Federal Aviation Administration

Safety Study Report on Reduced Lateral Separation from an Obstruction and/or Vectors below Minimum Vector Altitude for Chicago Midway International Airport (KMDW)

Flight Systems Laboratory
DOT-FAA-AFS-450-62

December 2010

Flight Systems Laboratory
6500 S. MacArthur Blvd.
Systems Training Building Annex, RM 217
Oklahoma City, Oklahoma 73169
Phone: (405) 954-8191

OK-11-0938

NOTICE

DOT-FAA-AFS-450-62

Flight Systems Laboratory
Flight Technologies and Procedures Division
Flight Standards Service

Safety Study Report on Reduced Lateral Separation from an Obstruction and/or Vectors below Minimum Vector Altitude for Chicago Midway International Airport (KMDW)

Reviewed by:

Stephen W. Barnes **Date**
Manager, Flight Systems Laboratory, AFS-450

Released by:

Leslie Smith **Date**
Manager, Flight Technologies and Procedures Division, AFS-400

December 2010

Technical Report

Technical Report Documentation Page

1. Report No. DOT-FAA-AFS-450-62	**2. Government Accession No.**	**3. Recipient's Catalog No.**
4. Title and Subtitle Safety Study Report on Reduced Lateral Separation from an Obstruction and/or Vectors below Minimum Vector Altitude for Chicago Midway International Airport (KMDW)		**5. Report Date** October 2010
6. Author(s) Dr. Gerry McCartor, AFS-450		**7. Performing Organization Code**
8. Performing Organization Name and Address Flight Systems Laboratory, AFS-450 6500 S. MacArthur Blvd, STB Annex, RM 217 Oklahoma City, Oklahoma 73169		**9. Type of Report and Period Covered** Technical report
10. Sponsoring Agency Name and Address Flight Systems Laboratory, AFS-450 6500 S. MacArthur Blvd, STB Annex, RM 217 Oklahoma City, Oklahoma 73169		
11. Supplementary Notes		

12. Abstract

Chicago Terminal Radar Approach Control (C90 TRACON) is requesting a waiver to Federal Aviation Administration (FAA) Order 7110.65 to allow reduced lateral separation from an obstruction (Willis Tower) and/or reduced vertical clearance above the protected airspace around the tower. Aircraft departing from Chicago Midway International Airport (KMDW) runways 22L and 31C, to the southwest and northwest, respectively, and joining the eastbound MIDWAY SEVEN or CICERO FOUR Standard Instrument Departures (SIDs) are initially cleared to 3,000 feet or lower and expected to complete their turns within four miles of the KMDW Distance Measuring Equipment (DME) facility or south of the 096 radial from Dupage VOR/DME. Aircraft that do not accomplish the turn in the allowed area must climb to 3,400 feet or higher to clear the Willis Tower obstacle clearance area (OCA). A small percentage of aircraft either do not achieve the necessary altitude or take a greater distance to complete the turn and penetrate the OCA, causing safety concerns. The Flight Systems Laboratory, AFS-450, was requested to evaluate the waiver request. C90 requested support from the Flight Systems Laboratory (FSL), AFS-450, to determine the acceptability of this waiver from a safety aspect in order to facilitate the Safety Management System (SMS) process applicable to the Air Traffic Organization (ATO). The results from the FSL studies will be included in the Safety Risk Management Document (SRMD) that has been prepared as part of the waiver request.

The study found that with continuous radar coverage, current and certified digital maps on modern high resolution displays and when limited to Instrument Flight Rules traffic on the procedure described above, reduction of the lateral obstacle clearance areas around the Willis Tower from three nautical miles to two nautical miles and lowering the minimum allowable altitude over the tower to 3,000 feet on the subject procedure did not appear to significantly impact the safety of the operations. Alternatively reducing the lateral clearance to 1.5 nautical miles and leaving the minimum altitude as is should also be considered.

13. Key Words Obstacle Clearance Areas, Standard Instrument Departures (SIDs)	**14. Distribution Statement** Controlled by AFS-450
15. Security Classification of This Report Unclassified	**16. Security Classification of This Page** Unclassified

Executive Summary

Aircraft departing from Chicago Midway International Airport (KMDW) on either runway 22L to the southwest or runway 31C to the northwest are turned northward to join the eastbound MIDWAY SEVEN or CICERO FOUR Standard Instrument Departures (SIDs). These aircraft are initially cleared to 3,000 feet or an assigned lower altitude and are expected to complete their turns either within four nautical miles of the KMDW Distance Measuring Equipment (DME) facility or south of the 096 radial from Dupage (DPA) VOR/DME. The 3,000 foot altitude restriction is dictated by traffic flows into or out of Chicago O'Hare International Airport (KORD). Aircraft that take a greater distance to complete the turn are then expected to climb to 3,400 feet or higher to clear the Willis Tower obstacle clearance area (OCA). A small percentage of these aircraft penetrate the southern edge of the OCA, causing safety concerns. Chicago Terminal Radar Approach Control (C90 TRACON) is requesting a waiver to Federal Aviation Administration (FAA) Order 7110.65 [2] to allow reduced lateral separation from obstructions and/or reduced vertical clearance above the protected airspace around Willis Tower. The C90 TRACON requested the safety analysis from the Flight Systems Laboratory (FSL), AFS-450, to determine the acceptability of these waiver requests from a safety aspect in order to facilitate the Safety Management System (SMS) process applicable to the Air Traffic Organization (ATO). The results from the FSL studies will be included in the Safety Risk Management Document (SRMD) [3] that has been prepared as part of the waiver request.

The FSL collected radar data from the Midway airport radar via the National Offload Program (NOP) for periods from February to August 2010. Almost 7,000 aircraft departing from the runway 22 or 31 complexes that turned eastbound and appeared to be on the Cicero Seven or Midway Four departure track were identified and their altitude and distance from Willis Tower determined. Tracks that turned northward after joining the eastbound departure routes were also included. The ninety tracks that penetrated the OCA were studied in particular detail with attention to aircraft type, airline, weather, and other factors.

Given that there are no changes to current Air Traffic procedures, that the reductions in the OCA are only allowed for the IFR aircraft on the procedures defined above, and that continuous radar surveillance on high resolution monitors with current, certified maps is maintained, reduction of the lateral obstacle clearance areas around the Willis Tower from three nautical miles to two nautical miles and lowering the minimum allowable altitude above the tower's OCA to 3,000 feet does not appear to significantly impact the safety of the operations. An alternative proposal would be to reduce the lateral clearance to 1.5 nautical miles and leave the vertical clearance as is. The study did note a significant number of aircraft flying through the current OCA that had leveled off at altitudes below the top of the OCA. It suggested that current Air Traffic procedures and airline operational policies should be examined to determine if it is possible to reduce the number of aircraft that are not climbing as they pass the OCA.

TABLE OF CONTENTS

1.0 Background………………………………………………………………..1
2.0 Discussion……………………………………………………………1
3.0 Analysis………………………………………………………….....1
4.0 Conclusion…………………………………………………………..10
5.0 References………………………………………………………...12

LIST OF ILLUSTRATIONS

Figures

Figure 1. Willis Tower CA………………………………………………...2
Figure 2. Pierce Plane through Willis Tower.....……………………………..3
Figure 3. Screen Capture of Track Analysis Tool………………….……..........4
Figure 4. OCA Penetrations…………………………………………….......9

Tables

Table 1. List of OCA Penetrations………………………..……….........5-7
Table 2. OCA Penetration Breakdown by Date and Runway………………..8

1.0 Background

Chicago Terminal Radar Approach Control (C90 TRACON) requested a waiver to Federal Aviation Administration (FAA) Order 7110.65 to allow reduced vertical clearance above the protected airspace around Willis Tower. Aircraft departing from Chicago Midway International Airport (KMDW) runways 22L and 31C, to the southwest and northwest, respectively, and joining the eastbound MIDWAY SEVEN or CICERO FOUR Standard Instrument Departures (SIDs) are initially cleared to 3,000 feet and expected to complete their turns either within four miles of the KMDW Distance Measuring Equipment (DME) facility or south of the 096 radial from Dupage VOR/DME facility. There are significant airspace restrictions in the area due to traffic in and out of Chicago O'Hare International Airport (KORD). Aircraft that take a greater distance to complete the turn and cannot avoid the lateral extent of the Willis Tower obstacle clearance area (OCA) are then expected to climb to 3,400 feet or higher to clear the OCA. A small percentage of aircraft penetrate the OCA, causing safety concerns. The C90 TRACON requested the safety analysis from the Flight Systems Laboratory (FSL), AFS-450, to determine the acceptability of these waiver requests from a safety aspect in order to facilitate the Safety Management System (SMS) process applicable to the Air Traffic Organization (ATO). The results from the FSL studies will be included in the Safety Risk Management Document (SRMD) [3] that has been prepared as part of the waiver request.

2.0 Discussion

The OCA defined in the 7110.65 is a vertical cylinder three nautical miles in radius from the highest point of the obstacle and 1,000 feet above the highest point, rounded up to the next 100 foot. The antenna/spire atop Willis Tower is 2,325 feet above mean sea level, setting the top of the OCA to 3,400 feet. The origin of the 3 miles lateral and 1,000 feet vertical clearance for an OCA is unclear and does not appear to be the result of a serious analytical study. As the standards were developed to accommodate a wide range of environmental and geographic conditions and much less accurate aircraft navigation and ground surveillance systems, they could be expected to be quite conservative in a modern operational environment within close range of multiple surveillance systems with precise digital mapping of all obstacles, extensive temperature, pressure, and wind measuring systems and with primarily modern turbojet aircraft.

3.0 Analysis

The obstacle clearance areas define boundaries around an obstacle such that the probability of an aircraft reported by the surveillance system to be at the boundary colliding with the obstacle will be extremely low. Based on the very limited number of such collisions in aviation history, it is reasonable to assume that the probability of impact, either laterally or vertically is significantly less than 1.0×10^{-7} per hour of flight.

(Note that for the collision risk purposes, we are not considering approaches or the initial phases of departures where the vertical clearance in particular may intentionally be much less than 1,000 feet.) If the aircraft is in the section of the OCA that is both above and outside the physical boundaries of the obstacle (see Figure 1), then the probability of a collision will be the product of the probabilities of the aircraft losing the vertical separation and losing the lateral separation from the obstacle, so the actual risk to an aircraft just inside the upper edge of the OCA (point A in Figure 1) is roughly 1.0×10^{-14}, significantly less than the nominally acceptable level of risk. The iso-probability contour that meets the acceptable level of risk can be roughly approximated by an ellipse tangent to the vertical and lateral OCA surfaces as shown in Figure 3.

Note that this argument assumes (1) both vertical and lateral OCA surfaces are at the same risk level; (2) the probability density functions are reasonably well behaved as the distance from the obstacle increases; and (3) vertical errors and lateral errors are independent of each other. Assumptions (2) and (3) are based on the physics of the situation during normal operations and previous experience. Assumption (1) is conservative as long as both surfaces are less than or equal to the assumed risk level.

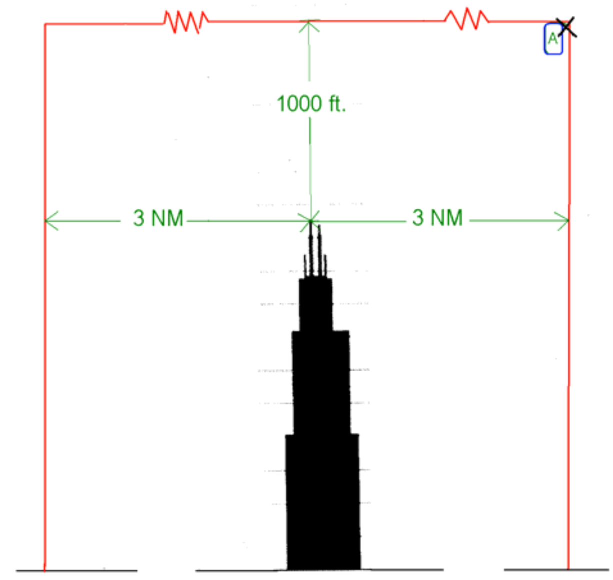

Figure 1. Willis Tower OCA (not to scale)

The Flight Systems Laboratory collected radar data from the Midway airport radar via the National Offload Program (NOP) for periods from February to August 2010. Aircraft departing from the runway 22 or 31 complexes that turned eastbound and appeared to be on the Cicero Seven or Midway Four departures were identified and their altitude and distance from Willis Tower determined as they passed through a plane that extended from 5 NM north of the tower to 10 NM south offset by 10° from true north. Tracks that turned northward after joining the departure were also included. Figure 2 is a screenshot from one of the tools used in the analysis. The orange line represents the plane through the center of Willis Tower perpendicular to the departure heading. The purple circle is the OCA around Willis Tower. The green lines are a sample of the radar tracks of departures from Midway, in this case from the runway 22's. Midway is shown near the center of the figure although the runways are difficult to discern against the background.

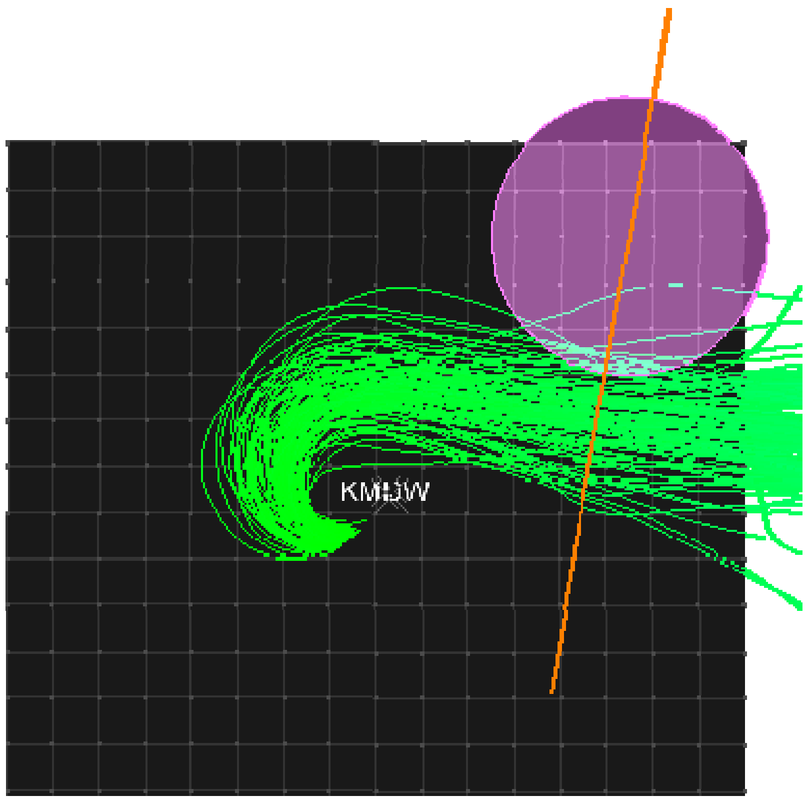

Figure 2. Pierce Plane through Willis Tower

Figure 3 is a screen capture from another tool. Across the top are several control buttons, the number of tracks shown and the number of OCA penetrations. The main plot shows the "pierce points" where the tracks penetrated the plane described above. The two smaller graphs below and to the right show the histograms with probability distribution overlays. The prominent peaks in the vertical histogram represent assigned cardinal altitudes (3000, 4000, and 5000 with a smaller peak at 6000). The red rectangle represents the current OCA around the Willis Tower. Pierce points inside it represent penetrations of the current OCA. The approximate iso-probability contour discussed above is shown in blue. Almost all of the OCA penetrations are outside the contour, suggesting that they should meet the acceptable risk criteria for obstacle clearance. (Unfortunately, there is not an obvious way to present this information to the controller.) The single pierce point that is on the left side of the obstacle at about 1900 feet is actually penetrating the OCA from the other direction. It is not addressed in this report. Aircraft types are color coded according to the list on the left of the screen. The text box in the lower right lists all the OCA penetrations along with a file identification, aircraft type and class, distance from the center of the OCA and the altitude at the pierce point. (If the aircraft is climbing, the altitude when it entered the OCA would be lower than the value shown.) This data is also saved in an output file for access by other programs.

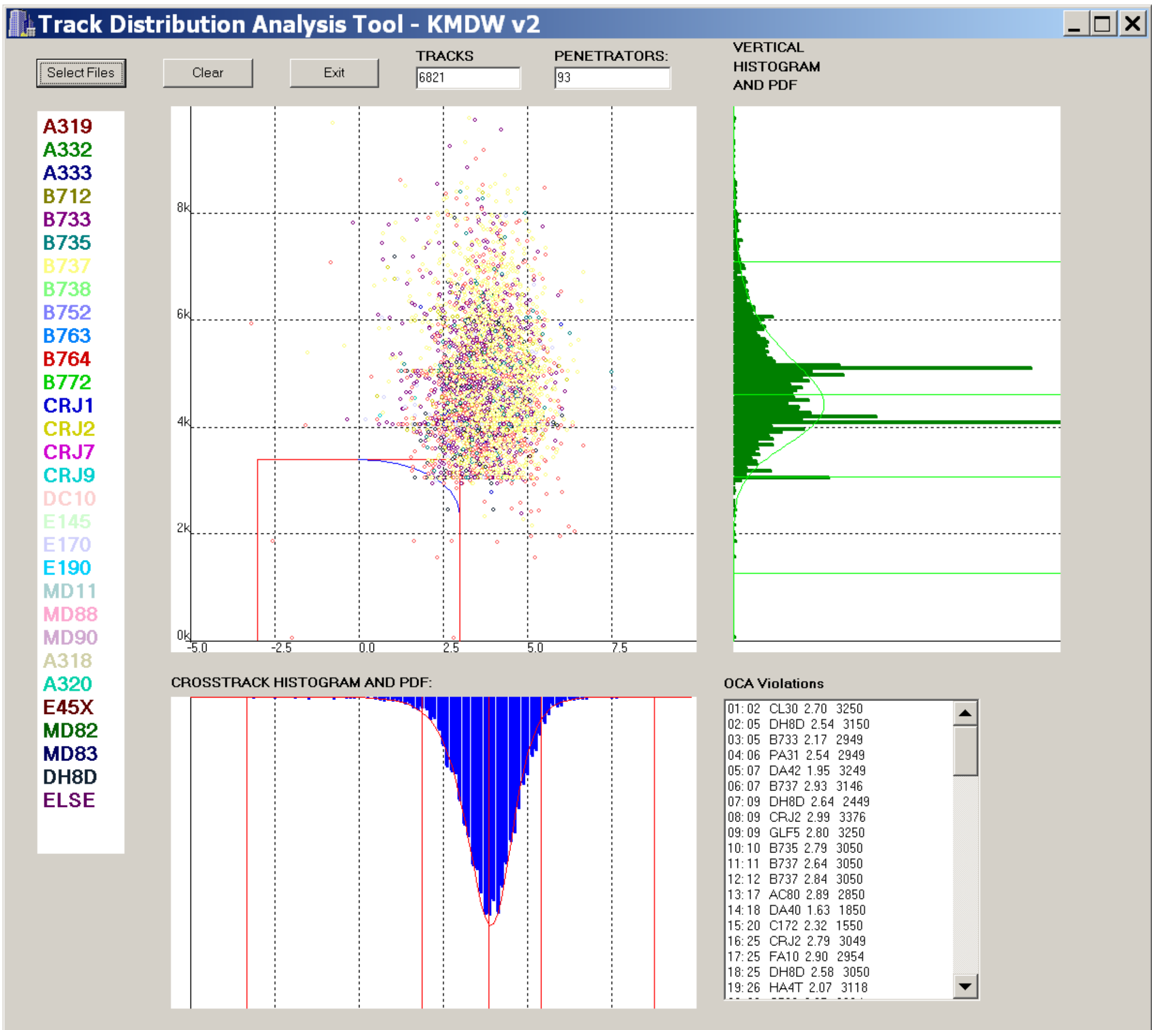

Figure 3. Screen Capture of Track Analysis Tool

Table 1 is a listing of all the OCA penetrations that occurred. A rate of climb was calculated by collecting altitude data from pierce points in geometric planes a mile and half before and after the primary plane. Item 85 was the wrong direction point mentioned earlier. Items 25 and 92 apparently had malfunctioning altitude transponders and were deleted from consideration. The remaining 89 penetrations (out of 6821 tracks) were examined in more detail. All but 14 of the 89 penetrations were outside the iso-probability contour. The 14 points inside the contour are highlighted in the table in red. Figure 4 is a plot showing just the penetrations. The data is further broken down in Table

2 by observation period and departure runway. Most of the violations occur on departures from Runways 31L/C/R. While having an advantage in initial heading (needing about 90 degrees less course change to turn eastward), the shorter distance between the runway end and the obstacle reduces the aircraft's ability to accomplish the turn and to climb to the assigned altitude.

It would seem reasonable to expect that either wind direction or aircraft type might be a primary factor driving the penetrations. A cursory examination of the penetrations data, however, shows a good mix of General Aviation, Business Jets, and Air Transport aircraft. An examination of the weather conditions reported at Midway during several of the penetrations also failed to show a strong correlation with wind direction and none of the reported winds examined were over 10 knots. Hence, weather does not seem to be a primary factor causing the penetrations. However, winds at altitude might have been different than those reported at Midway.

Table 1. List of OCA Penetrations

#	File ID	A/C Class	A/C Type	Range (nm)	Altitude (ft msl)	Climb Rate (ft/nm)
1	2	S	CL30	2.70	3250	99.83
2	5	L	DH8D	2.54	3150	201.19
3	5	L	B733	2.17	2949	179.12
4	6	S	PA31	2.54	2949	100.03
5	7	S	DA42	1.95	3249	166.80
6	7	L	B737	2.93	3146	195.72
7	9	L	DH8D	2.64	2449	28.96
8	9	L	CRJ2	2.99	3376	300.00
9	9	L	GLF5	2.80	3250	200.41
10	10	L	B735	2.79	3050	188.86
11	11	L	B737	2.64	3050	188.53
12	12	L	B737	2.84	3050	0.31
13	17	S	AC80	2.89	2850	168.77
14	18	S	DA40	1.63	1850	66.43
15	20	S	C172	2.32	1550	-34.37
16	25	L	CRJ2	2.79	3049	0.25
17	25	S	FA10	2.90	2954	33.64
18	25	L	DH8D	2.58	3050	73.93
19	26		HA4T	2.07	3118	193.63
20	26	S	C560	2.27	3304	205.30
21	26	L	B737	2.12	3051	0.24
22	26	L	B737	2.08	3382	402.49
23	28	L	B737	2.72	3298	311.97
24	28	L	E170	2.29	2996	-1.92

Table 1. List of OCA Penetrations

#	File ID	A/C Class	A/C Type	Range (nm)	Altitude (ft msl)	Climb Rate (ft/nm)
25	29	S	BE40	2.83	49	291.68
26	29	L	B737	2.74	3332	430.20
27	29	L	B737	2.96	3287	282.64
28	29	L	B733	2.20	3149	0.36
29	29	L	B733	2.76	3150	112.62
30	30	L	CRJ2	2.73	3150	89.42
31	30	L	CRJ2	2.20	3356	283.02
32	30	S	H25B	2.20	3195	244.92
33	30	L	GL5T	2.98	3149	0.47
34	30	S	FA50	2.65	3050	0.00
35	30	L	DH8D	1.68	3049	156.97
36	30	L	DH8D	2.58	3184	217.69
37	30	L	DH8D	2.36	3050	162.08
38	30	L	B737	2.83	3149	320.31
39	30	L	B733	2.21	3050	0.63
40	30	L	B733	2.91	3293	321.60
41	30	L	B737	2.82	3209	309.60
42	30	L	B733	2.51	3049	33.33
43	30	L	B737	2.18	3049	0.04
44	30	L	B733	2.89	3265	286.04
45	30	L	B733	2.88	3285	207.88
46	30	L	B733	2.46	3325	259.52
47	30	L	B733	2.98	3049	62.00
48	30	L	B737	2.64	3373	453.81
49	30	L	B737	2.88	3151	33.58
50	30	L	B733	2.90	3150	-26.95
51	31	L	DH8D	2.03	3331	301.02
52	32	L	B737	2.94	3150	0.10
53	32	S	PA32	2.18	3183	326.12
54	32	L	B733	2.71	3150	168.10
55	32	L	B733	2.53	3312	322.61
56	32	L	B733	2.39	3256	258.76
57	33	L	CL60	2.66	3149	150.36
58	33	L	B733	2.40	3366	222.59
59	33	L	DH8D	2.79	3389	226.56
60	33	L	B733	2.70	3097	133.52
61	33	L	GLF4	2.21	3278	241.45
62	33	L	B733	2.42	3049	0.08
63	33	L	B737	2.88	3060	248.51

Table 1. List of OCA Penetrations

#	File ID	A/C Class	A/C Type	Range (nm)	Altitude (ft msl)	Climb Rate (ft/nm)
64	33	L	B733	2.46	3149	205.71
65	33	S	CL30	2.45	3049	0.38
66	33	L	B733	2.53	3049	43.40
67	34	L	CRJ2	2.88	3049	134.32
68	34	L	CRJ2	2.74	3147	259.80
69	34	S	CL30	2.09	3288	309.78
70	34	L	DH8D	2.03	3049	5.52
71	34	L	B733	2.70	3150	67.45
72	34	L	B737	2.65	3050	99.77
73	34	L	B737	2.99	3049	258.62
74	34	L	B737	2.97	3351	315.58
75	34	L	B737	2.44	3049	103.50
76	35	S	PAT4	2.99	3050	33.23
77	35	S	G150	1.61	3249	184.64
78	35	L	GLF4	2.68	3332	314.37
79	35	L	B737	2.97	3384	228.47
80	35	L	B733	2.93	3050	0.11
81	35	L	B737	2.87	3049	258.65
82	35	L	B737	2.96	3050	147.00
83	35	S	GALX	2.87	3049	0.94
84	35	S	FA20	1.60	3187	274.74
85	35	S	C172			
86	35	L	B737	2.95	3321	405.02
87	35	L	B735	2.25	3173	253.36
88	36	L	GLF4	1.96	3048	0.61
89	36	L	B737	2.88	3050	-0.51
90	36	L	B737	2.41	3043	262.31
91	40	S	G150	2.82	3049	0.29
92	47	S	C172			

Table 2. OCA Penetration Breakdown by Date and Runway

Observation Period*	22L/R			31L/C/R		
	Total Tracks	Penetrations.	<Iso-Prob	Total Tracks	Penetrations.	<Iso-Prob
02-01-10_02-28-10	20	0	0	495	0	0
02-28-10_03-03-10	0	0	0	102	0	0
05-01-10_05-08-10	226	1	0	359	3	0
05-08-10_05-15-10	68	0	0	310	5	1
05-15-10_05-19-10	0	0	0	163	0	0
05-19-10_05-26-10	158	0	0	119	2	1
05-26-10_06_05-10	180	2	1	411	4	0
06-05-10_06-15-10	116	2	0	433	21	3
06-15-10_07-13-10	144	3	1	128	1	0
07-13-10_07-17-10	238	0	0	313	5	0
07-17-10_07-25-10	342	4	2	588	10	1
07-25-10_08-03-10	155	1	0	376	10	2
08-03-10_08-12-10	153	1	0	641	12	1
08-12-10_08-19-10	56	1	0	533	2	1

*Periods are not necessarily continuous

It was noted that more than half of the penetrations were 737's of various models (48 out of 90). However, further examination of air traffic out of Midway revealed that 737's represent an even greater percentage of the total traffic (63% versus 53%) and so they are actually under-represented in the penetrators list. The remaining tracks are split evenly between General Aviation (GA) aircraft (22) and regional jets and commercial turboprops (21). The worst violator in terms of least separation from the Willis Tower was a single engine piston GA aircraft. While it is listed in the NOP data as being IFR, the visibility and ceiling were both very good during the track's time period and one would have to consider the possibility that the pilot made a track deviation intentionally. It should be mentioned that any of the selected aircraft may not actually have been flying the departure of interest but just happened to meet the search criteria for inclusion in the penetrator's data set.

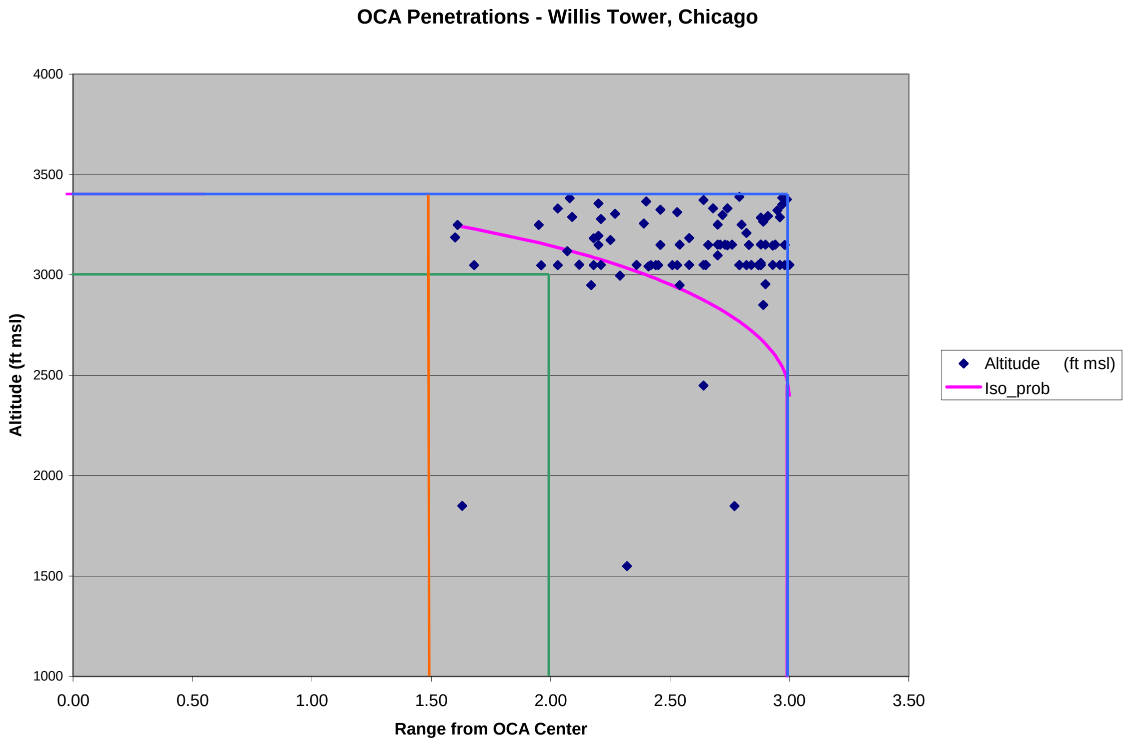

Figure 4. OCA Penetrations

The green lines shown in Figure 4 are a possible reduced OCA for the Willis Tower with a lateral protection zone of two miles rather than three and a reduced vertical clearance allowing a 3,000 foot ceiling to the OCA rather than the current 3,400 feet. This is one of the proposals in the C90 SRMD for the waiver. Only the deviating GA aircraft mentioned earlier would show up as a violator of this reduced OCA. Only five other aircraft (out of our total sample of almost 7,000 tracks) would violate the 2 NM lateral zone. These included two commercial operators (a Gulfstream IV business jet and a DeHavilland DH8 turboprop), and three small GA aircraft.

The suggested reduction in the lateral OCA can be supported by a number of factors. Given that the three mile limit is presumed safe at the limits of single radar coverage, it would be reasonable to assume that the surveillance accuracy is better at less than 20 NM for the multiple radars that provide coverage in the area (for redundancy, not multi-sensor applications). The three mile lateral boundary for OCA has historically supported an allowance for survey error and limited resolution in the presentation on the controller's display (based on the very limited number of collisions with obstacles while respecting the OCA under radar surveillance using older technology displays and surveying methods). The digital maps used in modern surveillance databases are accurate to within a few feet or even better (certainly smaller than the typical pixel size on a radar monitor) and the facility is using a modern high resolution color monitor with very accurate map display. The three mile value has also handled arbitrary aircraft headings and in this situation almost all of the traffic is moving tangentially to the southern boundary of the OCA.

The vertical reduction is more problematical. The altitude used by the surveillance system is the aircraft's transponder reported altitude and that accuracy is not range dependent so there is no significant improvement close to the airport. There should be an improvement in the quality of the surveyed height of the obstacle but this is offset in the Chicago area by the potentially very low temperatures in the area that can produce significant altimeter errors during winter. As pointed out in the C90 SRMD [3], there are intermediate segments of approved instrument approach procedures that pass either directly over or near the Willis Tower at 3,000 feet, but intermediate segments are allowed to be as low as 500 feet over an obstacle. The aircraft has generally started to decelerate for landing and so would be expected to be moving slower than the departing aircraft in the same airspace.

It should also be considered that all the altitude data presented here is based on the aircraft transponder reports and is already subject to temperature induced errors. The tracks from February that report their altitude as 3000 feet are very likely to actually be at 2800 feet or even lower. On the other hand, a track reporting 3300 feet in the August data may well be above the current OCA.

However, even the worst penetrator is more than a 1.5 nautical miles laterally from the spire and (excluding the assumed intentional deviation) more than 600 feet over the highest point of the obstacle (if we ignore temperature effects on altitude). If another "iso-probability" contour is constructed from the two NM line to the 3400 foot line, all of the observed aircraft are well clear of it. If all operational parameters that currently exist remain the same, the collision risk should be less than for the RNAV approaches that pass over the tower.

An alternative approach would be to reduce the lateral clearance to 1.5 nautical miles without making any adjustments to the vertical surface as shown by the orange line in Figure 4. If the reduction in lateral clearance does not generate any operational changes that would tend to decrease the separation between the aircraft and the obstacle, then the same arguments supporting the lateral reduction used earlier are relevant and the vertical issues are no longer a problem.

The rate of climb data showed that a significant number of the aircraft penetrating the OCA were not climbing but simply maintaining altitude (mostly at 3000 feet.) More than a quarter of the penetrations were climbing at less than 50 feet per nautical mile or less. Several others were well short of the 200 feet per nautical mile nominal climb rate and were presumably either just leveling off or just starting to climb out of an altitude as they went through the OCA. These penetrations might have been reduced or eliminated by appropriate pilot actions or controller directions.

4.0 Conclusion

Subject to several caveats, and barring any changes to the traffic dispersion, reduction of the lateral obstacle clearance areas around the Willis Tower from three nautical miles to two nautical miles and lowering the vertical clearance to 3,000 feet for aircraft departing from Chicago Midway International Airport to the southwest (runway 22's) and northwest (runway 31's) in accordance with the eastbound MIDWAY SEVEN or CICERO FOUR Standard Instrument Departures does not appear to significantly impact the safety of the operations. The caveats include: continuous radar coverage by systems with antennas within 20 nautical miles of the obstacle; high resolution displays with current, certified digital maps; use only for Instrument Flight Rules operations from Midway as defined above; and no changes to Air Traffic operational procedures or instrument flight procedure design standards that would allow or induce reduced separation between aircraft and the obstacle. *The current procedures appear to support an acceptable operation but if those procedures are relaxed because of the reduced OCA, the resultant additional variations may not be acceptable.* The study is not (at this point) recommending reductions of Obstacle Clearance Area standards so much as finding that, for procedures designed to the current standards, normal tracking performance may lead to OCA penetrations that are still within the acceptable safety margins at certain locations under certain conditions.

An alternative solution might be to reduce the lateral clearance areas to 1.5 NM without any changes to the vertical areas *subject to the same caveats as above*. The supporting arguments for reducing the lateral area are much stronger than those for the vertical.

In either case, continued monitoring of the traffic using the procedures is strongly recommended. If the relaxing of the OCA requirements allows additional variation in operational performance by either the aircraft or Air Traffic, safety may be adversely affected.

Current Air Traffic procedures and airline operational policies should be examined to determine if it is possible to reduce the number of aircraft that are not climbing as they pass the OCA or are departing at too high a speed to accomplish the eastward turn in the desired distance.

5.0 References

[1] Federal Aviation Administration. (2010) *Air Traffic Control* (DOT/FAA Order 7110.65T). Washington, DC: Federal Aviation Administration.

[2] Federal Aviation Administration. (2009) *Terminal Instrument Procedures (TERPS)* (DOT/ FAA Order 8260.3B Change 21). Washington, DC: Federal Aviation Administration.

[3] Federal Aviation Administration. (2010) *Waiver Request for Reduced Lateral Separation from an Obstruction and Vectors below Minimum Vector Altitude for Midway Airport Departures Eastbound/Northbound* (Version 1.0, June 4, 2010). Chicago Traffic Control Center (C90 TRACON). Chicago, IL: Federal Aviation Administration.