

Frog Mortar Creek Multibeam Bathymetric Survey Effort November 2013

Technical Memorandum



December 11, 2013

Prepared by:



TETRA TECH

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Bothell, WA 98011**

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Acronyms and Abbreviations

CTD	conductivity, temperature, depth
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
IMU	inertial measurement unit
INS	inertial navigation system
MBE	multibeam echosounder
MRU	motion reference unit
MSRN	Michigan State Reference Network
NAD83	North American Datum 1983
NAVD88	North American Vertical Datum 1988
QC	quality control
R/V	Research Vessel
RTK	real-time kinematic
USACE	United States Army Corps of Engineers
VCF	Vessel Configuration File

1.0 Overview

Tetra Tech conducted a high-resolution multibeam bathymetric survey for Lockheed Martin in Middle River, Maryland, from November 4-6, 2013. Table 1-1 lists the personnel and their roles in the survey. The survey area was divided into three priority sections, the North being the least, the South being the second and the main or highest priority being the middle of the survey area. The main survey area was collected to near full-bottom coverage; whereas, the other lower priority areas were collected in a “skunk striping” fashion. The lower priority areas were collected with the intent of interpolating data to create a general overview of the existing condition. Due to water levels and tidal influence, it was determined that collected multibeam only would derive the desired product. The primary survey equipment consisted of a multibeam echosounder (MBE) sonar system and associated vessel position and attitude measurement equipment. This system was used to map site bathymetry in the area shown in Frog Mortar Creek, Middle River, MD (Figure 1-1) in support of design and engineering of a proposed outfall.

Table 1-1. Survey Team

Name	Project Role
Robert Feldpausch	Project Manager / Principal Hydrographer
Kyle Enright	Project Field Lead / Hydrographer
Onthonio Whyte	Survey Vessel Captain

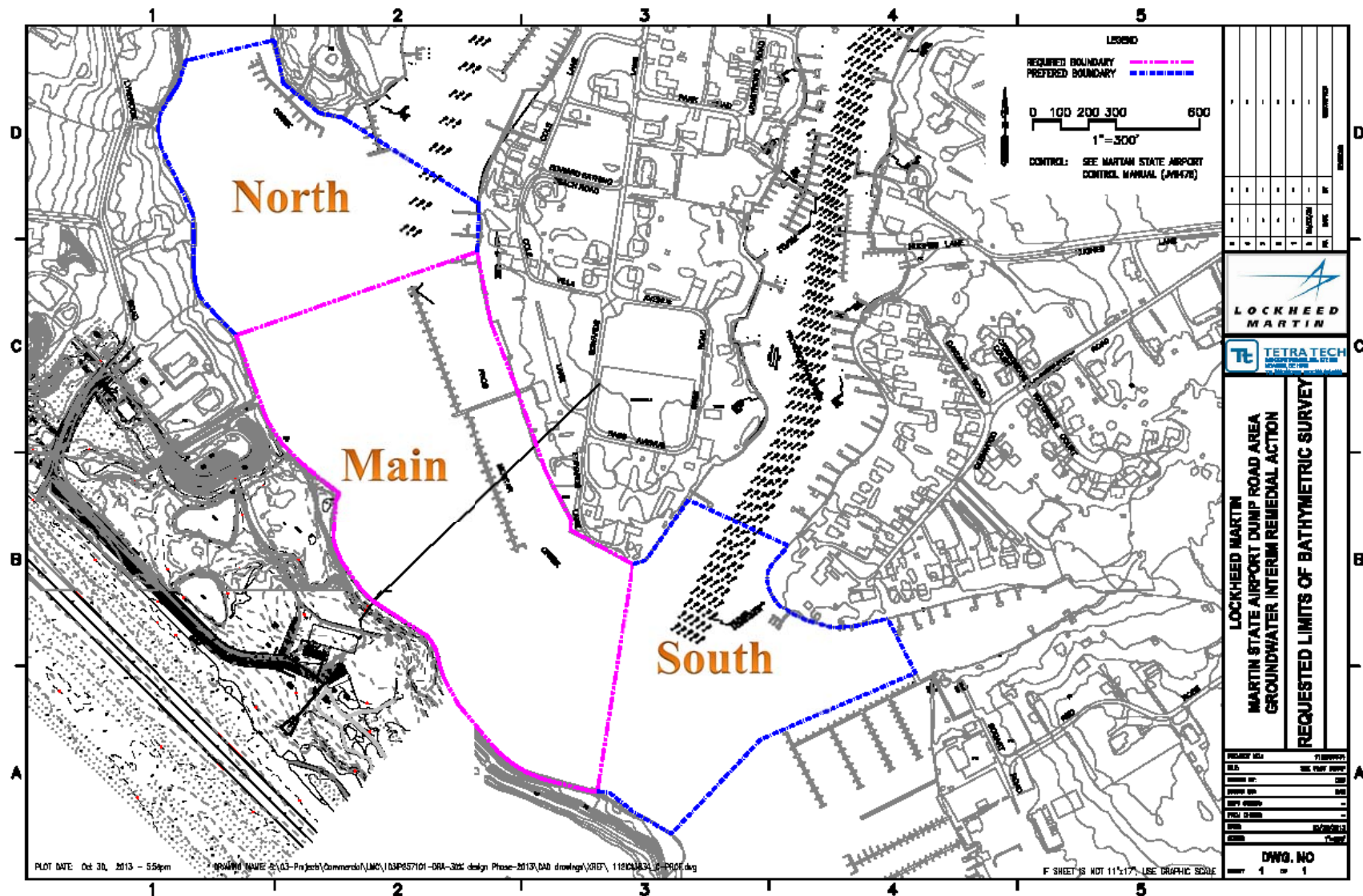


Figure 1-1. Frog Mortar Creek with the main Project Survey Area encompassed by the purple line; lower priority areas encompassed by the blue lines

2.0 System Setup

Tetra Tech configured their 18-foot jet boat (the Research Vessel [R/V] MIJITT) with a single-head MBE system (see Figure 2-1). The use of the flat bottom jet boat allowed Tetra Tech access to shallower water than other larger survey vessels.



Figure 2-1. RESON SeaBat 7125 Multibeam Survey Vessel – R/V MIJITT

The equipment used for the survey is shown in Table 2-1. Data collection and navigation software for the bathymetry survey was HYPACK[®]/HYSWEEP[®] v. 2013.

Table 2-1. Survey Equipment

Sensor Type	Manufacturer and Model
Multibeam Sonar	Reson SeaBat 7125
Motion Reference Unit (MRU)	IXSEA PHINS 6000
Heading	Trimble Ag DGPS
Elevation	Leica 1230 RTK GPS
Position	Leica 1230 RTK GPS
Sound Speed Profilers	Seabird MicroCat SBE-37 and YSI CastAway CTD

2.1 Vessel Offsets

The inertial navigation system (INS), IXSEA PHINS 6000, was used to define the origin and orientation of the X, Y, and Z axes of the vessel's local reference frame. Table 2-2 shows the offsets, measured in feet, that were used for the HYPACK and HYSWEEP hardware setup. These measurements were also utilized in the CARIS Hydrographic Information Processing System v7.1 (HIPS) Vessel Configuration File (VCF) for multibeam data processing. Offsets were derived from hand measurement by onsite Tetra Tech personnel.

Table 2-2. R/V MIJITT Sensor Offsets (in feet)

Sensor	Across (Starboard Positive)	Along (Forward Positive)	Vertical (Down Positive)
SeaBat 7125	0.00	3.80	4.14
Motion Sensor (IXSEA PHINS 6000)	0.00	0.00	0.00
Navigation (Trimble Ag DGPS)	-1.64	3.15	-3.13
GPS Tide (Leica RTK antenna)	0.00	3.15	-3.13

2.2 Geodesy Settings

Horizontal (X, Y) positioning data for the project were collected in North American Datum 1983 (NAD83) Maryland State Plane. Elevation data were collected in North American Vertical Datum 1988 (NAVD88) geoid model 2012a. Table 2-3 presents the geodesy settings used for the project.

Table 2-3. Survey Geodesy Settings

Parameter	Setting
Projection	State Plane
Zone	Maryland Zone 1900
Horizontal Datum	NAD-83
Vertical Datum	NAVD-88
Distance Unit	U.S. Survey feet
Depth Unit	U.S. Survey feet
Geoid Model	2012a

2.3 GPS Control and Validation

Vertical and horizontal positioning was achieved using high-accuracy Global Positioning System (GPS) systems with real-time kinematic (RTK) corrections. RTK corrections were transmitted via a base station GPS unit from a known control monument. A Leica 1230 GPS, identical to the system utilized on the R/V MIJITT, was used to verify the functionality and accuracy of the RTK GPS positioning. Each survey day a control point, which was established by JMT Engineering in 2005 (refer to Appendix B for monument data sheets), was occupied and the positional data were logged. Table 2-4 presents the results of a Leica point to point comparison at the time of point occupation. Martin State Airport control point MTN-2 was used as the QC point against the base station setup on MTN-1.

Table 2-4. Positioning QC Results (all units are shown in feet)

Date	PID	Observed			Delta		
		Easting	Northing	Elevation	Easting	Northing	Elevation
	<i>MTN-2</i>	<i>1,478,306.206</i>	<i>602,624.373</i>	<i>10.330</i>			
11/4/2013	131104QC1	1,478,306.227	602,624.303	10.262	-0.021	0.070	0.068
11/5/2013	131105QC1	1,478,306.192	602,624.363	10.370	0.014	0.010	-0.040
11/6/2013	131105QC1	1,478,306.202	602,624.370	10.410	0.004	0.003	-0.080

3.0 Survey Procedures

Surveys were conducted to document the elevation of bottom sediments in Frog Mortar Creek. A RESON SeaBat 7125 multibeam sonar was used to provide the highest possible resolution.

The support sensors used to measure vessel attitude (roll, pitch, and heave), position, heading, and sound speed through the water column were selected to ensure that the associated accuracies were commensurate with the accuracy and resolution of the sonar.

RTK GPS was used for height (Z), as well as position (X and Y), to compensate for changes in water surface elevation, vessel squat and settlement, and varying draft caused by vessel loading. Use of RTK GPS for height is typically known as “RTK tides.” With RTK tides, any changes in the elevation of the water surface are recorded and compensated for in real time and in the post-processed sounding data.

3.1 Multibeam Calibration — Patch Test Results

A standard patch test, also known as an installation calibration test, was carried out to calculate the angular offset between the multibeam echosounder and the motion reference unit (MRU). The installation calibration process is used to derive the roll, pitch, and yaw angular offsets between the multibeam sonar and the local reference frame defined by the MRU’s IMU. The installation calibration test is also used to determine latency in the positioning equipment. The sonar and acquisition computer are time-synchronized by the MRU’s GPS; as a result, no latency was detected between sensors (see Table 3-1).

Table 3-1. Multibeam Patch Test Results

Vessel	Sonar Head	Latency	Roll	Pitch	Yaw	Dates Valid
R/V MIJITT	1	0.00	-0.36	-7.09	6.00	11/4-11/6

3.2 Daily Quality Control Procedures

On each day, two types of QC procedures were performed: a bar check to confirm the sonar’s ability to record accurate depth measurements, and a water level check to verify accurate vertical referencing of the data. Tables 3-2 and 3-3 present the results of these QC procedures.

Table 3-2. Water Level QC Results

Daily Water Level Check								
R/V MIJITT MBE								
Project Avg.	0.020							
Project Stdv	0.179							
Project Min	-0.156							
Project Max	0.203							
Date	Time	Unit	Leica Rover Waterline Ht.(w/geoid)	- HYPACK Tide corr	INS Draft	Corr. Tide (No Pitch)	Diff (no pitch)	ABS(Diff)
11/4/2013*	n/a	Leica**	-104.15	-104.14	0.00	-104.14	0.01	0.01
11/5/2013	10:08	Leica	0.10	2.21	2.26	-0.05	-0.16	0.16
11/6/2013	8:21	Leica	0.90	3.30	2.20	1.10	0.20	0.20
*data collected in ellipsoidal height on 11/4/13								
**occupation from boat Lieca rather than through hypack								

Table 3-3. Bar Check QC Results (all units are in feet)

Daily Bar Check									
R/V MIJITT MBE									
Note: Hysweep bar check results are stored within each hypack project as "Barcheck.txt"									
Project Avg.	0.12								
Project Stdv.	0.09								
Project Min	0.02								
Project Max	0.20								
Date	time'	Bar Depth (ft)	Meas. Depth (ft)*	Meas. Depth (ft)**	Sonar Draft (ft)	Pitch Corr.	Corr. Depth	Diff.	ABS(Diff.)
11/04/13	11:15	5.00	3.58		1.44	0.00	5.02	0.02	0.02
11/05/13	11:14	5.00		8.99	4.14	0.00	4.85	-0.15	0.15
11/06/13	11:38	5.00	3.62		1.18	0.00	4.80	-0.20	0.20
*QC measured from Sonar Control Screen (depth measured under sonar head)									
**QC measured from Hysweep window (depth measured to INS)									

3.3 Sound Speed Casts

Changes in sound speed through the water column affect the MBE's individual beams in both the angle and distance calculated from the propagation times. To compensate for these effects, data processing must model the effects as a function of beam launch angle and time. To implement these calculations, sound speed profiles are recorded through the water column using conductivity, temperature, depth (CTD) sensors from which sound speeds versus depths are derived.

Sound speed casts were performed once for each area and patch test.

4.0 Bathymetry Results

Final charts from the multibeam bathymetry survey of Frog Mortar Creek in Middle River, MD are shown in Appendix A.

The main area or highest priority survey area was surveyed to near full bottom coverage where it was applicable along the shoreline with the MBE system alone. Additional data collection with the single-beam sonar was not pursued as bottom topography was subtle in the main body of the river and the shoreline slope was defined in the MBE data. The secondary focus areas were defined by a much more sparse coverage plan to aid in design and maximize survey efficiency. This provided an additional advantage to design as it was not originally scoped as a part of the work plan.

4.1 Bathymetry Repeatability/Accuracy

Accuracy and precision are a function of the positioning and attitude measurements errors, timing errors, water depth, and water sound speed profile.

Figure 4-1 and Table 4-1 present a comparison of surfaces created to the cross-line data.

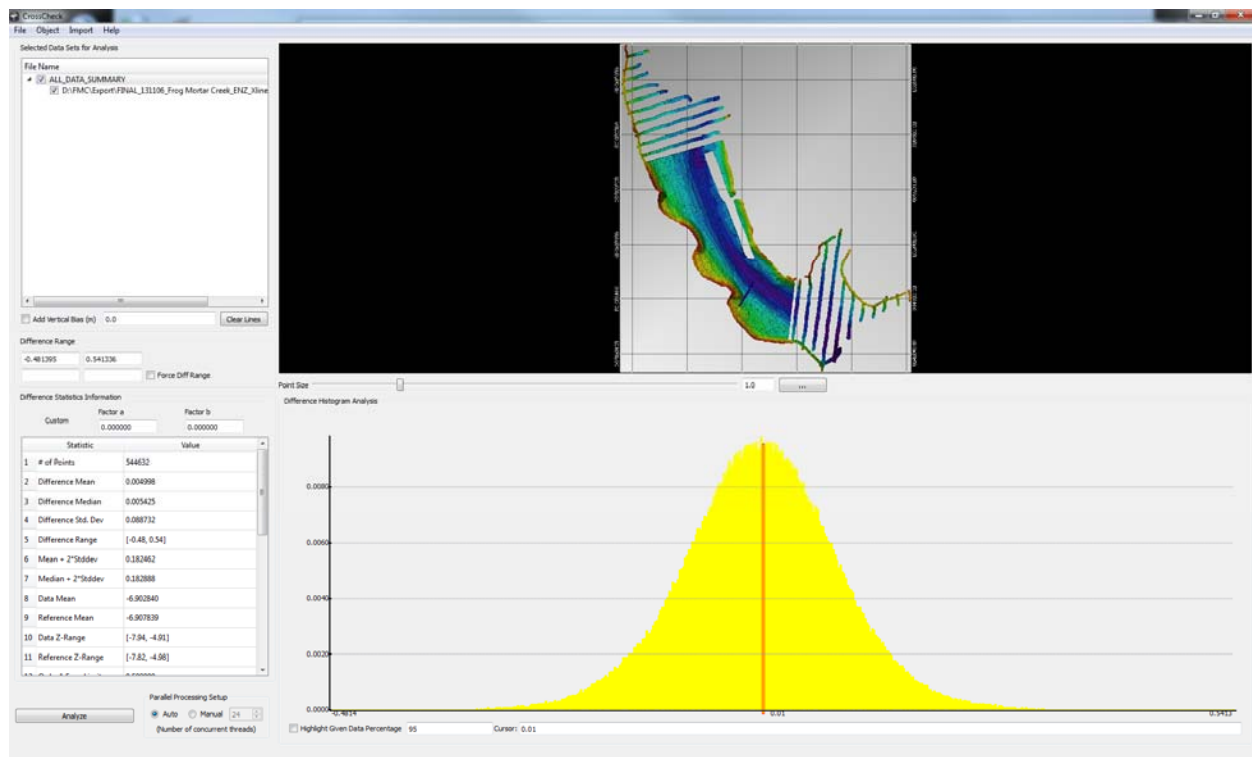


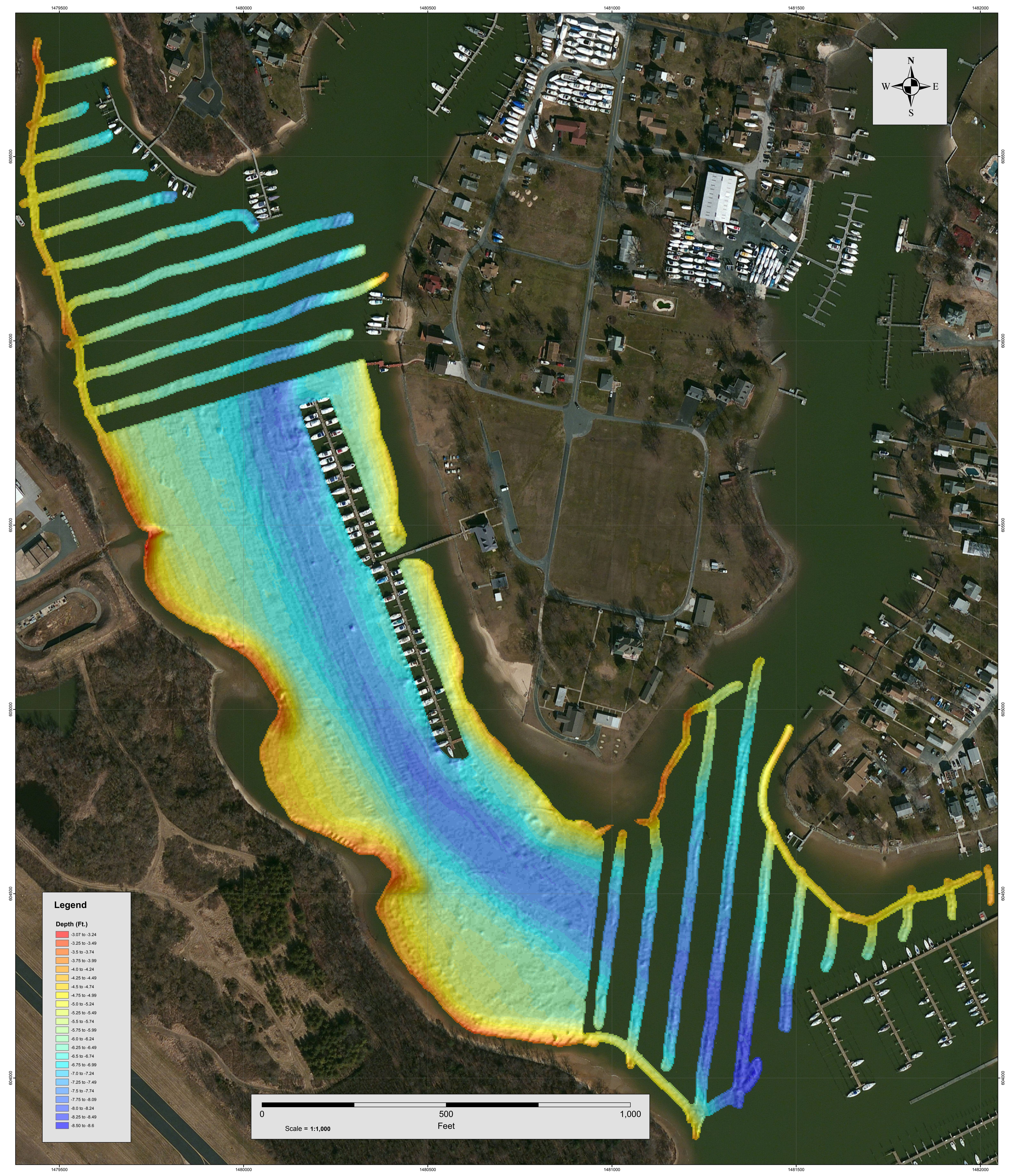
Figure 4-1. Final data set compared to Quality Assurance Cross-Line data (units in feet)


Table 4-1. IVS Cross-Check Analysis Data Printout

Statistics*	Value
544632	# Number of Points of Comparison
-2.103990	# Data Mean
-2.105513	# Reference Mean
0.001523	# Mean
0.001671	# Median
0.027044	# Std. Deviation
-3.910000	# Data Z - Range
-3.900000	# Ref. Z - Range
[-0.15, 0.16]	# Diff Z - Range
0.055610	# Mean + 2*stddev
0.055758	# Median + 2*stddev
0.500749	# Ord 1 Error Limit
1.001172	# Ord 2 Error Limit
0.250498	# Special Order Error Limit
0.000000	# Ord 1 P-Statistic
0.000000	# Ord 2 P-Statistic
0.000000	# Special Order P-Statistic
0	# Ord 1 - # Rejected
0	# Ord 2 - # Rejected
0	# Special Order - # Rejected
1	# Order 1 Survey ACCEPTED
1	# Order 2 Survey ACCEPTED
1	# Special Order Survey ACCEPTED
*Units in feet	

Appendix A

Frog Mortar Creek Bathymetry November 2013



Notes 1. Multibeam bathymetry data collected using Hypack/Hysweep. 2. Multibeam bathymetry processing performed using CARIS HIPS, IVS3D Fledermaus and Tetra Tech developed software. 3. Charts and other data products developed using ArcGIS and IVS3D Fledermaus. 4. Bathymetric surveys conducted November 4-6, 2013. 5. The bathymetric data represents conditions in the river at the time of collection. Bedforms are expected to change over time due to the varying water flows in the river and human influence. 6. Bathymetric surfaces derived using a 1 m CARIS CUBE grid. This gridding method takes into account calculated position and measurement uncertainty values for individual soundings as well as sonar beam footprint. 7. Horizontal and vertical control established by JMT Engineering at Martin State Airport.	Geodetic Settings		Survey Equipment		Frog Mortar Creek, Middle River, Maryland	
	Horizontal Datum	NAD 83	Multibeam Sonar	RESON Seabat 7125	<div>Tetra Tech, Inc. 19803 North Creek Parkway Bothell, WA 98011 www.tetratech.com</div> <div></div>	
	Projection	0700 Maryland State Plane	Positioning Systems	Leica 1230 RTK GPS /IXSEA PHINS 6000		
	Horizontal Units	U.S. Feet	Positioning System	IXSEA PHINS 6000	Principle Investigator:	K. Enright
	Vertical Units	U.S. Feet	Heading Sensor	IXSEA PHINS 6000	Drafted by:	J. MacLachlan
	Vertical Control	MTN-1	Motion Sensor	IXSEA PHINS 6000	Reviewed by:	R. Feldpausch
	Horizontal Control	MTN-1	Dates Surveyed	November 4-6, 2013	Plate 1: Sheet 1 of 1	
	Vertical Datum	NAVD88 g12a				

Appendix B

Control Monument Data Sheets

MARTIN STATE AIRPORT (MTN) - SURVEY CONTROL DATA

NAME OF STATION: MTN-1

DATE ESTABLISHED: August 2005

MARYLAND STATE PLANE COORDINATES (NAD 83):

NORTHING (Y):	601566.5555 US ft.	183357.853 m
EASTING (X):	1479508.9469 US ft.	450955.229 m
ORTHOMETRIC HEIGHT (NAVD 88):	7.66 US ft.	2.335 m
CONVERGENCE ANGLE:	0°22'15.1"	
SCALE FACTOR:	0.99997943	
COMBINED SCALE FACTOR:	0.99998425	

GEOGRAPHIC COORDINATES (NAD 83):

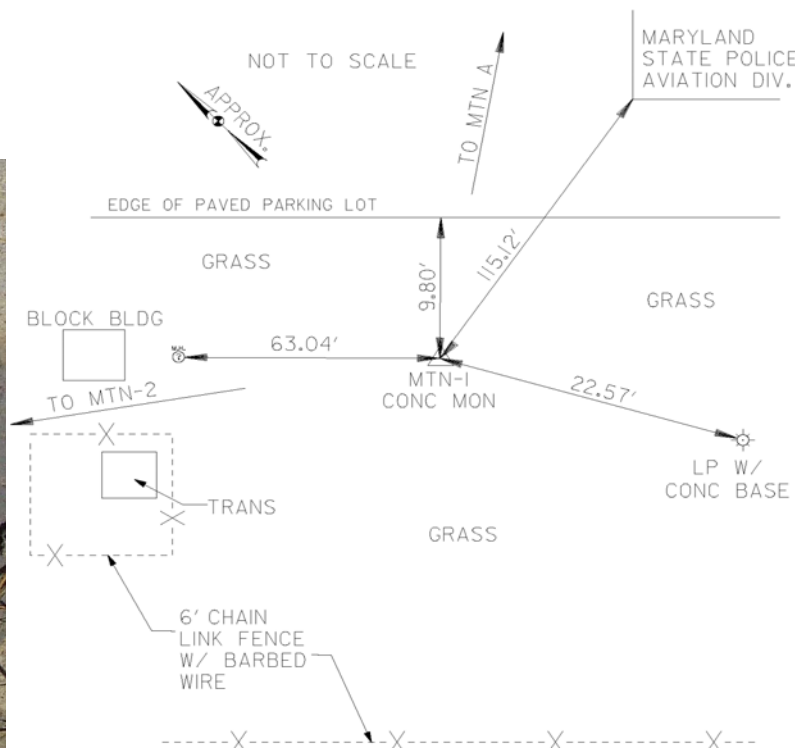
LATITUDE:	39°19'01.04312" (N)
LONGITUDE:	76°24'32.83307" (W)
ELLIPSOID HT:	-100.628 US ft. -30.671 m

AVAILABLE CONVENTIONAL BACKSIGHT POINTS (FIELD DATA):

<u>POINT</u>	<u>AZIMUTH</u>	<u>DISTANCE (US FT.)</u>	<u>DISTANCE (m)</u>
MTN A	51° 15' 50"	1027.33	313.131
MTN-2	311° 19' 55"	1601.77	488.220

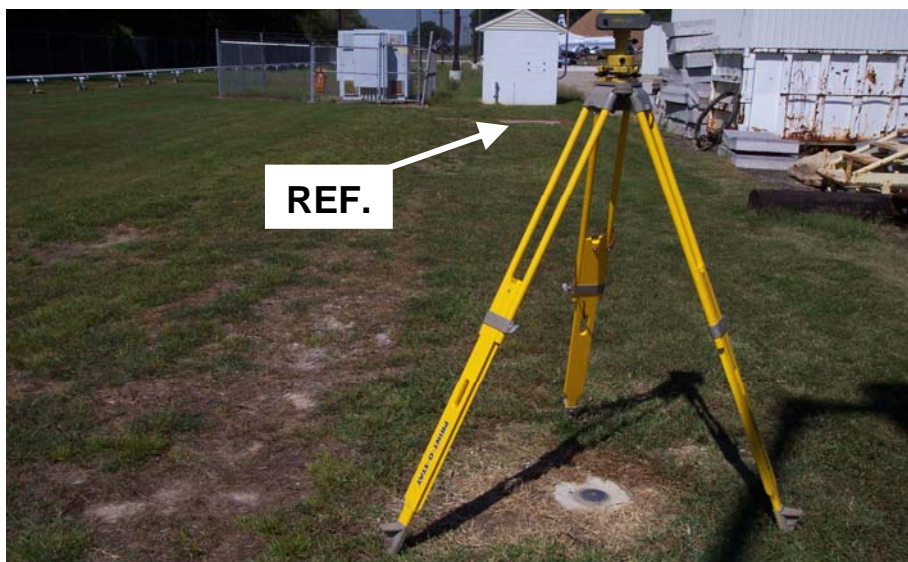
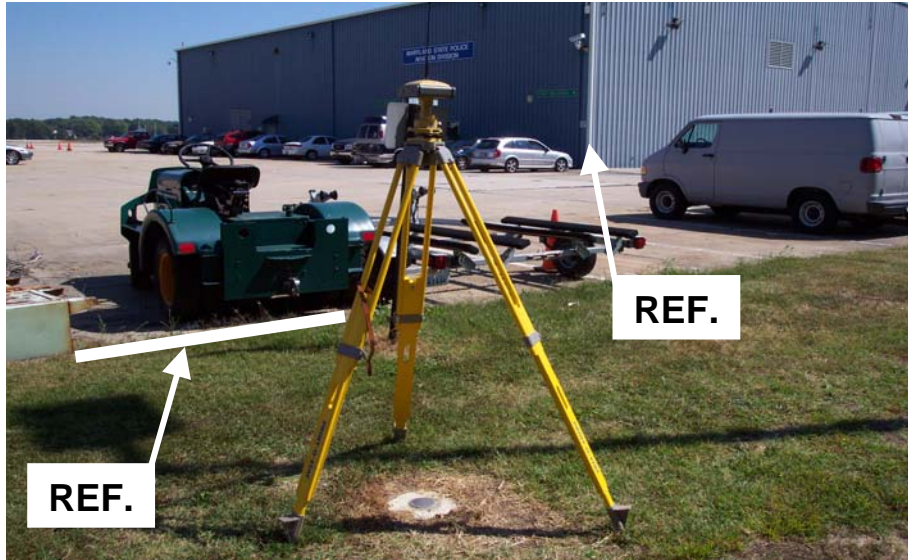
STATION DESCRIPTION:

To reach the monument from the traffic circle at MTN airport in front of the air traffic control tower, proceed S to Airside Access point by Hangars 4-6. After passing through the fence, proceed NE to the second Stop sign. Turn right and proceed SE past private plane hangars. Road will curve to the left, bearing North. At the intersection of T/L B and T/L G, turn right and proceed SE to Yield sign. Continue to Stop sign at Strawberry Point Road. Turn left on Strawberry Point Road. Continue past the entrance road to the maintenance shop and the salt dome. Road will turn to the left (North), passing along the back side of the historic aircraft display. Turn right (east) at the end of the road, continue to turn right, heading South along the front of the historic aircraft display. Monument is SW of the SW corner of the Strawberry Point Complex Maryland State Police hangar. Monument is 9.80' SW of the SW edge of paved parking lot, 63.04' SE of manhole in concrete, 22.57' NE of light pole with concrete base.



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MARTIN STATE AIRPORT (MTN) - SURVEY CONTROL DATA

NAME OF STATION: MTN-2

DATE ESTABLISHED: August 2005

MARYLAND STATE PLANE COORDINATES (NAD 83):

NORTHING (Y):	602624.3733 US ft.	183680.276 m
EASTING (X):	1478306.2055 US ft.	450588.633 m
ORTHOMETRIC HEIGHT (NAVD 88):	10.33 US ft.	3.147 m
CONVERGENCE ANGLE:	0°22'05.5"	
SCALE FACTOR:	0.99997983	
COMBINED SCALE FACTOR:	0.99998451	

GEOGRAPHIC COORDINATES (NAD 83):

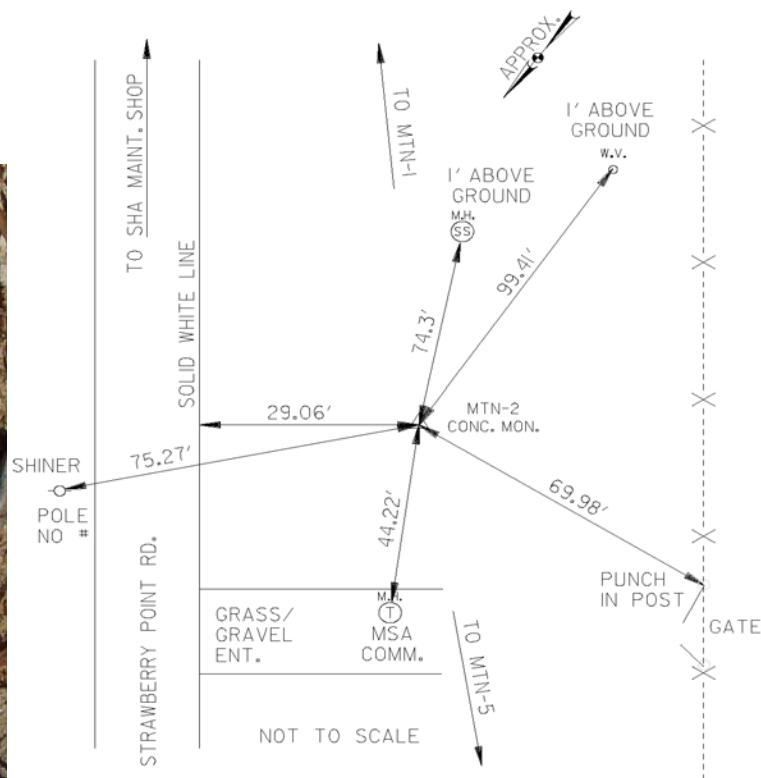
LATITUDE:	39°19'11.57473" (N)	
LONGITUDE:	76°24'48.05001" (W)	
ELLIPSOID HT:	-97.95 US ft.	-29.854 m

AVAILABLE CONVENTIONAL BACKSIGHT POINTS (FIELD DATA):

<u>POINT</u>	<u>AZIMUTH</u>	<u>DISTANCE (US FT.)</u>	<u>DISTANCE (m)</u>
MTN-1	131° 19' 55"	1601.78	488.224
MTN-5	301° 42' 27"	1027.94	313.317

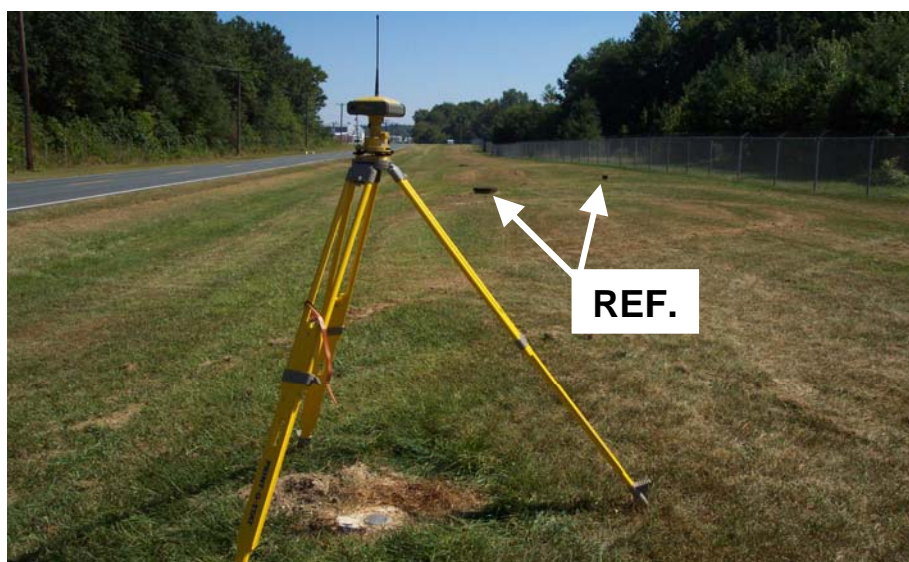
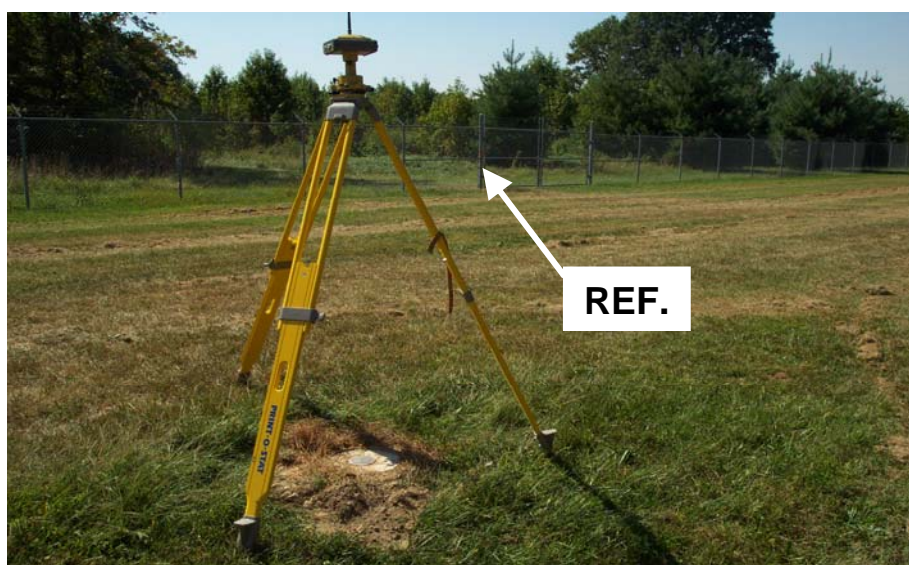
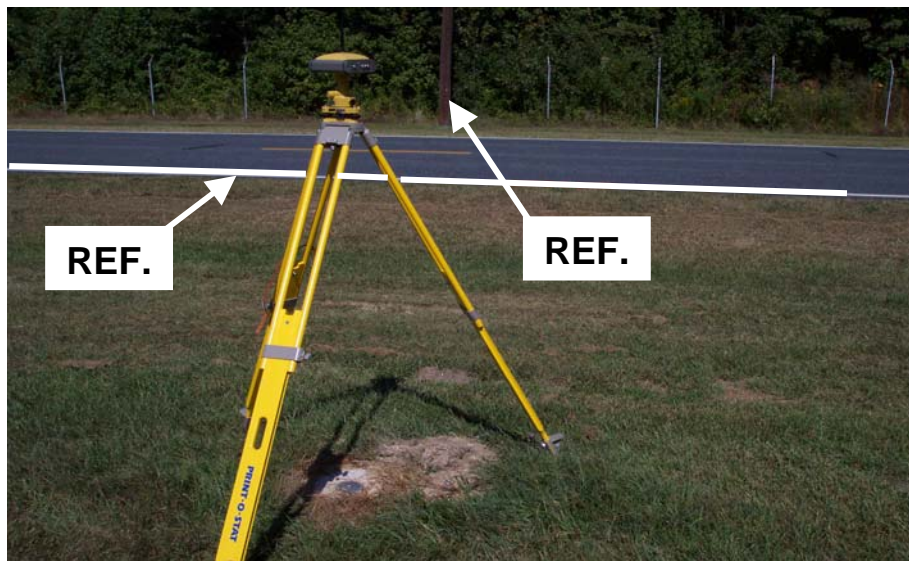
STATION DESCRIPTION:

To reach the monument from the traffic circle at MTN airport in front of the air traffic control tower, proceed S to Airside Access point by Hangars 4-6. After passing through the fence, proceed NE to the second Stop sign. Turn right and proceed SE past private plane hangars. Road will curve to the left, bearing North. At the intersection of T/L B and T/L G, turn right and proceed SE to Yield sign. Continue to Stop sign at Strawberry Point Road. Turn left on Strawberry Point Road. Proceed 1874 feet (0.35 mi.). Continue past the pump house and water tank to a gravel/grass lane and the station on the right. Monument is located 29.06' SW of SW edge of Strawberry Point Road, 74.3' N of Sanitary Sewer manhole 1' above ground, 99.41' N of water valve 1' above ground, 69.98' E of punch mark in southern gate post, 44.22' S of communications manhole in grass/gravel drive, 75.27' SW of nail and shiner in pole with no number.



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MARTIN STATE AIRPORT (MTN) - SURVEY CONTROL DATA

NAME OF STATION: MTN-3

DATE ESTABLISHED: August 2005

MARYLAND STATE PLANE COORDINATES (NAD 83):

NORTHING (Y):	603710.1733 US ft.	184011.229 m
EASTING (X):	1475839.5946 US ft.	449836.808 m
ORTHOMETRIC HEIGHT (NAVD 88):	14.25 US ft.	4.343 m
CONVERGENCE ANGLE:	0°21'45.9"	
SCALE FACTOR:	0.99998024	
COMBINED SCALE FACTOR:	0.99998473	

GEOGRAPHIC COORDINATES (NAD 83):

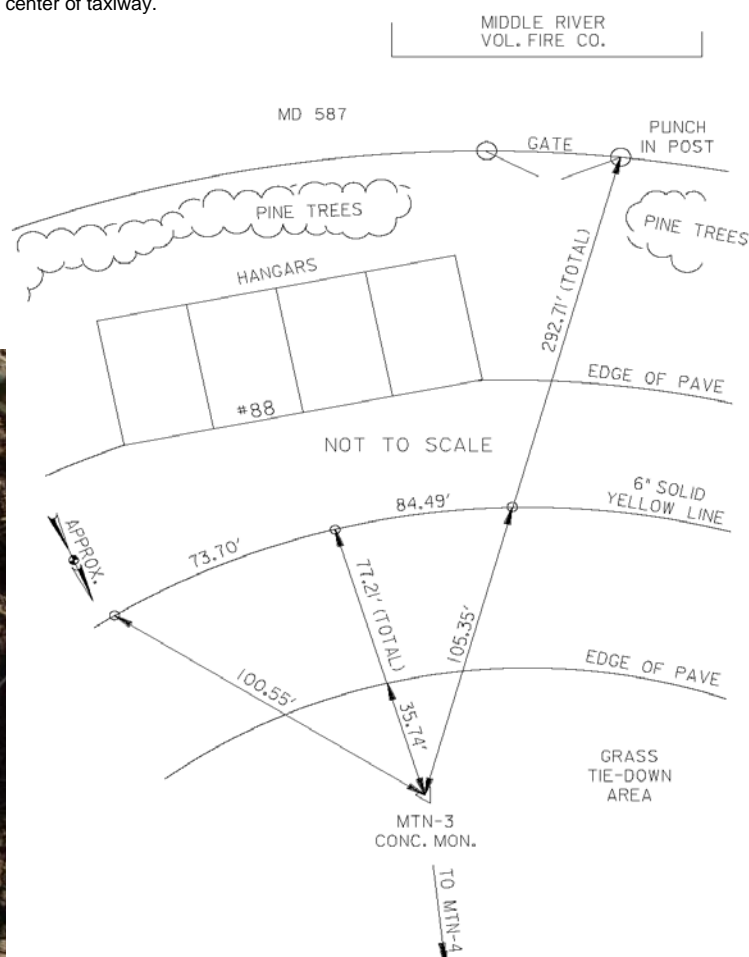
LATITUDE:	39°19'22.46174" (N)	
LONGITUDE:	76°25'19.34850" (W)	
ELLIPSOID HT:	-93.995 US ft.	-28.650 m

AVAILABLE CONVENTIONAL BACKSIGHT POINTS (FIELD DATA):

<u>POINT</u>	<u>AZIMUTH</u>	<u>DISTANCE (US FT.)</u>	<u>DISTANCE (m)</u>
MTN-4	18° 54' 10"	2272.00	692.507

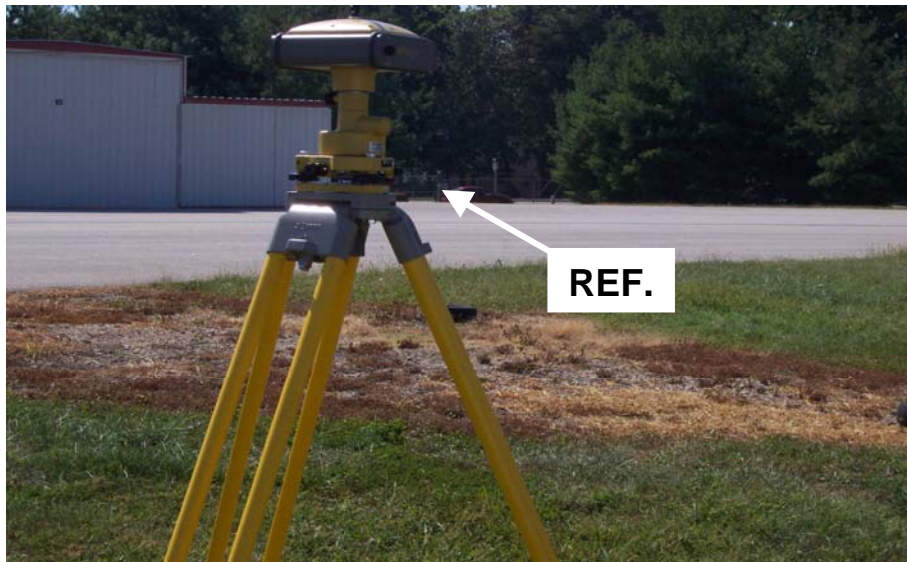
STATION DESCRIPTION:

To reach the monument from the traffic circle at MTN airport in front of the air traffic control tower, proceed S to Airside Access point by Hangars 4-6. After passing through the fence, proceed NE to the second Stop sign. Turn right and proceed SE past private plane hangars. Where the road curves to the left, the station is on the left between aircraft tiedowns. Monument is 292.71' NE of punch mark in western gate post to MD 587, 105.35' NE of MAG Nail on same line, set in solid yellow line at center of taxiway, 77.21' N of MAG Nail set in solid yellow line at center of taxiway in line with Hanger #88, 35.74' N of N edge of taxiway on same line, 100.55' NW of MAG Nail set in solid yellow line at center of taxiway.



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MARTIN STATE AIRPORT (MTN) - SURVEY CONTROL DATA

NAME OF STATION: MTN-4

DATE ESTABLISHED: August 2005

MARYLAND STATE PLANE COORDINATES (NAD 83):

NORTHING (Y):	605859.5918 US ft.	184666.373 m
EASTING (X):	1476575.6200 US ft.	450061.149 m
ORTHOMETRIC HEIGHT (NAVD 88):	16.82 US ft.	5.125 m
CONVERGENCE ANGLE:	0°21'51.9"	
SCALE FACTOR:	0.99998104	
COMBINED SCALE FACTOR:	0.99998542	

GEOGRAPHIC COORDINATES (NAD 83):

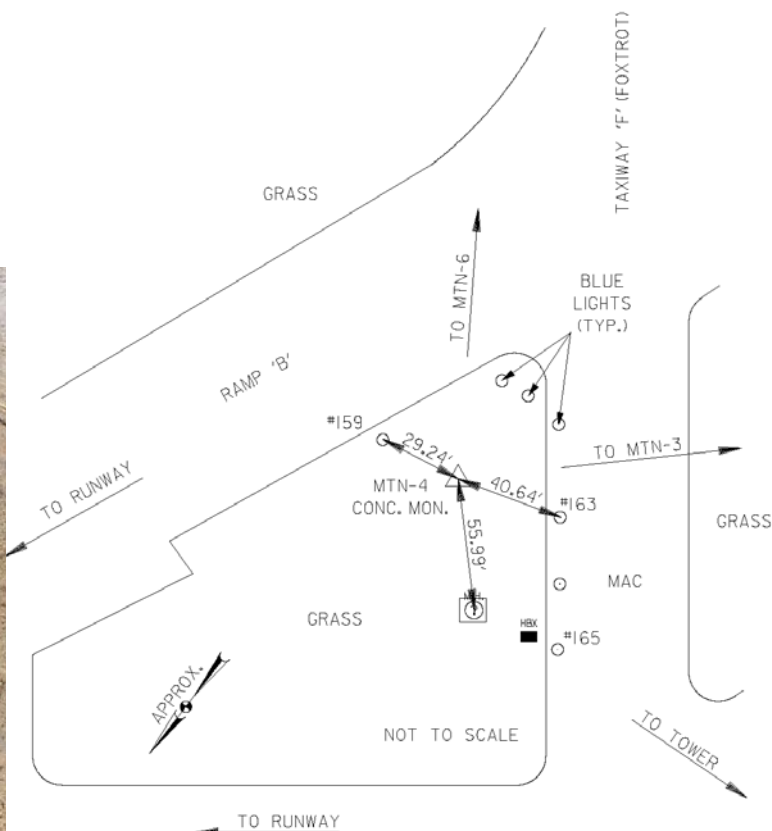
LATITUDE:	39°19'43.65932" (N)
LONGITUDE:	76°25'09.80871" (W)
ELLIPSOID HT:	-91.422 US ft. -27.865 m

AVAILABLE CONVENTIONAL BACKSIGHT POINTS (FIELD DATA):

<u>POINT</u>	<u>AZIMUTH</u>	<u>DISTANCE (US FT.)</u>	<u>DISTANCE (m)</u>
MTN B	318° 58' 21"	1076.78	328.203
MTN-3	198° 54' 10"	2271.98	692.499
MTN-6	139° 31' 29"	2360.13	719.369
MTN A	134° 20' 41"	5222.32	1591.765
MARTAIR AZ MK	302° 12' 00"	2675.15	815.387

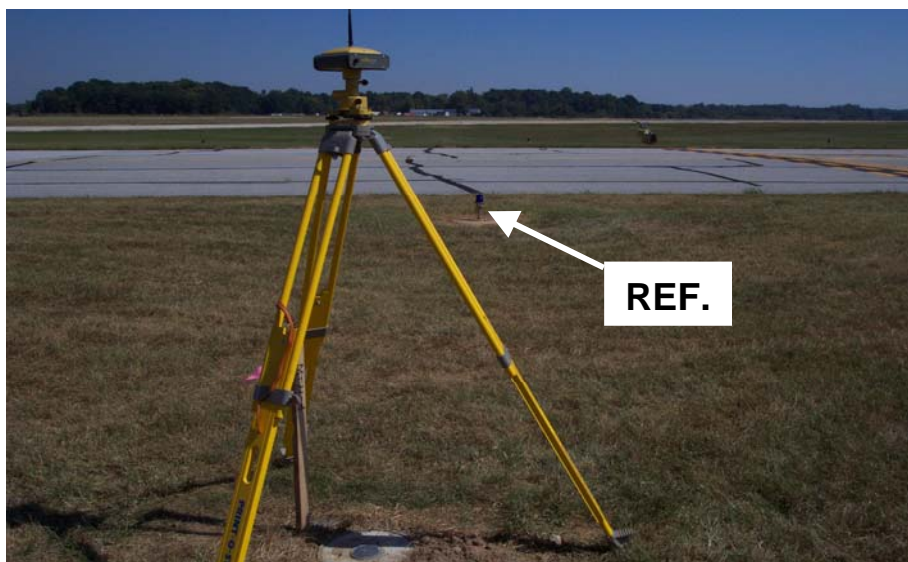
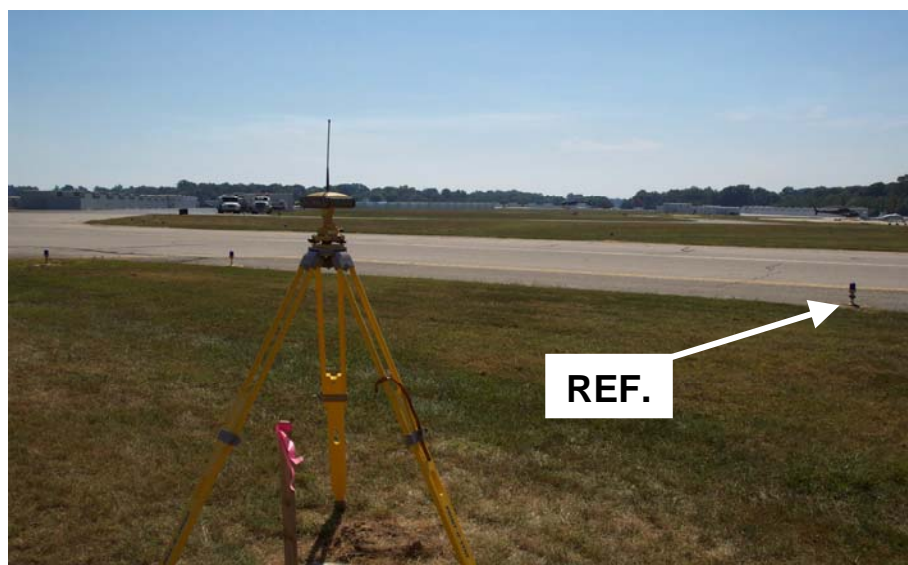
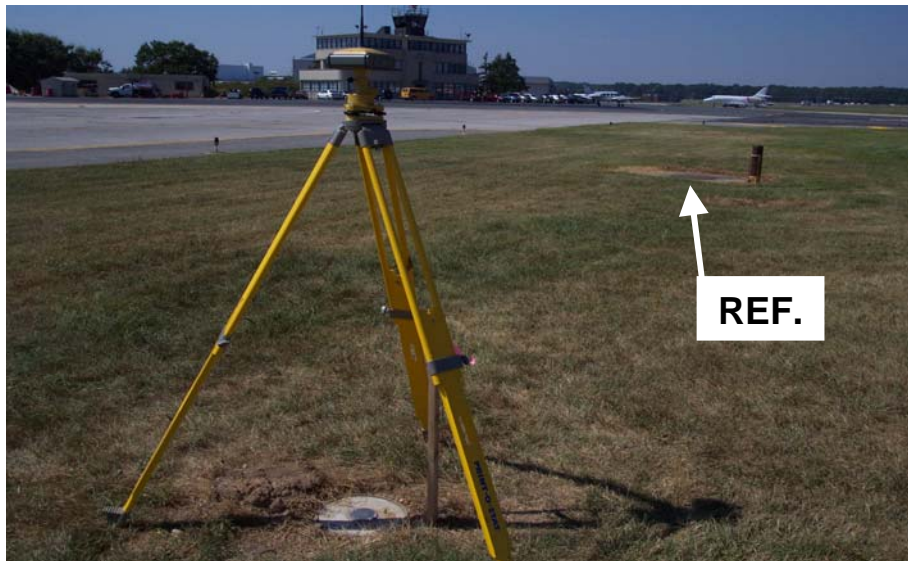
STATION DESCRIPTION:

To reach the monument from the traffic circle at MTN airport in front of the air traffic control tower, proceed S to Airside Access point by Hangars 4-6. After passing through the fence, proceed NE to the second Stop sign. Turn left and pass in front of the helicopter hangar. Proceed to small triangular grass island next to Taxiway B in front of the air-traffic control tower and station on the right. Permission must be granted from Tower Control to cross Taxiway 'F' on foot (must park and walk out to MTN-4). Monument is 29.24' SW of ground light #159, 40.64' NE of ground light #163, and 55.99' from center of manhole in concrete.



SURVEYED BY: JMT ENGINEERING

SPARKS, MARYLAND



MARTIN STATE AIRPORT (MTN) - SURVEY CONTROL DATA

NAME OF STATION: MTN-5

DATE ESTABLISHED: August 2005

MARYLAND STATE PLANE COORDINATES (NAD 83):

NORTHING (Y):	603164.6275 US ft.	183844.946 m
EASTING (X):	1477431.7132 US ft.	450322.087 m
ORTHOMETRIC HEIGHT (NAVD 88):	5.87 US ft.	1.789 m
CONVERGENCE ANGLE:	0°21'58.6"	
SCALE FACTOR:	0.99998003	
COMBINED SCALE FACTOR:	0.99998493	

GEOGRAPHIC COORDINATES (NAD 83):

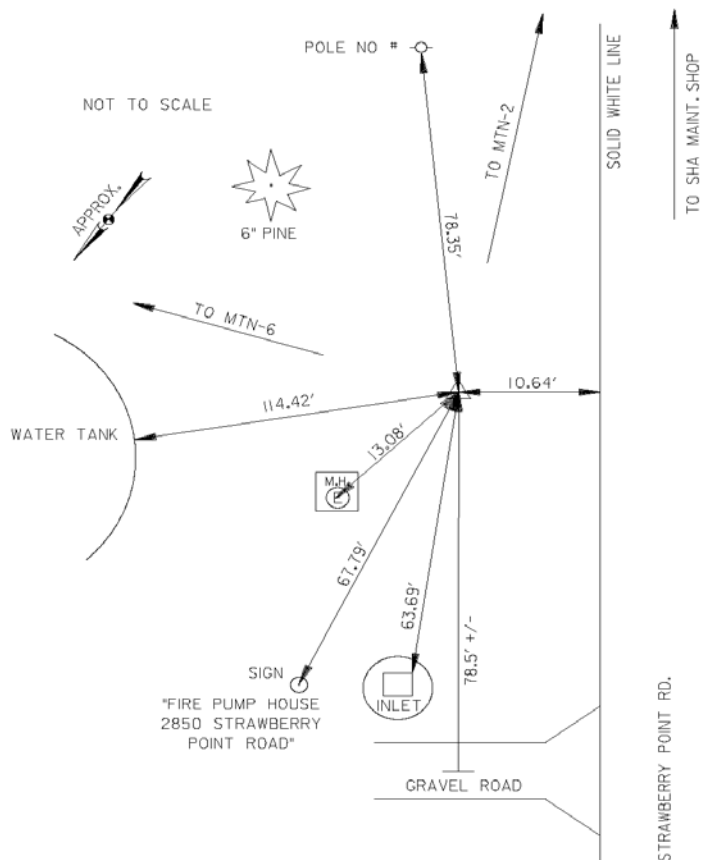
LATITUDE:	39°19'16.96973" (N)
LONGITUDE:	76°24'59.13338" (W)
ELLIPSOID HT:	-102.401 US ft. -31.212 m

AVAILABLE CONVENTIONAL BACKSIGHT POINTS (FIELD DATA):

<u>POINT</u>	<u>AZIMUTH</u>	<u>DISTANCE (US FT.)</u>	<u>DISTANCE (m)</u>
MTN-6	36° 54' 57"	1125.30	342.991
MTN-2	121° 42' 27"	1027.93	313.314

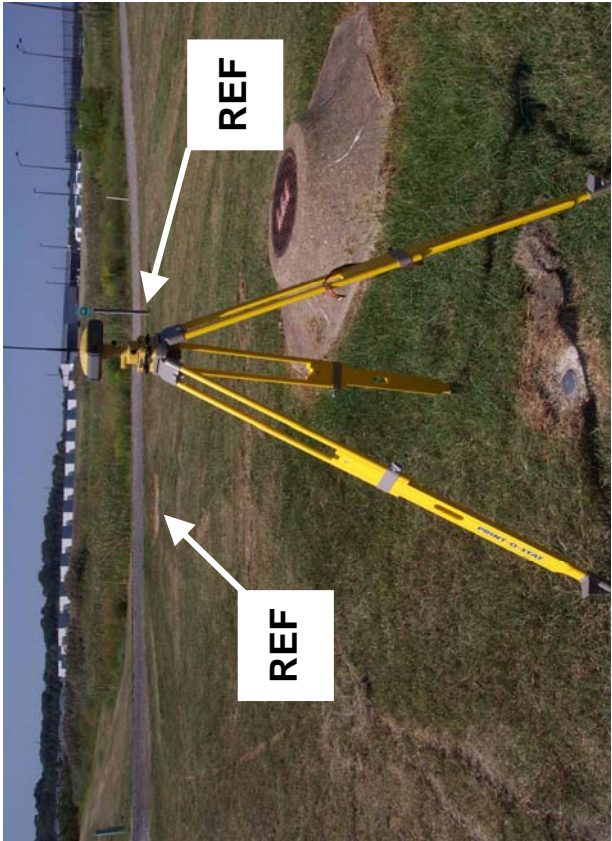
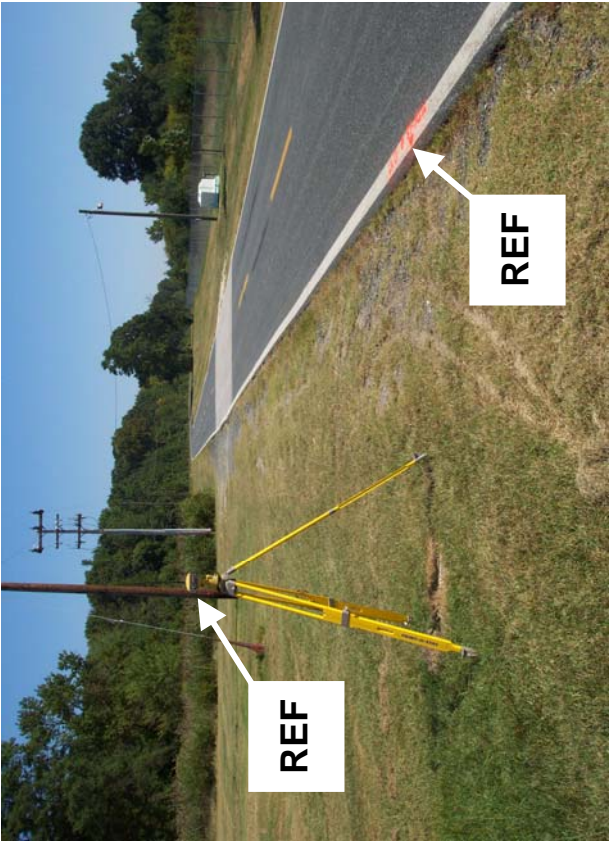
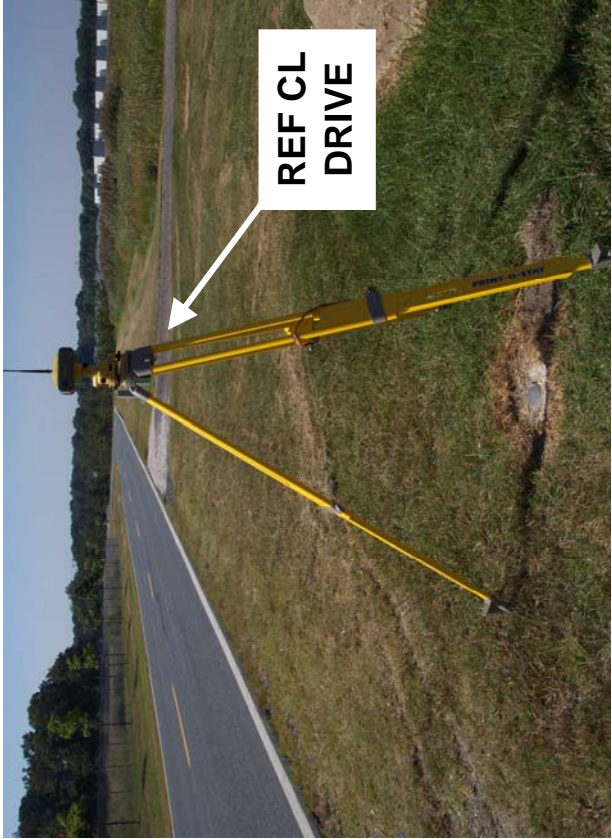
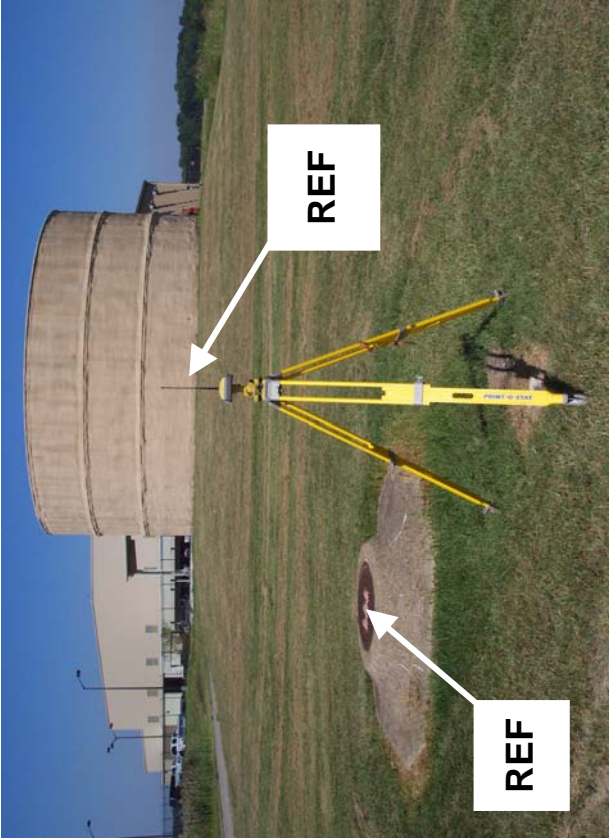
STATION DESCRIPTION:

To reach the monument from the traffic circle at MTN airport in front of the air traffic control tower, proceed S to Airside Access point by Hangars 4-6. After passing through the fence, proceed NE to the second Stop sign. Turn right and proceed SE past private plane hangars. Road will curve to the left, bearing North. At the intersection of T/L B and T/L G, turn right and proceed SE to Yield sign. Continue to Stop sign at Strawberry Point Road. Turn left on Strawberry Point Road. Proceed 819 feet (0.16 mi.) to station the left. Station is located approximately 78.5 feet past the centerline of gravel/grass road (entrance to fire pump house/water tank). Monument is 63.69' SE of drop inlet in concrete near edge of gravel road, 67.79' SE of sign (Fire Pump House 2850 Strawberry Point Road), 114.42' S of face of water tower, 78.35' NW of guy pole with no number, and 10.64' NE of NE edge of Strawberry Point Road.



SURVEYED BY: JMT ENGINEERING

SPARKS, MARYLAND



MARTIN STATE AIRPORT (MTN) - SURVEY CONTROL DATA

NAME OF STATION: MTN-6

DATE ESTABLISHED: August 2005

MARYLAND STATE PLANE COORDINATES (NAD 83):

NORTHING (Y):	604064.3021 US ft.	184119.168 m
EASTING (X):	1478107.5955 US ft.	450528.096 m
ORTHOMETRIC HEIGHT (NAVD 88):	12.86 US ft.	3.919 m
CONVERGENCE ANGLE:	0°22'04.0"	
SCALE FACTOR:	0.99998036	
COMBINED SCALE FACTOR:	0.99998493	

GEOGRAPHIC COORDINATES (NAD 83):

LATITUDE:	39°19'25.81887" (N)		
LONGITUDE:	76°24'50.45958" (W)		
ELLIPSOID HT:	-95.427 US ft.	-29.086 m	

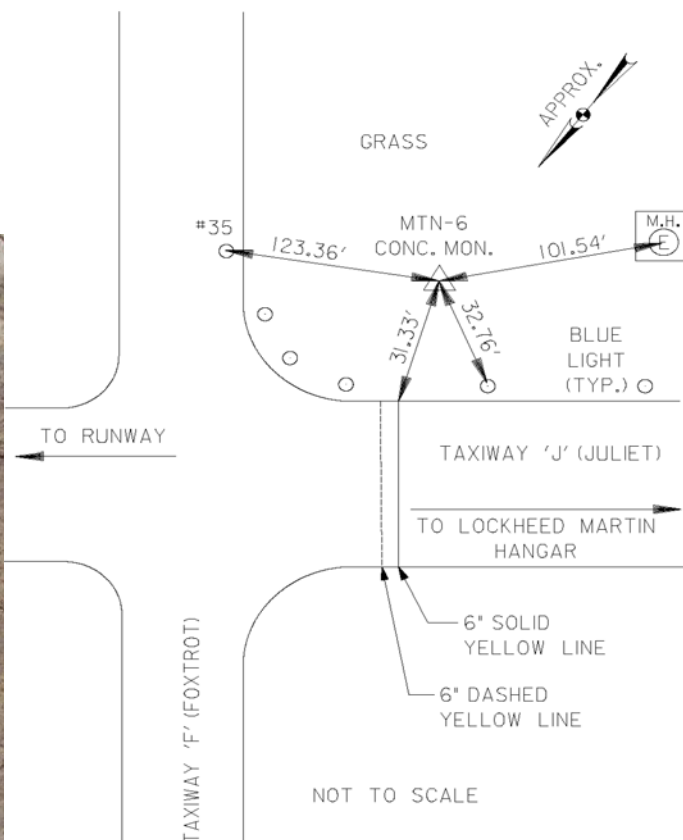
AVAILABLE CONVENTIONAL BACKSIGHT POINTS (FIELD DATA):

<u>POINT</u>	<u>AZIMUTH</u>	<u>DISTANCE (US FT.)</u>	<u>DISTANCE (m)</u>
MTN A	130° 06' 04"	2879.72	877.740
MTN-5	216° 54' 57"	1125.29	342.989
MTN-4	319° 31' 29"	2360.15	719.375
MTN-B	319° 21' 07"	3436.89	1047.566

STATION DESCRIPTION:

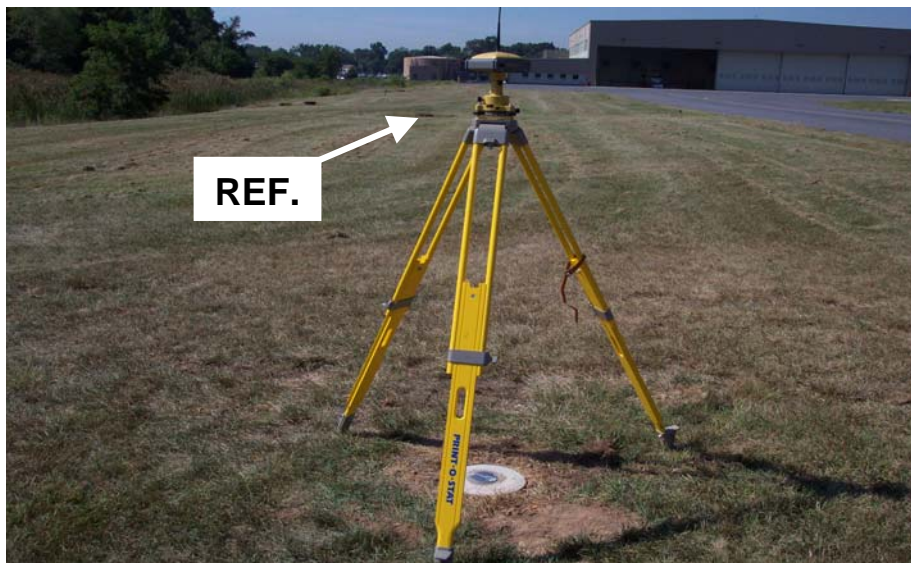
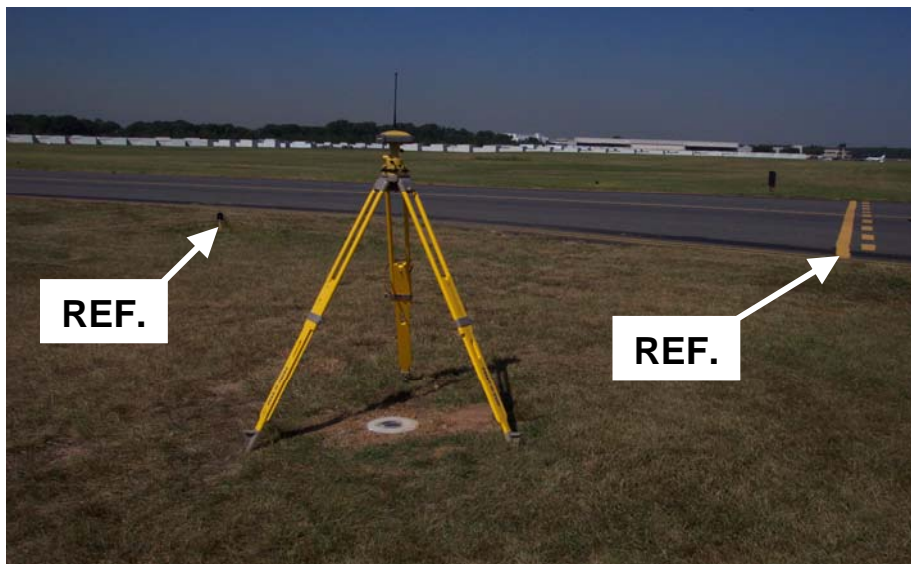
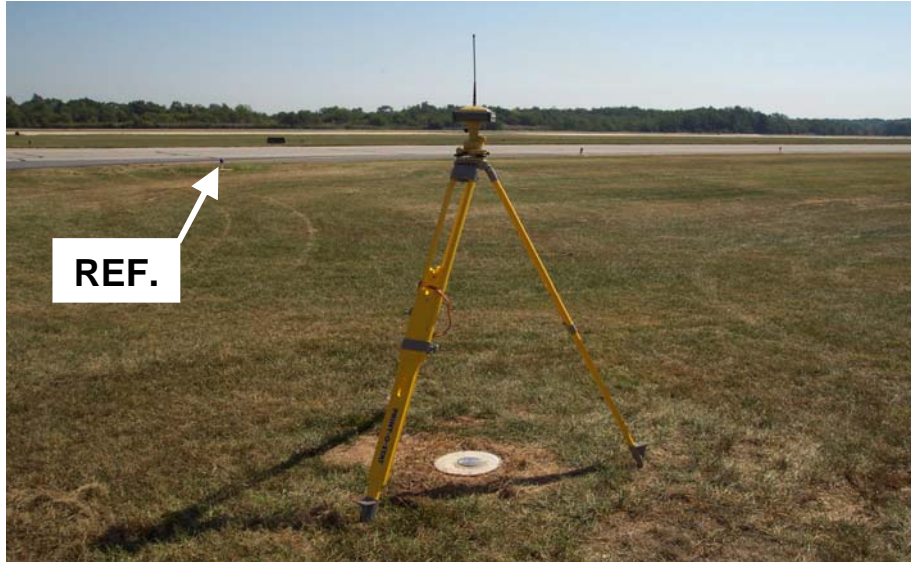
To reach the monument from the traffic circle at MTN airport in front of the air traffic control tower, proceed S to Airside Access point by Hangars 4-6. After passing through the fence, proceed NE to the second Stop sign. Turn right and proceed SE past private plane hangars. Road will curve to the left, bearing North. At the intersection of T/L B and T/L G, turn right and proceed SE to Yield sign. Continue to Stop sign at Strawberry Point Road. Turn left on Strawberry Point Road. Continue to the pump house and water tank on the left. Turn left into gravel lane. Park at pump house. Walk along fence and wetlands area to Taxiway F and the station on the right. Station is near the intersection of Taxiway F, Taxiway J, and the entrance road to Lockheed Martin's hangar/facility. Monument is 123.36' W of taxiway light #35, 101.54' NE of center of electric manhole 0.5' above ground, 32.76' SE of ground way light with no number, 31.33' S of S end 6" solid yellow line on Taxiway 'J'.

***Monument is outside the APRL. Access to this monument by way of Taxiway "F" requires airport tower permission.**



SURVEYED BY: JMT ENGINEERING

SPARKS, MARYLAND



MARTIN STATE AIRPORT (MTN) - SURVEY CONTROL DATA

NAME OF STATION: MTN-7

DATE ESTABLISHED: August 2005

MARYLAND STATE PLANE COORDINATES (NAD 83):

NORTHING (Y):	US ft.	m
EASTING (X):	US ft.	m
ORTHOMETRIC HEIGHT (NAVD 88):	US ft.	m
CONVERGENCE ANGLE:		
SCALE FACTOR:		
COMBINED SCALE FACTOR:		

GEOGRAPHIC COORDINATES (NAD 83):

LATITUDE:	(N)	
LONGITUDE:	(W)	
ELLIPSOID HT:	US ft.	m

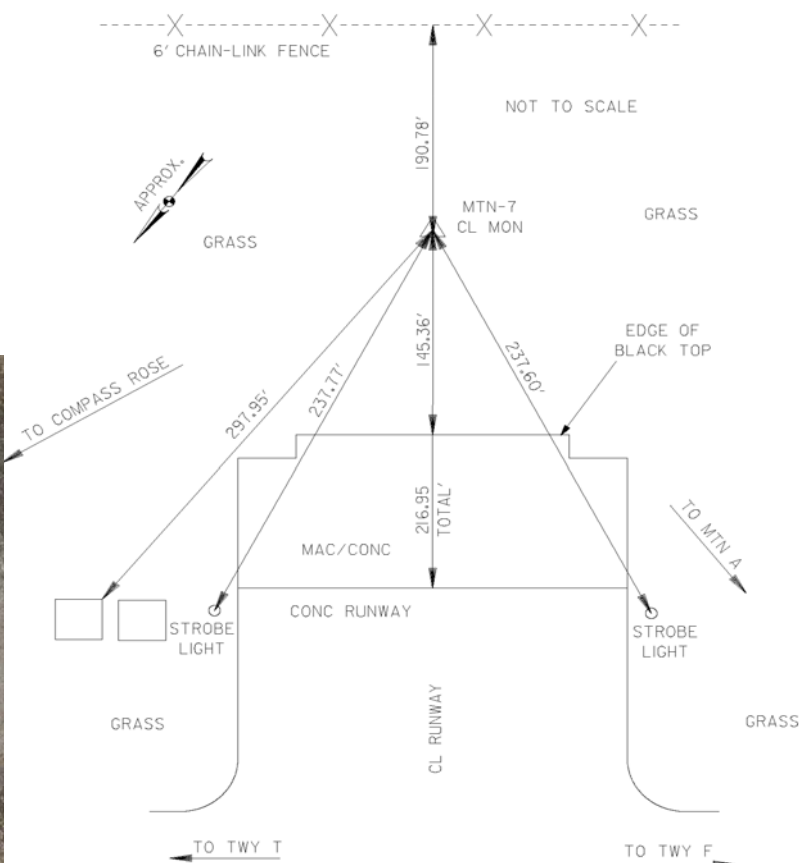
AVAILABLE CONVENTIONAL BACKSIGHT POINTS (FIELD DATA):

<u>POINT</u>	<u>AZIMUTH</u>	<u>DISTANCE (US FT.)</u>	<u>DISTANCE (m)</u>
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STATION DESCRIPTION:

***SHALL NOT BE OCCUPIED FOR SURVEY CONTROL.
THIS POINT IS INTENDED FOR RECOVERY OF THE
RUNWAY CENTERLINE ONLY**

AT THE 33 END OF THE RUNWAY



SURVEYED BY: JMT ENGINEERING

SPARKS, MARYLAND

MARTIN STATE AIRPORT (MTN) - SURVEY CONTROL DATA

NAME OF STATION: MTN-8

DATE ESTABLISHED: August 2005

MARYLAND STATE PLANE COORDINATES (NAD 83):

NORTHING (Y):	US ft.	m
EASTING (X):	US ft.	m
ORTHOMETRIC HEIGHT (NAVD 88):	US ft.	m
CONVERGENCE ANGLE:		
SCALE FACTOR:		
COMBINED SCALE FACTOR:		

GEOGRAPHIC COORDINATES (NAD 83):

LATITUDE:	(N)	
LONGITUDE:	(W)	
ELLIPSOID HT:	US ft.	m

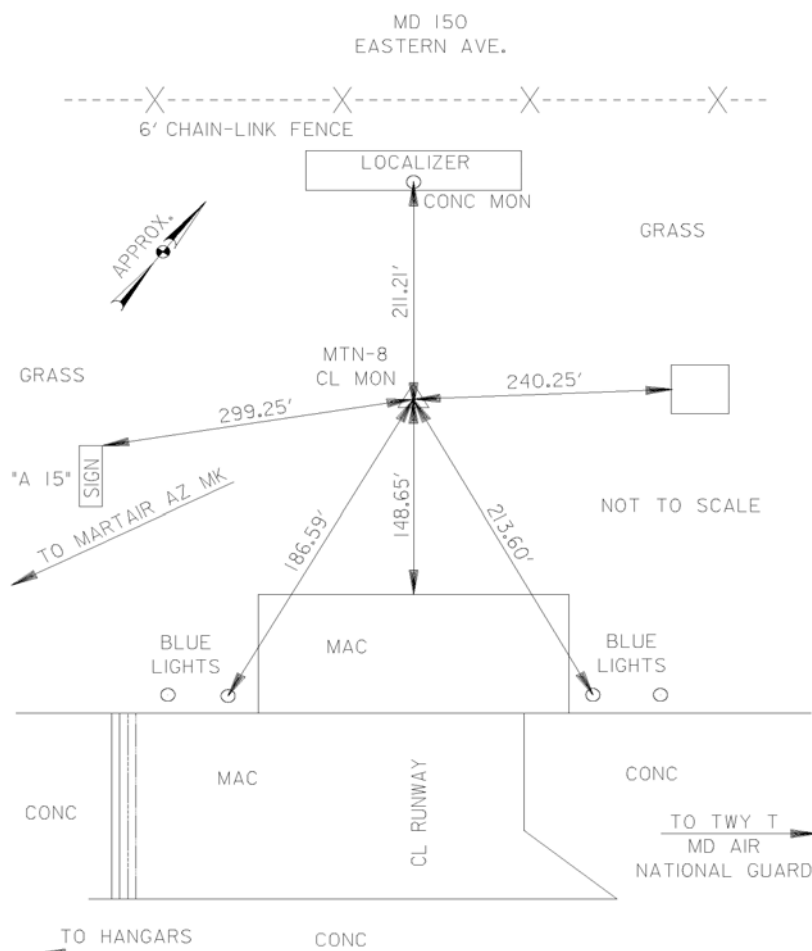
AVAILABLE CONVENTIONAL BACKSIGHT POINTS (FIELD DATA):

<u>POINT</u>	<u>AZIMUTH</u>	<u>DISTANCE (US FT.)</u>	<u>DISTANCE (m)</u>
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STATION DESCRIPTION:

***SHALL NOT BE OCCUPIED FOR SURVEY CONTROL.**
THIS POINT IS INTENDED FOR RECOVERY OF THE
RUNWAY CENTERLINE ONLY

AT THE 15 END OF THE RUNWAY



SURVEYED BY: JMT ENGINEERING

SPARKS, MARYLAND

MARTIN STATE AIRPORT (MTN) - SURVEY CONTROL DATA

NAME OF STATION: MARTAIR AZ MK

DATE ESTABLISHED: 1985

NGS PID: JV6476

MARYLAND STATE PLANE COORDINATES (NAD 83):

NORTHING (Y):	607285.0956 US ft.	185100.8676 m
EASTING (X):	1474311.9473 US ft.	449371.18 m
ORTHOMETRIC HEIGHT (NAVD 88):	20.71 US ft.	6.311 m
CONVERGENCE ANGLE:	0°21'33.9"	
SCALE FACTOR:	0.99998159	
COMBINED SCALE FACTOR:	0.99998578	

GEOGRAPHIC COORDINATES (NAD 83):

LATITUDE:	39 19 57.88957 (N)	
LONGITUDE:	076 25 38.50226 (W)	
ELLIPSOID HT:	-87.54 US ft.	-26.681 m

AVAILABLE CONVENTIONAL BACKSIGHT POINTS (FIELD DATA):

<u>POINT</u>	<u>AZIMUTH</u>	<u>DISTANCE (US FT.)</u>	<u>DISTANCE (m)</u>
MTN B	111° 29' 52"	1673.275	510.015
MTN-4	122° 12' 00"	2675.150	815.387

STATION DESCRIPTION:

SEE NGS DATASHEETS ATTACHED

HORZ ORDER - B

VERT ORDER - THIRD

ELLIP ORDER - FOURTH CLASS II



SURVEYED BY: JMT ENGINEERING

SPARKS, MARYLAND

DATASHEETS

1 National Geodetic Survey, Retrieval Date = NOVEMBER 8, 2005

JV6476 *****

JV6476 PACS - This is a Primary Airport Control Station.

JV6476 DESIGNATION - MARTAIR AZ MK

JV6476 PID - JV6476

JV6476 STATE/COUNTY- MD/BALTIMORE

JV6476 USGS QUAD - MIDDLE RIVER (1985)

JV6476

JV6476 *CURRENT SURVEY CONTROL

JV6476

JV6476* NAD 83(1991)- 39 19 57.88957(N) 076 25 38.50226(W) ADJUSTED

JV6476* NAVD 88 - 6.311 (meters) 20.71 (feet) ADJUSTED

JV6476

JV6476 X - 1,159,303.234 (meters) COMP

JV6476 Y - -4,802,017.867 (meters) COMP

JV6476 Z - 4,020,941.106 (meters) COMP

JV6476 LAPLACE CORR- -2.64 (seconds) DEFLEC99

JV6476 ELLIP HEIGHT- -26.67 (meters) (08/09/02) GPS OBS

JV6476 GEOID HEIGHT- -32.99 (meters) GEOID03

JV6476 DYNAMIC HT - 6.308 (meters) 20.70 (feet) COMP

JV6476 MODELED GRAV- 980,107.4 (mgal) NAVD 88

JV6476

JV6476 HORZ ORDER - B

JV6476 VERT ORDER - THIRD

JV6476 ELLP ORDER - FOURTH CLASS II

JV6476

JV6476.This mark is at Martin State Airport (MTN)

JV6476

JV6476.The horizontal coordinates were established by GPS observations

JV6476.and adjusted by the National Geodetic Survey in March 1998.

JV6476

JV6476.The orthometric height was determined by differential leveling

JV6476.and adjusted by the National Geodetic Survey in February 1998.

JV6476

JV6476.The X, Y, and Z were computed from the position and the ellipsoidal ht.

JV6476

JV6476.The Laplace correction was computed from DEFLEC99 derived deflections.

JV6476

JV6476.The ellipsoidal height was determined by GPS observations

JV6476.and is referenced to NAD 83.

JV6476

JV6476.The geoid height was determined by GEOID03.

JV6476

JV6476.The dynamic height is computed by dividing the NAVD 88

JV6476.geopotential number by the normal gravity value computed on the

JV6476.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

JV6476.degrees latitude (g = 980.6199 gals.).

JV6476

JV6476.The modeled gravity was interpolated from observed gravity values.

JV6476

JV6476; North East Units Scale Factor Converg.
JV6476;SPC MD - 185,100.867 449,371.180 MT 0.99998159 +0 21 33.9
JV6476;SPC MD - 607,285.09 1,474,311.95 sFT 0.99998159 +0 21 33.9
JV6476;UTM 18 - 4,354,674.286 376,980.708 MT 0.99978633 -0 54 17.3

JV6476

JV6476! - Elev Factor x Scale Factor = Combined Factor

JV6476!SPC MD - 1.00000418 x 0.99998159 = 0.99998577

JV6476!UTM 18 - 1.00000418 x 0.99978633 = 0.99979051

JV6476

JV6476: Primary Azimuth Mark Grid Az

JV6476:SPC MD - MARTAIR 111 32 54.8

JV6476:UTM 18 - MARTAIR 112 48 46.0

JV6476

JV6476|-----|
JV6476| PID Reference Object Distance Geod. Az |
JV6476| dddmmss.s |
JV6476| JV6144 MARTAIR 496.478 METERS 1115428.7 |
JV6476|-----|

JV6476

JV6476

SUPERSEDED SURVEY CONTROL

JV6476

JV6476 ELLIP H (03/24/98) -26.61 (m) GP() 4 1
JV6476 NAD 83(1991)- 39 19 57.88953(N) 076 25 38.50223(W) AD() B
JV6476 ELLIP H (11/22/95) -26.61 (m) GP() 1 1
JV6476 NAD 83(1991)- 39 19 57.88854(N) 076 25 38.50294(W) AD() 1
JV6476 ELLIP H (01/27/92) -26.53 (m) GP() 4 1
JV6476 NAD 83(1986)- 39 19 57.88372(N) 076 25 38.51118(W) AD() 1
JV6476 NAD 27 - 39 19 57.49393(N) 076 25 39.65548(W) AD() 1
JV6476 NAVD 88 (03/24/98) 6.31 (m) 20.7 (f) LEVELING 3
JV6476 NGVD 29 (11/20/87) 6.3 (m) 21. (f) GPS OBS

JV6476

JV6476.Superseded values are not recommended for survey control.

JV6476.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

JV6476.See file dsdata.txt to determine how the superseded data were derived.

JV6476

JV6476_U.S. NATIONAL GRID SPATIAL ADDRESS: 18SUJ7698154674(NAD 83)

JV6476_MARKER: DZ = AZIMUTH MARK DISK

JV6476_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT

JV6476_SP_SET: SET IN TOP OF CONCRETE MONUMENT

JV6476_STAMPING: MARTAIR 1985

JV6476_MARK LOGO: NGS

JV6476_MAGNETIC: N = NO MAGNETIC MATERIAL

JV6476_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO

JV6476+STABILITY: SURFACE MOTION

JV6476_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

JV6476+SATELLITE: SATELLITE OBSERVATIONS - October 01, 2002

JV6476

JV6476 HISTORY - Date Condition Report By
JV6476 HISTORY - 1985 MONUMENTED NGS
JV6476 HISTORY - 19860123 GOOD
JV6476 HISTORY - 19911107 GOOD NGS
JV6476 HISTORY - 19940902 GOOD NGS

JV6476 HISTORY	- 19950201 GOOD	MCCRON
JV6476 HISTORY	- 19961010 GOOD	NGS
JV6476 HISTORY	- 19970620 GOOD	DMW
JV6476 HISTORY	- 19980928 GOOD	DMW
JV6476 HISTORY	- 19990902 GOOD	MDSHA
JV6476 HISTORY	- 20020929 GOOD	JCLS
JV6476 HISTORY	- 20021001 GOOD	JCLS

JV6476

JV6476 STATION DESCRIPTION

JV6476

JV6476'DESCRIBED BY NATIONAL GEODETIC SURVEY 1985 (RGP)

JV6476'THE STATION IS LOCATED ABOUT 16 KM (10 MI) EAST FROM THE APPROXIMATE

JV6476'CENTER OF BALTIMORE, 5-1/2 KM (3-1/2 MI) SOUTH FROM WHITE MARSH

JV6476'AND 1 KM (1/2 MI) EAST FROM THE APPROXIMATE CENTER OF MIDDLE

JV6476'RIVER.

JV6476'

JV6476'OWNERSHIP--STATE OWNED PROPERTY.

JV6476'

JV6476'NO TO REACH NECESSARY.

JV6476'

JV6476'THE STATION SURFACE MARK IS A STANDARD NGS AZIMUTH MARK DISK

JV6476'STAMPED--MARTAIR--1985 SET IN THE TOP OF A 25 CM (10 INCH)

JV6476'ROUND CONCRETE POST WHICH IS FLUSH WITH THE SURFACE. THE SUB

JV6476'SURFACE DISK IS IDENTICAL TO THE SURFACE MARK AND IT IS SET IN

JV6476'A MASS OF CONCRETE 114 CM (45 INCHES) BELOW THE SURFACE.

JV6476'

JV6476'THE MARK IS LOCATED 67.9 METERS (222.9 FT) EAST FROM THE EAST

JV6476'CORNER OF THE MIDDLE RIVER POST OFFICE, 16.7 METERS (54.7 FT) EAST

JV6476'NORTHEAST FROM THE NORTHEAST CURB OF THE STATE HIGHWAY 587,

JV6476'23.0 METERS (75.6 FT) SOUTHWEST FROM THE EDGE OF A TAXI STRIP AND

JV6476'0.5 METER (1.8 FT) SOUTHEAST FROM A CARSONITE WITNESS POST.

JV6476

JV6476 STATION RECOVERY (1986)

JV6476

JV6476'RECOVERED 1986

JV6476'RECOVERED IN GOOD CONDITION.

JV6476

JV6476 STATION RECOVERY (1991)

JV6476

JV6476'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1991

JV6476'THE STATION IS LOCATED AT THE NW END OF THE INNER TAXIWAY NEAR THE

JV6476'INTERSECTION WITH TAXIWAY A WEST. THE STATION IS 45 FT (13.7 M) SW OF

JV6476'THE CENTERLINE EXTENSION OF THE RAMP AREA TO THE EAST, 74.9 FT (22.8

JV6476'M) WEST OF THE WEST EDGE OF THE TAXIWAY, 135 FT (41.1 M) SW OF THE NW

JV6476'CORNER OF ASPHALT, 180.4 FT (55.0 M) NW OF THE W CORNER OF A SIGN A,

JV6476'AND 18.5 FT (5.6 M) EAST OF A FENCE. THE STATION IS A STANDARD NGS

JV6476'DISK SET IN THE TOP OF A CONCRETE POST FLUSH WITH THE GROUND STAMPED

JV6476'MARTAIR 1985.

JV6476

JV6476 STATION RECOVERY (1994)

JV6476

JV6476'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1994 (RAH)

JV6476'RECOVERED IN GOOD CONDITION.

JV6476'

JV6476'CONTACT MR. JAKE WEST, AIRPORT MANAGER, MARTIN STATE AIRPORT, BOX 20,
JV6476'701 WILSON POINT ROAD, BALTIMORE, MD 21220, PHONE (410) 682-8810.

JV6476'

JV6476'TO REACH THE STATION FROM THE CONTROL TOWER, GO NORTHWESTERLY FOR
JV6476'0.42 KM (0.25 MI) ALONG AN APRON AND TAXIWAY TO THE STATION ON THE RIGHT.

JV6476'

JV6476'THE STATION IS LOCATED 55.0 M (180.4 FT) NORTHEAST OF THE WEST CORNER
JV6476'OF A SIGN A, 41.1 M (134.8 FT) SOUTHWEST OF THE NORTHWEST CORNER OF
JV6476'ASPHALT PAVEMENT, 22.8 M (74.8 FT) WEST IF THE WEST EDGE OF THE
JV6476'TAXIWAY, 5.6 M (18.4 FT) EAST OF A CHAIN LINK FENCE, AND THE MONUMENT
JV6476'IS FLUSH WITH THE GROUND.

JV6476'

JV6476'DESCRIBED BY KLF.

JV6476

JV6476 STATION RECOVERY (1995)

JV6476

JV6476'RECOVERY NOTE BY J R MCCRONE JR INCORPORATED 1995 (HAS)

JV6476'RECOVERED AS DESCRIBED.

JV6476

JV6476 STATION RECOVERY (1996)

JV6476

JV6476'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1996 (AJL)

JV6476'RECOVERED AS DESCRIBED.

JV6476

JV6476 STATION RECOVERY (1997)

JV6476

JV6476'RECOVERY NOTE BY DAFT MCCUNE WALKER INCORPORATED 1997 (DMM)

JV6476'RECOVERED AS DESCRIBED.

JV6476

JV6476 STATION RECOVERY (1998)

JV6476

JV6476'RECOVERY NOTE BY DAFT MCCUNE WALKER INCORPORATED 1998 (JMS)

JV6476'RECOVERED IN GOOD CONDITION.

JV6476

JV6476 STATION RECOVERY (1999)

JV6476

JV6476'RECOVERY NOTE BY MARYLAND DOT HIGHWAY ADMINISTRATION 1999 (DMM)

JV6476'RECOVERED AS DESCRIBED

JV6476

JV6476 STATION RECOVERY (2002)

JV6476

JV6476'RECOVERY NOTE BY JOHN CHANCE LAND SURVEYS INC 2002 (MRY)

JV6476'RECOVERED IN GOOD CONDITION.

JV6476

JV6476 STATION RECOVERY (2002)

JV6476


JV6476'RECOVERY NOTE BY JOHN CHANCE LAND SURVEYS INC 2002

JV6476'RECOVERED IN GOOD CONDITION.

*** retrieval complete.

Elapsed Time = 00:00:00

MARTIN STATE AIRPORT (MTN) - SURVEY CONTROL DATA

NAME OF STATION: MTN A		DATE ESTABLISHED: 1989	
NGS PID: AA9279			
MARYLAND STATE PLANE COORDINATES (NAD 83):			
NORTHING (Y):	602209.3862 US ft.	183553.788 m	
EASTING (X):	1480310.2956 US ft.	451199.481 m	
ORTHOMETRIC HEIGHT (NAVD 88):	5.4 US ft.	1.64 m	
CONVERGENCE ANGLE:	0°22'21.5"		
SCALE FACTOR:	0.99997967		
COMBINED SCALE FACTOR:	0.99998459		
GEOGRAPHIC COORDINATES (NAD 83):			
LATITUDE:	39 19 07.34515 (N)		
LONGITUDE:	076 24 22.58368 (W)		
ELLIPSOID HT:	-102.92 US ft.	-31.370 m	
AVAILABLE CONVENTIONAL BACKSIGHT POINTS (FIELD DATA):			
<u>POINT</u>	<u>AZIMUTH</u>	<u>DISTANCE (US FT.)</u>	<u>DISTANCE (m)</u>
MTN B	315° 08' 07"	6296.22	1919.092
MTN-6	310° 06' 04"	2879.73	877.743
MTN-4	314° 20' 41"	5222.33	1591.769
MTN-1	231° 15' 50"	1027.35	313.137
STATION DESCRIPTION:			
SEE NGS DATASHEETS ATTACHED			
<p>HORZ ORDER - FIRST</p> <p>ELLP ORDER - FOURTH CLASS II</p>			
			
SURVEYED BY: JMT ENGINEERING		SPARKS, MARYLAND	

DATASHEETS

1 National Geodetic Survey, Retrieval Date = NOVEMBER 8, 2005

AA9279 *****

AA9279 SACS - This is a Secondary Airport Control Station.

AA9279 DESIGNATION - MTN A

AA9279 PID - AA9279

AA9279 STATE/COUNTY- MD/BALTIMORE

AA9279 USGS QUAD - MIDDLE RIVER (1985)

AA9279

AA9279 *CURRENT SURVEY CONTROL

AA9279

AA9279* NAD 83(1991)- 39 19 07.34515(N) 076 24 22.58368(W) ADJUSTED

AA9279* NAVD 88 - 1.64 (meters) 5.4 (feet) GPS OBS

AA9279

AA9279 X - 1,161,301.923 (meters) COMP

AA9279 Y - -4,802,547.463 (meters) COMP

AA9279 Z - 4,019,732.347 (meters) COMP

AA9279 LAPLACE CORR- -2.19 (seconds) DEFLEC99

AA9279 ELLIP HEIGHT- -31.37 (meters) (08/19/02) GPS OBS

AA9279 GEOID HEIGHT- -33.03 (meters) GEOID03

AA9279

AA9279 HORZ ORDER - FIRST

AA9279 ELLP ORDER - FOURTH CLASS II

AA9279

AA9279.This mark is at Martin State Airport (MTN)

AA9279

AA9279.The horizontal coordinates were established by GPS observations

AA9279.and adjusted by the National Geodetic Survey in April 1998.

AA9279

AA9279.The orthometric height was determined by GPS observations and a

AA9279.high-resolution geoid model.

AA9279

AA9279.GPS derived orthometric heights for airport stations designated as
AA9279.PACS or SACS are published to 2 decimal places. This maintains
AA9279.centimeter relative accuracy between the PACS and SACS. It does
AA9279.not indicate centimeter accuracy relative to other marks which are
AA9279.part of the NAVD 88 network.

AA9279

AA9279.The X, Y, and Z were computed from the position and the ellipsoidal ht.

AA9279

AA9279.The Laplace correction was computed from DEFLEC99 derived deflections.

AA9279

AA9279.The ellipsoidal height was determined by GPS observations

AA9279.and is referenced to NAD 83.

AA9279

AA9279.The geoid height was determined by GEOID03.

AA9279

AA9279; North East Units Scale Factor Converg.

AA9279;SPC MD - 183,553.788 451,199.481 MT 0.99997967 +0 22 21.5

AA9279;SPC MD - 602,209.39 1,480,310.30 sFT 0.99997967 +0 22 21.5

AA9279;UTM 18 - 4,353,087.565 378,774.082 MT 0.99978094 -0 53 28.2

AA9279

AA9279! - Elev Factor x Scale Factor = Combined Factor

AA9279!SPC MD - 1.00000492 x 0.99997967 = 0.99998459

AA9279!UTM 18 - 1.00000492 x 0.99978094 = 0.99978586

AA9279

AA9279 SUPERSEDED SURVEY CONTROL

AA9279

AA9279 ELLIP H (04/02/98) -31.31 (m) GP() 4 2

AA9279 NAD 83(1991)- 39 19 07.34511(N) 076 24 22.58365(W) AD() 1

AA9279 ELLIP H (11/30/95) -31.31 (m) GP() 4 2

AA9279

AA9279.Superseded values are not recommended for survey control.

AA9279.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

AA9279.See file dsdata.txt to determine how the superseded data were derived.

AA9279

AA9279_U.S. NATIONAL GRID SPATIAL ADDRESS: 18SUJ7877453088(NAD 83)

AA9279_MARKER: DD = SURVEY DISK

AA9279_SETTING: 30 = SET IN A LIGHT STRUCTURE

AA9279_SP_SET: SET IN A LIGHT STRUCTURE

AA9279_STAMPING: MTN A 1989

AA9279_MARK LOGO: NOS

AA9279_MAGNETIC: O = OTHER; SEE DESCRIPTION

AA9279_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO

AA9279+STABILITY: SURFACE MOTION

AA9279_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

AA9279+SATELLITE: SATELLITE OBSERVATIONS - September 02, 1999

AA9279

AA9279 HISTORY - Date Condition Report By

AA9279 HISTORY - 1989 MONUMENTED NOS

AA9279 HISTORY - 19911107 GOOD NOS

AA9279 HISTORY - 19940902 GOOD NGS

AA9279 HISTORY - 19961010 GOOD NGS

AA9279 HISTORY - 19990902 GOOD MDSHA

AA9279

AA9279 STATION DESCRIPTION

AA9279

AA9279'DESCRIBED BY NATIONAL OCEAN SERVICE 1991

AA9279'THE STATION IS LOCATED AT THE MARTIN STATE AIRPORT SOUTHWEST OF RUNWAY

AA9279'END 32, AND NORTH OF THE PARALLEL TAXIWAY. THE STATION IS A STANDARD

AA9279'NOS DISK SET IN THE NE CORNER OF THE INNER CONCRETE SECTION OF A STORM

AA9279'DRAIN. THE STATION IS 126.6 FT (38.6 M) NW OF THE CENTERLINE OF A

AA9279'TAXIWAY, 70.7 FT (21.5 M) NNE OF TAXIWAY LIGHT 81, 118.0 FT (36.0 M)

AA9279'NE OF THE CENTERLINE OF THE PARALLEL TAXIWAY, AND 55.5 FT (16.9 M) SE

AA9279'OF THE SE CORNER OF A SIGN E. THE DISK IS STAMPED MTN A 1989.

AA9279

AA9279 STATION RECOVERY (1994)

AA9279

AA9279'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1994 (RAH)

AA9279'THE STATION IS LOCATED ABOUT 6.4 KM (3.95 MI) SOUTH-SOUTHEAST OF WHITE

AA9279'MARSH, 5.3 KM (3.30 MI) NORTHEAST OF ESSEX, AND 4.8 KM (3.00 MI)

AA9279'SOUTHWEST OF CHASE, NEAR THE NORTHEAST CORNER OF THE INNER CONCRETE

AA9279'SECTION OF A STORM DRAIN NEAR THE SOUTHEAST END OF THE ACTIVE RUNWAY

AA9279'14-32. OWNERSHIP- STATE OF MARYLAND. CONTACT MR. JAKE WEST, AIRPORT
AA9279'MANAGER, MARTIN STATE AIRPORT, BOX 20, 701 WILSON POINT ROAD,
AA9279'BALTIMORE, MD 21220, PHONE (410) 682-8810.

AA9279'

AA9279'TO REACH THE STATION FROM THE CONTROL TOWER, GO SOUTHEAST FOR 1.12 KM
AA9279'(0.70 MI) ALONG AN APRON AND THE SOUTHERN PARALLEL TAXIWAY TO RUNWAY
AA9279'14-32 AND THE STATION ON THE LEFT.

AA9279'

AA9279'THE STATION IS LOCATED 38.6 M (126.6 FT) NORTHWEST OF THE CENTERLINE
AA9279'OF A CONNECTING TAXIWAY, 36.0 M (118.1 FT) NORTHEAST OF THE PARALLEL
AA9279'TAXIWAY, 21.5 M (70.5 FT) NORTH-NORTHEAST OF A TAXIWAY LIGHT NUMBER
AA9279'81, AND 16.9 M (55.4 FT) SOUTHEAST OF THE SOUTHEAST CORNER OF A SIGN
AA9279'E.

AA9279'

AA9279'DESCRIBED BY KLF.

AA9279

AA9279 STATION RECOVERY (1996)

AA9279

AA9279'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1996 (AJL)

AA9279'RECOVERED AS DESCRIBED.

AA9279

AA9279 STATION RECOVERY (1999)

AA9279

AA9279'RECOVERY NOTE BY MARYLAND DOT HIGHWAY ADMINISTRATION 1999 (DMM)

AA9279'RECOVERED AS DESCRIBED

MARTIN STATE AIRPORT (MTN) - SURVEY CONTROL DATA

NAME OF STATION: MTN B

DATE ESTABLISHED: 1998

NGS PID: AI4374

MARYLAND STATE PLANE COORDINATES (NAD 83):

NORTHING (Y):	606671.9075 US ft.	184913.9672 m
EASTING (X):	1475868.8004 US ft.	449845.7101 m
ORTHOMETRIC HEIGHT (NAVD 88):	16.8 US ft.	5.12 m
CONVERGENCE ANGLE:	0°21'46.3"	
SCALE FACTOR:	0.99998135	
COMBINED SCALE FACTOR:	0.99998573	

GEOGRAPHIC COORDINATES (NAD 83):

LATITUDE:	39 19 51.73216 (N)	
LONGITUDE:	076 25 18.73818 (W)	
ELLIPSOID HT:	-91.417 US ft.	-27.864 m

AVAILABLE CONVENTIONAL BACKSIGHT POINTS (FIELD DATA):

<u>POINT</u>	<u>AZIMUTH</u>	<u>DISTANCE (US FT.)</u>	<u>DISTANCE (m)</u>
MARTAIR AZ MK	291° 29' 52"	1673.30	510.023
MTN-4	138° 58' 21"	1076.79	328.206
MTN-6	139° 21' 07"	3436.91	1047.572
MTN A	135° 08' 07"	6296.23	1919.095

STATION DESCRIPTION:

SEE NGS DATASHEETS ATTACHED

HORZ ORDER - FIRST

ELLIP ORDER - FOURTH CLASS I



SURVEYED BY: JMT ENGINEERING

SPARKS, MARYLAND

DATASHEETS

1 National Geodetic Survey, Retrieval Date = NOVEMBER 8, 2005

AI4374 *****

AI4374 SACS - This is a Secondary Airport Control Station.

AI4374 DESIGNATION - MTN B

AI4374 PID - AI4374

AI4374 STATE/COUNTY- MD/BALTIMORE

AI4374 USGS QUAD - MIDDLE RIVER (1985)

AI4374

AI4374 *CURRENT SURVEY CONTROL

AI4374

AI4374* NAD 83(1991)- 39 19 51.73216(N) 076 25 18.73818(W) ADJUSTED

AI4374* NAVD 88 - 5.12 (meters) 16.8 (feet) GPS OBS

AI4374

AI4374 X - 1,159,791.391 (meters) COMP

AI4374 Y - -4,802,022.850 (meters) COMP

AI4374 Z - 4,020,793.468 (meters) COMP

AI4374 LAPLACE CORR- -2.55 (seconds) DEFLEC99

AI4374 ELLIP HEIGHT- -27.87 (meters) (10/28/02) GPS OBS

AI4374 GEOID HEIGHT- -33.00 (meters) GEOID03

AI4374

AI4374 HORZ ORDER - FIRST

AI4374 ELLP ORDER - FOURTH CLASS I

AI4374

AI4374.This mark is at Martin State Airport (MTN)

AI4374

AI4374.The horizontal coordinates were established by GPS observations

AI4374.and adjusted by the National Geodetic Survey in March 2000.

AI4374

AI4374.The orthometric height was determined by GPS observations and a

AI4374.high-resolution geoid model.

AI4374

AI4374.GPS derived orthometric heights for airport stations designated as

AI4374.PACS or SACS are published to 2 decimal places. This maintains

AI4374.centimeter relative accuracy between the PACS and SACS. It does

AI4374.not indicate centimeter accuracy relative to other marks which are

AI4374.part of the NAVD 88 network.

AI4374

AI4374.The X, Y, and Z were computed from the position and the ellipsoidal ht.

AI4374

AI4374.The Laplace correction was computed from DEFLEC99 derived deflections.

AI4374

AI4374.The ellipsoidal height was determined by GPS observations

AI4374.and is referenced to NAD 83.

AI4374

AI4374.The geoid height was determined by GEOID03.

AI4374

AI4374; North East Units Scale Factor Converg.

AI4374;SPC MD - 184,913.967 449,845.710 MT 0.99998135 +0 21 46.3

AI4374;SPC MD - 606,671.91 1,475,868.80 sFT 0.99998135 +0 21 46.3

AI4374;UTM 18 - 4,354,477.001 377,450.907 MT 0.99978491 -0 54 04.7

AI4374

AI4374! - Elev Factor x Scale Factor = Combined Factor

AI4374!SPC MD - 1.00000437 x 0.99998135 = 0.99998572

AI4374!UTM 18 - 1.00000437 x 0.99978491 = 0.99978928

AI4374

AI4374 SUPERSEDED SURVEY CONTROL

AI4374

AI4374 ELLIP H (03/31/00) -27.86 (m) GP() 4 1

AI4374

AI4374.Superseded values are not recommended for survey control.

AI4374.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

AI4374.See file dsdata.txt to determine how the superseded data were derived.

AI4374

AI4374_U.S. NATIONAL GRID SPATIAL ADDRESS: 18SUJ7745154477(NAD 83)

AI4374_MARKER: DD = SURVEY DISK

AI4374_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT

AI4374_SP_SET: SET IN TOP OF CONCRETE MONUMENT

AI4374_STAMPING: MTN B 1998

AI4374_MARK LOGO: MDSHA

AI4374_MAGNETIC: N = NO MAGNETIC MATERIAL

AI4374_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO

AI4374+STABILITY: SURFACE MOTION

AI4374_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

AI4374+SATELLITE: SATELLITE OBSERVATIONS - 1998

AI4374

AI4374 HISTORY - Date Condition Report By

AI4374 HISTORY - 1998 MONUMENTED MDSHA

AI4374

AI4374 STATION DESCRIPTION

AI4374

AI4374'DESCRIBED BY MARYLAND DOT HIGHWAY ADMINISTRATION 1998 (DMM)

AI4374'STATION IS LOCATED ON THE MARTIN STATE AIRPORT BETWEEN RUNWAY 15-33

AI4374'AND AN AIRCRAFT TIE-DOWN AREA NEAR HANGAR 2. IT IS 199.8 FT (60.9 M)

AI4374'SSW OF RUNWAY LIGHT 2, 169.2 FT (51.6 M) NE OF THE NE EDGE OF THE

AI4374'TIE-DOWN AREA, 156.0 FT (47.5 M) SW OF THE SW EDGE OF THE RUNWAY,

AI4374'152.7 FT (46.5 M) W OF RUNWAY LIGHT 3, 35.5 FT (10.8 M) N OF A

AI4374'DRAINAGE INLET AND 2.7 FT (0.8 M) SW OF A CARSONITE WITNESS POST.

AI4374'MONUMENT IS A MARYLAND STATE HIGHWAY ADMINISTRATION DISK SET IN THE

AI4374'TOP OF A 12 IN ROUND CONCRETE POST WHICH IS FLUSH WITH THE GROUND.

*** retrieval complete.

Elapsed Time = 00:00:00

Appendix C

Electronic Deliverable (ASCII gridded data set)

DELIVERED ON 12/02/2013