



COLLECTION REPORT – USGS LIDAR ACQUISITION

BAA Benton County Arkansas QL2 Lidar

15 January 2016

Prepared for

United States Geological Survey
1400 Independence Road
Rolla, MO 65401
573.308.3587

Prepared by

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Fugro was tasked with planning, acquiring, processing, and producing derivative products of lidar data collected at an aggregate nominal pulse spacing (ANPS) of 0.7 meters, including overlap, for an Area of Interest (AOI) that includes the majority of Benton County, Arkansas. The AOI covers approximately 880 square miles. A 100-meter buffer was added to the AOI covering approximately 889 square miles; all products will be generated to the limit of this buffered boundary.

Lidar data, and derivative products produced in compliance with the task order will be based on the “**U.S. Geological Survey National Geospatial Program Lidar Base Specification Version 1.2**”. In addition to the Specification Requirements, the task order will meet NEEA QL2.

All acquisition occurred during leaf off conditions between December 2 and 4, 2015 by Fugro.

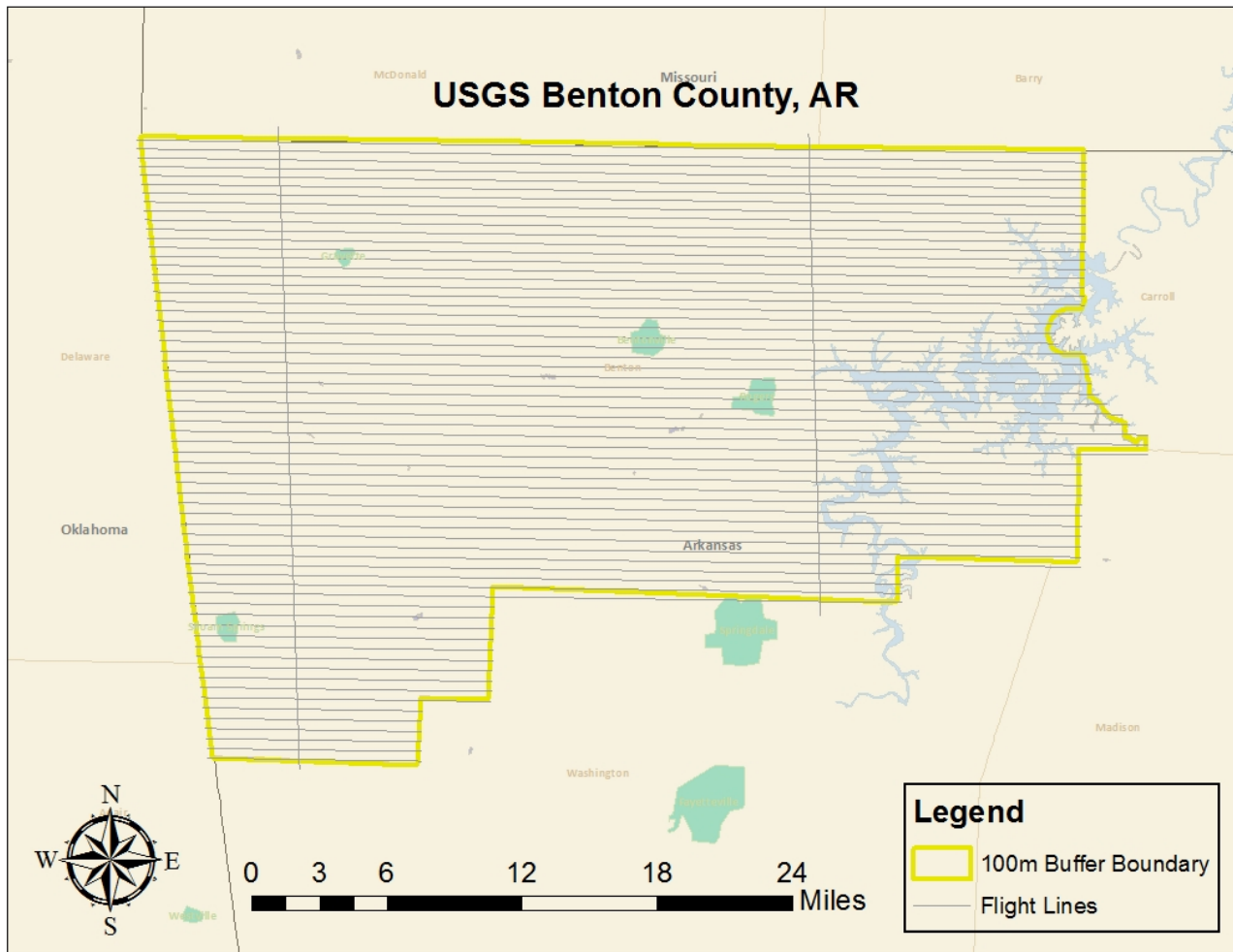


Figure 1: Flight plan

The following is detail on the lidar acquisition covering the Benton County, Arkansas lidar buffered boundary.

Collections:	5
Collection Dates:	December 2 nd - 4 th , 2015
Field of View (FOV):	60 degrees
Average Point Density (planned):	2 ppsm
Flight Level(s) AMT:	3200 ft
Sensor Type:	Riegl Q-680i
Sensor Serial Number(s):	165

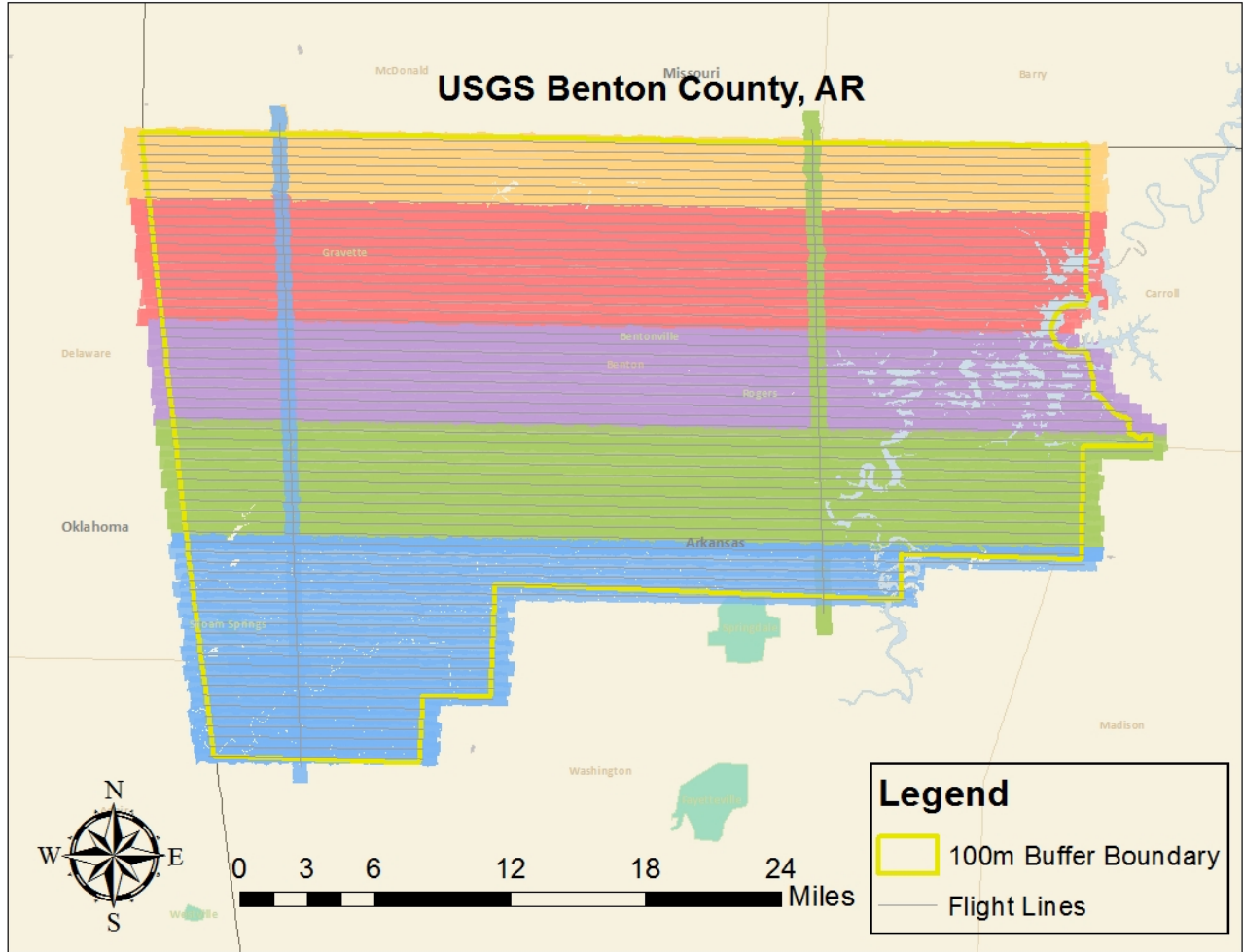


Figure 2: Executed Collection Footprints

All acquired lidar data was QC'd and accepted for processing.

Below are the acquisition logs and GPS plots from all collections covering the Benton County, Arkansas lidar buffered boundary.



Acquisition and Processing details ----- Collection 1 (December 2, 2015)

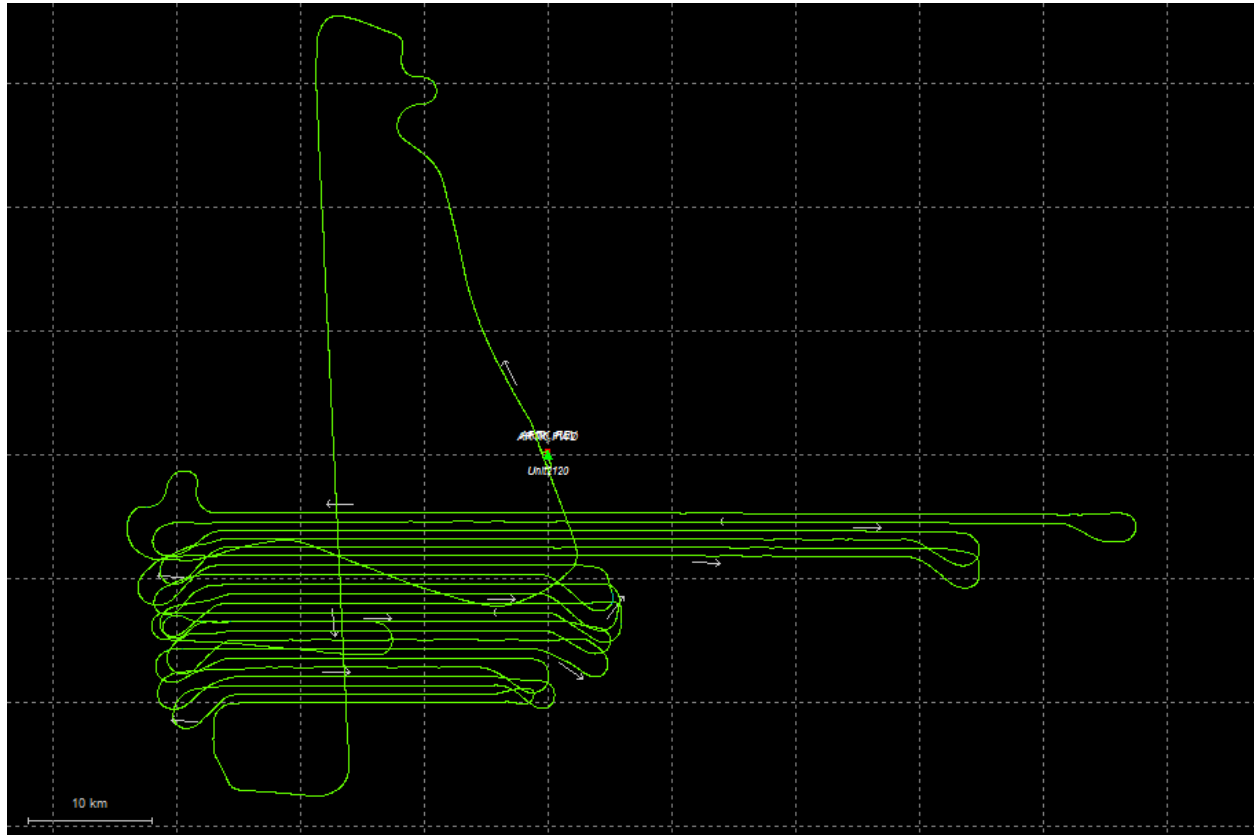
Log:

15.2		Lift Begin			Lift End			Flt	Flt	Hobbs	Activity
	Airport	Chocks	Hobbs	Airport	Chocks	Hobbs	Duration	Hrs	Hrs		
1	KXNA	22:55	9695.3	KXNA	4:15	9700.5	5:20	5.25	5.2	0103-Mob/Demob	
2											
3											

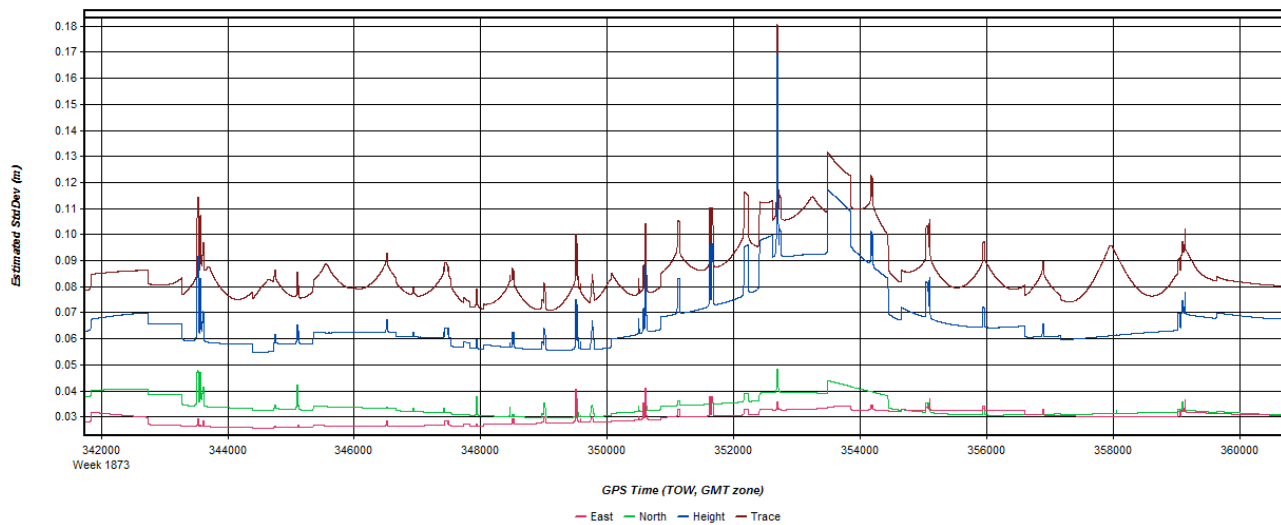
FUGRO		Fugro Geospatial, Inc.		Q680i Flight Log	
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FGI Job # 22.15003800	Project Name USGS-Bentonville			Operator Chris Fought		Unit 165	IMU	Ground Temp °C 2.0 0.0		Min Range' 2000	Data Logger Drives DR680-9					
Flight Date 2-Dec-15	GPS Day 15-336	Lift 1	System R680i	Pilot Kris Farrell		Sun* NA	Solar Times (UTC) NA	Pulse Rate 240K	Flying Temp °C -1.0 -4.0	Max Range' 4000	Download Drive EP750#85					
Mission ID (yyymmdd_Sen_Job_Lit) 151202_165_15003800_01			Aircraft N62912	Airport ID KXNA	FMS CCNS 1	UTC -6	AMT (ft) 3000	Speed 150	FOV 22	Scan Rate (Hz) 240	MTA 0.581	km/WPT 30.13 30.18	Altitude Setting 30.13 30.18	Humidity @ Alt 63%	Shipping Track	
Base 1 ID 0466	Location KXNA		Rec ID GR3	Ant ID GR3	ARP (m) 1.8	Start Time (UTC) 02-Dec-15 22:50		Stop Time (UTC) 03-Dec-15 04:15		GPS Filename Unit21202w.tps	Operator Chris Fought		Data With AB			
Area	Flight #	Client	Wpt	Distance		UTC		Dir	Altitude (GPS)	Speed (knots)	Scan Rate	Comments and Conditions		SVs	PDOP	
				From	To	Begin	End					Start	End			
BENTON COUNTY												static		8	1.3	
												S turn		11	1.0	
	65		81	1	46.5	0	23:29:40	23:40:21	177	3,200	150	240.0	Cross line		11	0.9
	64		1	27	0	15.1	23:46:10	23:50:04	90	3,200	150	240.0			11	1.0
	63		27	1	15.1	0	23:52:59	23:57:12	270	3,200	150	240.0			10	1.1
	62		1	27	0	15.1	00:00:39	00:04:40	90	3,200	150	240.0			9	1.1
	61		28	1	15.7	0	00:08:31	00:12:48	270	3,200	150	240.0			9	1.2
	60		1	28	0	15.7	00:16:45	00:20:45	90	3,200	150	240.0			10	1.2
	59		28	1	15.7	0	00:24:23	00:28:33	270	3,200	150	240.0			10	1.2
	58		1	37	0	20.9	00:32:17	00:37:20	90	3,200	150	240.0			11	1.2
	57		37	1	20.9	0	00:40:53	00:46:08	270	3,200	150	240.0			11	1.1
	56		1	37	0	20.9	00:49:22	00:54:32	90	3,200	150	240.0			10	1.2
	55		38	1	21.5	0	00:57:50	01:03:00	270	3,200	150	240.0			10	1.2
	55		7	15	3.5	8.1	01:06:48	01:08:07	90	3,200	150	240.0	calibration line		10	1.1
	54		1	38	0	21.5	01:15:38	01:20:44	90	3,200	150	240.0			10	1.0
	53		38	1	21.5	0	01:24:33	01:29:55	270	3,200	150	240.0			9	1.1
	52		1	38	0	21.5	01:33:16	01:38:21	90	3,200	150	240.0			8	1.1
	51		38	1	21.5	0	01:42:15	01:47:28	270	3,200	150	240.0			9	1.2
	50		1	38	0	21.5	01:50:48	01:56:03	90	3,200	150	240.0			9	1.0
	49		39	1	22.1	0	01:59:39	02:04:59	270	3,200	150	240.0			8	1.2
	48		1	89	0	51.1	02:08:57	02:20:41	90	3,200	150	240.0			8	1.2
	47		89	1	51.1	0	02:24:19	02:35:57	270	3,200	150	240.0			8	1.4
	46		1	89	0	51.1	02:39:07	02:50:40	90	3,200	150	240.0			9	1.2
	45		89	1	51.1	0	02:54:09	03:06:03	270	3,200	150	240.0			8	1.3
	44		1	111	0	63.9	03:09:03	03:23:46	90	3,200	150	240.0			9	1.1
	43		112	1	64.5	0	03:27:32	03:42:23	270	3,200	150	240.0			10	1.1
							03:42:30	03:44:45					S turn		10	1.0
							03:59:30	04:04:30					static		8	1.3

Trajectory and GPS Plots:

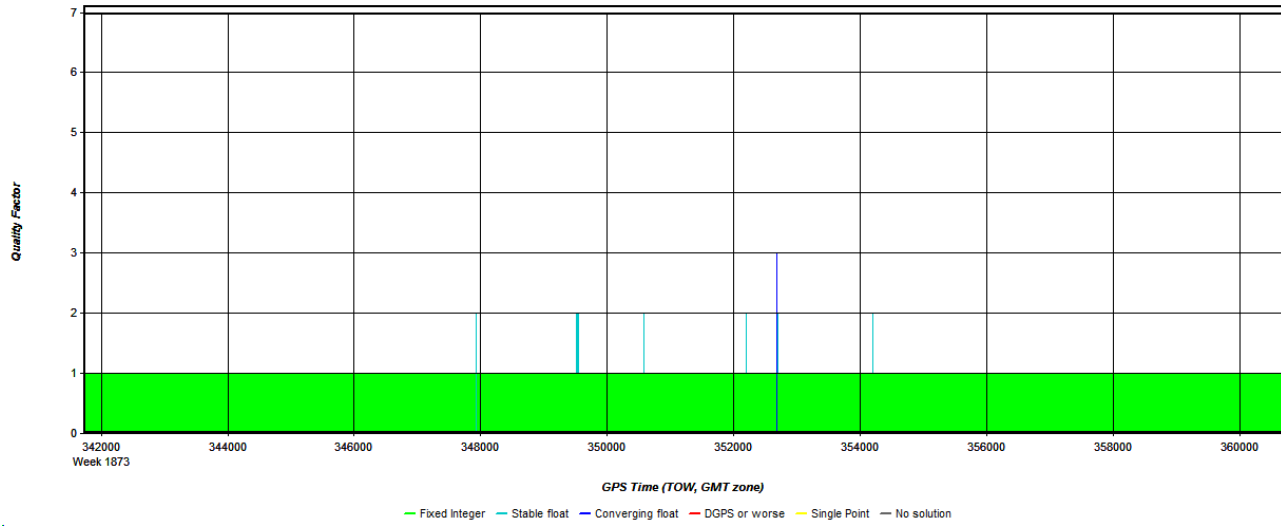


Estimated Accuracy

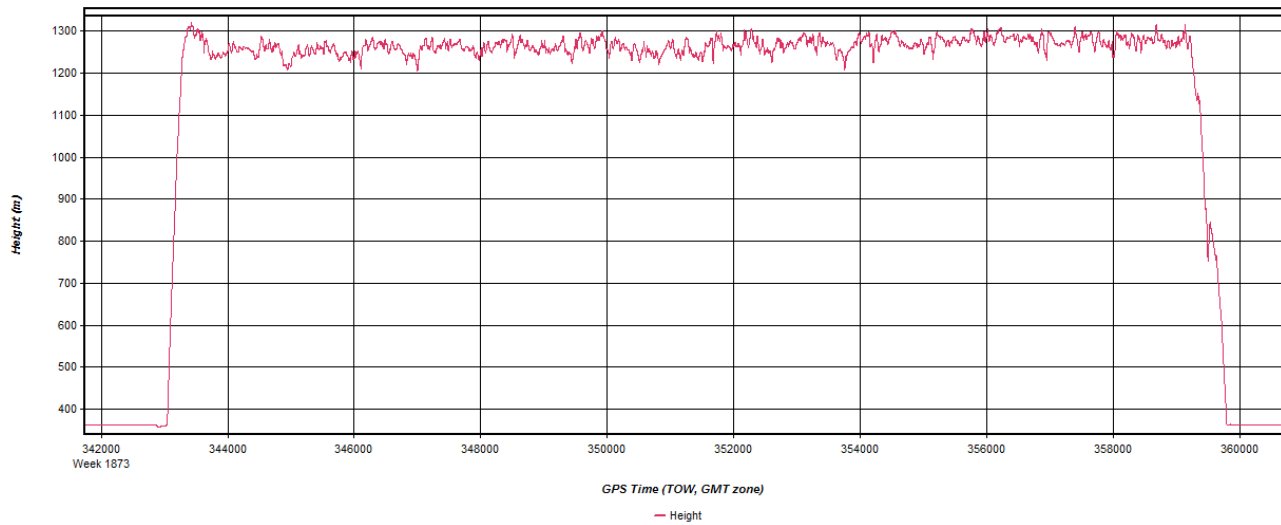




Quality Factor

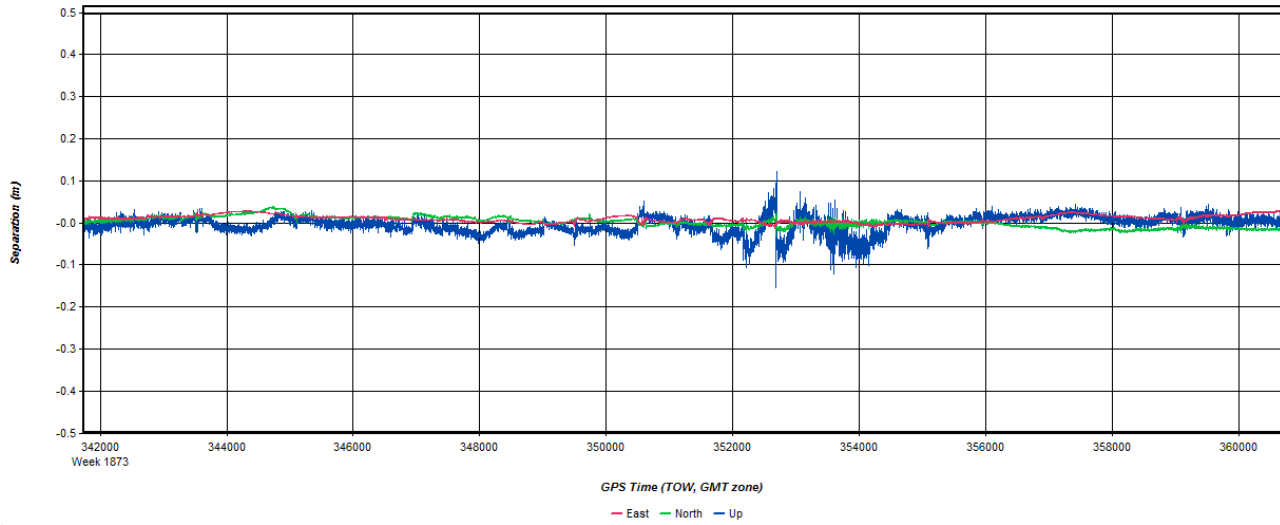


Height

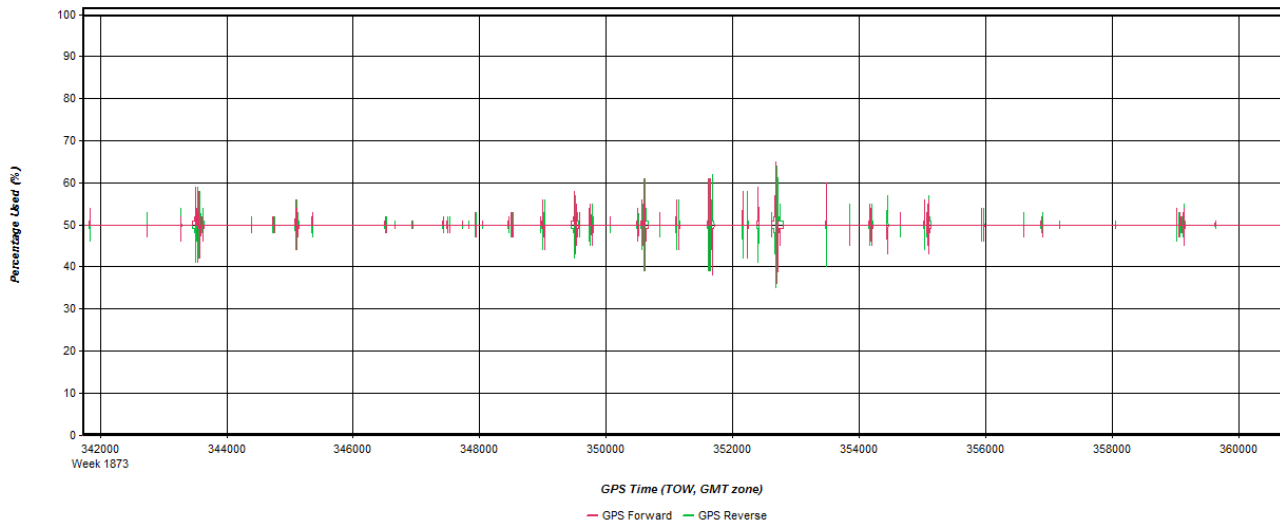




Combined Forward/Reverse Separation

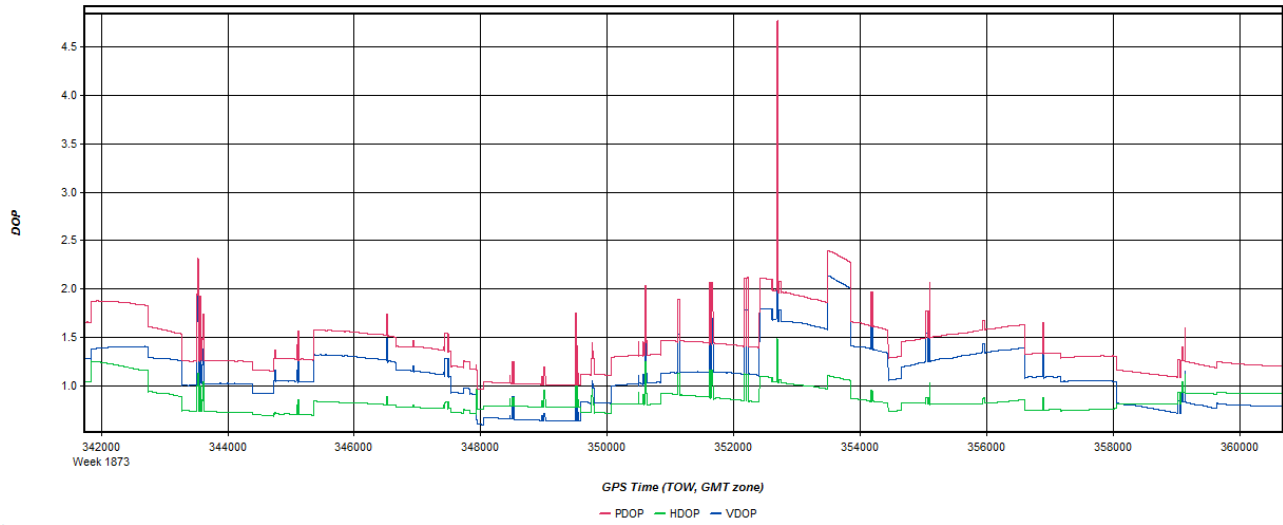


Combined Forward/Reverse Weighting

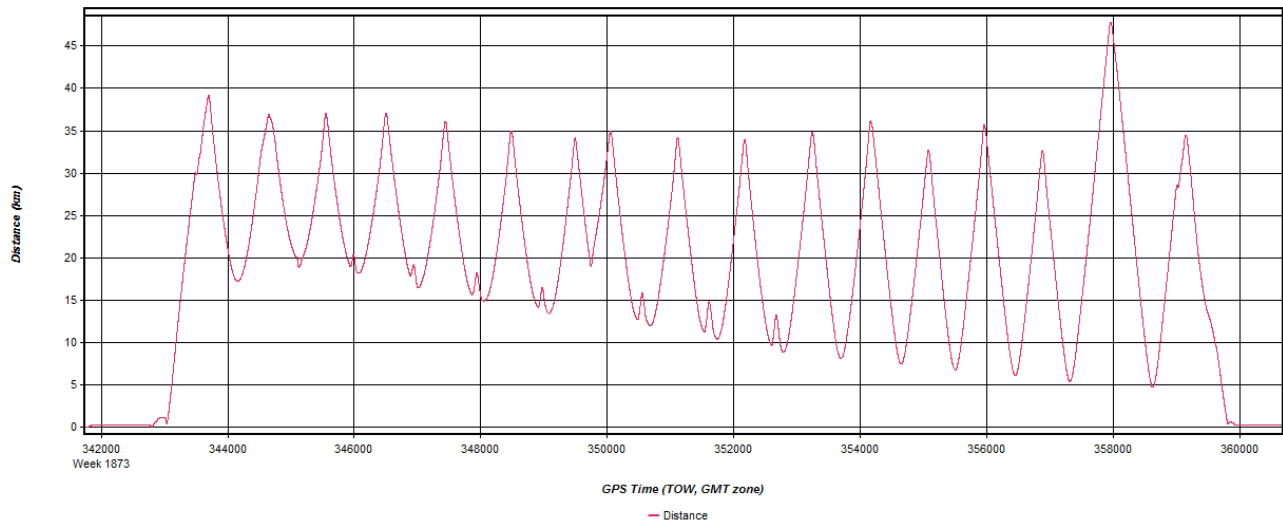




PDOP

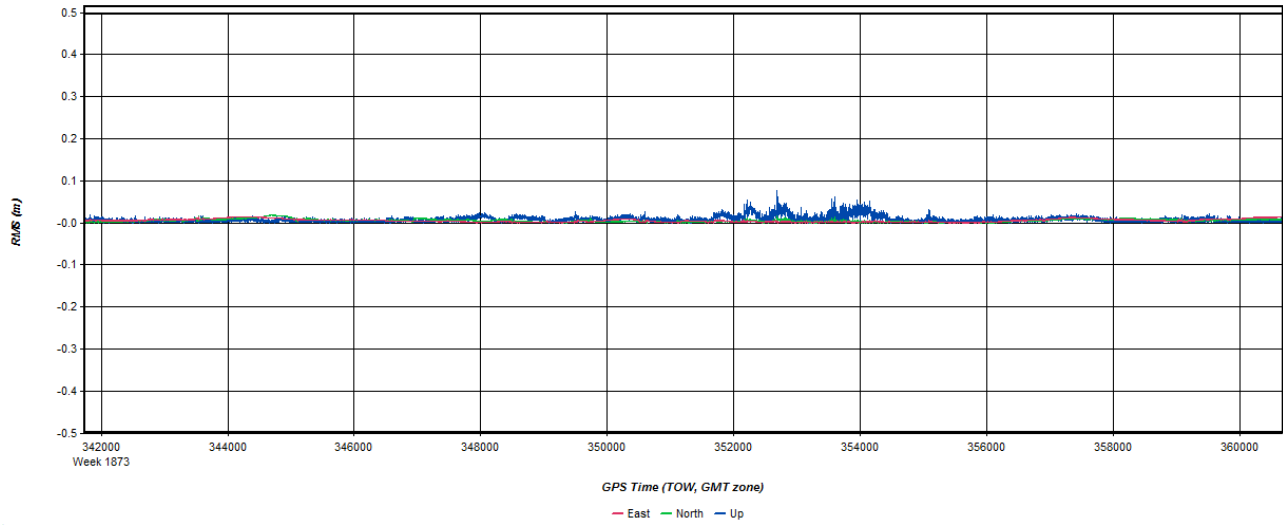


Distance from Base

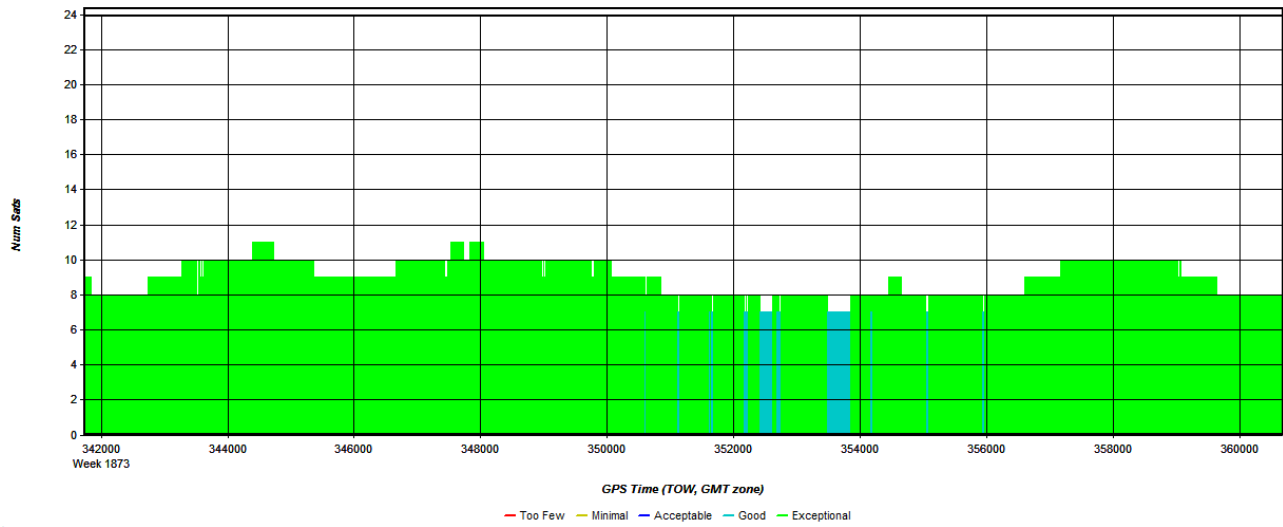




Combined RMS



SVs





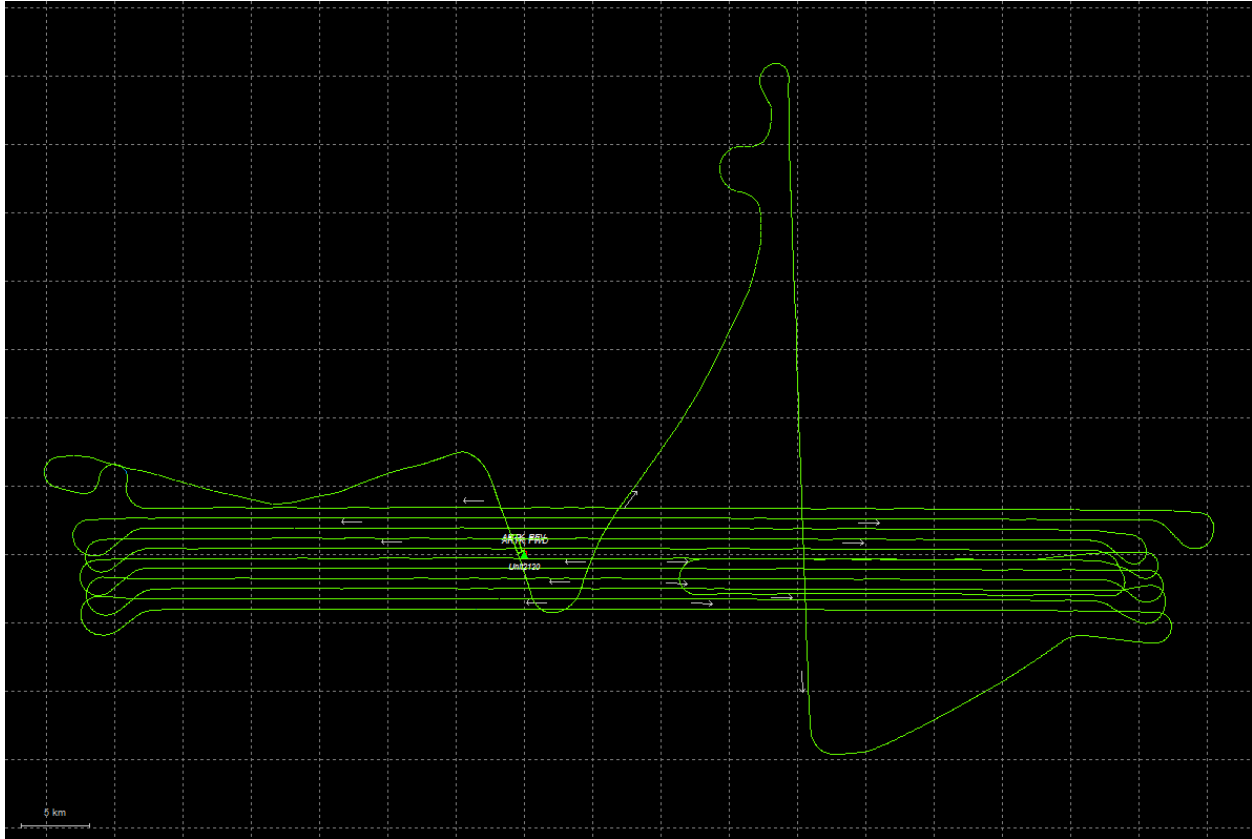
Acquisition and Processing details ----- Collection 2 (December 3, 2015)

Log:

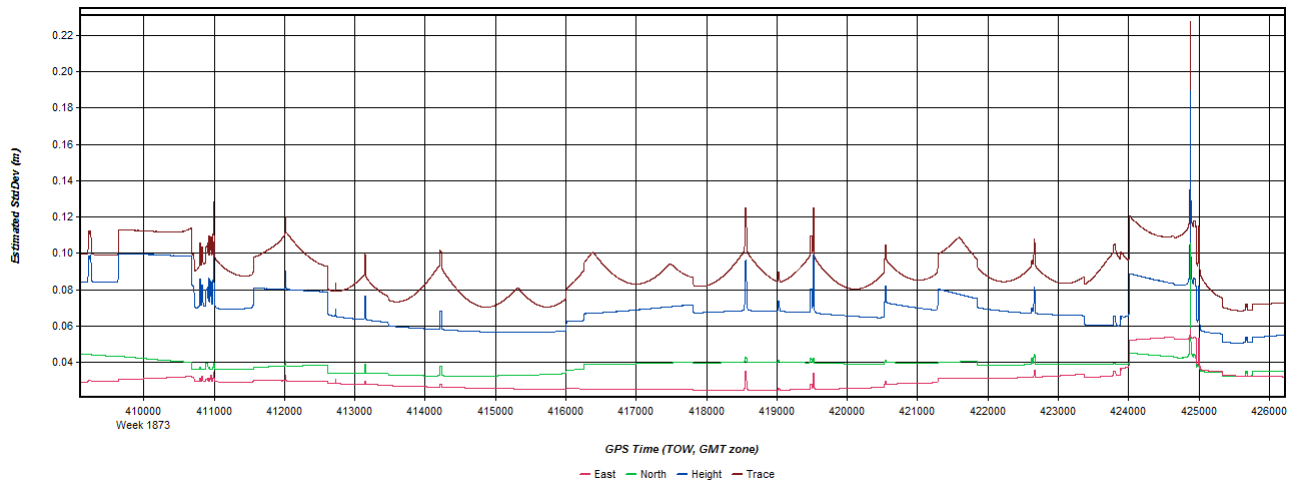
FUGRO		Fugro Geospatial, Inc.										Q680i Flight Log	
15.2		Lift Begin			Lift End			Flt	Flt	Hobbs	Activity		
		Airport	Chocks	Hobbs	Airport	Chocks	Hobbs	Duration	Hrs	Hrs			
1		KXNA	17:35	9700.5	KXNA	22:28	9705.4	4:53	5.00	4.9	0103-Mob/Demob		
2													
3													

FGL Job # 22.15003800		Project Name USGS-Bentonville			Operator Chris Fought		Unit 165	IMU		Ground Temp °C 8.0 12.0		Mn Range' 2100	Data Logger Drives DR680-10			
Flight Date 3-Dec-15		GPS Day 15-337	Lift 2	System R680i	Plot Kris Farrell		Sun° NA	Solar Times (UTC) NA		Pulse Rate 240K		Flying Temp °C 1.0 2.0	Max Range' 4052	Download Drive EP750#53		
Mission ID (yyymmdd_Sen_Job_Lift) 151203_165_15003800_02				Aircraft N62912	Airport ID KXNA	FMS CCNS 1	UTC -6	AMT (ft) 3200	Speed 150	FOV 22	Scan Rate (Hz) 110	MTA 2	km/WPT 0.581	Altitude Setting 30.18 30.33	Humidity @ Alt 61%	Shipping Track
Base 1 ID 0466	Location KXNA		Rec ID GR3	Ant ID GR3	ARP (m) 1.8	Start Time (UTC) 03-Dec-15 17:15		Stop Time (UTC) 03-Dec-15 22:25		GPS Filename Unit21213r.tps		Operator Chris Fought		Data With AB		
Area	Flight #		Wpt		Distance		UTC		Dir	Altitude (GPS)	Speed (knots)	Scan Rate	Comments and Conditions		SVs	PDDP
	FGI	Client	From	To	Begin	End	Start	End								
BENTON COUNTY							17:43:00	17:48:00					static		9	1.1
							18:06:00	18:08:30					S turn		10	1.1
	66		62	1	35.4	0	18:11:27	18:19:49	177	4,208	150	110.0	cross line		10	1.1
	42		112	1	64.5	0	18:28:33	18:43:23	270	4,208	150	110.0			10	1.1
	41		1	112	0	64.5	18:46:50	19:01:19	90	4,208	150	110.0			10	1.0
	40		112	1	64.5	0	19:04:42	19:19:56	270	4,208	150	110.0			10	1.1
	39		1	112	0	64.5	19:23:03	19:37:41	90	4,208	150	110.0			10	1.2
	38		112	1	64.5	0	19:41:01	19:56:00	270	4,208	150	110.0			9	1.0
	37		1	113	0	65.1	19:59:16	20:13:57	90	4,208	150	110.0			9	1.2
	37		83	70	47.6	40.1	20:20:48	20:22:44	270	4,208	150	110.0	calibration line		9	1.4
	36		113	1	65.1	0	20:32:11	20:47:04	270	4,208	150	110.0			9	1.4
	35		1	113	0	65.1	20:50:01	21:04:50	90	4,208	150	110.0			9	1.2
	34		113	1	65.1	0	21:07:27	21:22:08	270	4,258	150	110.0			9	1.2
	33		1	121	0	69.7	21:25:23	21:42:20	90	4,158	150	110.0			8	1.1
	32		121	1	69.7	0	21:44:16	21:59:59	270	4,158	150	110.0			11	1.0
							22:00:00	22:02:15					S turn		12	1.0
							22:18:00	22:23:00					static		11	1.1

Trajectory and GPS Plots:

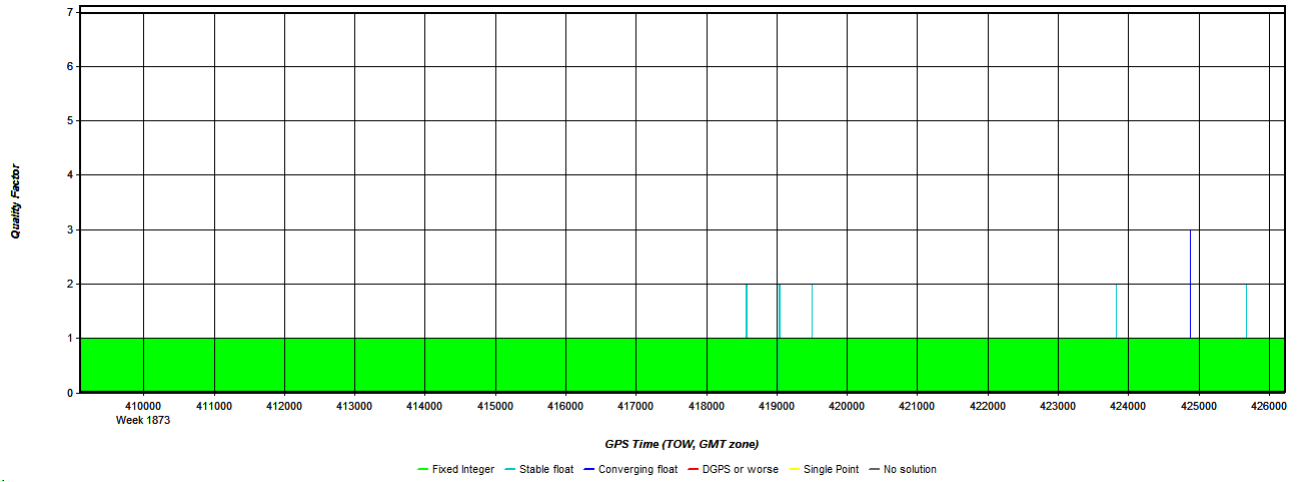


Estimated Accuracy

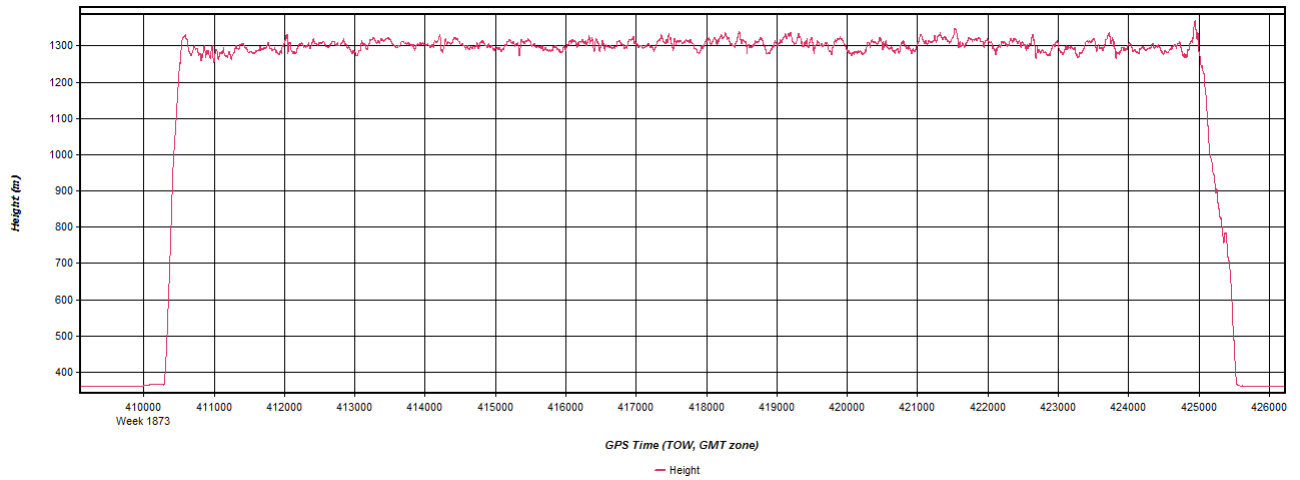




Quality Factor

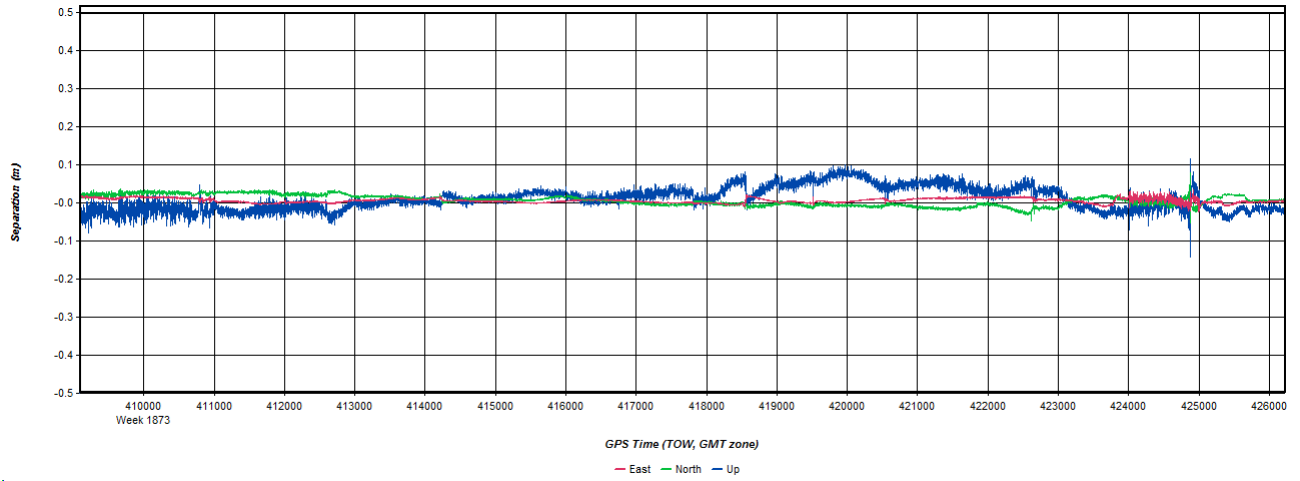


Height

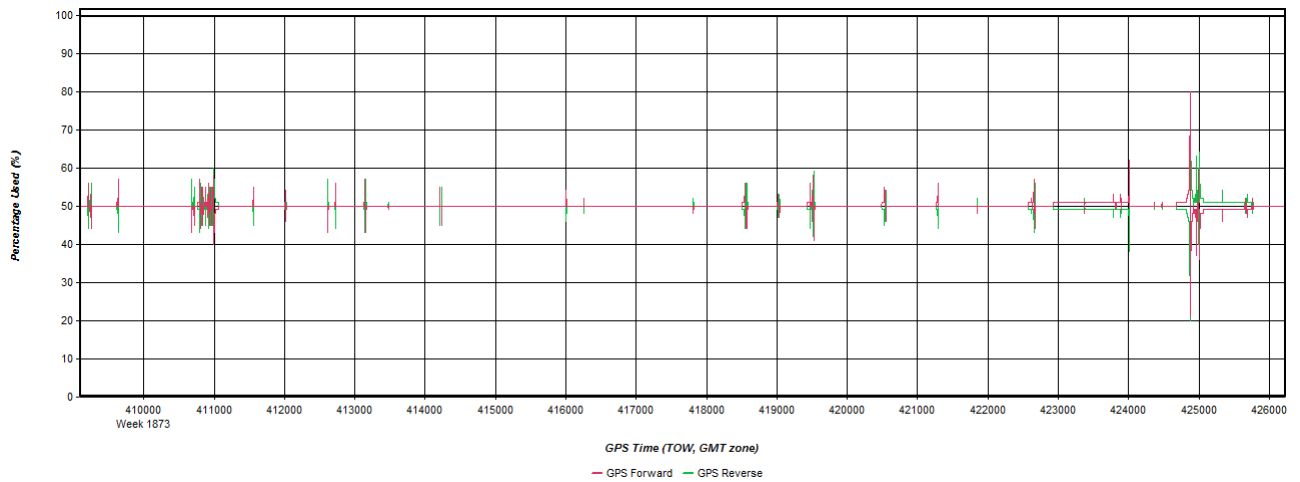




Combined Forward/Reverse Separation

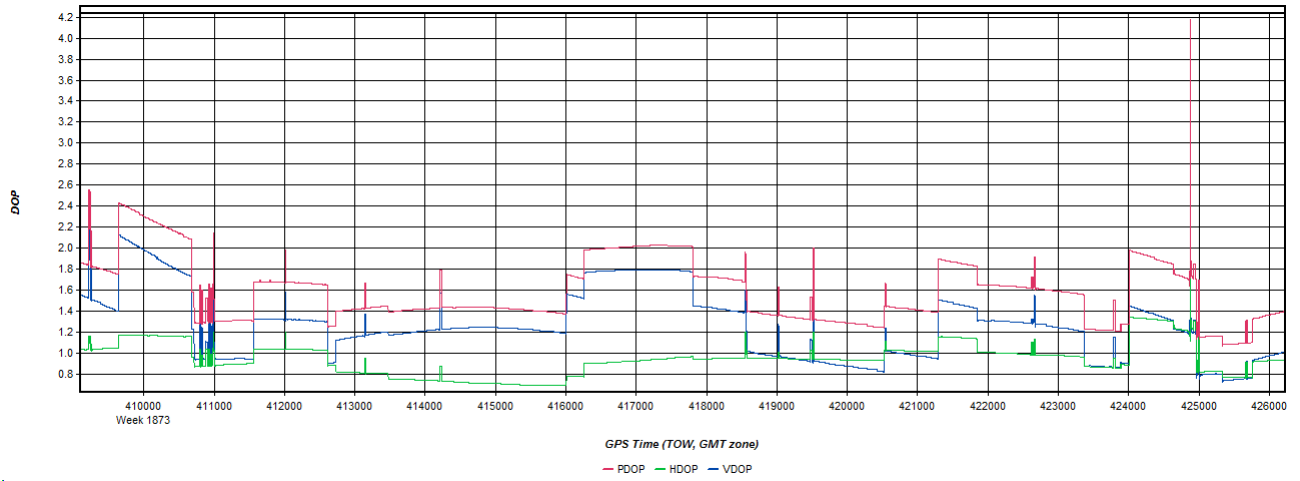


Combined Forward/Reverse Weighting

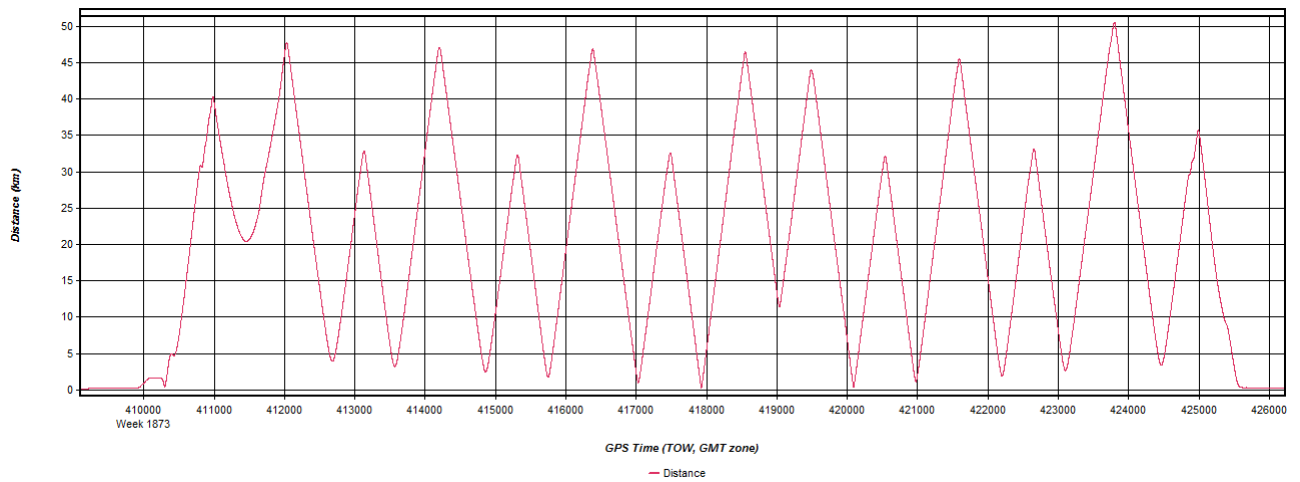




PDOP

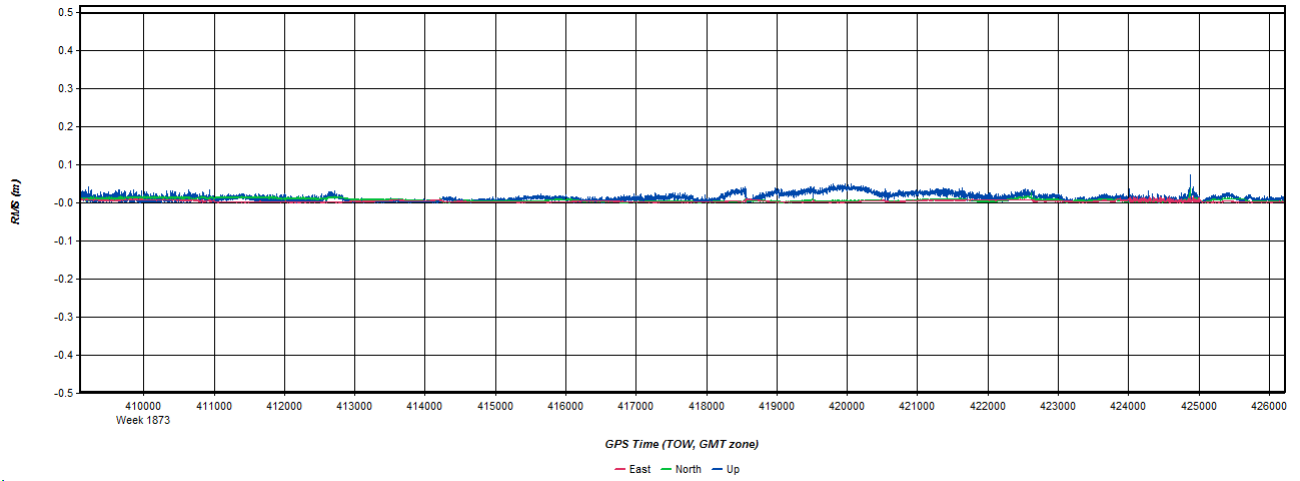


Distance from Base

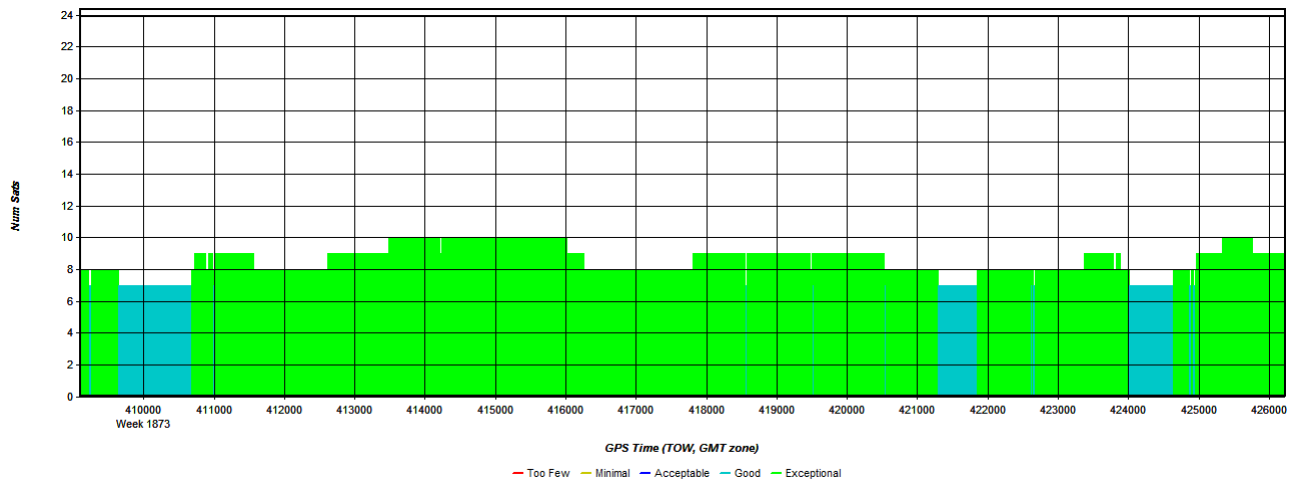




Combined RMS



SVs





Acquisition and Processing details ----- Collection 3 (December 3, 2015)

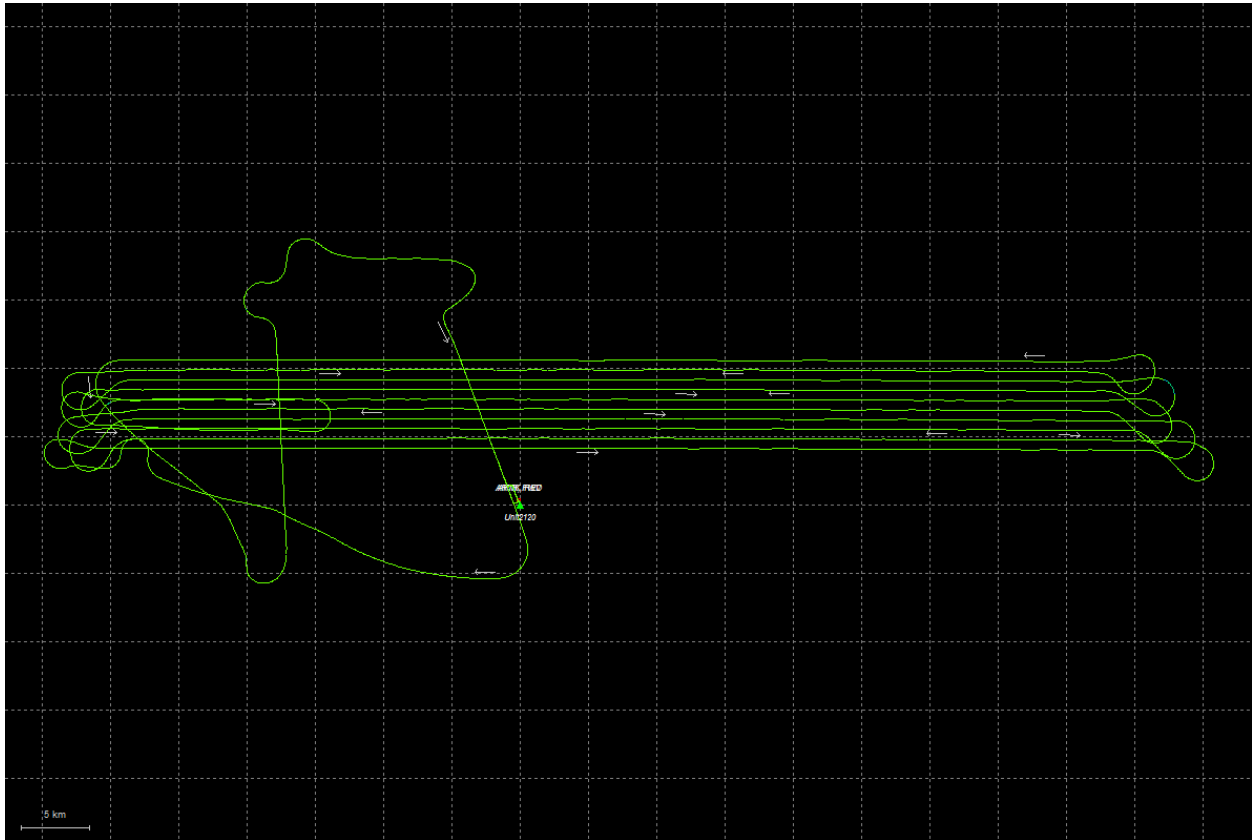
Log:

15.2		Lift Begin			Lift End			Flt	Flt	Hobbs	Activity
Airport	Chocks	Hobbs	Airport	Chocks	Hobbs	Duration	Hrs	Hrs			
1	KXNA	23:10	9705.4	KXNA	3:30	9709.7	4:20	4.25	4.3	0103-Mob/Demob	
2											
3											

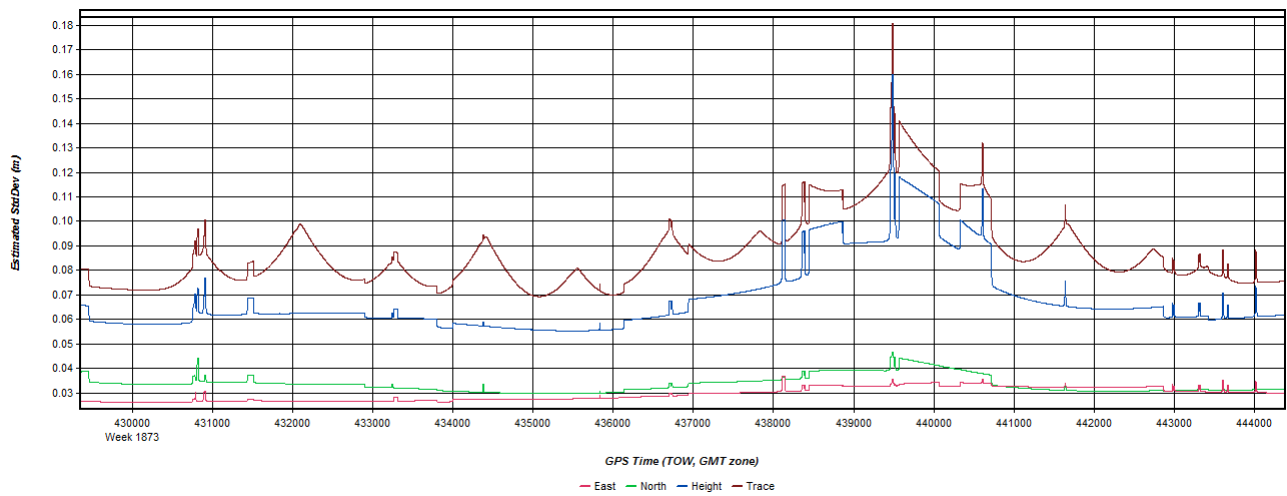
Q680i Flight Log

FGL Job # 22.15003800		Project Name USGS-Bentonville			Operator Chris Fought		Unit 165	IMU	Ground Temp °C 10.0 3.0		Mn Range' 2100	Data Logger Drives DR680-1			
Flight Date 3-Dec-15		GPS Day 15-337	Lift 3	System R680i	Pilot Kris Farrell		Sun° NA	Solar Times (UTC) NA	Pulse Rate 240K	Flying Temp °C 1.0 3.0		Max Range' 4052	Download Drive EP750#53		
Mission ID (yyymmdd_Sen_Job_Lift) 151203_165_15003800_03				Aircraft N62912	Airport ID KXNA	FMS CCNS 1	UTC -6	AMT (ft) 3200	Speed 150	FOV 22	Scan Rate (Hz) 110	MTA 0.581	km/WPT 30.35 30.40	Humidity @ Alt 63%	Shipping Track
Base 1 ID 0466	Location KXNA		Rec ID GR3	Ant ID GR3	ARP (m) 1.8	Start Time (UTC) 03-Dec-15 22:30		Stop Time (UTC) 04-Dec-15 03:30		GPS Filename Unit21213w.tps		Operator Chris Fought	Data With AB		
Area	Flight #	Client	Wpt	Distance		UTC		Dir	Altitude (GPS)	Speed (knots)	Scan Rate	Comments and Conditions		SVs	PDOP
				From	To	Begin	End					Start	End		
BENTON COUNTY													static	11	1.1
													S turn	11	0.9
	31		1	122	0	70.3	23:43:09	23:59:43	90	4,108	150	110.0		11	0.9
	30		120	1	69.1	0	0:03:02	0:19:12	270	4,058	150	110.0		9	1.2
	29		1	119	0	68.6	0:22:32	0:38:12	90	4,058	150	110.0		10	1.2
	28		117	1	67.4	0	0:41:34	0:56:56	270	4,008	150	110.0		11	1.1
	27		1	116	0	66.8	1:00:31	1:16:07	90	4,008	150	110.0		10	1.1
	26		115	1	66.2	0	1:19:36	1:34:59	270	4,058	150	110.0		9	1.1
	26		11	17	5.8	9.3	1:39:34	1:40:42	90	4,058	150	110.0	calibration line	9	1.1
	25		1	115	0	66.2	1:47:04	2:02:22	90	4,058	150	110.0		9	1.1
	24		116	1	66.8	0	2:05:57	2:21:19	270	4,058	150	110.0		8	1.3
	23		1	115	0	66.2	2:24:26	2:39:11	90	4,058	150	110.0		9	1.1
	22		112	1	64.5	0	2:42:49	2:57:45	270	4,058	150	110.0		8	1.3
	65		37	59	20.9	33.7	3:04:34	3:07:13	357	4,058	150	110.0	crossing line	9	1.1
							3:07:20	3:09:25					S turn	10	1.1
							3:20:15	3:25:15					static		

Trajectory and GPS Plots:

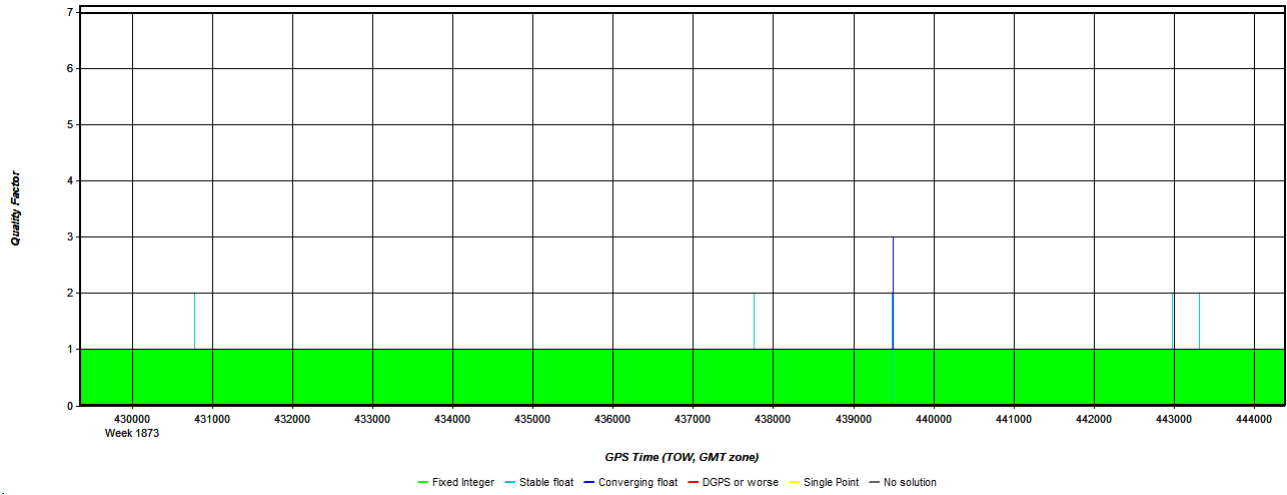


Estimated Accuracy

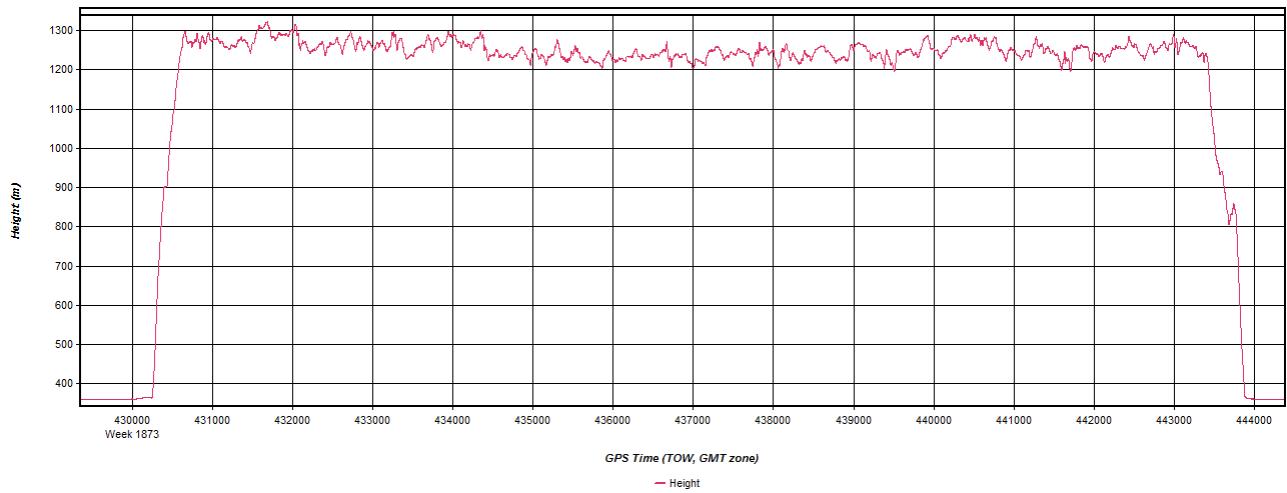




Quality Factor

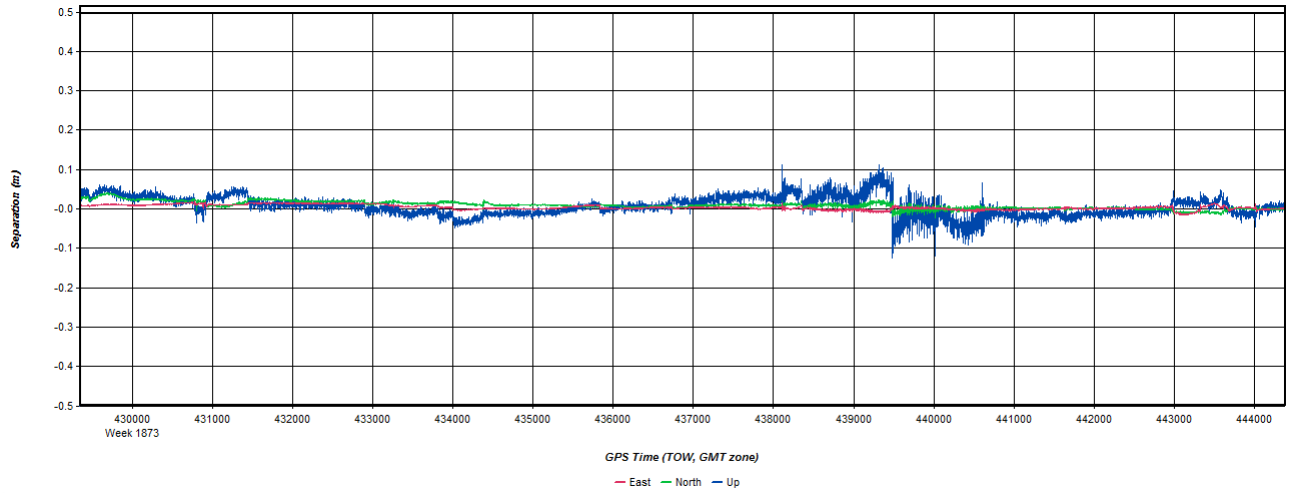


Height

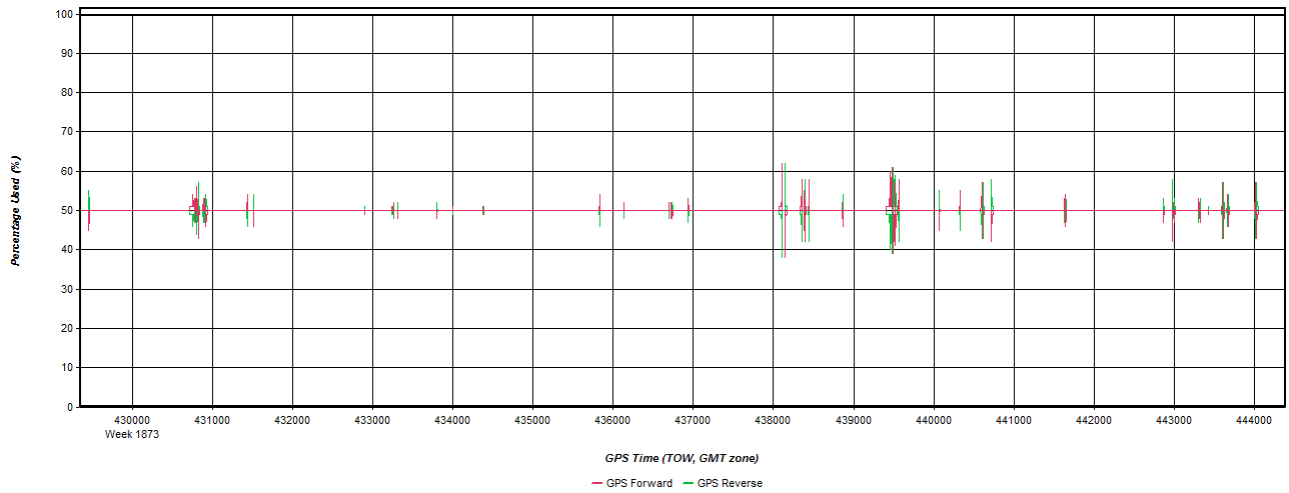




Combined Forward/Reverse Separation

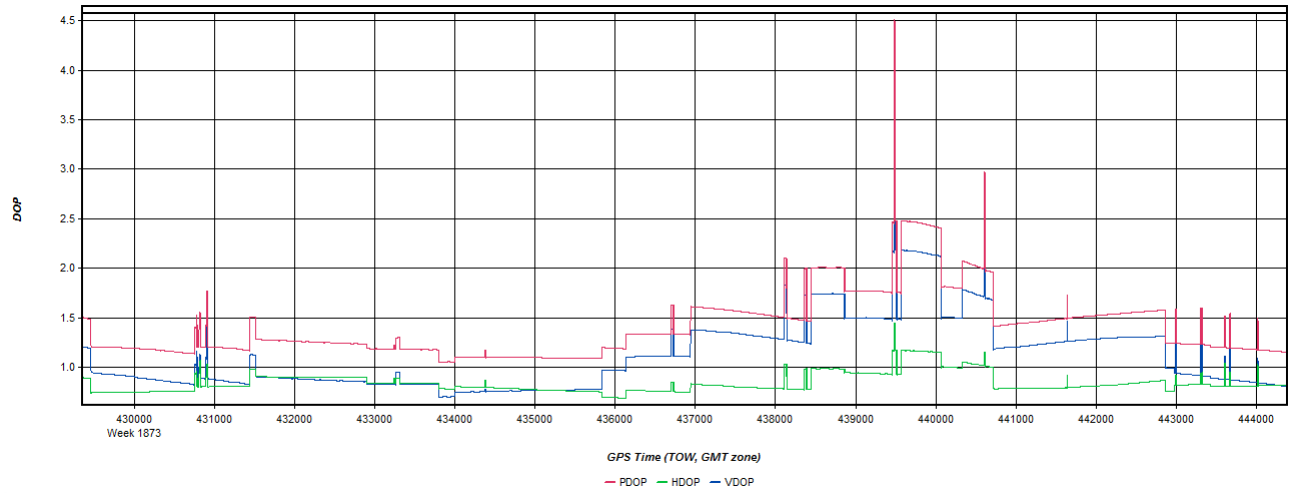


Combined Forward/Reverse Weighting

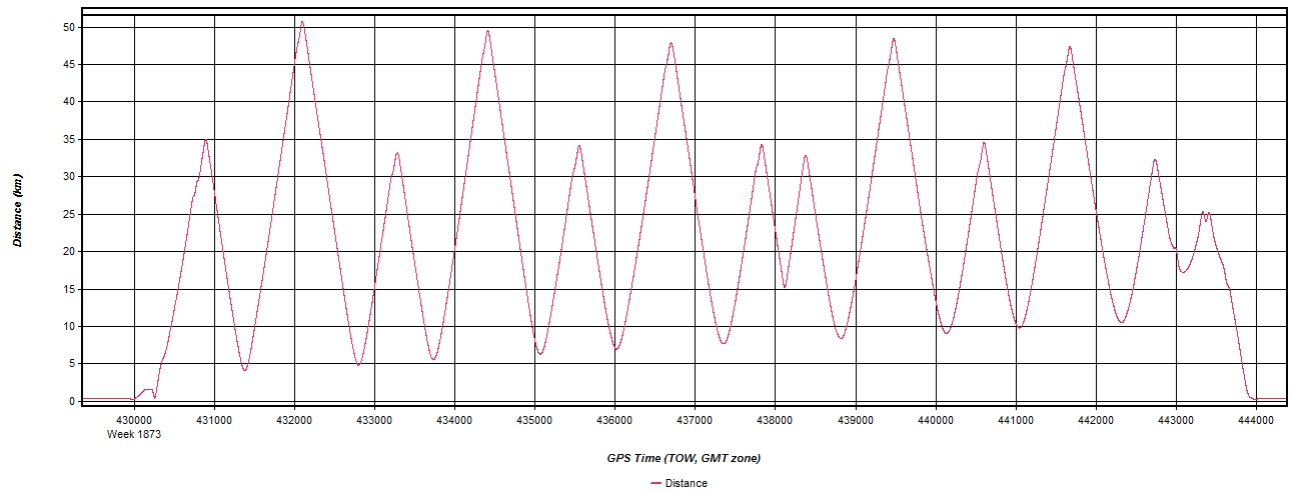




PDOP

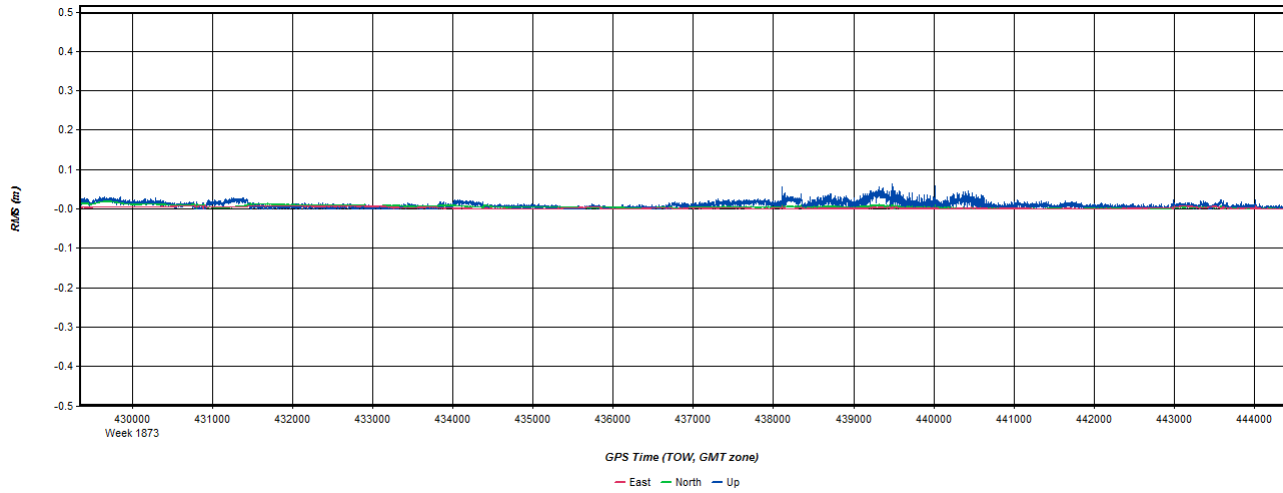


Distance from Base

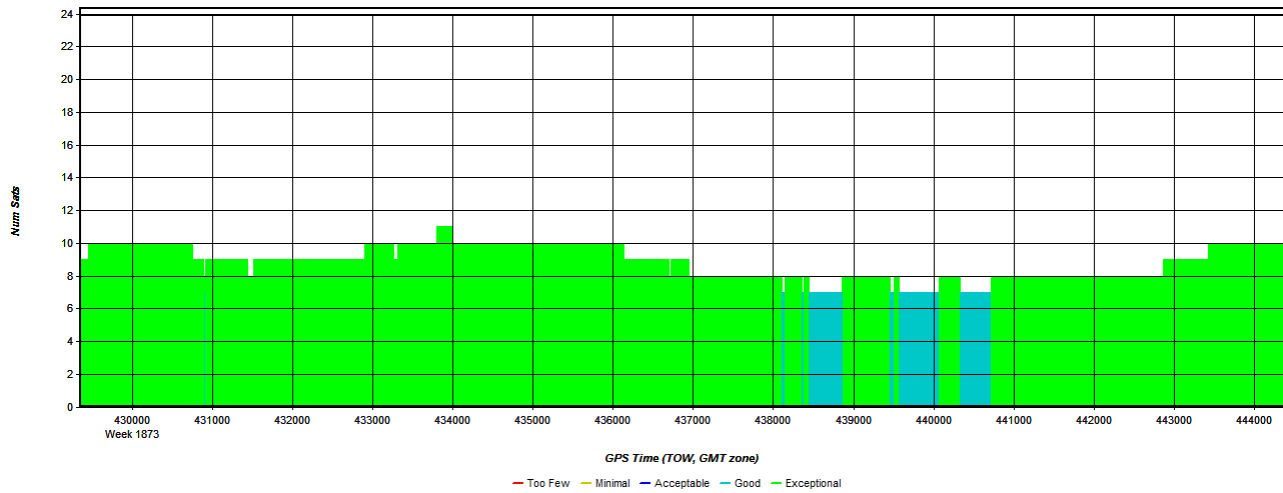




Combined RMS



SVs





Acquisition and Processing details ----- Collection 4 (December 4, 2015)

Log:



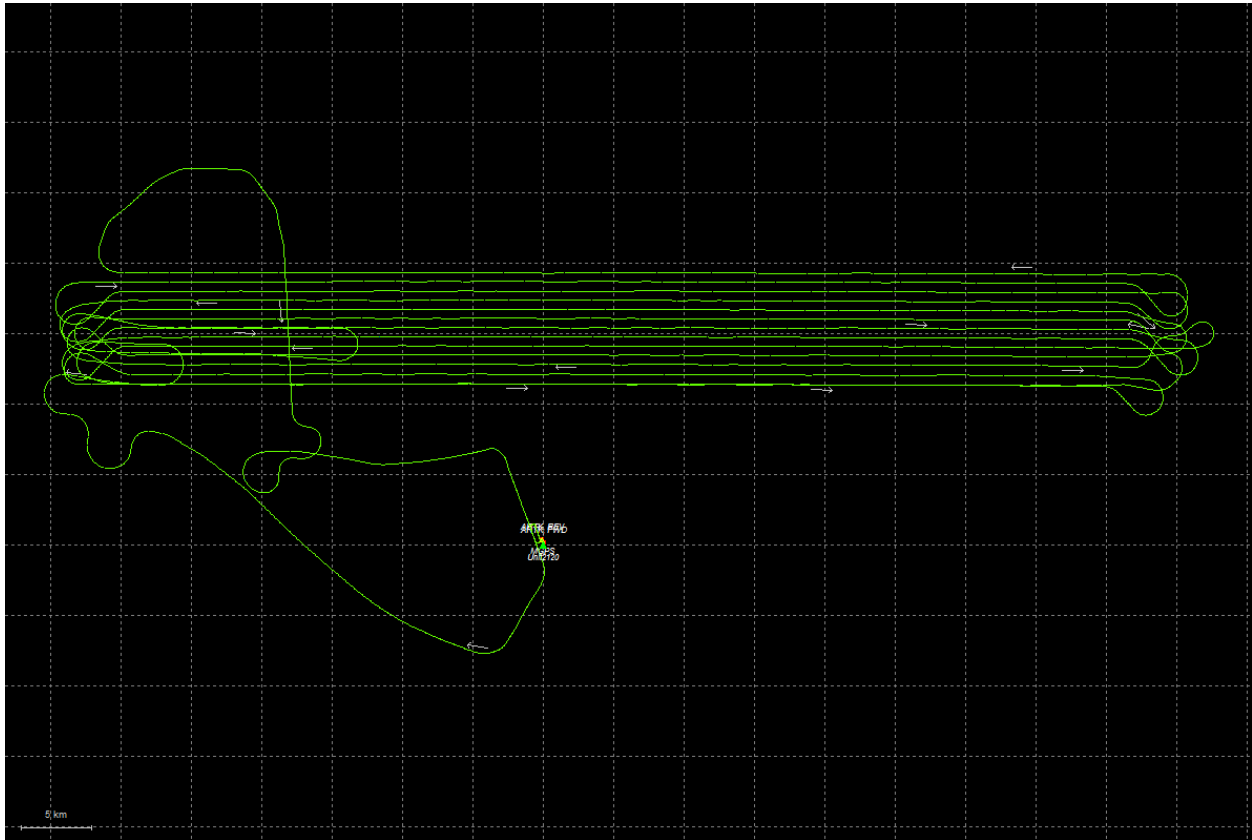
Fugro Geospatial, Inc.

15.2	Lift Begin			Lift End			Fit Duration	Fit Hrs	Hobbs Hrs	Activity
	Airport	Chocks	Hobbs	Airport	Chocks	Hobbs				
1	KXNA	16:43	9709.7	KXNA	22:12	9715.2	5:29	5.50	5.5	0103-Mob/Demob
2										
3										

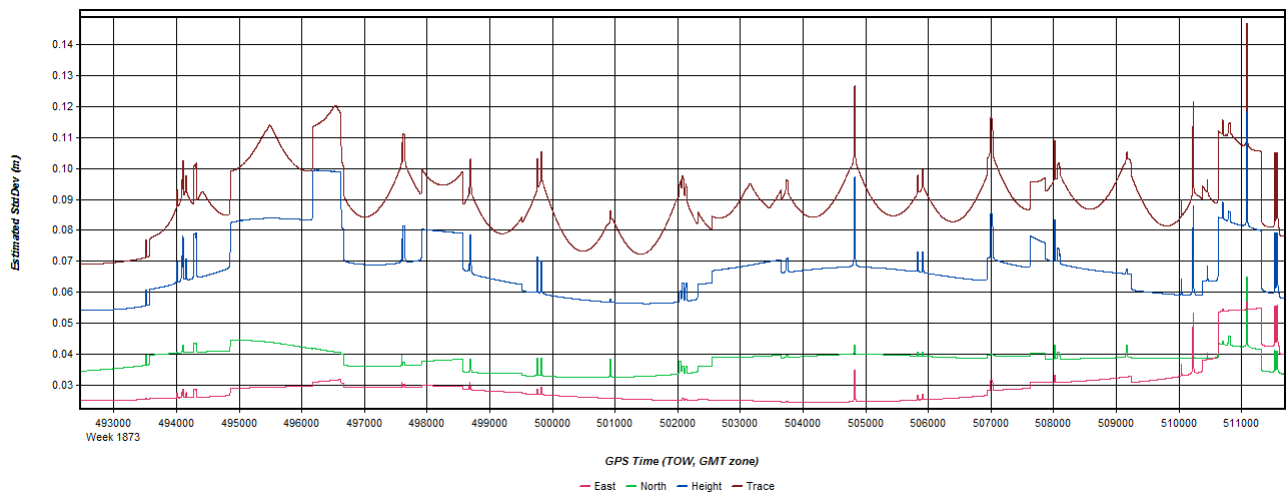
Q680i
Flight Log

FGL Job #		Project Name				Operator		Unit	IMU	Ground Temp °C		Mn Range'	Data Logger Drives					
22.15003800		USGS-Bentonville				Chris Fought		165		6.0	14.0	2100	DR680-2					
Flight Date		GPS Day	Lift	System	Plot		Sun*	Solar Times (UTC)		Pulse Rate		Flying Temp °C	Max Range'	Download Drive				
4-Dec-15		15-338	4	R680i	Kris Farrell		NA	NA		240K		2.0	0.0	4052	EP750#54			
Mission ID (yyymmdd_Sen_Job_Lift)				Aircraft	Airport ID	FMS	UTC	AMT (ft)	Speed	FOV	Scan Rate (Hz)	MTA	km/WPT	Alt Setting	Humidity @ Alt	Shipping Track		
151204_165_15003800_04				N62912	KXNA	CCNS 1	-6	3200	150	22	110		0.581	30.52	30.43	75%		
Base 1 ID	Location		Rec ID	Ant ID	ARP (m)	Start Time (UTC)		Stop Time (UTC)		GPS Filename		Operator		Data				
0466	KXNA		GR3	GR3	1.8	04-Dec-15 16:30		04-Dec-15 22:10		Unit21204q.tps		Chris Fought		With AB				
Area	Flight #	Wpt	Distance		UTC		Fit Dir	Altitude (GPS)	Speed (knots)	Scan Rate	Comments and Conditions				SVs	PDOP		
	FGI	Client	From	To	Begin	End					Start	End						
BENTON COUNTY											static				10	1.2		
											S turn				9	1.0		
	21		1	111	0	63.9	17:21:19	17:36:11	90	4,108	150	110.0	had to reload rpp file bol-				10	1.0
	20			112	1	64.5	17:39:01	17:53:49	270	4,108	150	110.0					9	1.1
	21		1	111	0	63.9	17:56:43	18:11:32	90	4,108	150	110.0	re fly of line 21 just in case POS file needs to be adjusted				11	1.0
	18			116	1	66.8	18:14:29	18:29:54	270	4,158	150	110.0					9	1.1
	19		1	114	0	65.7	18:32:50	18:47:59	90	4,158	150	110.0					9	1.2
	17			116	1	66.8	18:51:49	19:07:08	270	4,158	150	110.0					10	1.1
	16		1	116	0	66.8	19:10:09	19:25:34	90	4,108	150	110.0					10	1.1
	15			116	1	66.8	19:28:49	19:43:52	270	4,108	150	110.0					8	1.2
	15		14	21	7.6	11.6	19:48:29	19:49:38	90	4,108	150	110.0	calibration line				9	1.2
	14		1	116	0	66.8	19:56:13	20:11:46	90	4,108	150	110.0					9	1.2
	13			116	1	66.8	20:14:29	20:29:51	270	4,108	150	110.0					9	1.3
	12		1	116	0	66.8	20:32:51	20:48:12	90	4,108	150	110.0					9	1.2
	11			117	1	67.4	20:50:49	21:06:08	270	4,108	150	110.0					9	1.1
	10		1	117	0	67.4	21:09:17	21:24:40	90	4,108	150	110.0					9	1.2
	9			117	1	67.4	21:27:26	21:42:47	270	4,058	150	110.0					11	1.0
	65		68	54	38.9	30.8	21:48:05	21:50:25	177	4,058	150	110.0	cross line				11	0.9
							21:50:30	21:52:30					S turn				12	0.9
							22:02:00	22:07:00					static				11	1.0

Trajectory and GPS Plots:

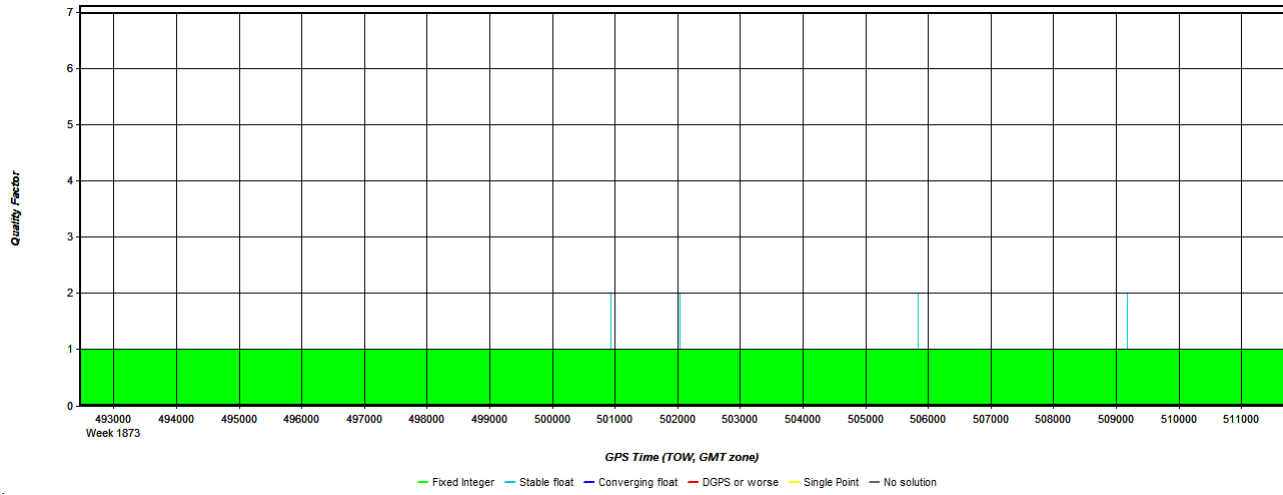


Estimated Accuracy

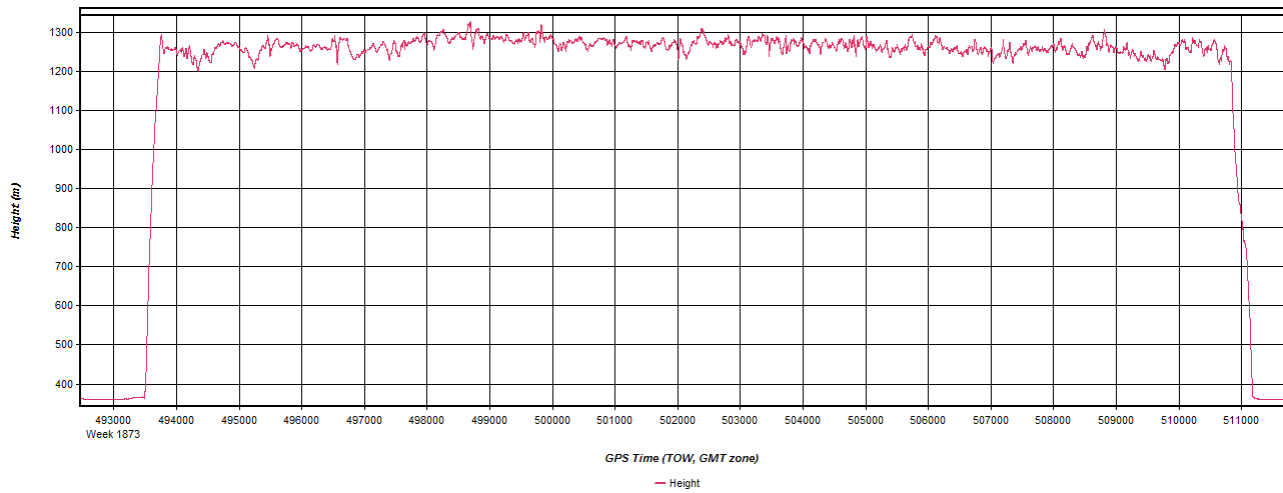




Quality Factor

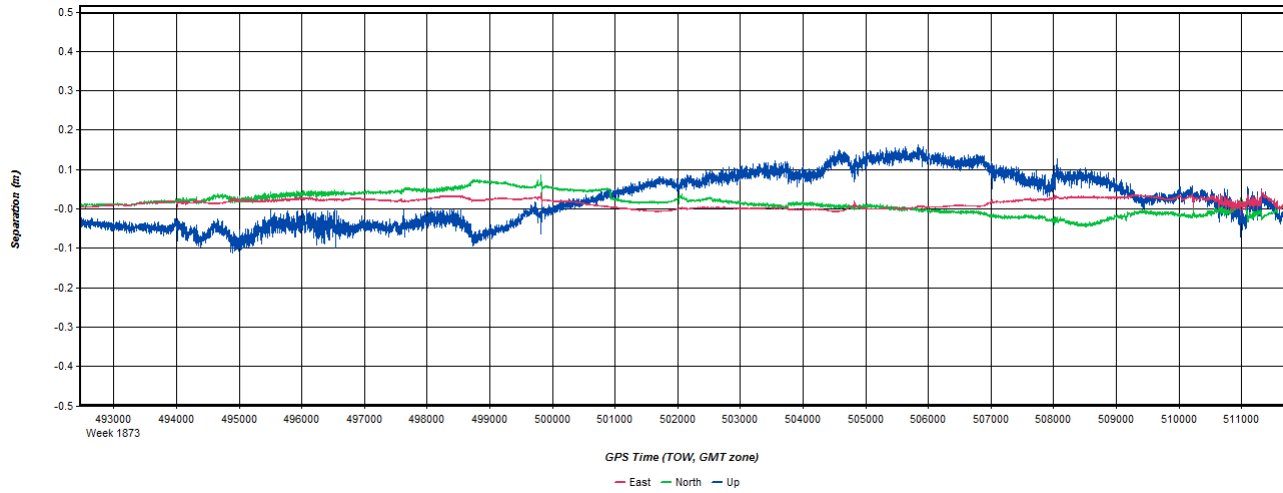


Height

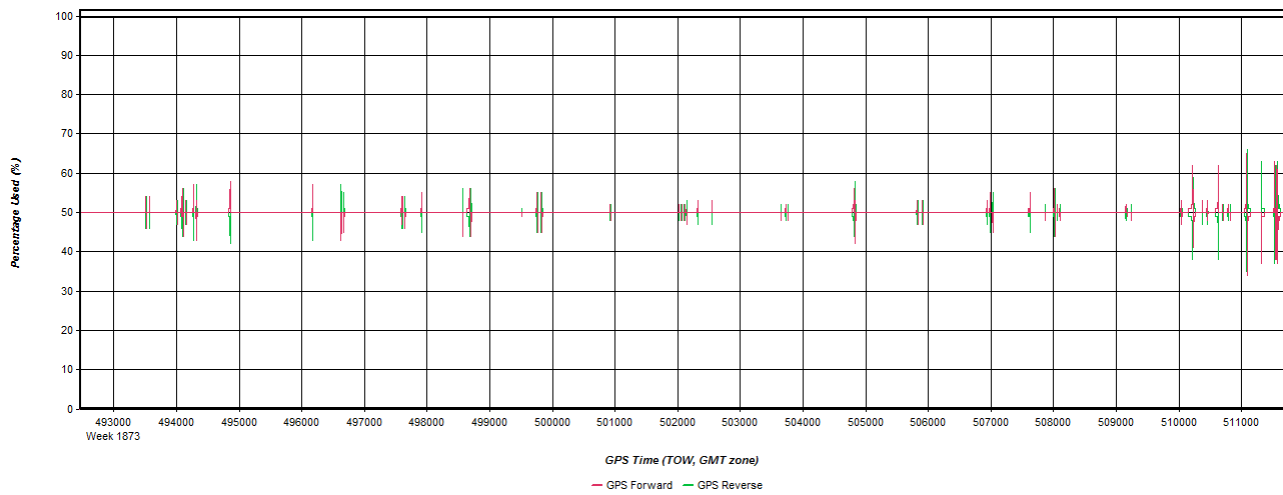




Combined Forward/Reverse Separation

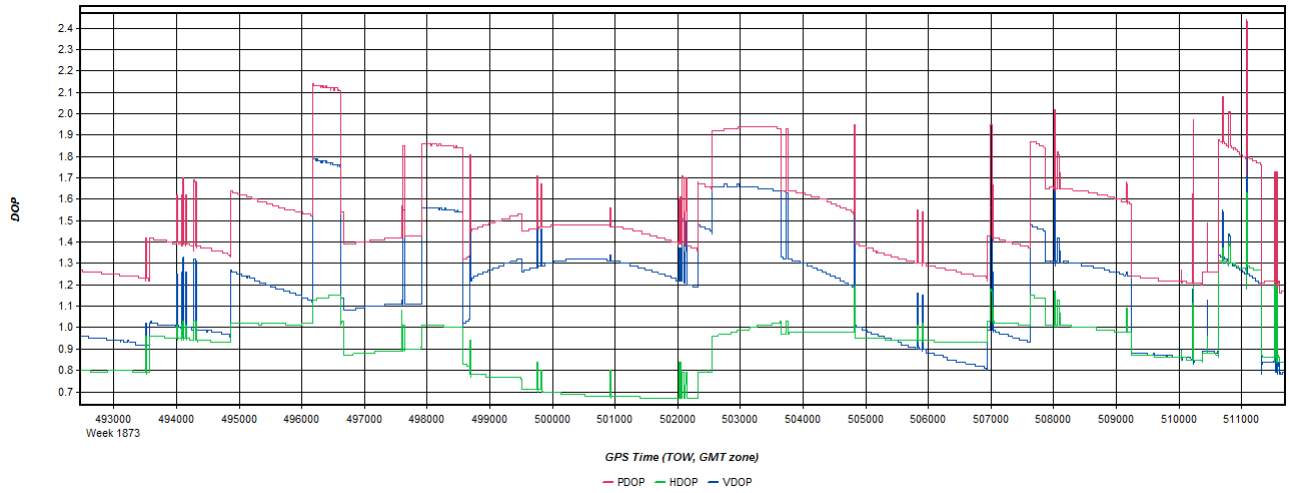


Combined Forward/Reverse Weighting

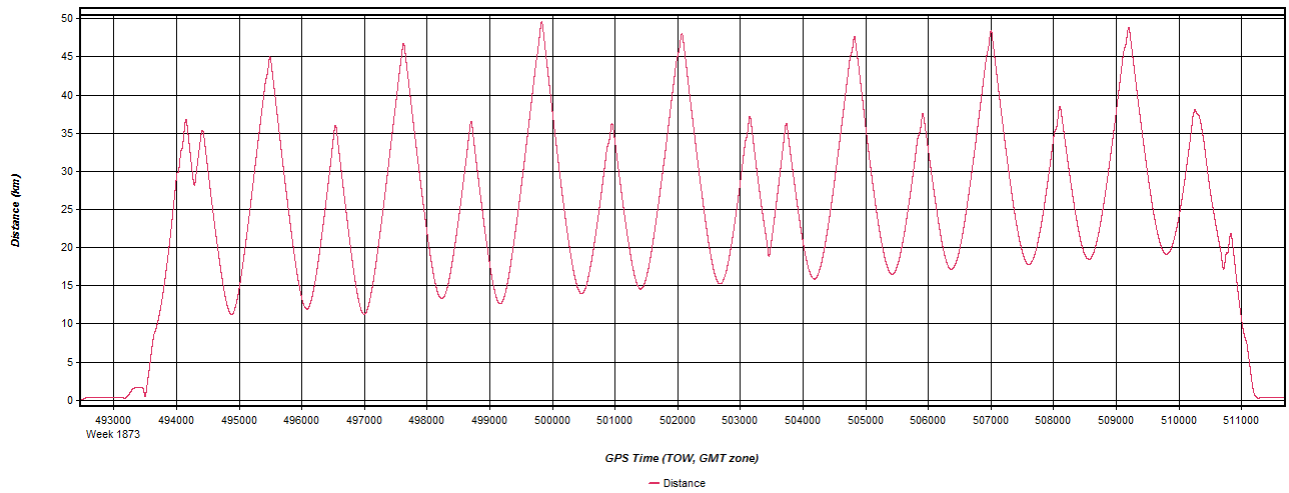




PDOP

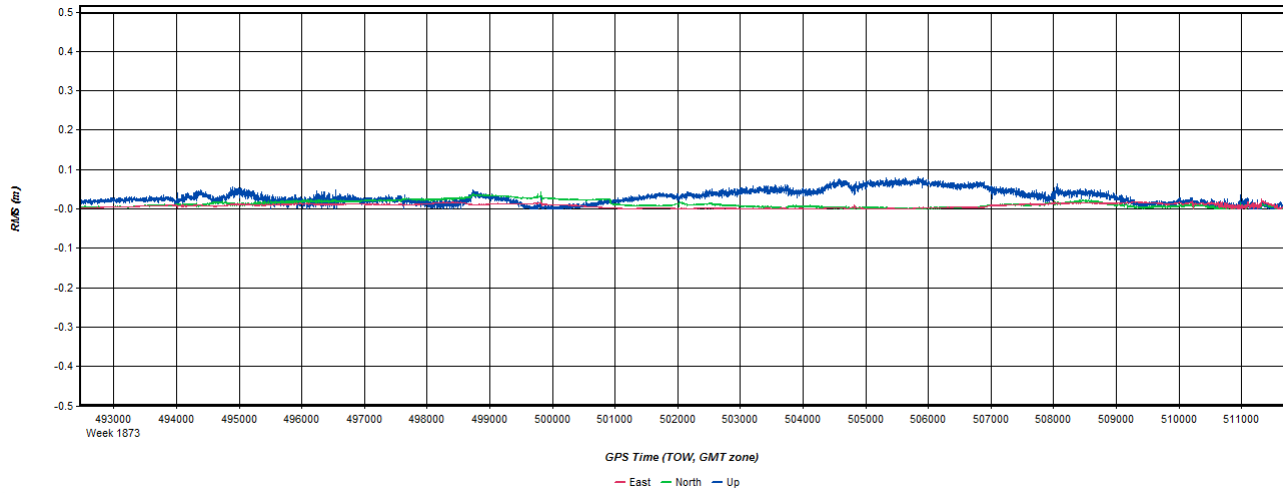


Distance from Base

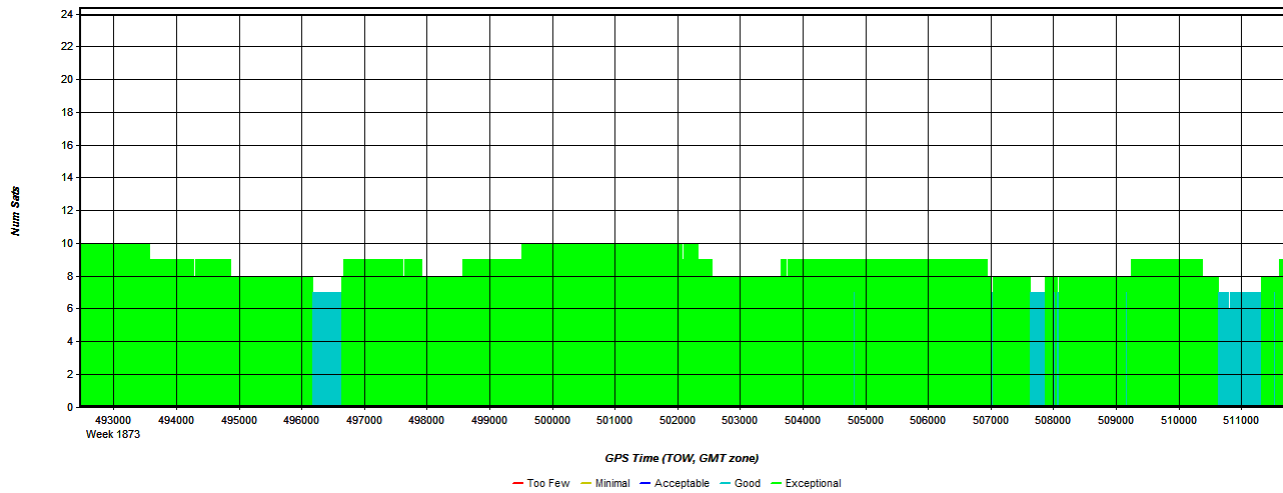




Combined RMS



SVs





Acquisition and Processing details ----- Collection 5 (December 4, 2015)

Log:



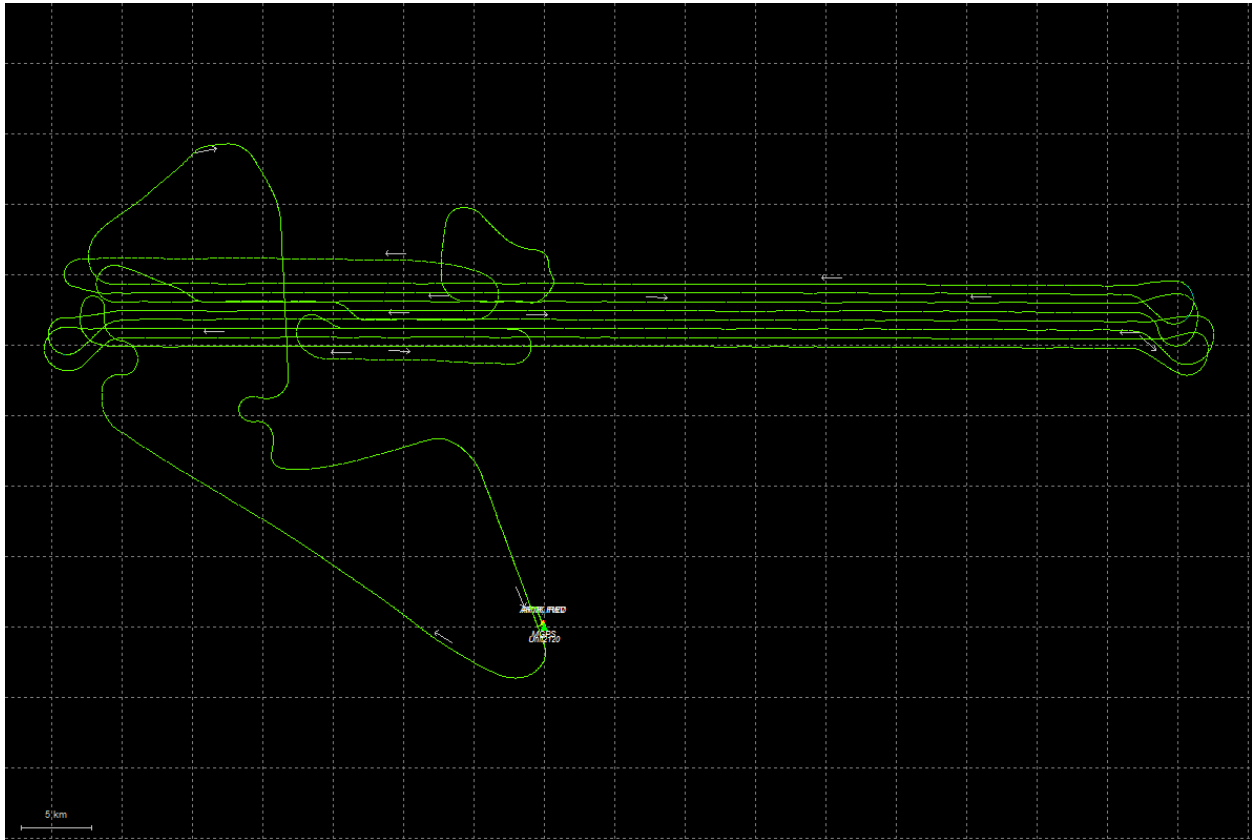
Fugro Geospatial, Inc.

15.2	Lift Begin			Lift End			Flt Duration	Flt Hrs	Hobbs Hrs	Activity
	Airport	Chocks	Hobbs	Airport	Chocks	Hobbs				
1	KXNA	22:45	9715.2	KXNA	2:40	9719.1	3:55	4.00	3.9	0103-Mob/Demob
2										
3										

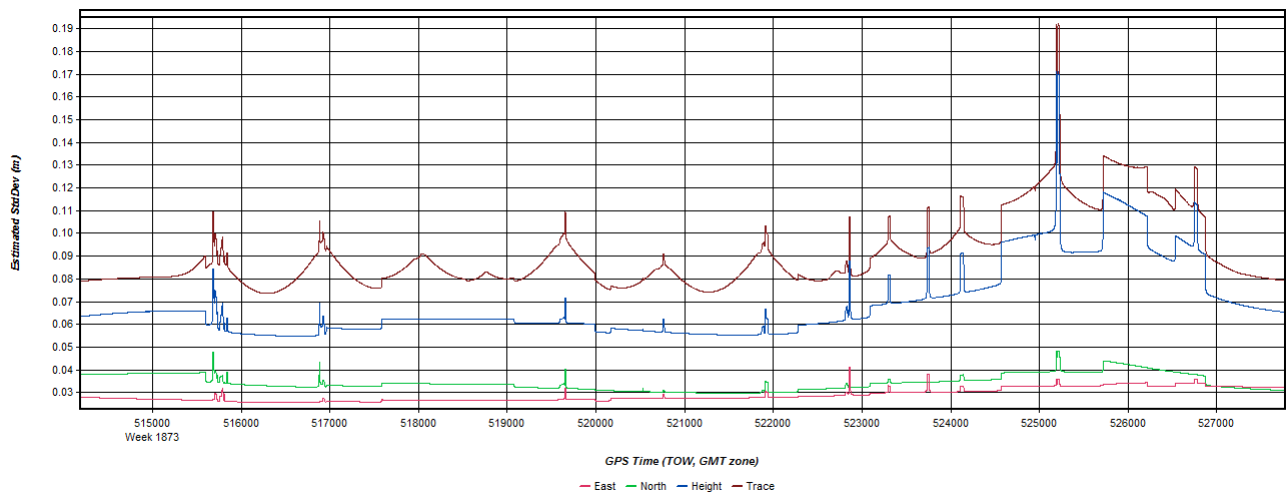
Q680i
Flight Log

FGL Job #		Project Name				Operator		Unit	IMU	Ground Temp °C		Mn Range'	Data Logger Drives			
22.15003800	USGS-Bentonville				Chris Fought		165		14.0 5.0		2100	DR680-6				
Flight Date		GPS Day	Lift	System	Pilot		Sun*	Solar Times (UTC)		Pulse Rate	Flying Temp °C		Max Range'	Download Drive		
4-Dec-15		15-338	5	R680i	Kris Farrell		NA	NA		240K	2.0 -2.0		4052			
Mission ID (yyymmdd_Sen_Job_Lift)				Aircraft	Airport ID	FMS	UTC	AMT (ft)	Speed	FOV	Scan Rate (Hz)	MTA	km/WPT	Altitude Setting	Humidity @ Alt	Shipping Track
151204_165_15003800_05				N62912	KXNA	CCNS 1	-6	3200	150	22	110		0.581	30.43 30.47	15%	
Base 1 ID	Location		Rec ID	Ant ID	ARP (m)	Start Time (UTC)		Stop Time (UTC)		GPS Filename		Operator		Data		
0466	KXNA		GR3	GR3	1.8	04-Dec-15 22:30		05-Dec-15 02:40		Unit21204w.tps		Chris Fought		With AB		
Area	Flight #		Wpt		Distance		UTC		Dir	Altitude (GPS)	Speed (knots)	Scan Rate	Comments and Conditions		SVs	PDOP
	FGL	Client	From	To	Begin	End	Start	End								
BENTON							22:52:00	22:57:00					static		9	1.3
COUNTY							23:13:45	23:15:40					S turn		10	1.0
	8		1	117	0	67.4	23:17:41	23:33:09	90	4,058	150	110.0			11	1.0
	7		117	1	67.4	0	23:36:28	23:51:47	270	4,058	150	110.0			11	1.0
	6		1	42	0	23.8	23:55:18	0:01:08	90	4,008	150	110.0	from wpt 34 to 42 range readings dropped		9	1.2
	6		30	117	16.8	67.4	0:06:48	0:18:18	90	4,008	150	110.0	re flew portion to fill in possible gap of previous line		10	1.2
	5		117	1	67.4	0	0:21:53	0:37:10	270	4,008	150	110.0	low retrns wpts36-45		10	1.2
	4		1	118	0	68	0:40:38	0:56:11	90	4,008	150	110.0			10	1.2
	3		118	45	68	25.6	0:59:26	1:09:23	270	4,008	150	110.0	had to abort line for air traffic		10	1.1
	3		45	1	25.6	0	1:14:45	1:20:47	270	4,008	150	110.0			9	1.1
	3		15	22	8.1	12.2	1:24:20	1:25:26	90	4,008	150	110.0	calibration line		8	1.3
	5		35	45	19.8	25.6	1:26:53	1:27:51	90	4,008	150	110.0	re fly of low return area		8	1.3
	2		1	118	0	68	1:36:00	1:51:31	90	4,008	150	110.0			9	1.1
	1		118	1	68	0	1:54:26	2:09:52	270	3,958	150	110.0			8	1.1
	65		81	69	46.5	39.5	2:15:45	2:17:46	177	4,058	150	110.0	cross line		8	1.4
							2:17:50	2:20:10					S turn		8	1.1
							2:30:20	2:35:20					static		9	1.2

Trajectory and GPS Plots:

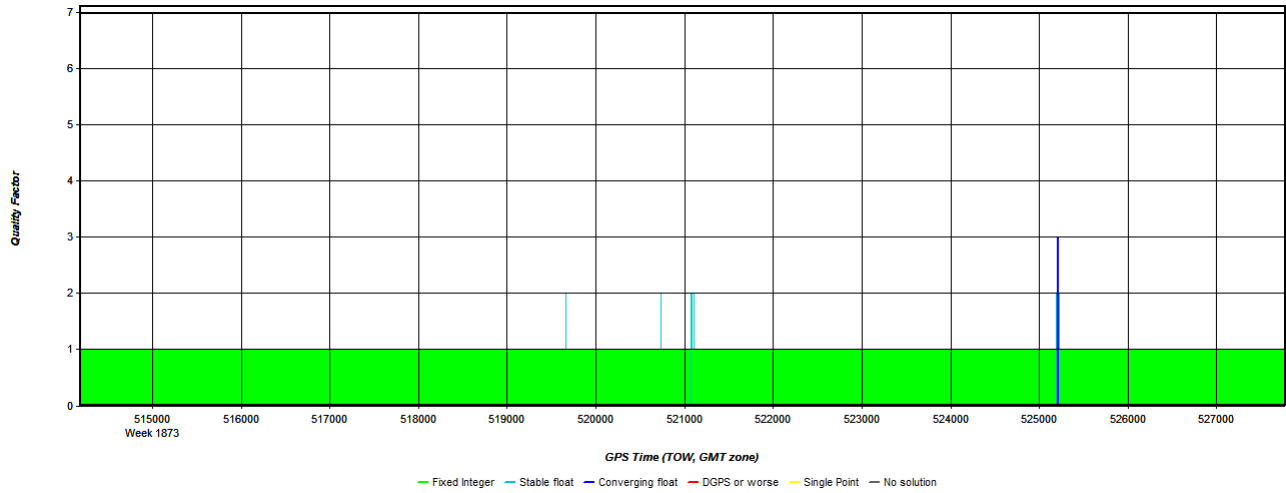


Estimated Accuracy

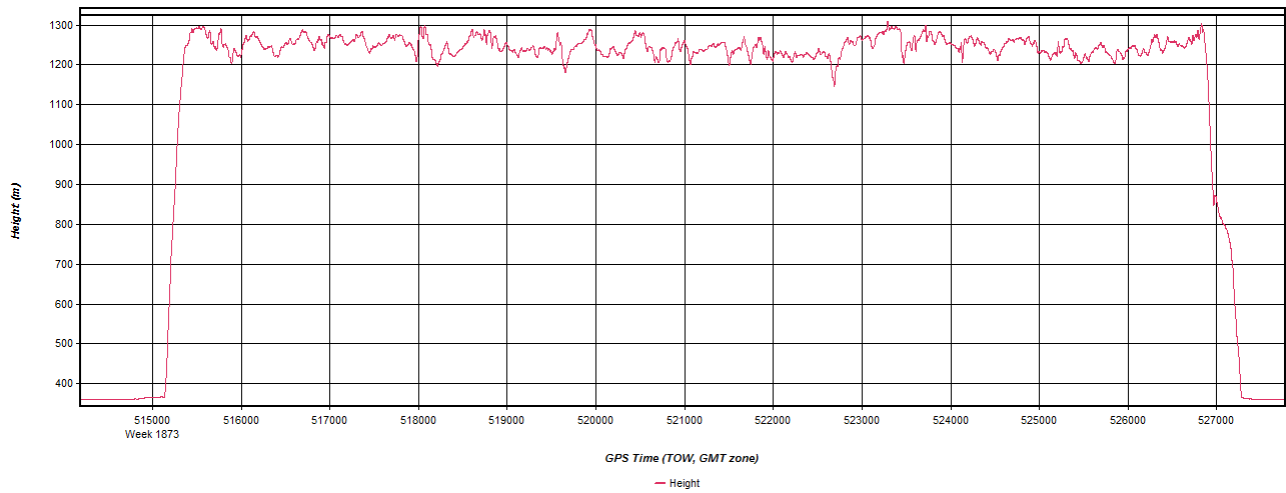




Quality Factor

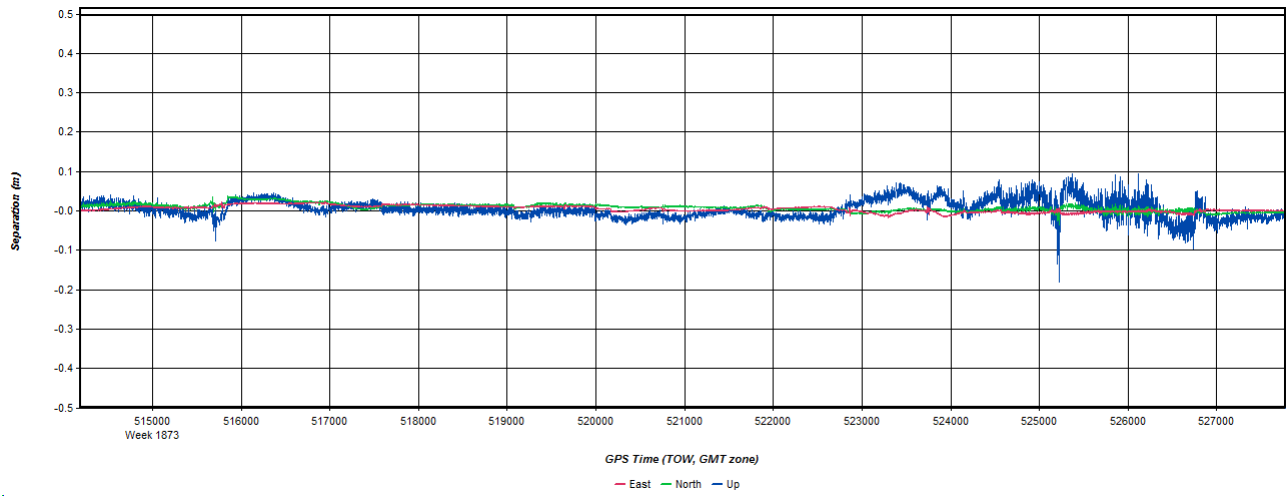


Height

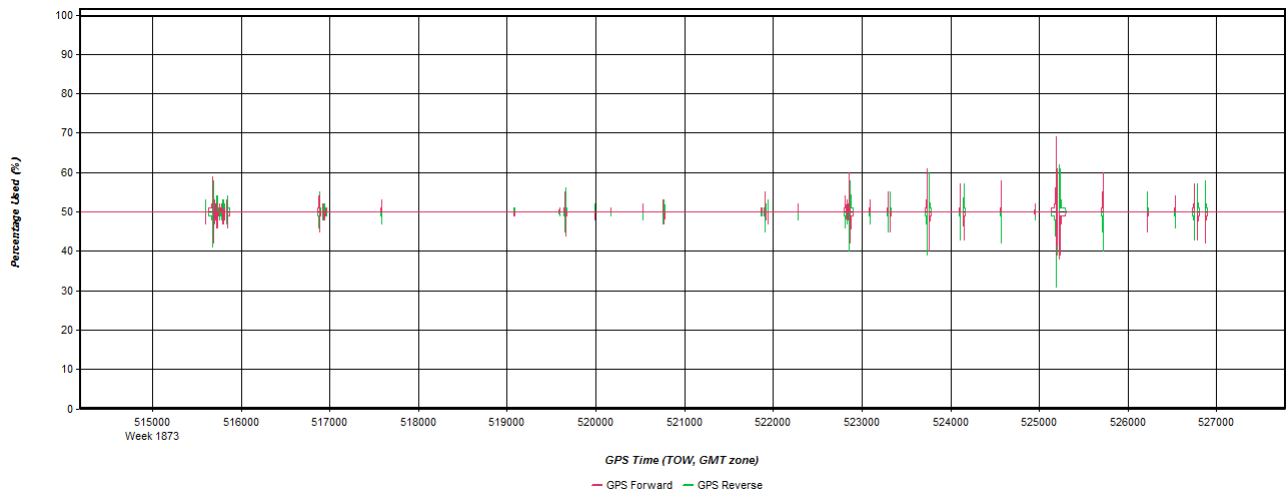




Combined Forward/Reverse Separation

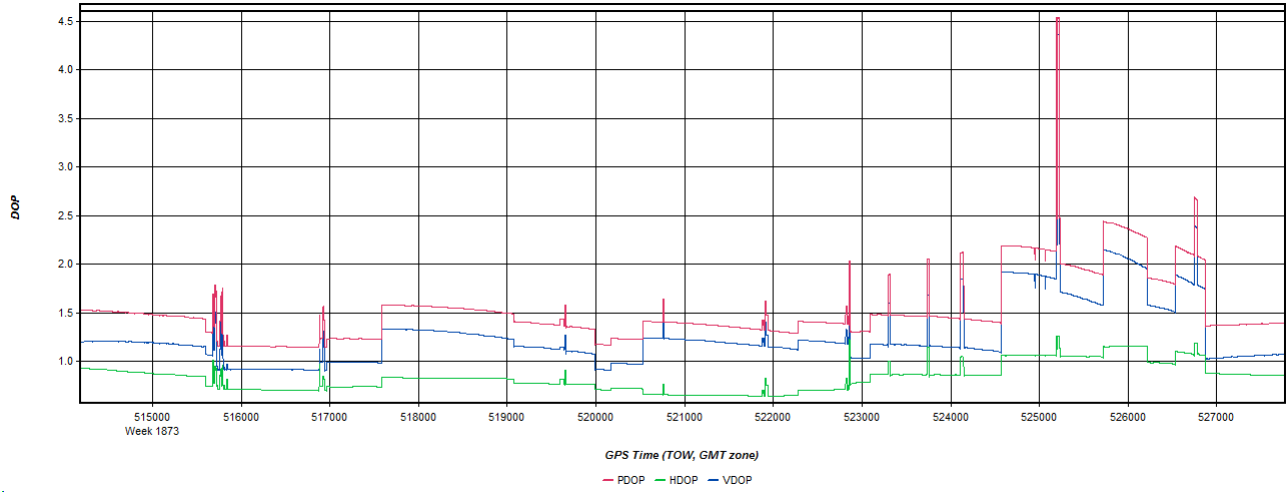


Combined Forward/Reverse Weighting

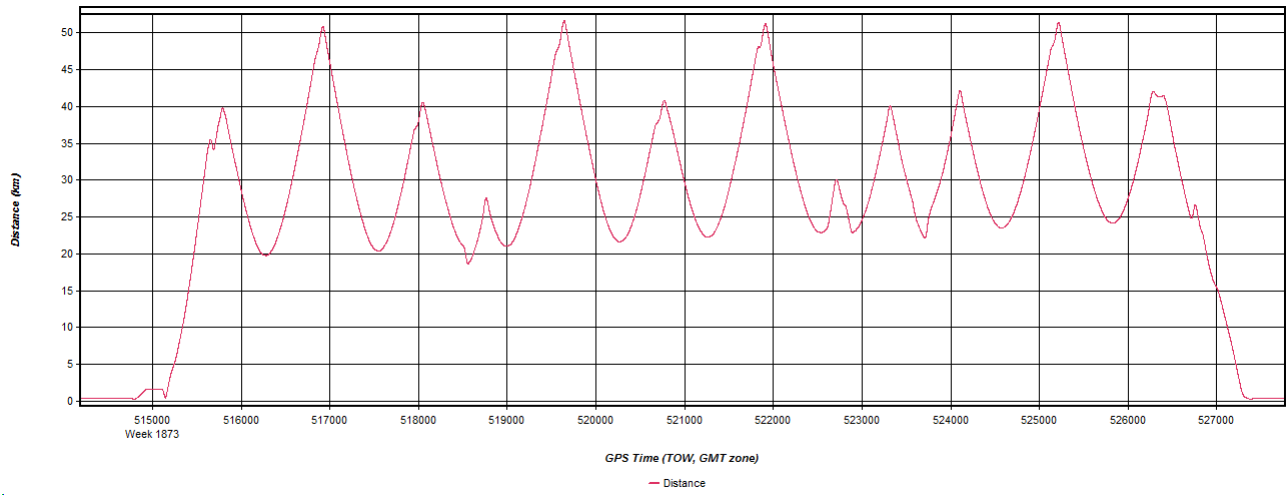




PDOP

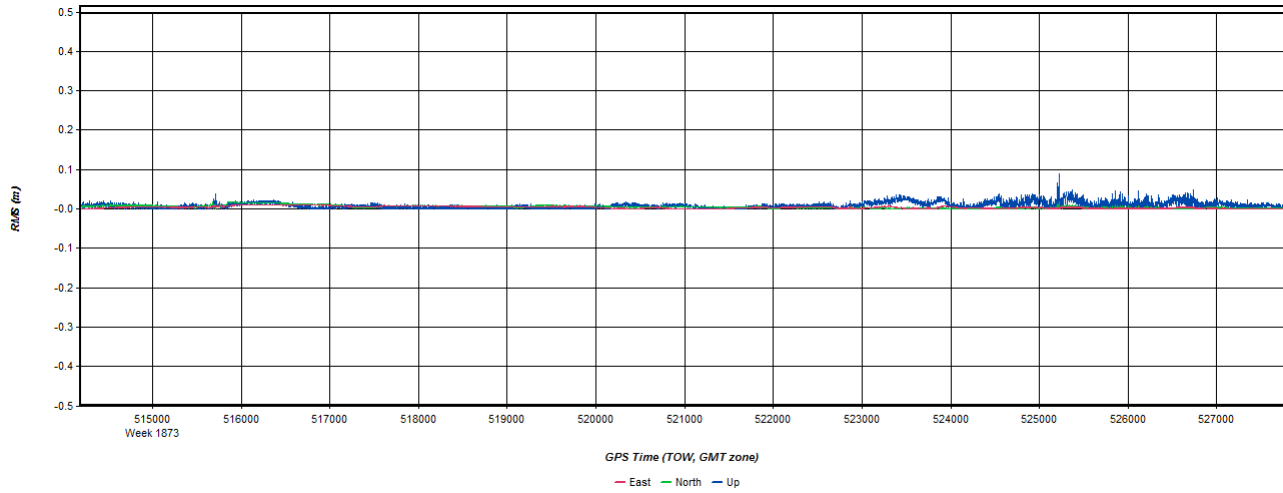


Distance from Base





Combined RMS



SVs

