DOT/FAA/CT-82/103

Flight Test Route Structure Statistics of Helicopter GPS Navigation with the Magnavox Z-Set

Robert D. Till

December 1982

Data Report

U.S. Department of Transportation
Federal Aviation Administration
Technical Center
Atlantic City Airport, N.J. 08405

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-82/103		

4. Title and Subtitle	5. Report Date
FLIGHT TEST ROUTE STRUCTURE STATISTICS OF HELICOPTER GPS NAVIGATION WITH THE MAGNAVOX Z-SET	December 1982
	6. Performing Organization Code ACT-100
7. Author(s) Robert D. Till	8. Performing Organization Report No. DOT/FAA/CT-82/103
9. Performing Organization Name and Address Federal Aviation Administration Technical Center Atlantic City Airport, New Jersey 08405	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. 045-330-130
12. Sponsoring Agency Name and Address Federal Aviation Administration Technical Center Atlantic City Airport, New Jersey 08405	13. Type of Report and Period Covered Data Report July 1981 - November 1981
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The Federal Aviation Administration (FAA) Technical Center conducted this test project under Technical Program Document (TPD) 04-150 to determine the operational suitability of the Navigation Satellite Timing and Ranging Global Positioning System (NAVSTAR GPS) for rotary wing aircraft. The flight tests were conducted in a CH-53A helicopter using a prototype low cost GPS receiver, the Magnavox Z-set. Over 15 hours of radar tracked en route and nonprecision approach flight tests were flown with two-dimensional GPS derived guidance (crosstrack and distance-to-go) used as the primary navigation system.

This report includes tabulated statistical analysis of navigation errors for the flight test route segments flown. The results of the data presented in this report are summarized, analyzed, and discussed in the FAA Technical Center final report number FAA/CT-82/74, "Helicopter GPS Navigation with the Magnavox Z-Set."

17. Key Words	18. Distribution Statement
NAVSTAR GPS Z-Set Helicopter	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	41	

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INTRODUCTION

PURPOSE.

The purpose of the test program was to collect operational performance data on a low-cost Navigation Satellite Timing and Ranging Global Positioning System (NAVSTAR GPS) receiver for evaluation of helicopter area navigation. This report includes, in tabular form, statistical documentation of en route and nonprecision approach operational performance data.

The results have been analyzed and summarized in the Federal Aviation Administration (FAA) Technical Center final report number FAA/CT-72/74, "Helicopter GPS Navigation with the Magnavox Z-Set" (reference 1).

The test data demonstrate the perturbational effects of user-satellite geometry and satellite constellation changes. The operational performance data were analyzed in the final report with respect to criteria specified in FAA Advisory Circular (AC) 90-45A and the Federal Radionavigation Plan (FRP).

BACKGROUND.

Detailed background information is included in the final report (reference 1). The tabular data presented within this report were too detailed and voluminous for inclusion in the final report. Flight test results with respect to AC 90-45A and the FRP performance criteria were presented and summarized in the final report in tables and histograms.

DISCUSSION

EQUIPMENT DESCRIPTION.

The Magnavox Z-set used in this test program is a prototype low-cost Phase 1, coarse acquisition (C/A) code GPS receiver developed by the Department of Defense (DOD). The receiver was delivered to the FAA by the DOD for independent test and evaluation. The Z-set was provided with an optional Z-set interface module (ZIM) to permit substitution of barometric altitude (aided altitude) for a satellite range measurement when less than four satellites were available for the navigation solution. User position data are computed by the Z-set in an earth-centered earth-fixed (ECEF) coordinate system referenced to the DOD World Geodetic System 1972 (WGS-72) (reference 2).

DATA COLLECTION SYSTEM.

The airborne test vehicle was a Sikorsky twin-turbine CH-53 helicopter. Unique hardware and software (described in reference 1, appendix A) were developed to collect data from the Z-set and display crosstrack navigation guidance on a course deviation indicator (CDI). A Norden PDP 11/34M minicomputer controlled data collection and computed navigation guidance through software resident in memory. ECEF user position and velocity, satellite position, satellite range and identification, time, and computed navigation guidance were recorded on a digital recorder at the Z-set position update rate (nominally, every 1.2 seconds).

The flight tests were tracked by the Technical Center's dual Nike X-band radars. The tracking data were time-tagged with range time every 0.1 second and recorded on a digital recorder for post-flight processing.

DATA PROCESSING.

The tracked radar tapes were post-flight processed by the FAA Honeywell model 66/60 computer to generate a 9-track, 800 bits per inch (bpi) tape. The tracking data were stored in X, Y, and Z coordinates, with respect to the Technical Center's reference origin. The Honeywell tapes were reformatted to a Digital Equipment Corporation (DEC) compatible format in the Helicopter Program computer laboratory. The radar DEC compatible tapes were time merged with Z-set data to within 50 milliseconds. Z-set data and time of validity were read during the merge process. The Z-set position estimates were updated to the tagged time code generator time through addition of the velocity estimates scaled by the combined Z-set and data collection computer latency time delays.

Radar data were translated to a WGS-72 ECEF reference system. Merged data files were temporarily stored on disk packs for fast access by data analysis software. Position errors were computed by differencing radar (ground truth) and Z-set ECEF positions. Position errors compensated for Z-set data latency were translated to east, north, and up (ENU) errors and were edited for wild points. Selected route segments were statistically processed to determine their mean, standard deviation (1 sigma), 2 sigma, two dimensional (2D) mean, two distance root mean squared (drms), 3D mean and 3D two root mean squared (rms) error values. The data are presented in tables 1 through 12. These parameters are described in reference 1, appendix E.

Position errors uncompensated for Z-set data latency were computed for along-track error (ATE), navigation crosstrack (NCT) error, total system crosstrack (TSCT) error, and flight technical error (FTE). These statistically processed data are presented in tables 13 through 23. Definitions of the data terminology used in the tables are presented here to facilitate an understanding of the test results.

ATE: Defined as a fix error along the flight track resulting from the total error contribution of the airborne and ground equipment only.

FTE: Defined as the indicated deviation perpendicular to the desired course in the horizontal reference plane. Crosstrack error presented to the pilot on the CDI was recorded and represents FTE.

GDOP: Geometric dilution of precision reflects the influence of satellite geometry on the user's estimate of his position and his clock offset.

HDOP: Horizontal dilution of precision reflects the influence of satellite geometry on the user's estimate of his position.

Kurtosis Coefficient (Kurt Coeff): Describes the peakedness of a statistical distribution. If the Kurtosis coefficient is 3, the distribution is Gaussian (mesokurtic); if the coefficient is less than 3, the distribution is flat or platykurtic; if the coefficient is greater than 3, the distribution is peaked or leptokurtic.

NCT Error: Defined as the distance between the true position (ground truth) and the GPS estimated position measured perpendicular to the desired course in the horizontal reference plane.

Skew Coefficient: Indicates the symmetry of a statistical distribution with respect to a Standard Gaussian distribution. Zero skew indicates the distribution is symmetrical, while positive or negative values indicate the distribution is skewed right or left.

TSCT Error: Defined as the actual aircraft deviation perpendicular to the desired course in the horizontal reference plane.

2 drms: The radius of a circle that contains at least 95 percent of the possible fixes that can be obtained with a system at any one place.

2D Navigation System Errors (NSE): Defined as the linear sum of the mean and 2 sigma values of the root-sum-square (rss) combination of the horizontal error statistics. The 2D NSE value, when compensated for Z-set data latency, is defined as the linear sum of the 2D mean 2 drms values of the east and north errors. The 2D NSE values uncompensated for Z-set data latency were obtained from ATE and NCT error statistics.

TEST RESULTS

The test results are presented in tables 1 through 23 for the four route structures flown (described in reference 1). The flight test configuration matrix is reported with respect to the four following classifications: familiarization and checkout (flight 1); navigation with four plus (4+) satellites, which denotes five satellites were available for the navigation solution (flights 9, 12, 14, and 15); navigation with four satellites (flights 5, 6, 7, 8, and 11); and navigation with three satellites (flights 10 and 13).

REFERENCES

1. Till, Robert D., Helicopter GPS Navigation with the Magnavox Z-Set, FAA Technical Center, FAA-CT-82-74, March 1982.

2. World Geodetic System Committee, The Department of Defense World Geodetic System 1972, Defense Mapping Agency, Washington, D.C., May 1974.

TABLE 1. GPS NIKE APPROACH TRACKED POSITION ERRORS WITH Z-SET DATA LATENCY COMPENSATION, FLIGHT 1

FLIGHT LF 201-81 4 SATELLITES NAVIGATION WITH AIDED ALTITUDE

POSITION ERROR	ROUTE	WAYPOINTS FROM-TO	MEAN METERS	1σ METERS	2D-MEAN METERS	2dRMS METERS	2D NSE 2D-MEAN +2dRMS METERS	3D-MEAN METERS	3D-2RMS METERS	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SKEW COEFF.	KURT. COEF.	SAMPLES
EAST	1	7-8	6.6	8.5										-0.5	3.3	
NORTH			13.0	7.7										-0.2	1.7	
UP			-45.9	22.2										-0.1	2.2	
					14.2	22.9	37.1	48.1	60.0	3.3	3.5	4.6	4.1			41
EAST	1	8-1	2.2	5.2										0.9	4.0	
NORTH			19.1	5.9										0	2.7	
UP			37.0	13.7										-0.1	2.1	
					19.2	15.7	34.9	41.7	31.7	3.7	4.2	15.6	16.8			93
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																

TABLE 2. GPS NIKE APPROACH TRACKED POSITION ERRORS WITH Z-SET DATA LATENCY COMPENSATION, FLIGHT 5

FLIGHT 5F268-81 4 SATELLITES NAVIGATION WITH AIDED ALTITUDE

POSITION ERROR	ROUTE	WAYPOINTS FROM-TO	MEAN METERS	1σ METERS	2D-MEAN METERS	2drms METERS	2DNSE 2D-MEAN +2drms METERS	3D-MEAN METERS	3D-2RMS METERS	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SKEW COEFF.	KURT. COEF.	SAMPLES
EAST	1	7-8	-4.5	10.4										0.3	2.6	
NORTH			1.0	7.0										-0.4	3.7	
UP			0	30.2										-0.6	2.7	
					4.7	25.0	29.7	4.7	65.4	2.6	2.8	11.5	12.3			86
EAST	1	8-1	5.0	9.9										-0.4	2.1	
NORTH			3.3	6.6										-0.1	2.2	
UP			5.6	35.7										0	1.6	
					6.0	23.8	29.8	8.2	75.3	2.8	3.1	12.2	13.2			145
EAST	2	3-4	-6.2	16.5										0.3	2.1	
NORTH			-34.4	9.2										-0.5	2.2	
UP			-47.4	54.9										0	1.7	
					34.9	37.8	72.7	58.9	116.2	7.6	7.9	23.2	23.8			26
EAST	2	4-5	8.5	11.8										-1.4	4.9	
NORTH			-38.4	5.1										-1.7	9.2	
UP			-16.8	28.4										-2.1	8.4	
					39.3	25.8	65.1	42.7	62.5	7.9	9.0	23.8	26.4			118
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																

TABLE 3. GPS NIKE APPROACH TRACKED POSITION ERRORS WITH Z-SET DATA LATENCY COMPENSATION, FLIGHT 6

FLIGHT 6F27/-8i 4 SATELLITES NAVIGATION WITH AIDED ALTITUDE

POSITION ERROR	ROUTE	WAYPOINTS FROM-TO	MEAN METERS	1σ METERS	2D-MEAN METERS	2drms METERS	2D NSE 2D-MEAN +2drms METERS	3D-MEAN METERS	3D-2RMS METERS	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SKEW COEFF.	KURT. COEF.	SAMPLES
EAST	1	7-8	2.0	19.1										-0.7	3.4	
NORTH			-8.1	7.7										0	2.0	
UP			0.2	82.4										-0.8	2.7	
					8.3	41.1	49.4	8.3	169.8	5.9	6.7	19.7	21.3			75
EAST	1	8-1	-2.4	6.5										-0.1	1.5	
NORTH			-2.2	8.3										1.0	3.4	
UP			-14.0	23.8										-0.3	2.9	
					3.2	21.1	24.3	14.4	52.0	6.7	12.4	21.3	33.4			149
EAST	2	3-4	-32.0	28.0										-1.4	3.1	
NORTH			-15.8	15.8										-1.3	3.8	
UP			-143.2	93.6										-1.5	3.5	
					35.7	64.2	99.9	147.6	198	23.2	24.9	55.4	59.2			14
EAST	2	4-5	-60.8	23.6										-0.8	3.3	
NORTH			-0.7	15.7										-1.2	4.3	
UP			-244.8	76.8										0.9	3.3	
					60.8	56.8	117.6	252.2	163.8	25	31.4	59.4	72.6			90
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																

TABLE 4. GPS NIKE APPROACH TRACKED POSITION ERRORS WITH Z-SET DATA LATENCY COMPENSATION, FLIGHT 7

FLIGHT 7F275-81 4 SATELLITES NAVIGATION WITHOUT AIDED ALTITUDE

POSITION ERROR	ROUTE	WAYPOINTS FROM-TO	MEAN METERS	1σ METERS	2D-MEAN METERS	2drms METERS	2DNSE 2D-MEAN +2drms METERS	3D-MEAN METERS	3D-2RMS METERS	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SK&W COEFF.	KURT. COEF.	SAMPLES
EAST	1	7-8	4.2	12.9										-1.8	7.1	
NORTH			-1.1	6.5										-0.9	3.3	
UP			6.2	39.8										-2.2	7.9	
					4.4	28.8	33.2	7.5	84.6	3.6	3.9	14.2	15.1			85
EAST	1	8-1	12.7	5.3										-0.3	2.1	
NORTH			3.8	8.2										1.1	3.7	
UP			46.6	21.6										-0.9	3.0	
					13.2	19.4	32.6	48.5	47.3	3.9	4.7	15.1	16.8			171
EAST	2	4-5	-25.6	4.0										0.4	2.7	
NORTH			-29.7	6.2										0	2.2	
UP			-140.5	50.3										0.4	2.7	
					39.2	30.6	69.8	145.9	105.1	11.3	13	31	34.6			101
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																

TABLE 5. GPS NIKE APPROACH TRACKED POSITION ERRORS WITH Z-SET DATA LATENCY COMPENSATION, FLIGHT 8

FLIGHT 8F279-81 4 SATELLITES NAVIGATION WITHOUT AIDED ALTITUDE

POSITION ERROR	ROUTE	WAYPOINTS FROM-TO	MEAN METERS	1σ METERS	2D-MEAN METERS	2drms METERS	2D NSE 2D-MEAN +2drms METERS	3D-MEAN METERS	3D-2RMS METERS	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SKEW COEFF.	KURT. COEF.	SAMPLES	
EAST	1	7-8	-3.8	32.8										0.2	1.3		
NORTH			-13.2	9.6										0	1.2		
UP			-43.9	108.8										0.1	1.2		
					13.9	65.2	82.4	46.0	139.2	9.2	9.0	26.7	73.5			27	
EAST	1	8-1	1.9	15.0										-0.1	2.3		
NORTH			-4.9	16.6										0	1.8		
UP			0	30.2										-0.2	2.1		
					5.2	44.7	49.9	5.2	90	9.7	32	27.6	73.5			101	
EAST	2	3-4	-320.8	86.8										-0.8	2.0		
NORTH			211	66.9										-0.9	2.2		
UP			-1058.3	286.2										-0.8	2.0		
					384	219.2	594.2	115.8	613	65.5	82.5	142	178			8	
EAST	2	4-5	-532.1	82.0										-0.4	1.6		
NORTH			370.1	134.6										-0.3	1.6		
UP			-1259.2	184.2										-0.3	1.9		
					649	476	1119	1416	598	82.5	122	176	256			103	2 SAT. NAV.
EAST																	
NORTH																	
UP																	
EAST																	
NORTH																	
UP																	

TABLE 6. GPS NIKE APPROACH TRACKED POSITION ERRORS WITH Z-SET DATA LATENCY COMPENSATION, FLIGHT 9

FLIGHT 9F 289-81 4+ SATELLITES NAVIGATION WITHOUT AIDED ALTITUDE

POSITION ERROR	ROUTE	WAYPOINTS FROM-TO	MEAN METERS	1σ METERS	2D-MEAN METERS	2drms METERS	2D NSE 2D-MEAN +2drms METERS	3D-MEAN METERS	3D-2RMS METERS	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SKEW COEFF.	KURT. COEF.	SAMPLES
EAST	3	5-6	-3.4	10.3										[illegible]	1.8	
NORTH			5.2	6.4										[illegible]	2.78	
UP			20.6	38.4										0.14	1.56	
					6.3	24.2	30.5	21.5	[illegible]	1.95	1.99	4.66	4.08			89
EAST	3	6-1	-6.52	3.85										-0.15	3.14	
NORTH			1.21	7.78										0.6	2.57	
UP			-22.6	7.39										0.14	1.84	
					6.6	17.4	24.0	28.4	[illegible]	1.99	[illegible]	[illegible]	4.73			186
EAST	3	5-6	-10.9	11.0										-0.2	2.9	
NORTH			33.9	45.4										1.71	4.79	
UP			-24.7	43.3										-0.95	[illegible]	
					35.6	93.4	129.0	43.3	127	2.51	3.06	5.01	5.37			80
EAST	3	6-1	-4.1	6.1										-0.2	2.46	
NORTH			3.7	12.2										0.5	2.93	
UP			-17.4	15.0										-0.5	2.44	
					5.5	27.3	32.8	18.2	40.5	3.06	3.2	5.37	5.46			209
EAST	2	3-4	5.5	7.9										-0.04	2.61	
NORTH			-50.4	15.0										0.28	2.24	
UP			87.4	5.3										-0.3	2.81	
					50.7	34	84.7	101	35.6	3.34	3.35	5.52	5.57			47
EAST	2	4-5	0.4	12.1										0.13	2.47	
NORTH			-48.0	14.8										0.31	3.3	
UP			98.5	10.7										0.21	2.45	
					48	38.1	86.1	109.6	43.7	3.35	3.38	5.52	5.53			140

TABLE 7. GPS NIKE APPROACH TRACKED POSITION ERRORS WITH Z-SET DATA LATENCY COMPENSATION, FLIGHT 10

FLIGHT 10F295-81 3 SATELLITES NAVIGATION WITHOUT AIDED ALTITUDE

POSITION ERROR	ROUTE	WAYPOINTS FROM-TO	MEAN METERS	1σ METERS	2D-MEAN METERS	2drms METERS	2D NSE 2D-MEAN +2drms METERS	3D-MEAN METERS	3D-2RMS METERS	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SKEW COEFF.	KURT. COEF.	SAMPLES
EAST	3	5-6	107	17.4										0.17	1.53	
NORTH			161	27.4										-0.01	1.93	
UP			643	100										0.04	1.66	
					193	64.9	257.9	671	211							73
EAST	3	5-6	174	23.2										-0.13	1.71	
NORTH			36	13.9										0.64	2.30	
UP			698	104										0.05	1.82	
					177	54.1	231.1	720	215							89
EAST	3	6-1	70.2	34										-0.18	1.81	
NORTH			9.6	12.4										-0.18	2.37	
UP			273	132										0.15	1.76	
					70.9	72.4	282	-75								127
EAST	2	3-4	269	24.6										-0.46	1.94	
NORTH			-140	13.1										0.78	3.02	
UP			857	85.8	304	55.7	359.7	907	180					-0.34	1.79	
																137
EAST	2	4-5	167	36.2										-0.15	1.81	
NORTH			-1.6	11.4										0.53	3.58	
UP			600	111										-0.06	1.73	
					204	76	280	540	245							145
EAST																
NORTH																
UP																

TABLE 8. GPS NIKE APPROACH TRACKED POSITION ERRORS WITH Z-SET DATA LATENCY COMPENSATION, FLIGHT 11

FLIGHT 11F295-81 4 SATELLITES NAVIGATION WITHOUT AIDED ALTITUDE

POSITION ERROR	ROUTE	WAYPOINTS FROM-TO	MEAN METERS	1σ METERS	2D-MEAN METERS	2drms METERS	2DNSE 2D-MEAN +2drms METERS	3D-MEAN METERS	3D-2RMS METERS	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SKEW COEFF.	KURT. COEF.	SAMPLES
EAST	4	7-8	-104	12.1										-0.08	1.83	
NORTH			22.3	8.1										0.13	1.87	
UP			-369	45.3										0.01	1.91	
					107	29.2	136.2	384	95.2	12.7	14.25	33.9	37.1			53
EAST	4	8-1	-132	37										0.82	2.16	
NORTH			43.8	23.6										-0.24	2.24	
UP			-461	127										0.84	2.21	
					139	87.9	226.9	482	268	14.3	17.4	37.2	43.4			109
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																

TABLE 9. GPS NIKE APPROACH TRACKED POSITION ERRORS WITH Z-SET DATA LATENCY COMPENSATION, FLIGHT 12

FLIGHT 12F 296-97   4+ SATELLITE NAVIGATION WITHOUT AIDED ALTITUDE

POSITION ERROR	ROUTE	WAYPOINTS FROM-TO	MEAN METERS	1σ METERS	2D-MEAN METERS	2drms METERS	2D NSE 2D-MEAN +2drms METERS	3D-MEAN METERS	3D-2RMS METERS	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SKEW COEFF.	KURT. COEF.	SAMPLES	
EAST	3	5-6	-0.63	7.14										0.05	[illegible]		
NORTH			-18.3	6.84										0.26	1.89		
UP			-28.7	26.9										-0.11	2.21		
					18.3	17.8	38.1	34	57.3	1.82	[illegible]	8.31	8.58			70	
EAST	3	6-1	-5.59	9.28										-0.1	2.33		
NORTH			-6.7	15.9										1.19	4.0		
UP			-42.6	34.3										1.23	3.61		
					[illegible]	36.9	45.6	43.4	77.9	1.85	1.86	4.38	8.66			104	SAT CONSTELLATION CHANGE
EAST	3	5-6	-13.7	[illegible]										0.94	3.71		
NORTH			-10.5	3.91										-0.16	2.17		
UP			-61.3	17.2										0.46	2.4		
					17.2	14.8	32	63.7	[illegible]	1.99	[illegible]	4.38	8.66			65	
EAST	3	6-1	-17.0	8.63										-0.28	1.83		
NORTH			5.22	9.67										1.02	3.10		
UP			-68	14.9										-0.27	3.04		
					17.8	[illegible]	43.7	70.3	[illegible]	2.02	2.09	4.75	4.77			162	
EAST	2	3-4	-13.5	[illegible]										[illegible]	[illegible]		
NORTH			-38	[illegible]										0.32	[illegible]		
UP			-72.7	17.8										[illegible]	3.39		
					40.3	11	51.3	[illegible]	37.3	[illegible]	2.48	4.98	5.01			[illegible]	
EAST	2	4-5	-11.7	4.67										[illegible]	[illegible]		
NORTH			-59.9	51										[illegible]	[illegible]		
UP			-56.9	27.9										[illegible]	4.7		
					[illegible]	111	[illegible]	62.3	[illegible]	[illegible]	[illegible]	[illegible]	5.37			[illegible]	SAT [illegible] CHANGE

TABLE 10. GPS NIKE APPROACH TRACKED POSITION ERRORS WITH Z-SET DATA LATENCY COMPENSATION, FLIGHT 13

FLIGHT 13F306-81 3 SATELLITES NAVIGATION WITH AIDED ALTITUDE

POSITION ERROR	ROUTE	WAYPOINTS FROM-TO	MEAN METERS	1σ METERS	2D-MEAN METERS	2drms METERS	2DNSE 2σ-MEAN +2drms METERS	3D-MEAN METERS	3D-2RMS METERS	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SKEW COEFF.	KURT. COEF.	SAMPLES
EAST	3	5-6	-4.23	9.94										0.17	2.69	
NORTH			16.6	8.72										-0.52	2.93	
UP			1.96	6.0										-0.37	3.59	
					17.2	26.5	43.7	17.3	29.1							94
EAST	3	6-1	-7.58	10.5										-0.54	3.24	
NORTH			18.5	15.8										[illegible]	2.27	
UP			2.14	4.6										-0.01	2.68	
					20	37.9	57.9	20.1	39							158
EAST	3	5-6	-2.68	9.38										0.[illegible]2	2.67	
NORTH			9.23	9.66										0.11	2.11	
UP			-4.27	6.89										0.31	2.90	
					9.6	26.8	36.4	10.5	35.1							96
EAST	3	6-1	-2.41	9.42										0.58	3.94	
NORTH			16.2	15.3										-1.12	6.74	
UP			0.41	5.53										0.35	3.08	
					16.4	36	52.4	16.4	37.6							185
EAST	2	3-4	12.8	7.28										0.07	2.94	
NORTH			-23.8	5.99										0.36	2.73	
UP			-0.26	5.73										0.13	2.32	
					27	18.9	45.9	27	22.1							73
EAST																
NORTH																
UP																

TABLE 11. GPS NIKE APPROACH TRACKED POSITION ERRORS WITH Z-SET DATA LATENCY COMPENSATION, FLIGHT 14

FLIGHT 14F 307-81 4+ SATELLITES NAVIGATION WITH AIDED ALTITUDE

POSITION ERROR	ROUTE	WAYPOINTS FROM-TO	MEAN METERS	1σ METERS	2D-MEAN METERS	2drms METERS	2D NSE 2D-MEAN +2drms METERS	3D-MEAN METERS	3D-2RMS METERS	HDOP MIN.	HDOP MAX	GDOP MIN	GDOP MAX	SR&W COEFF.	KUET. COEF.	SAMPLES
EAST	3	5-6	5.26	11.6										0.58	2.4	
NORTH			-12.2	9.35										-0.06	2.23	
UP			-2.73	19.2										0.19	1.96	
					13.3	9.8	43.1	13.6	48.6	2.4	2.42	4.56	4.58			100
EAST	3	6-1	-5.97	9.83										-0.14	2.91	
NORTH			4.14	13.9										0.92	2.85	
UP			-10.8	8.7										0.92	4.21	
					7.3	34	41.3	13	38.2	2.37	2.42	4.56	4.6			129
EAST	3	5-6	-3.52	6.8										0.52	2.5	
NORTH			-0.5	5.5										-0.41	2.84	
UP			-6.2	15.7										0.03	2.12	
					3.4	17.6	21	7.1	36	2.21	2.23	4.6	4.65			97
EAST	3	6-1	-6.37	7.49										-0.29	2.53	
NORTH			2.16	8.8										0.7	3.25	
UP			-12.8	8.92										0.78	3.55	
					6.7	23.1	29.8	14.4	29.2	2.17	2.86	4.56	4.76			169
EAST	2	3-4	0.25	3.22										0.65	3.78	
NORTH			-9.06	6.66										-0.3	2.45	
UP			10.4	8.53										0.55	2.91	
					9.06	14.8	23.86	13.8	22.6	1.84	1.89	4.32	4.33			97
EAST	2	4-5	5.59	3.64										-0.20	2.8	
NORTH			-21	5.59										-0.7	2.89	
UP			-7.5	6.01										0.12	2.08	
					21.7	13.3	35	23	18	1.76	1.84	4.32	4.32			150

TABLE 12. GPS NIKE APPROACH TRACKED POSITION ERRORS WITH Z-SET DATA LATENCY COMPENSATION, FLIGHT 15

FLIGHT 15F328-81 4T SATELLITE NAVIGATION WITH AIDED ALTITUDE

POSITION ERROR	ROUTE	WAYPOINTS FROM-TO	MEAN METERS	1σ METERS	2D-MEAN METERS	2drms METERS	2DNSE 2D-MEAN +2drms METERS	3D-MEAN METERS	3D-2RMS METERS	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SKEW COEFF.	KURT. COEF.	SAMPLES
EAST	3	5-6	2.72	8.46										0.66	2.59	
NORTH			-4.15	7.58										-0.56	2.61	
UP			-2.6	21										-0.97	2.82	
					4.96	22.7	27.7	5.6	47.8	2.21	2.23	4.57	4.62			93
EAST	3	6-1	-1.11	5.75										-0.26	2.6	
NORTH			3.77	8.97										0.54	2.20	
UP			-5.07	8.29										1.25	5.01	
					3.73	21.3	25.3	6.4	27	2.10	2.23	4.57	4.75			131
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																
EAST																
NORTH																
UP																

TABLE 13. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 5 (SHEET 1 OF 2)

FLIGHT SF 268-81, 4 SATELLITES NAVIGATION, WITH AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ± 2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	1	2-3	10.1	343		0.31	1.99						
FTE			203	378		0.18	1.95						
NCT			-10.4	11.1	21.5	0.01	2.14						
ATE			-63.5	26.3	89.8	2.11	11.5						
2D NSE			64.4	34.4	98.8			2.07	2.07	5.23	5.35	107	
TSCT	1	3-4	60.5	147		0.05	2.66						
FTE			54.9	160		0.03	2.61						
NCT			4.82	20.3	25.1	0.01	2.74						
ATE			-77.9	30.9	108.8	3.17	17.51						
2D NSE			78.0	37	115			1.86	2.03	5.4	6.53	379	
TSCT	1	4-5	-48.8	126		-0.42	2.58						RADAR NOISE
FTE			-38.4	130		-0.3	2.72						
NCT			-9.9	20.9	30.8	-0.72	5.71						
ATE			-54.2	46.7	100.9	3.7	40.12						
2D NSE			55.1	51.1	106.2			1.79	1.84	4.61	8.1	395	
TSCT	1	5-6	108	177		0.32	2.02						
FTE			110	177		0.37	2.11						
NCT			-1.26	13.6	14.9	-0.31	2.18						
ATE			-55.6	16.8	72.4	4.03	27.2						
2D NSE			55.6	21.6	77.2			2.05	3.45	7.52	9.57	216	
TSCT	1	6-7	132	246		-0.47	2.6						
FTE			123	248		-0.39	2.64						
NCT			9.05	19.2	28.25	0.12	3.35						
ATE			-60.1	20.4	80.5	3.08	19.05						
2D NSE			60.8	28	88.8			2.17	2.43	10.13	11.11	198	
					APPROACH								
TSCT	1	7-8	54.7	108		-0.44	2.19						
FTE			62.4	108		-0.27	1.83						
NCT			-6.88	33.3	40.2	0.23	2.96						
ATE			-40.2	10.3	50.5	-0.11	2.28						
2D NSE			40.8	34.8	75.6			2.55	2.77	11.49	12.16	108	
					APPROACH								
TSCT	1	8-1	-107	150		1.59	5.62						
FTE			109	157		1.18	4.91						
NCT			2.05	31.8	33.9	-0.07	2.48						
ATE			-50.5	14.4	64.8	1.56	16.97						
2D NSE			50.5	34.9	85.4			2.78	3.14	12.18	13.16	157	

TABLE 13. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 5 (SHEET 2 OF 2)

FLIGHT 5F 268-81, 4 SATELLITES NAVIGATION, WITH AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ±2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	2	2-3	24.4	139		0.17	2.13						
FTE			25.2	136		0.13	2.07						
NCT			-0.95	10.7	11.65	-0.8	3.84						
ATE			-787	35.4	114.1	0.27	1.85						
2D NSE			78.7	37.0	115.7			5.15	6.27	17.92	20.32	199	
					APPROACH								
TSCT	2	3-4	37.5	58.1		-0.3	1.34						
FTE			23.7	75.7		-0.17	1.41						
NCT			13.8	25	38.8	0.21	1.43						
ATE			-47.5	62.9	110.4	-0.16	2.0						
2D NSE			49.4	67.7	117.1			7.59	7.91	23.16	23.91	38	
					APPROACH								
TSCT	2	4-5	16.5	39.0		0.16	2.91						
FTE			2.28	44.8		0.36	3.4						
NCT			14.3	13.0	27.3	0.49	5.63						
ATE			-67.3	42.4	109.7	1.55	5.09						
2D NSE			68.8	44.3	113.1			7.89	9.07	23.83	26.46	134	
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													

TABLE 14. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 6 (SHEET 1 OF 2)

FLIGHT 6F271-81, 4 SATELLITES NAVIGATION, WITH AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ± 2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	1	3-4	-32.6	251		-0.21	2.54						
FTE			-36.3	254		-0.13	2.52						
NCT			2.85	19.8	22.7	-0.03	2.73						
ATE			-71.3	9.8	81.1	1.66	13.99						
2D NSE			71.4	27.9	99.3			1.79	1.99	7.15	9.29	666	
TSCT	1	4-5	-24.6	270		0.18	2.16						RADAR NOISE
FTE			-15.8	275.1		0.19	2.22						
NCT			-8.25	22.6	30.9	0.10	3.40						
ATE			-37.1	47.0	84.1	-0.37	2.85						
2D NSE			38.0	52.1	90.1			2.18	3.08	10.12	12.78	483	
TSCT	1	5-6	78.8	80.4		-0.44	2.95						
FTE			91.6	87.7		-1.04	3.85						
NCT			-12.1	27.5	39.6	0.73	2.91						
ATE			-40.9	11.6	52.2	-0.47	2.86						
2D NSE			42.7	29.8	67.5			3.49	4.4	13.8	16.1	274	
TSCT	1	6-7	71.4	207		0.87	2.89						
FTE			61.2	213		0.82	2.76						
NCT			10.6	13.5	24.1	-0.22	2.0						
ATE			-37.7	28.1	65.8	1.7	523						
2D NSE			39.2	31.2	70.4			4.7	5.6	16.8	19	199	
					APPROACH								
TSCT	1	7-8	69	98.9		0.65	3.0						
FTE			66.6	130		1.48	5.2						
NCT			3.2	67.2	70.4	-0.47	3.09						
ATE			-24.9	20.6	45.5	0.47	2.83						
2D NSE			26.1	70.3	96.4			5.93	6.65	19.67	21.23	111	
					APPROACH								
TSCT	1	8-1	-0.32	27.1		1.93	6.58						
FTE			4.41	37.9		0.6	2.75						
NCT			-3.8	21.3	25.06	-0.33	2.48						
ATE			-30.4	14.6	45	0.59	3.99						
2D NSE			30.7	25.8	56.5			6.74	12.41	21.4	33.4	176	
TSCT	2	2-3	10.1	199		-0.18	2.13						
FTE			-31.2	205		-0.26	2.18						
NCT			41.1	27.1	68.2	0.39	2.67						
ATE			-129	33.4	162.4	-0.27	2.39						
2D NSE			135.1	43.0	178.1			13.2	18.9	35.1	46.8	216	

TABLE 14. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 6 (SHEET 2 OF 2)

FLIGHT 6F 271-81, 4 SATELLITES NAVIGATION, WITH AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ±2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	2	3-4	-19.7	84.7		-0.82	2.07						APPROACH
FTE			-13.8	85.6		-0.94	2.66						
NCT			-5.8	27	32.8	-2.11	7.7						
ATE			3.16	32	35.2	2.31	6.2						
2D NSE			6.6	69.4	76			23.2	24.9	55.4	59.2	39	
TSCT	2	4-5	-41	54.1		-0.29	2.5						APPROACH
FTE			-16.1	42.5		-0.13	2.14						
NCT			-24.8	42.4	67.2	0.62	2.49						
ATE			-54.1	96.4	150.5	-0.49	2.28						
2D NSE			59.5	105.3	164.8			25	31.4	59.4	72.6	137	
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													

TABLE 15. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 7 (SHEET 1 OF 2)

FLIGHT TF 275-81, 4 SATELLITES NAVIGATION, WITHOUT AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ± 2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	1	2-3	71.2	163		-0.47	1.93						
FTE			79.1	158		-0.62	2.01						
NCT			-7.97	244	32.4	-0.22	2.26						
ATE			-50	17	67	-3.27	-9.99						
2D NSE			52.6	29.7	92.3			1.93	1.96	5.69	5.83	99	
TSCT	1	3-4	-26.6	195		-0.41	4.29						
FTE			-28	196.7		-0.43	4.29						
NCT			0.58	16.3	16.9	-0.16	2.61						
ATE			-72.2	16.4	88.6	-0.3	2.79						
2D NSE			72.2	23.2	95.4			1.81	1.91	5.95	7.66	786	
TSCT	1	4-5	21.8	223		0.31	2.02						RADAR NOISE
FTE			24.6	223		0.82	2.09						
NCT			-3.27	17.2	19.5	0.52	3.77						
ATE			-31.5	37.5	89.3	0.07	3.05						
2D NSE			51.5	41.3	92.8			1.83	2.11	7.94	9.74	476	
TSCT	1	5-6	12.9	234		0.34	2.33						
FTE			12.2	236		0.4	2.42						
NCT			7.82	26.1	33.9	-1.0	4.38						
ATE			-69.2	15.9	85.1	-0.29	2.7						
2D NSE			69.6	30.5	100.1			2.23	2.63	10.2	11.6	274	
TSCT	1	6-7	119	121		-1.32	3.28						
FTE			109	125		-1.24	3.1						
NCT			10	12.5	22.5	1.58	5.29						
ATE			-72.6	11.6	84.2	0.01	2.63						
2D NSE			73.3	17.1	90.4			2.82	3.35	12.2	13.6	113	
					APPROACH								
TSCT	1	7-8	26.2	222		-1.06	3.67						
FTE			23.3	226		-0.67	2.89						
NCT			4.07	11.1	15.3	0.71	2.76						
ATE			-40.7	5.77	46.5	0.4	2.02						
2D NSE			40.9	12.5	53.4			3.56	3.93	14.8	15.06	45	
					APPROACH								
TSCT	1	8-1	19.2	49.1		-0.76	3.05						
FTE			2.23	45		-0.63	2.36						
NCT			18	17.1	35.1	-0.27	2.13						
ATE			-39.4	11.4	50.8	0.44	3.37						
2D NSE			43.3	20.5	63.8			3.14	4.66	15.1	16.77	183	

TABLE 15. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 7 (SHEET 2 OF 2)

FLIGHT 7F275-81, 4 SATELLITES NAVIGATION, WITHOUT AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ±2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	2	2-3	17.7	155		-0.19	1.9						
FTE			8.58	162		-0.12	1.82						
NCT			8.94	17.6	26.5	0.19	2.73						
ATE			-91	28	119	-0.15	2.07						
2D NSE			91.4	33	124.4			7.16	9.53	22.26	27.2	274	
					APPROACH								
TSCT	2	3-4	6.35	31.1		1.79	4.2						
FTE			3.7	18.2		1.79	4.2						
NCT			2.6	12.9	15.5	1.79	4.2						
ATE			-17.5	86.6	103.5	1.79	4.2						
2D NSE			17.5	86.6	104.1			11.2	11.4	30.8	31.2	6	
					APPROACH								
TSCT	2	4-5	5.89	48.9		-0.14	1.75						
FTE			6.05	55.9		-0.24	1.71						
NCT			-0.06	16.8	169	0.49	2.44						
ATE			-18.1	44.1	62.2	-0.48	2.89						
2D NSE			18.1	47.2	653			11.3	13	31	34.6	122	
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													

TABLE 16. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 8 (SHEET 1 OF 2)

FLIGHT 8F279-81, 4 SATELLITES NAVIGATION, WITHOUT AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ±2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	1	2-3	503	314		-1.39	6.54						
FTE			521	323		-1.4	6.7						
NCT			-17.9	18.5	36.4	-0.05	2.9						
ATE			-44.2	29.6	73.8	1.0	6.3						
2D NSE			47.7	34.9	82.6			1.78	1.8	6.95	7.29	[illegible]	NEW PILOT
TSCT	1	3-4	-285	522		-0.64	1.89						
FTE			-292	521		-0.63	1.89						
NCT			5.8	18.7	24.5	0.58	5.07						
ATE			-68.2	33.9	102.1	2.25	10.5						
2D NSE			68.5	38.7	107.2			1.78	2.0[illegible]	[illegible]	[illegible]	[illegible]	
TSCT	1	4-5	72.9	186		0.01	2.4						RADAR NOISE
FTE			88.4	180		0	[illegible]						
NCT			-14.9	17.9	32.8	0.18	3.28						
ATE			-39.0	[illegible]	91.8	0.37	[illegible]						
2D NSE			41.7	55.8	97.5			2.8	4.9	[illegible]	17	625	
TSCT	1	5-6	118	332		0	1.83						
FTE			131	325		0.02	1.87						
NCT			-12.2	35.5	47.7	-0.02	4.08						
ATE			-57.8	35	92.8	2.3	8.39						
2D NSE			59.1	49.9	109			5.1	6.6	17.6	20.8	[illegible]60	
TSCT	1	6-7	-47	127		-0.8	8.1						
FTE			-8.8	132		-1.4	[illegible]						
NCT			4.2	17	[illegible]	1.6	3.7						
ATE			-11.8	48.2	60	-1.6	[illegible]						
2D NSE			12.6	57.1	69.7			6.9[illegible]	8.4	[illegible]	[illegible]	[illegible]	
					APPROACH								
TSCT	1	7-8	11	86.8		0.71	3						
FTE			11.3	135		-0.04	[illegible]						
NCT			0.44	113	[illegible]	0.06	1.3						
ATE			-50	40.3	90.3	0.8	3.6						
2D NSE			[illegible]	[illegible]	[illegible]			[illegible]	9.7	[illegible]	[illegible]	[illegible]	
					APPROACH								
TSCT	1	[illegible]	55.5	176		0.5	2						
FTE			52.3	147		0.9	[illegible]						
NCT			4.2	54.9	59.1	[illegible]	[illegible]						
ATE			-43.4	27.3	70.7	0.8	[illegible]						
2D NSE			43.6	61.3	104.9			[illegible]	32	27.8	[illegible]	140	

TABLE 16. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 8 (SHEET 2 OF 2)

FLIGHT 8F 279-81, 4 SATELLITES NAVIGATION, WITHOUT AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ±2σ METERS	SKEW COEFF	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	2	2-3	257	417		0.2	1.7						
FTE			120	366		0.3	2						
NCT			136	145	281	-1	3.2						
ATE			-230	225	455	1.8	6.7						
2D NSE			2.675	268.5	536			32	47.1	73.5	104	194	
					APPROACH								
TSCT	2	3-4	-366	201		-2.5	7.7						
FTE			3.6	44.2		3.8	18.8						
NCT			-40.2	207	247.2	-2.3	6.3						
ATE			82.5	427	509.5	2.3	6.3						
2D NSE			91.7	474.9	566.6			65.5	89.4	141.5	178	79	
					APPROACH								
TSCT	2	4-6	-290	327		0.67	2.1						2 SATELLITE NAVIGATION
FTE			2.2	176		-0.25	2.6						
NCT			287	285	572	1.2	3.2						
ATE			581	950	1531	-0.8	3.6						
2D NSE			648.2	991.8	1639.8			83.5	121.7	176	256	160	
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													

TABLE 17. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 9 (SHEET 1 OF 2)

FLIGHT 9F289-81, 4+ SATELLITES NAVIGATION, WITHOUT AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ± 2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	3	3-4	6.1	238		0.46	3.41						
FTE			6.2	231.3		0.41	3.3						
NCT			-0.9	31.1	32	0.45	3.1						
ATE			-74.9	16.2	91.1	0.24	2.7						
2D NSE			74.9	35.1	110			1.7	1.8	4.5	4.6	341	
TSCT	3	4-5	22.7	326		1.2	3.5						RADAR NOISE
FTE			21.7	331		1.2	3.5						
NCT			10.9	20	30.9	-0.6	3						
ATE			-69.4	24.4	93.8	1.9	12.1						
2D NSE			70.3	31.5	101.8			1.85	1.91	4.58	4.63	199	
APPROACH													
TSCT	3	5-6	12.2	82.2		-0.1	2.2						
FTE			17.1	66.8		0.07	2						
NCT			-4.1	29.1	33.2	0.2	1.8						
ATE			35.7	7.2	42.9	0.2	2.8						
2D NSE			36	29.9	65.9			1.95	1.99	4.66	4.68	89	
APPROACH													
TSCT	3	6-1	-4.7	27.4		0.6	2.6						
FTE			7.9	27.6		0.05	2.4						
NCT			-11.7	13.2	24.9	-1	4.5						
ATE			-42.3	20.6	62.9	-0.2	2.1						
2D NSE			43.9	24.5	68.4			1.99	2.06	4.69	4.73	188	
TSCT	3	2-3	-49.1	60.2		0.06	1.7						
FTE			-37	70.1		0.1	1.5						
NCT			-12.1	13.1	25.2	0.5	1.9						
ATE			-56	20.4	76.4	0.3	2.1						
2D NSE			57.3	24.2	81.5			2.14	2.16	4.78	4.8	57	
TSCT	3	3-4	-16.4	16.3		1	3.2						
FTE			-15.4	17.3		1.1	3.1						
NCT			-1.85	20.4	22.3	-0.2	2.2						
ATE			-75.3	10.4	85.7	0.4	3.8						
2D NSE			75.3	22.9	96.2			2.2	2.36	4.82	4.92	351	
TSCT	3	4-5	20.7	34.6		0.1	1.7						
FTE			19.8	35.3		0.1	1.7						
NCT			9.9	36.1	46	-0.2	2.2						
ATE			-60.9	36.5	97.4	0.4	4.4						
2D NSE			61.7	51.4	113.1			2.38	2.47	4.94	4.99	218	

TABLE 17. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 9 (SHEET 2 OF 2)

FLIGHT 9F289-81, 4T SATELLITES NAVIGATION, WITHOUT AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ± 2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	3	5-6	4.9	100		-0.04	2.3						APPROACH
FTE			40.9	96.7		-0.75	2.7						SATELLITE
NCT			-35.1	59.2	94.3	-1.4	4						CONSTELLATION CHANGE
ATE			-72.4	122	194	-1.2	3.9						
2D NSE			80.4	135.8	216.3			2.57	3.06	5.01	5.37	101	
					APPROACH								
TSCT	3	6-1	12.1	44.3		-0.07	2.7						
FTE			22.5	39.9		0.7	3.8						
NCT			-9.5	27.1	36.6	-0.2	2.6						
ATE			-37.6	23.5	61.1	-0.3	2.5						
2D NSE			38.7	35.8	74.5			3.06	3.2	5.37	5.46	246	
TSCT	2	2-3	-134	171		-0.3	1.7						3 SATELLITE
FTE			-108	164		-0.2	1.9						NAVIGATION
NCT			-25.7	31.3	57	0.1	2.6						
ATE			-53.9	25.4	79.3	0.3	3.1						
2D NSE			59.7	40.3	100			3.23	3.31	5.47	5.51	316	
					APPROACH								
TSCT	2	3-4	70.4	43.2		-2	6.8						3 SATELLITE
FTE			22.2	37.6		-0.5	2.2						NAVIGATION
NCT			48.2	27.8	76	-2.3	8.5						
ATE			-87	50.3	137.3	2.2	8.5						
2D NSE			99.4	57.4	156.8							54	
TSCT	2	4-5	72.9	34.8		0.6	2.5						3 SATELLITE
FTE			13.6	38.3		0.6	3.2						NAVIGATION
NCT			59.4	22.6	82	0.2	2.7						
ATE			-75.8	44.1	119.9	-0.1	2.6						
2D NSE			96.3	49.6	145.9							168	
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													

TABLE 18. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 10 (SHEET 1 OF 2)

FLIGHT 10 OF 293-81, 3 SATELLITES NAVIGATION, WITHOUT AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ±2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	3	3-4	-89.7	103.7	192.4	-0.3	1.5						
FTE			-89.6	144	233.6	0.5	2.2						
NCT			-0.96	101	102	0.07	1.7						
ATE			278	18.2	296	70.5	—						
2D NSE			278.5	103.1	381.6							397	
TSCT	3	4-5	-176	236	412	1.1	4.2						
FTE			-41.1	242	283	2.2	8						
NCT			-134	112	246	0.7	3.5						
ATE			-284	178	462	2.6	8.6						
2D NSE			314	210.4	524.4							231	
					APPROACH								
TSCT	3	5-6	142	91.5	151.5	-0.5	2.1						
FTE			22.2	86.6	108.8	-0.3	1.8						
NCT			121	34.9	155.9	0.3	2						
ATE			-124	27.9	151.9	0.2	1.7						
2D NSE			173.3	44.7	218							75	
					APPROACH								
TSCT	3	6-1	61.2	72.7	133.9	0.4	2						
FTE			29.2	27.4	56.6	-0.4	2.6						
NCT			32.9	60.6	93.5	0.2	1.8						
ATE			-82.6	29.2	111.8	-0.4	1.9						
2D NSE			88.9	67.3	156.2							131	
TSCT	3	2-3	496	83.2	579.2	-1.4	4.3						
FTE			511	88.7	599.7	-1.2	3.6						
NCT			-15.2	14.3	29.5	0.5	2.6						
ATE			-24.2	27.9	52.1	-1.1	3.9						
2D NSE												59	
TSCT	3	3-4	515	184	699	2.7	16.2						
FTE			-34.9	122	156.9	0.01	2						
NCT			-481	109	590	1.4	6.9						
ATE			198	81	279	-2.6	12.5						
2D NSE			520.2	232	752.2							315	
TSCT	3	4-5	62.5	251	313.5	-0.4	2.7						
FTE			-18	258	276	-0.6	3						
NCT			81	56.7	137.7	-2.5	8.6						
ATE			-511	355	866	1.8	6.3						
2D NSE			517.3	359.5	876.8							209	

TABLE 18. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 10 (SHEET 2 OF 2)

FLIGHT 10 F29&-81, 3 SATELLITES NAVIGATION, WITHOUT AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ±2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	3	5-6	312	109	421	1.2	3.3						APPROACH
FTE			8.8	476	484.8	-6.5	44.2						
NCT			270	66.3	336.3	-0.2	1.8						
ATE			-33.1	11	44.1	0.04	2.8						
2D NSE			271.7	67.2	338.9							96	
					APPROACH								
TSCT	3	6-1	116	135	251	0.6	2.8						
FTE			55	56.3	61.8	0.9	3						
NCT			112	110	222	-0.3	2						
ATE			-37.2	19.6	56.8	-0.3	2.8						
2D NSE			117.8	111.9	229.7							131	
TSCT	2	1-2	132	150	282	-0.1	1.6						
FTE			142	693	707.2	-3.5	13.9						
NCT			28.2	20.3	48.5	-0.9	3						
ATE			-46.2	9.4	55.6	0.03	2.1						
2D NSE			54.1	22.3	76.4							50	
TSCT	2	2-3	2	320	322	-0.7	1.8						
FTE			223	236	459	-0.5	1.8						
NCT			-221	103	324	0.4	2.2						
ATE			274	148	422	-0.5	2.2						
2D NSE			351.8	180.4	532.2							249	
					APPROACH								
TSCT	2	3-4	143	119	262	-0.5	2.6						
FTE			-19.9	139	158.9	-0.7	2.6						
NCT			163	34	197	-0.1	1.8						
ATE			-508	72.7	580.7	0.1	1.6						
2D NSE			533.5	80.2	613.7							99	
TSCT	2	4-5	94	593	153.3	1.8	5.8						
FTE			-28.9	47.1	76	1	4.1						
NCT			123	31.1	154.1	-0.2	3						
ATE			-355	124	479	0.2	1.9						
2D NSE			376	128.2	504.2							151	
TSCT													
FTE													
NCT													
ATE													
2D NSE													

TABLE 19. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 11

FLIGHT 11 F296-81, 4 SATELLITES NAVIGATION, WITHOUT AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ± 2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	4	1-2	499	380		-0.01	2						
FTE			373	1128		-2.5	7.8						
NCT			-12.5	24.7	37.2	-0.2	1.7						
ATE			-53.4	12.3	65.7	0.7	3.5						
2D NSE			54.8	27.6	82.4			1.95	1.96	5.62	5.65	22	
TSCT	4	2-3	169	228		0.2	1.9						
FTE			180	231		0.1	1.8						
NCT			-11.1	14.1	25.2	-0.2	1.8						
ATE			-58.5	24.7	83.4	2.8	14.2						
2D NSE			59.5	28.4	87.6			1.92	1.94	5.72	5.82	75	
TSCT	4	3-4	147	368		-0.04	1.8						6 ORBITAL TURNS
FTE			145	366		-0.05	1.8						
NCT			1.2	26.2	27.4	0.7	2.8						
ATE			61	17.9	78.9	4.2	29.4						
2D NSE			61	31.8	92.8			1.83	1.9	5.93	6.44	298	
TSCT	4	4-5	-13.7	202		-0.2	2.8						
FTE			-38.4	202		-0.1	2.9						
NCT			24.5	18.1	42.6	0.08	2.9						
ATE			-67	14.9	81.9	1.6	14.3						
2D NSE			71.3	23.4	103.7			1.84	2.33	8.42	10.62	586	
TSCT	4	6-7	157	356		0.9	3.1						
FTE			129	376		0.9	3						
NCT			27.4	46	73.4	0.2	2.7						
ATE			-86.6	22.4	109	1.06	10.2						
2D NSE			90.8	51.1	141.9			4.22	10.25	15.81	28.78	846	
					APPROACH								
TSCT	4	7-8	-143	146		0.6	2.4						
FTE			16.5	92.5		0.5	2.5						
NCT			-159	125	284	1.8	5.2						
ATE			-98.3	344	122.7	1.9	5.4						
2D NSE			181.6	142.8	324.4			12.7	14.2	33.9	36.9	93	
					APPROACH								
TSCT	4	8-1	-224	215		0.4	1.6						
FTE			7	118		0.4	2.4						
NCT			-230	141	371	0.8	2.1						
ATE			-119	546	173.6	0.6	2.3						
2D NSE			258.9	151.2	410.1			14.3	17.4	37.2	43.4	160	

TABLE 20. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 12 (SHEET 1 OF 2)

FLIGHT 12F296-81, 4+ SATELLITES NAVIGATION, WITHOUT AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FOM-TO	MEAN METERS	2σ METERS	MEAN ± 2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	3	3-4	141	206		-0.01	2.1						
FTE			145	202		-0.05	2						
NCT			-4.4	22.4	26.8	0.6	3.5						
ATE			-58.4	16.2	74.6	0.5	6.9						
2D NSE			58.5	27.7	86.2			1.78	1.87	6.11	7.29	181	
TSCT	3	4-5	-76.6	431		-0.7	2.7						
FTE			-95	439		-0.8	2.8						
NCT			20.7	16.2	36.9	0.7	3.3						
ATE			-60.5	15.3	75.8	-0.2	2.5						
2D NSE			64	22.3	86.3			1.78	1.81	7.44	8.19	274	
					APPROACH								
TSCT	3	5-6	91.6	183.7		0.1	2						
FTE			89	184		-0.1	1.9						
NCT			3.4	24.7	28.1	-0.06	2.1						
ATE			-47.8	18.6	66.4	3.1	17.5						
2D NSE			47.9	30.9	78.8			1.82	1.85	8.31	8.58	54	
					APPROACH								
TSCT	3	6-1	4.2	76.7		1	3.2						
FTE			14.2	82		1	3.1						
NCT			-9.1	29.9	39	-0.5	2.8						
ATE			-53.6	19.1	72.7	-0.9	4.3						
2D NSE			54.3	25.5	89.8			1.65	1.85	4.4	8.6	113	
TSCT	3	2-3	340	763		0.3	1.1						SATELLITE CONSTELLATION CHANGE
FTE			320	320		0.5	1.4						
NCT			207	459	665	0.2	1.1						
ATE			226	504	730	0.2	1.11						
2D NSE			306.6	681.8	988.4			1.66	1.69	4.43	4.46	104	
TSCT	3	3-4	78	145		-0.3	2.9						
FTE			73.5	144		-0.1	2.6						
NCT			3.6	25.4	29	-0.6	3.6						
ATE			-66.1	7.1	73.2	0.1	2.6						
2D NSE			66.2	26.4	92.6			1.72	1.88	4.49	4.62	539	
TSCT	3	4-5	-68.4	331		-0.8	2.9						
FTE			-92.9	336		-0.8	2.9						
NCT			24.9	14.4	39.3	0.6	3.4						
ATE			-56.7	16.8	73.5	0.8	10						
2D NSE			61.9	22.2	84.1			1.89	1.97	4.63	4.7	256	

TABLE 20. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 12 (SHEET 2 OF 2)

FLIGHT 12F 296-81, 4+ SATELLITES NAVIGATION, WITHOUT AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ± 2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	3	5-6	68.0	144		0.6	2.4						APPROACH
FTE			89	146		0.7	2.4						
NCT			-19.6	21.2	40.8	0.7	3.1						
ATE			-53.5	104	63.?	0.2	2.5						
2D NSE			57	23.4	80.6			1.97	2.02	4.71	4.73	76	
					APPROACH								
TSCT	3	6-1	5.2	65.1		0.4	2.2						
FTE			32.2	55		0.6	2.5						
NCT			-26.1	26.8	[illegible]	-0.4	2						
ATE			45.4	41.7	37.1	1.6	4.2						
2D NSE			52.4	49.5	101.9			[illegible]	[illegible]	-.75	-.77	169	
TSCT	2	1-2	86.5	75.1		0.9	2.4						
FTE			68.1	56.1		-6.1	38.6						
NCT			-25.3	16.4	41.7	-0.7	3.2						
ATE			-52.8	13.1	65.9	-0.1	2						
2D NSE			59.3	21	79.5			2.20	2.22	4.84	4.86	42	
TSCT	2	2-3	228	349		-0.9	2.8						
FTE			236	348		-0.9	2.8						
NCT			-8.74	20.1	[illegible]	-0.1	3.1						
ATE			-76.7	21.7	98.6	2.4	18.2						
2D NSE			77.4	29.6	107			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
TSCT	2	3-4	-39.5	227		-1.2	2.8						
FTE			-57.1	228		-1.1	2.7						
NCT			17.6	10.4	28	-0.7	2.6						
ATE			-42.1	12.?	[illegible]	0.5	2.8						
2D NSE			45.[illegible]	6.4	6[illegible]			2.43	2.48	4.98	5.11	70	
TSCT	2	4-5	9.7	82.1		0.7	2.8						SATELLITE
FTE			-34.8	170		-0.4	2.9						CONSTELLATION CHANGE
NCT			44.7	127	171.7	1.5	4.1						
ATE			-56.4	68.5	124.9	1.3	3.9						
2D NSE			72	144.1	216.1			2.48	3.36	5.01	5.39	128	
TSCT													
FTE													
NCT													
ATE													
2D NSE													

TABLE 21. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 13 (SHEET 1 OF 2)

FLIGHT 13F306-81, 3 SATELLITES NAVIGATION, WITH AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ±2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	3	2-3	25.7	96.5	122.2	0.2	1.9						
FTE			-0.1	95.5	95.6	-0.02	2						
NCT			25.7	26.1	51.8	0.7	3.7						
ATE			-92.2	26.0	118.2	3.6	27.1						
2D NSE			95.7	36.8	132.5							98	
TSCT	3	3-4	10.5	339	349.5	0.8	3.2						
FTE			-30.4	334	364.4	0.7	3.6						
NCT			40.1	21.6	61.7	0.4	5.4						
ATE			-74.5	31.4	105.9	0.9	6.3						
2D NSE			84.6	38.1	122.7							323	
TSCT	3	4-5	189	237	426	-0.4	2						
FTE			194	241	429	-0.5	2						
NCT			-5.2	16.5	21.8	-0.6	3.4						
ATE			-42.2	45.2	87.4	1.2	2.7						
2D NSE			42.5	48.1	90.6							199	
					APPROACH								
TSCT	3	5-6	-28.6	189	217.6	0.2	1.8						
FTE			-10.6	198	208.6	0.1	1.8						
NCT			-14.9	29.7	44.6	0.08	2.3						
ATE			-65.6	23.5	89.1	0.5	3.2						
2D NSE			67.2	37.9	105.1							107	
					APPROACH								
TSCT	3	6-1	-6.85	109	110.9	-0.1	2.1						
FTE			11.3	108	119.3	-0.09	2.1						
NCT			-17.2	31.6	48.8	-0.5	3.5						
ATE			-57	42.9	99.9	2	10.4						
2D NSE			59.5	53.3	112.8							184	
TSCT	3	1-2	185	49.6	234.6	-0.9	4						
FTE			208	13.2	221.2	0.8	3.2						
NCT			-22.6	51.4	74	-0.7	3.2						
ATE			-94.3	22.9	107.2	0.6	2.5						
2D NSE			87.2	56.3	143.5							32	
TSCT	3	2-3	90.1	499	589.1	-1.6	5						
FTE			81.2	509	590.2	-1.6	5						
NCT			9.4	29.1	38.5	0.3	2.5						
ATE			-70	17.6	87.6	-0.3	2.6						
2D NSE			70.6	34	104.6							167	

TABLE 21. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 13 (SHEET 2 OF 2)

FLIGHT 13E306-81, 3 SATELLITES NAVIGATION, WITH AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ±2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	3	3-4	-10.2	256	266.2	0.2	2.1						
FTE			-34.5	264	298.5	0.2	2.1						
NCT			23.4	24.7	48.1	-0.03	2.4						
ATE			-68.3	23.1	86.4	2	13.5						
2D NSE			72.2	33.8	106							399	
TSCT	3	4-5	269	245	514	-0.3	2.3						
FTE			269	243	512	-0.2	2.4						
NCT			0.6	16.6	17.2	0.7	4.5						
ATE			-71.9	37.9	109.9	2.5	10.5						
2D NSE			71.9	41.4	113.3							206	
					APPROACH								
TSCT	3	5-6	94.5	77.1	171.6	-1	4.1						
FTE			105	44.6	149.6	-0.2	3						
NCT			-9.7	30.2	39.9	0.2	2						
ATE			-54.7	16	70.7	0.06	2.4						
2D NSE			65.5	34.2	99.7							107	
					APPROACH								
TSCT	3	6-1	31.1	193	224.1	2.9	11.1						
FTE			41.3	183	224.3	3	11.9						
NCT			-9.3	38.6	47.9	1.4	7.2						
ATE			53.8	46.8	100.6	2.9	12.3						
2D NSE			54.6	60.7	115.3							211	
TSCT	2	2-3	-36.3	216	252.3	-1.1	4.6						
FTE			-35.8	210	245.8	-1.1	4.6						
NCT			-0.6	19.3	19.9	0.1	2.8						
ATE			-58.6	24.9	83.5	1.6	8.4						
2D NSE			58.6	31.5	90.1							274	
					APPROACH								
TSCT	2	3-4	208	605	813	1.3	3.2						
FTE			215	627	842	1.2	3.2						
NCT			-7.4	350	357.4	0.05	1.8						
ATE			-71.2	32	103.2	2.8	13.8						
2D NSE			71.6	47.3	118.9							90	
					APPROACH								
TSCT	2	4-5	59.8	99.9	159.7	0.7	2.1						
FTE			54.9	108	162.9	0.6	2.1						
NCT			5.1	17	22.1	0.3	2.6						
ATE			-67.1	19.4	86.5	0.02	2.8						
2D NSE			67.3	25.8	93.1							109	

TABLE 22. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 14 (SHEET 1 OF 2)

FLIGHT 14F307-81, 4T SATELLITES NAVIGATION, WITH AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ± 2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	3	4-5	199	111		0.01	2						SATELLITE CONSTELLATION CHANGE
FTE			183	113		0.08	2						
NCT			16.6	13.4	30	-0.01	2.9						
ATE			-57	17	74	0.26	2.5						
2D NSE			59.4	21.7	81.1			2.43	2.48	4.55	4.56	176	
			APPROACH										
TSCT	3	5-6	32.2	73.2		0.5	1.8						
FTE			22.2	93.7		0.2	1.9						
NCT			10.9	39.6	50.5	0.6	2.1						
ATE			-39.3	12	51.3	0.4	2.7						
2D NSE			40.8	41.3	82.1			2.41	2.42	4.57	4.58	103	
			APPROACH										
TSCT	3	6-1	18.7	51.6		0.08	2.2						
FTE			30.8	46.4		0.2	1.9						
NCT			-11.1	35.1	46.4	-0.8	2.6						
ATE			-47.8	17.2	65	-0.3	3.1						
2D NSE			49	39.1	88.1			2.39	2.40	4.58	4.60	135	
TSCT	3	1-2	164	104		-0.5	2						
FTE			168	105		-0.8	2.2						
NCT			-2.7	16.8	19.5	-0.6	2.2						
ATE			-37.7	13	50.7	-0.02	2.1						
2D NSE			37.7	21.2	58.9			2.39	2.40	4.61	4.62	36	
TSCT	3	2-3	146	203		-0.4	1.8						
FTE			167	199		-0.5	1.8						
NCT			-21.3	19.5	40.8	-0.2	2.5						
ATE			-73.4	23.9	97.3	2.7	17						
2D NSE			76.4	30.9	107.3			2.40	2.41	4.63	4.66	90	
TSCT	3	3-4	-138	278		-0.3	1.7						
FTE			-139	336		-2.7	20.4						
NCT			-7.7	17	24.7	-0.3	2.9						
ATE			-84.1	16.6	100.7	3.3	33.3						
2D NSE			84.4	23.7	108			2.42	2.50	4.68	4.86	335	
TSCT	3	4-5	190	149		-0.1	1.8						SATELLITE CONSTELLATION CHANGE
FTE			179	150		0.1	2.4						
NCT			11.9	24.7	36.6	-3.5	22.3						
ATE			-67	24.5	91.5	1	9.9						
2D NSE			68	34.8	102.3			2.29	2.25	4.47	4.56	219	

TABLE 22. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 14 (SHEET 2 OF 2)

FLIGHT 14E307-81, 4+ SATELLITES NAVIGATION, WITH AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN ± 2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	3	5-6	12.6	70.6		-0.2	2.1						APPROACH
FTE			3.6	32.6		-9.3	90.4						
NCT			-5.6	21.1	26.7	0.7	2.3						
ATE			-46.2	91	55.3	0.1	2.4						
2D NSE			46.5	23	69.5			2.21	2.23	4.60	4.65	100	
					APPROACH								
TSCT	3	6-1	0.3	57.9		-0.3	2.8						SATELLITE CONSTELLATION CHANGE
FTE			11.5	59.9		-0.5	2.6						
NCT			-10.3	21.9	32.2	-0.5	3.3						
ATE			-38.7	26.7	65.4	3.4	20						
2D NSE			40.1	34.6	74.7			2.21	2.84	4.64	4.65	175	
TSCT	2	1-2	102	117		0.03	1.5						
FTE			118	140		0.06	1.4						
NCT			-14.4	24.9	39.3	0.1	1.7						
ATE			-69.4	20.2	89.6	-0.4	2.1						
2D NSE			70.9	32.1	103			2.21	2.25	4.39	4.40	46	
TSCT	2	2-3	122	356		0.09	1.4						
FTE			12.5	36.1		0.1	1.4						
NCT			-2.8	22.4	25.2	-0.01	3.1						
ATE			-72.1	17.1	89.2	2.7	24.1	2.0	2.16	4.34	4.38	224	
2D NSE			72.1	28.2	100.3								
					APPROACH								
TSCT	2	3-4	27.5	77.5		0.3	2						
FTE			27.4	81.1		0.3	2						
NCT			-0.01	12.3	12.3	0.3	2.2						
ATE			-47.8	17.4	65.2	1.5	10.3						
2D NSE			47.8	21.3	69.1			1.84	1.89	4.32	4.33	104	
					APPROACH								
TSCT	2	4-5	32.8	46.7		0.7	3.3						
FTE			26.9	47.6		0.7	3.2						
NCT			6	13	19	1.2	4.1						
ATE			-51.2	13.6	64.8	-0.4	2.7						
2D NSE			51.5	18.8	70.3			1.76	1.84	4.32	4.32	102	
TSCT													
FTE													
NCT													
ATE													
2D NSE													

TABLE 23. GPS NAVIGATION ERROR STATISTICS WITHOUT Z-SET DATA LATENCY COMPENSATION, FLIGHT 15

FLIGHT 15F328-81, 4+ SATELLITES NAVIGATION, WITH AIDED ALTITUDE

PARAMETER	ROUTE	ROUTE SEGMENT FROM-TO	MEAN METERS	2σ METERS	MEAN + 2σ METERS	SKEW COEFF.	KURTOSIS COEFF	HDOP MIN	HDOP MAX	GDOP MIN	GDOP MAX	SAMPLES	COMMENTS
TSCT	3	4-3	64.3	200		-0.6	3.2						
FTE			62.8	200		-0.5	3.2						
NCT			0.7	13	13.7	-0.4	3.5						
ATE			-75.4	6.5	81.9	-40.3	—						
2D NSE			75.4	14.5	89.9			2.33	2.41	4.33	4.39	309	
TSCT	3	4-5	132	265		-0.4	2.1						
FTE			111	268		-0.4	2						
NCT			13.9	22.6	36.5	0.2	2.1						
ATE			-58.4	10	68.4	-0.1	2.7						
2D NSE			60	24.7	84.7			2.25	2.29	4.46	4.54	199	
					APPROACH								
TSCT	3	5-6	11.7	63.5		0.1	1.7						
FTE			8.1	79.2		-0.1	1.6						
NCT			4.4	11.2	15.6	0.4	2.4						
ATE			-41.7	12.5	54.2	-0.4	3.6						
2D NSE			41.9	25.6	67.5			2.21	2.23	4.58	4.63	99	
TSCT	3	6-1	-2.3	49.9		-1.2	3.1						
FTE			2.74	42.5		-1.3	3.8						
NCT			-4.1	19.1	23.2	-0.3	2.3						
ATE			-40.1	15.1	55.2	0.5	2.8						
2D NSE			40.3	24.4	64.7			2.16	2.21	4.63	4.75	132	
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													
TSCT													
FTE													
NCT													
ATE													
2D NSE													