

Check Point Survey Report
“Norfolk, VA LiDAR Task Order”
USGS Contract: G10PC00013
Task Order Number: G13PD000279



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a) Point Documentation Report & Photos of Survey Points	
b) Final Coordinate List in Excel Format	
c) NGS Data Sheets for Project Controls	

1. INTRODUCTION

1.1 Project Summary

Dewberry Engineers Inc. is under contract to United States Geodetic Survey to provide 100 QA Check Points for 933 square miles in Chesapeake, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Virginia Beach, and York Counties in Virginia. Under the above USGS Task Order, Dewberry is tasked to complete the quality assurance of high resolution LiDAR-derived elevation products. As a part of this work Dewberry staff will complete checkpoint surveys that will be used to evaluate vertical accuracy on the bare-earth terrain derived from the LiDAR.

Existing NGC Control Points were located and surveyed to check the accuracy of the RTK/GPS survey equipment with the results shown in section 2.4 of this report.

As an internal QA/QC procedure and to verify that the Check Points meet the 95% confidence level approximately 50% of the points were re-observed and are shown in section 5 in this report.

Final horizontal coordinates are referenced to UTM Zone 18 North, NAD83, in meters. Final Vertical elevations are referenced to NAVD88, in meters.

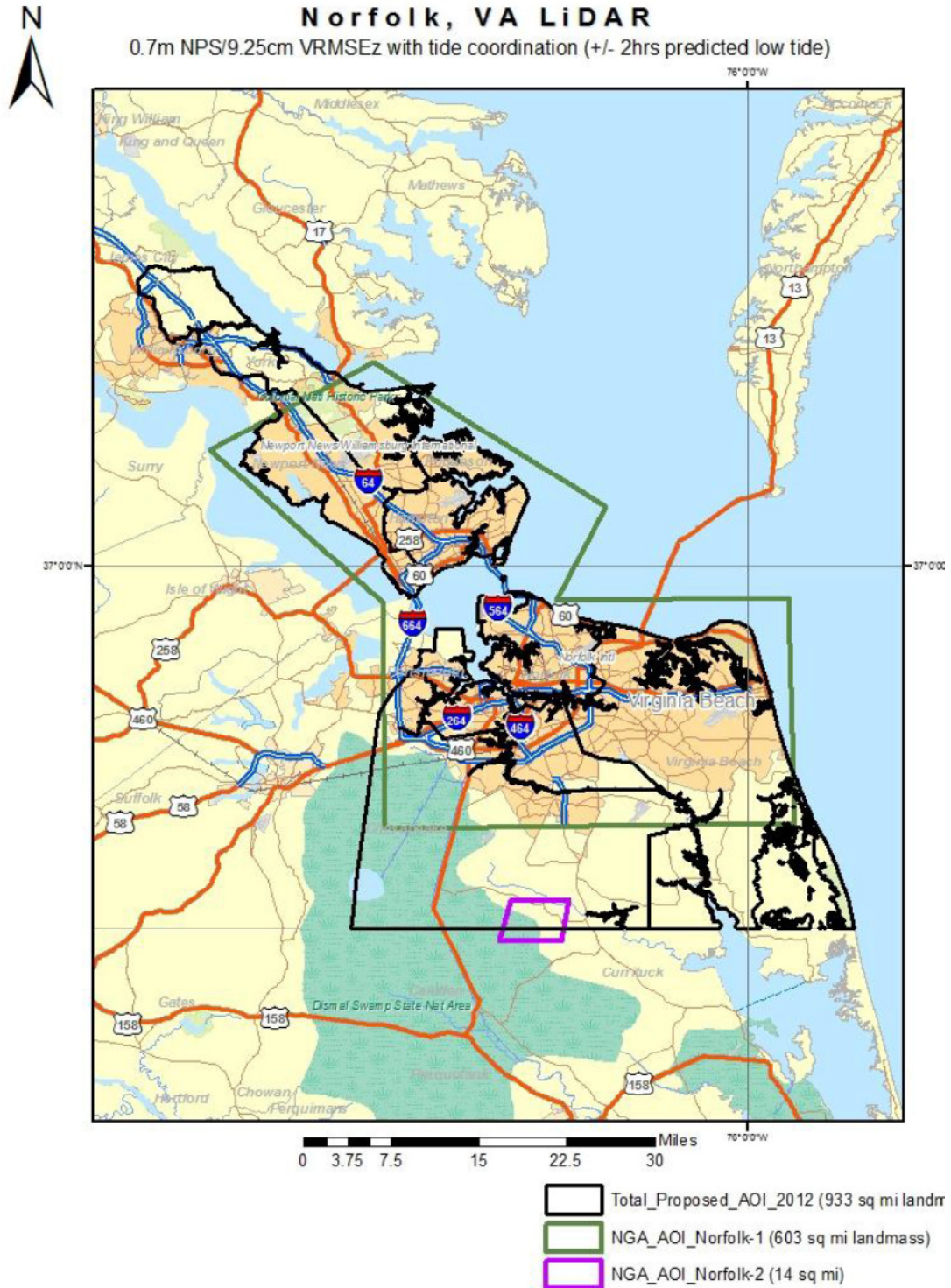
1.2 Points of Contact

Questions regarding the technical aspects of this report should be addressed to:

Dewberry Engineers Inc.

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1.3 Project Area



2. PROJECT DETAILS

2.1 Survey Equipment

In performing the GPS observations, Trimble R-8 GNSS receiver/antenna attached to a 2 meter fixed height pole with a Trimble TSC2 Data Collector to collect GPS raw data were used to perform the field surveys.

2.2 Survey Point Detail

The 100 Check Points were well distributed throughout the project area so as to cover as many flight lines as possible using “dispersed method” of placement.

A “Ground Control Point Documentation Report” sheet was used to show the placement of the nail and a sketch for each of the points surveyed.

2.3 Network Design

The GPS survey performed by Dewberry Engineers Inc. located in Charlotte, NC was tied to a Real Time Network (RTN) managed by KeyNetGPS inc. KeyNetGPS is a series of continuously operating, high precision GNSS reference stations. These reference stations have all been linked together using Trimble VRS3Net App software, creating a Virtual Reference Station System (VRS).

2.4 Field Survey Procedures and Analysis

Dewberry Engineers Inc. used Trimble R-8 GNSS receivers, which is a geodetic quality dual frequency GPS receiver, to collect data at each surveyed location.

All locations were occupied once with approximately 50% of the locations being re-observed. All re-observations matched the initially derived station positions within the allowable tolerances of 5cm or within the 95% confidence level. Each occupation which utilized the VRS network was occupied for approximately three (3) minutes in duration and measured to at least 180 epochs.

Field GPS observations are detailed on the "Ground Control Point Documentation Reports" submitted as part of this report.

10 existing NGS monuments listed in the NSRS database were located as an additional QA/QC method to check the accuracy of the VRS network. Some of these monuments were used as Horizontal and Vertical control checks. Some monuments were used as Horizontal or Vertical checks only as shown in the table below.

NGS PT. ID	AS SURVEYED(m)			AS PUBLISHED(m)			Δ N	Δ E	Δ ELEV	CHK TYPE
	NORTHING	EASTING	ELEV	NORTHING	EASTING	ELEV				
DOUGLAS CHK	4075440.488	380599.04	3.73	4,075,440.59	380,599.12	3.75	-	-0.084	-	VERT.
STATION 509	4100627.566	384554.955	2.124	4,100,627.56	384,554.95	2.3	0.010	0.007	X	HORIZ.
STATION 537	4098672.971	376462.99	3.503	4,098,672.96	376,463.00	4	0.008	-0.006	X	HORIZ.
STATION 538	4097985.036	375769.747	2.108	4,097,985.03	375,769.74	2	0.004	0.007	X	HORIZ.
F-455	4096857.383	376079.277	3.927	X	X	3.957	X	X	-	VERT.
MON 007	4135651.82	349236.942	23.259	4,135,651.79	349,236.96	23.5	0.031	-0.022	X	HORIZ.
124	4107886.234	372228.771	8.579	4,107,886.28	372,228.77	8.7	-	0.003	X	HORIZ.
PASCALE	4071366.848	371222.946	5.515	4,071,366.85	371,222.94	5.6	0.003	0.009	X	HORIZ.
PEAKE	4094521.001	376414.781	2.479	4,094,520.99	376,414.77	2.5	0.008	0.013	-	VERT.
D 470	4076051.123	3999352.192	3.401	X	X	3.447	X	X	-	VERT.

The above results indicate that the VRS network is providing positional values within the 5cm parameters for this survey.

2.5 Data Processing Procedures

After field data is collected the information is downloaded from the data collectors into the office software. The software programs used Trimble Business Center and Arc Map 10.

Downloaded data is run through the Trimble Business Center program to obtain the following reports; points report, point comparison, and a point detail report. The reports are reviewed for point accuracy and precision.

After review of the point data an "ASCII" or "txt" file is created. Point files are loaded into Arc Map 10(GIS software) to make a visual check of the point data to make sure it also checks with the "Ground Control Point Documentation Report" sketch and description as well as the Pt#, Coordinates, and Elevation.

3. FINAL COORDINATES

The final coordinate system for checkpoints is as follows:

Coord System = UTM

UTM Zone = Zone 18

Horiz Datum = NAD83

Vert Datum = NAVD88

Units = both in Meters

Geoid Model = GEOID12A

BRUSHLAND and LOW TREES			
BLT-1	4127850.095	351760.734	18.183
BLT-2	4124969.354	354157.693	26.867
BLT-3	4116934.625	374985.334	1.681
BLT-4	4112722.605	377113.574	1.301
BLT-5	4105501.265	363984.403	5.313
BLT-6	4101703.518	376746.304	3.508
BLT-7	4091258.47	387491.887	0.708
BLT-8	4083420.214	376730.499	5.063
BLT-9	4083180.738	409359.513	1.461
BLT-10	4078664.264	381578.163	0.747
BLT-11	4072438.855	393248.624	5.015

BLT-12	4071563.329	402227.485	3.332
BLT-13	4067495.229	392360.215	4.073
BLT-14	4060371.467	381270.904	4.561
BLT-15	4061689.787	400675.21	3.101
BLT-16	4058718.15	418260.165	0.336
BLT-17	4051271.046	381142.027	0.508
BLT-18	4051529.692	391753.707	3.966
BLT-19	4049846.406	410587.042	0.215
BLT-20	4045956.462	393929.901	1.76
FORESTED			
FO-1	4136323.776	350228.113	23.871
FO-2	4126211.091	360014.272	8.932
FO-3	4118875.446	366402.057	16.648
FO-4	4112572.968	372250.758	4.076
FO-5	4108269.849	362705.508	9.253
FO-6	4101531.898	381648.883	2.403
FO-7	4096033.448	372274.821	5.794
FO-8	4084210.274	399373.443	5.089
FO-9	4078442.28	400259.407	3.628
FO-10	4073199.529	370329.394	6.472
FO-11	4071580.897	372624.23	4.829
FO-12	4067053.555	415396.475	0.702
FO-13	4068198.754	397579.131	2.607
FO-14	4067550.12	376314.026	4.690
FO-15	4060962.236	395885.204	2.266
FO-16	4055125.178	410438.562	0.44
FO-17	4056004.221	380058.909	4.986
FO-18	4049656.47	396892.944	2.857
FO-19	4045705.789	403974.708	1.817
FO-20	4046751.378	391556.197	3.545
GRASS,WEEDS,and CROPS			
GWC-1	4134125.481	344779.064	35.965
GWC-2	4118838.763	360405.124	13.727
GWC-3	4119343.897	373059.394	1.28
GWC-4	4109732.524	381475.24	0.319
GWC-5	4107208.362	376178.523	2.294
GWC-6	4096625.795	376137.546	4.989
GWC-7	4114829.507	365940.986	17.938
GWC-8	4082613.859	393786.442	6.043
GWC-9	4084165.948	404973.792	4.738

GWC-10	4078316.06	393746.948	1.982
GWC-11	4072545.385	375676.882	4.983
GWC-12	4073011.615	409067.175	5.377
GWC-13	4067042.59	403954.911	4.174
GWC-14	4066255.187	377981.16	3.71
GWC-15	4061512.702	392212.252	6.443
GWC-16	4055382.316	402351.116	2.44
GWC-17	4056359.548	386220.44	5.163
GWC-18	4049194.933	386712.905	3.966
GWC-19	4046257.13	409971.276	2.111
GWC-20	4046741.634	376541.932	4.16
OPEN			
OT-1	4133416.989	348684.803	25.196
OT-2	4120908.932	365374.175	19.117
OT-3	4113702.121	360651.125	10.775
OT-4	4105404.702	385773.144	1.138
OT-5	4107753.528	365920.254	9.605
OT-6	4101773.558	371637.824	6.304
OT-7	4097123.061	382129.104	2.298
OT-8	4086525.625	383472.444	3.377
OT-9	4078298.891	404011.498	4.043
OT-10	4078657.569	387312	2.843
OT-11	4072616.492	387581.48	5.668
OT-12	4066448.202	409482.049	2.486
OT-13	4067562.414	381818.542	2.601
OT-14	4061599.984	378660.721	4.475
OT-15	4060963.643	409784.125	1.461
OT-16	4055461.44	397899.773	3.726
OT-17	4051531.896	376373.966	5.115
OT-18	4049989.779	385337.991	4.057
OT-19	4045755.088	399629.718	2.501
OT-20	4046832.726	389710.031	3.427
URBAN			
UT-1	4130867.113	350036.421	21.875
UT-2	4122275.214	366296.536	1.73
UT-3	4112855.286	365989.516	16.203
UT-4	4110977.445	360182.785	9.528
UT-5	4107289.791	371528.47	8.849
UT-6	4102065.181	365947.433	9.063
UT-7	4094026.888	375440.462	1.167
UT-8	4046143.784	386772.856	5.124

UT-9	4046143.784	386772.856	5.124
UT-10	4046143.784	386772.856	5.124
UT-11	4046143.784	386772.856	5.124
UT-12	4046143.784	386772.856	5.124
UT-13	4046143.784	386772.856	5.124
UT-14	4046143.784	386772.856	5.124
UT-15	4046143.784	386772.856	5.124
UT-16	4046143.784	386772.856	5.124
UT-17	4046143.784	386772.856	5.124
UT-18	4046143.784	386772.856	5.124
UT-19	4046143.784	386772.856	5.124
UT-20	4046143.784	386772.856	5.124

4. GPS OBSERVATIONS

NORFOLK, VA LiDAR 2013						
POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY	RE-OBSERV. DATE	RE-OBSERV. TIME	
BRUSHLANDS AND LOW TREES						
BLT-1	5/6/2013	239	8:13	N/A	N/A	
BLT-2	5/5/2013	240	12:15	N/A	N/A	
BLT-3	5/5/2013	240	10:14	N/A	N/A	
BLT-4	5/5/2013	240	8:58	N/A	N/A	
BLT-5	5/4/2013	241	13:42	N/A	N/A	
BLT-6	5/4/2013	241	11:22	N/A	N/A	
BLT-7	5/4/2013	241	7:22	N/A	N/A	
BLT-8	5/2/2013	243	14:53	N/A	N/A	
BLT-9	5/3/2013	242	12:29	N/A	N/A	
BLT-10	5/2/2013	243	15:28	N/A	N/A	
BLT-11	5/2/2013	243	10:52	N/A	N/A	
BLT-12	5/2/2013	243	19:30	N/A	N/A	
BLT-13	5/1/2013	244	12:52	N/A	N/A	
BLT-14	5/1/2013	244	16:45	5/22/2013	12:03	
BLT-15	5/1/2013	244	11:15	N/A	N/A	

BLT-16	4/30/2013	245	17:18	N/A	N/A
BLT-17	4/29/2013	246	12:18	N/A	N/A
BLT-18	4/29/2013	246	15:32	N/A	N/A
BLT-19	4/30/2013	245	12:07	N/A	N/A
BLT-20	4/29/2013	246	15:07	N/A	N/A
FORESTED					
FO-1	5/6/2013	239	9:35	N/A	N/A
FO-2	5/5/2013	240	13:43	N/A	N/A
FO-3	5/5/2013	240	11:00	N/A	N/A
FO-4	5/5/2013	240	9:26	N/A	N/A
FO-5	5/4/2013	241	14:05	N/A	N/A
FO-6	5/4/2013	241	9:54	N/A	N/A
FO-7	5/4/2013	241	11:55	N/A	N/A
FO-8	5/3/2013	242	15:08	N/A	N/A
FO-9	5/3/2013	242	14:19	N/A	N/A
FO-10	5/2/2013	243	13:16	N/A	N/A
FO-11	5/2/2013	243	12:32	N/A	N/A
FO-12	4/30/2013	245	16:14	N/A	N/A
FO-13	5/1/2013	244	12:01	N/A	N/A
FO-14	5/1/2013	244	15:28	N/A	N/A
FO-15	5/1/2013	244	9:57	N/A	N/A
FO-16	4/30/2013	245	12:36	N/A	N/A
FO-17	4/29/2013	246	17:47	N/A	N/A
FO-18	4/30/2013	245	7:23	N/A	N/A
FO-19	4/30/2013	245	9:41	N/A	N/A
FO-20	4/29/2013	246	14:25	N/A	N/A
GRASS, WEEDS, and CROPS					
GWC-1	5/6/2013	239	9:08	5/6/2013	10:42
GWC-2	5/5/2013	240	14:38	5/22/2013	17:15
GWC-3	5/5/2013	240	10:34	5/5/2013	17:53
GWC-4	5/5/2013	240	8:27	N/A	N/A
GWC-5	5/4/2013	241	15:31	N/A	N/A
GWC-6	5/4/2013	241	8:49	N/A	N/A
GWC-7	5/5/2013	240	16:04	5/22/2013	16:50
GWC-8	5/2/2013	243	18:02	5/3/2013	10:24
GWC-9	5/3/2013	242	13:09	5/22/2013	7:30
GWC-10	5/2/2013	243	18:26	N/A	N/A
GWC-11	5/2/2013	243	12:01	5/3/2013	7:52
GWC-12	5/3/2013	242	11:24	5/3/2013	17:04
GWC-13	5/1/2013	244	11:39	5/22/2013	8:36

GWC-14	5/1/2013	244	15:08	5/22/2013	12:40
GWC-15	5/1/2301	244	19:21	N/A	N/A
GWC-16	4/30/2013	245	10:51	N/A	N/A
GWC-17	4/29/2013	246	16:10	5/22/2013	11:31
GWC-18	4/29/2013	246	12:52	N/A	N/A
GWC-19	4/30/2013	245	11:25	N/A	N/A
GWC-20	4/29/2013	246	11:52	4/29/2013	17:20
OPEN					
OT-1	5/6/2013	239	10:31	5/22/2013	17:40
OT-2	5/5/2013	240	13:15	5/5/2013	17:24
OT-3	5/5/2013	240	14:58	5/22/2013	16:22
OT-4	5/4/2013	241	10:50	5/4/2013	17:48
OT-5	5/4/2013	241	14:44	5/22/2013	15:10
OT-6	5/4/2013	241	12:39	5/4/2013	16:46
OT-7	5/4/2013	241	9:37	5/4/2013	18:07
OT-8	5/2/2013	243	16:57	5/3/2013	9:59
OT-9	5/3/2013	242	14:01	5/22/2013	7:58
OT-10	5/2/2013	243	16:16	5/3/2013	9:27
OT-11	5/2/2013	243	11:16	5/3/2013	9:07
OT-12	4/30/2013	245	15:52	5/22/2013	9:02
OT-13	5/1/2013	244	14:44	5/2/2013	8:51
OT-14	5/1/2013	244	16:18	5/22/2013	12:23
OT-15	4/30/2013	245	15:36	5/1/2031	8:05
OT-16	4/30/2013	245	18:49	5/1/2013	9:28
OT-17	4/29/2013	246	11:25	4/29/2013	17:30
OT-18	4/29/2013	246	12:35	4/29/2013	17:03
OT-19	4/30/2013	245	8:53	N/A	N/A
OT-20	4/29/2013	246	14:04	5/22/2013	10:49
URBAN					
UT-1	5/6/2013	239	8:38	N/A	N/A
UT-2	5/5/2013	240	11:45	5/5/2013	17:34
UT-3	5/5/2013	240	15:43	5/6/2013	11:41
UT-4	5/5/2013	240	15:23	5/22/2013	15:48
UT-5	5/4/2013	241	15:08	5/6/2013	12:53
UT-6	5/4/2013	241	13:15	5/22/2013	14:35
UT-7	5/4/2013	241	8:04	5/4/2013	17:15
UT-8	5/2/2013	243	17:24	5/3/2013	9:43
UT-9	5/3/2013	242	11:51	5/3/2013	16:45
UT-10	5/2/2013	243	14:14	5/3/2013	8:18
UT-11	5/2/2013	243	11:38	5/3/2013	8:43
UT-12	5/2/2013	243	19:02	5/3/2013	10:54

UT-13	5/1/2013	244	14:18	5/2/2013	8:26
UT-14	5/1/2013	244	13:46	5/2/2013	9:11
UT-15	4/30/2013	245	17:01	5/22/2013	9:27
UT-16	4/30/2013	245	13:26	5/1/2013	8:27
UT-17	4/29/2013	246	15:47	5/6/2013	16:30
UT-18	4/30/2013	245	9:25	5/1/2013	7:10
UT-19	4/30/2013	245	11:43	5/1/2013	8:46
UT-20	4/29/2013	246	13:40	4/29/2013	13:45

5. POINT COMPARISON

LiDAR QA				
PT ID	CHK PT	DELTA N	DELTA E	DELTA EL
BLT-14	BLT-14CHK3	0.007	-0.002	0.022
GWC-1	GWC-1CHK	-0.036	-0.023	-0.034
GWC-2	GWC-2CHK2	-0.018	0.021	-0.029
GWC-3	GWC-3CHK	-0.013	-0.007	0.051
GWC-7	GWC-7CHK2	-0.008	-0.031	0.002
GWC-8	GWC-8CHK	0.02	0.018	-0.001
GWC-9	GWC-9CHK2	-0.024	0.005	0.016
GWC-11	GWC-11CHK	-0.023	0.022	0.004
GWC-12	GWC-12CHK	0.001	-0.016	0.002
GWC-13	GWC-13CHK	0.012	-0.028	-0.026
GWC-14	GWC-14CHK2	-0.009	0.006	0.012
GWC-17	GWC-17CHK2	0.021	-0.024	0.016
GWC-20	GWC-20CHK	0	0.002	-0.008
OT-1	OT-1CHK2	-0.008	-0.015	0.017
OT-2	OT-2CHK	0.003	0.002	-0.012
OT-3	OT-3CHK2	-0.022	0.003	-0.045
OT-4	OT-4CHK	-0.019	0.009	-0.004
OT-5	OT-5CHK2	-0.014	-0.011	-0.043
OT-6	OT-6CHK	0.007	0.004	0.002
OT-7	OT-7CHK	-0.042	0.016	0.07
OT-8	OT-8CHK	-0.001	0.011	-0.008

OT-9	OT-9CHK2	-0.008	0.006	-0.007
OT-10	OT-10CHK	-0.002	0.001	-0.015
OT-11	OT-11CHK	-0.002	0.018	-0.011
OT-12	OT-12CHK2	-0.018	0.007	0.006
OT-13	OT-13CHK	-0.012	0.014	-0.007
OT-14	OT-14CHK2	0.002	0.026	0.025
OT-15	OT-15CHK	0.005	0.007	0.007
OT-16	OT-16CHK	-0.009	-0.007	0.072
OT-17	OT-17CHK	0.003	-0.012	0.009
OT-18	OT-18CHK	-0.01	-0.008	-0.01
OT-19	OT-19CHK	-0.012	0.003	-0.008
OT-20	OT-20CHK	0	-0.002	0.041
UT-2	UT-2CHK	-0.003	0.005	-0.019
UT-3	UT-3CHK2	-0.007	-0.011	-0.01
UT-4	UT-4CHK2	-0.018	-0.034	-0.047
UT-5	UT-5CHK2	-0.007	-0.012	-0.033
UT-6	UT-6CHK2	0.011	0.012	-0.046
UT-7	UT-7CHK	-0.015	-0.008	0.019
UT-8	UT-8CHK	0.003	-0.004	0.005
UT-9	UT-9CHK	-0.012	-0.004	0.011
UT-10	UT-10CHK	0.007	0	-0.021
UT-11	UT-11CHK	0.001	0.023	0.012
UT-12	UT-12CHK	0.013	-0.023	0.031
UT-13	UT-13CHK	-0.012	0.007	0.001
UT-14	UT-14CHK	-0.015	-0.002	0.027
UT-15	UT-15CHK2	0.01	0.007	-0.011
UT-16	UT-16CHK	-0.003	0.01	0.019
UT-17	UT-17CHK2	-0.038	0.006	-0.004
UT-18	UT-18CHK	0.007	0.009	-0.016
UT-19	UT-19CHK	0.009	0.02	0.03
UT-20	UT-20CHK	-0.004	0.007	-0.003