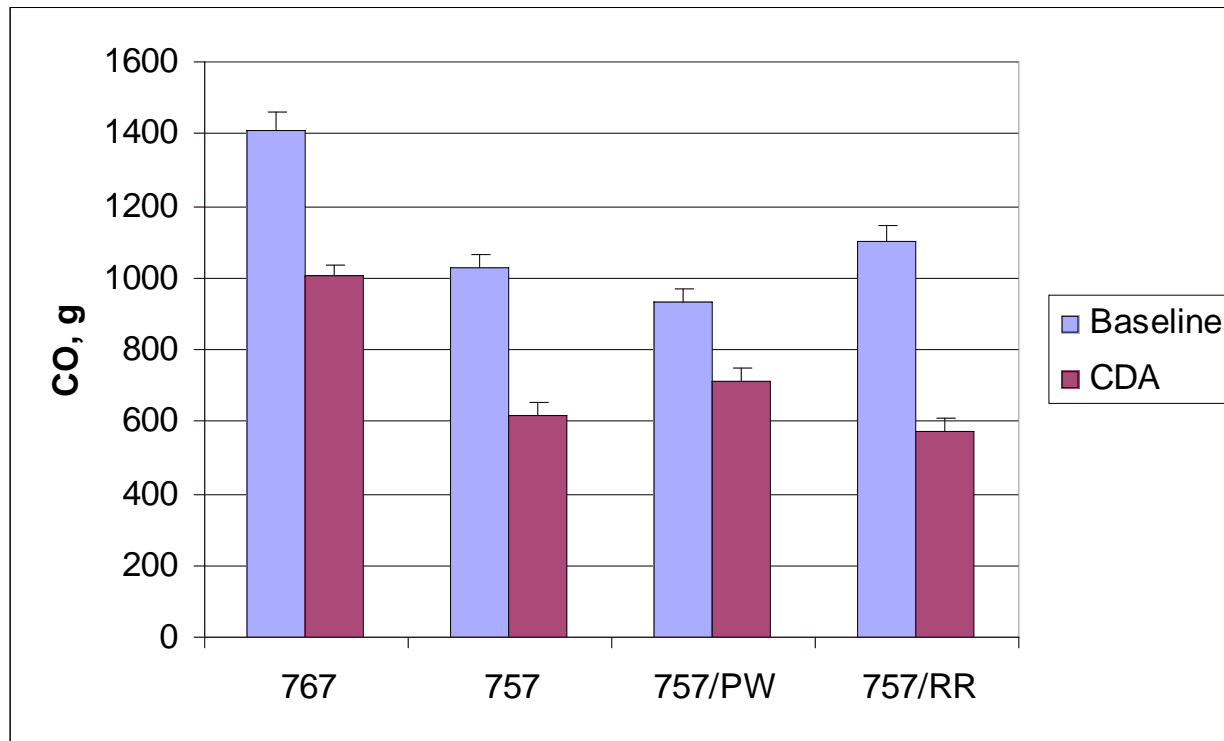


CO produced by the B757-200 and B767-300 aircraft vs. fuel burned



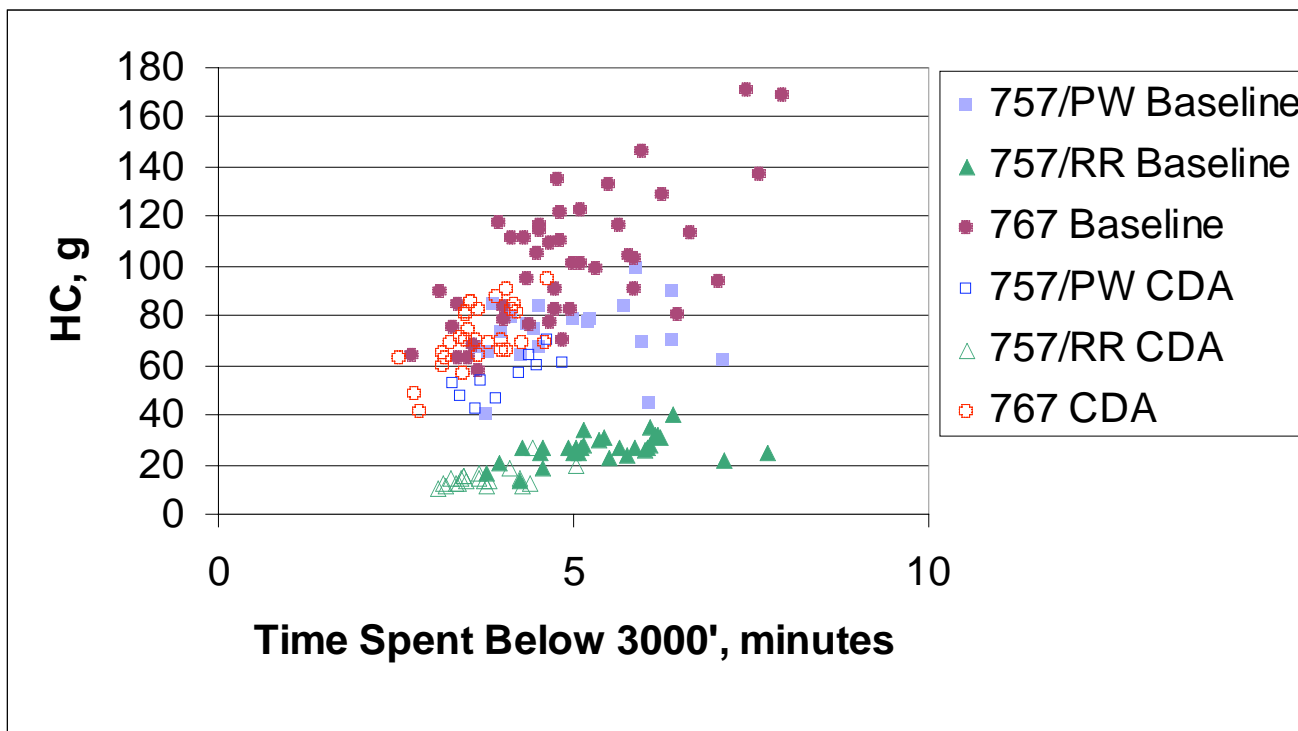


Average CO produced by the B757-200 and B767-300 aircraft



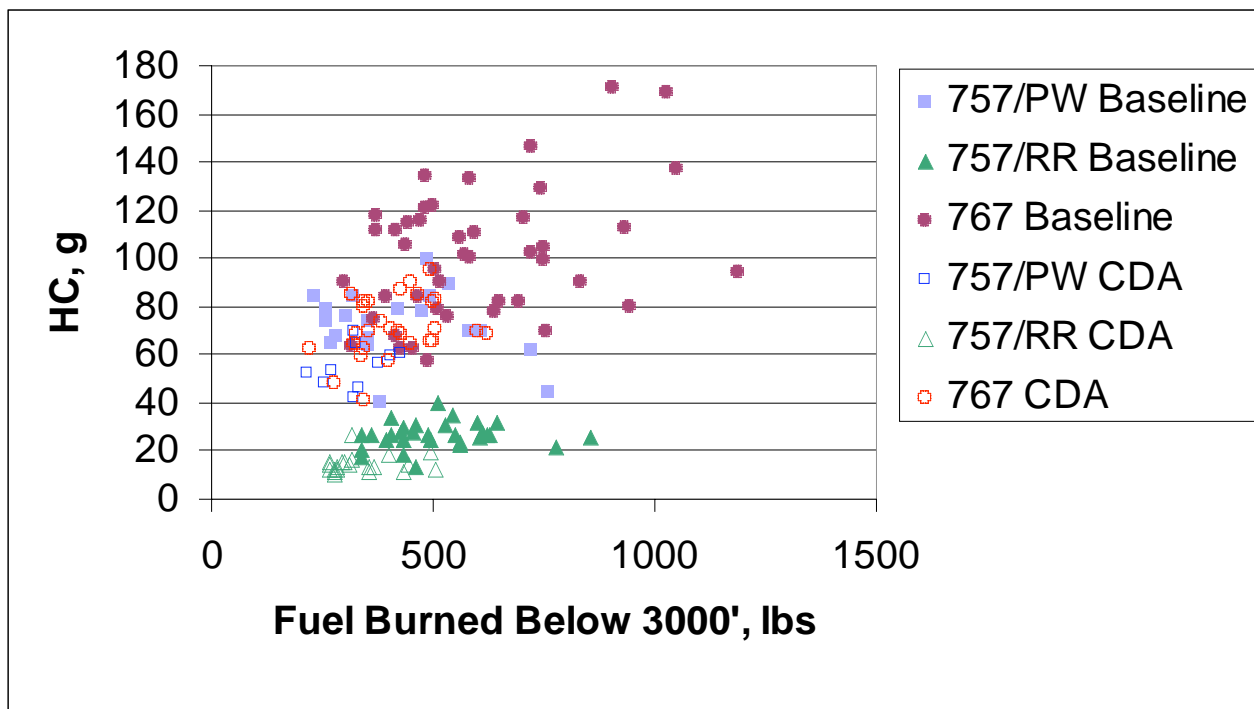


HC produced by the B757-200 and B767-300 aircraft vs. time





HC produced by the B757-200 and B767-300 aircraft vs. fuel burned





Average HC produced by the B757-200 and B767-300 aircraft

