Geophysical Prove-Out
Letter Report
Fort McClellan, Alabama

Task Order 0019
Contract Number DACA87-99-D-0010

U.S. Army Corps of Engineers
Engineering and Support Center
Huntsville, Alabama

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1.0 INTRODUCTION

The United States Army Engineering and Support Center, Huntsville (USAESCH) has contracted Foster Wheeler Environmental Corporation under Contract DACA87-99-D-0010, to perform a Geophysical Prove-Out (GPO) at Fort McClellan located in Anniston, Alabama. The GPO was performed during the week of May 12th, 2003. Foster Wheeler Environmental Corporation (FWENC) utilized two (2) three (3) man teams to acquire geophysical data in the Eastern Bypass Y Area. Essential aspects of the GPO will be discussed in the following report with additional information, to include all digital data, provided on the CD-ROM submitted as a supplement to this report.

2.0 OBJECTIVE

The objective of the GPO was to demonstrate and document the performance of the data acquisition methodology and spatial sampling protocols, sensor(s) and positioning equipment, data analysis and management systems, data transfer procedures, and the geophysical Quality Control (QC) system. In addition, the GPO test was used to validate each team member's ability to perform his or her required task. Each team member received internal certification stating that their performance met the project requirements as outlined in the Amendment 1 to the Eastern Bypass Work Plan. The following components of the geophysical system were evaluated during the GPO field program to ensure the program objectives were met:

- Spatial sample density (i.e., line and station spacing)
- Navigation and positioning methodologies
- Sensor and positioning system platform (stability, noise characteristics, and ergonomics)
- Data processing, analysis and interpretation, management, and transfer system
- Quality Assurance (QA) Control, documentation protocol for data acquisition, processing and analysis, and data management and transfer

The GPO test grid was designed and placed in a location were it can be maintained for ongoing usage. It is the intention of FWENC to validate the geophysical systems throughout the duration of the present contract as well as any subsequent removal actions. These validations will occur based on modifications to the geophysical sensors, positioning equipment, or acquisition/reacquisition procedures that affect the accuracy and/or repeatability of the data and cannot be assessed in real-time during normal field operations.

3.0 LOCATION

The GPO area is located near the scrap yard off of Bains Gap Road (see Appendix A). The GPO area is representative of the environment encountered during geophysical operations at Fort McClellan. Two test grids were constructed in this area. Test grid #1 was used for this GPO.

4.0 EQUIPMENT

Based on FWENC previous experience at numerous UXO sites, the EM61 MK2 instrument was selected because it has exhibited the best potential to meet the similar program objectives. Foster Wheeler Environmental has evaluated the following equipment in the GPO test grid.

4.1 EM61 MK2

The EM61 MK2 version of the Geonics EM61 will be used in the differential mode for this project, which utilizes multiple time-gates centered at 216, 366, 660 (bottom coil) and 660 (top coil) μs. The signal intensity for a given ferrous target recorded by the earlier time-gates is generally a factor of 2 to 4 times that recorded by the standard (660μs) EM61 MK2 time-gate. This feature facilitates a more efficient and repeatable interpretation of smaller targets such as 37mm projectiles.

4.2 CONSTELLATION POSITIONING SYSTEM

The Constellation Positioning System was selected for the system's ability to acquire data in heavily wooded areas. This system consists of four (4) laser transmitters, each with a unique signature of light pulses, optical sensors, and signal processing. The positioning is based on line-of-sight triangulation. The Constellation system remotely transmits data from a handheld computer to a stationary laptop. The resulting positioning file is then merged with the sensor data to produce a .xyz file.

4.3 SEEDED ITEMS

All seeded items were buried by qualified UXO personnel following a background survey of the test grid (see Appendix B). All items detected during the background survey, were removed from the ground. Photographs of the seeded items can be found in the attached CD-ROM. Locations of the items can be found in Appendix C.

5.0 PROCEDURES

5.1 DATA ACQUISITION

Data was acquired at a line spacing of 2.5 ft. Prior to starting the acquisition session, the coil height was measured to 16 inches above ground level. Shake tests were performed to verify that all cables were secure in position. All three time-gates were electronically nulled to zero in a magnetically "quiet" area using the Geonics MKII acquisition software. Following these procedures, static and dynamic data were recorded to facilitate shift and drift corrections.

5.2 DATA PROCESSING

Data were stored on PCMCIA cards during data acquisition. After acquisition on the test grid was completed, data was transferred from the PCMCIA cards to the site laptop PC for processing. A Foster Wheeler Environmental geophysicist performed preliminary geophysical and navigation data processing and Quality Control (QC) checks. The final analysis and interpretation of the data was performed at the Foster Wheeler Environmental processing center

at Fort McClellan, Alabama. Processing, QC, analysis, and interpretation of the data was performed with internally developed software that has been specifically produced to integrate and interpret digital geophysical data acquired with the Constellation Positioning System. Geosoft Oasis Montaj Mapping software was also used to graphically display data and select targets. Data transfer was fully tested during the GPO. This included the transfer of raw EM and positioning data. Corrected and leveled processed data were converted to column delimited ASCII format.

5.3 REACQUISITION

Target reacquisition accuracy was evaluated using Vulcan II Laser System to locate the Foster Wheeler Environmental seed items. A UXO Technician used a Vallon VMX2 to pinpoint the target location as indicated by the Vulcan II System. The combination of the Vulcan II and Vallon was able to locate all the seeded items within the required distance specified under DID OE-005-05A.01. An audible response was used to pinpoint the location of the seeded items and the response was noted in the operator's logbook. The reacquired point locations were determined using a Leica Total Station. The results can be found in Table 4 of Appendix C. The xy "offset" indicates the distance between the known location of the item and the reacquired location.

5.4 QUALITY CONTROL

Instrument and function checks were performed at the beginning and end of every data acquisition session. Independent QC tests performed included static test, line test, and positioning (cloverleaf) test. The digital QC data has been included on the CD-ROM submitted with this report.

5.5 STATIC TESTS

The static test involved locating the instrument over a quiet area and recording data for a minimum of 3 minutes, then placing a spherical item under the instrument and recording an additional 3 minutes of data. Each of the instrument configuration static tests showed normal background noise levels (0 to 2 mV for the bottom coil and 0 to 4 mV for the upper coil. Slight variations were due to normal instrument noise. The figures located in Appendix D, representing the static calibration and static response, were generated using the Geosoft Department of Defense UXO Quality Control System. The static calibration dialog automatically generates a profile view of the channel data in the database and flags data residing outside 2 standard deviations. The data used for the static calibration is recorded with every file that is collected in the field for one minute in the beginning (labeled BEG) of the file and one minute at the end (labeled END) of the file. The test performed for the static response involves placing a known calibration object with a known amplitude response beneath the sensor. The purpose is to inspect the consistency of the instrument response throughout the course of the project. The figures contain graphical views (EM values vs. record number) that provide a visual display of the selected data. The data used for the static response is recorded with every file that is collected in the field for one minute in the beginning (labeled BEG) of the file and one minute at the end (labeled END) of the file.

The MK2 backpacks have been observed to have more drift than the standard MK1, for which the processing software was designed. Foster Wheeler is working with Geosoft on developing software more suitable for the MK2 system. The instrument drift displayed in these figures is removed from the data through internally developed software.

5.6 SIX-LINE TESTS

The six-line test (see Appendix E) involved collecting data along a 60-foot line six times (80-foot was not possible due to area size limitations). The purpose of this line test was to determine noise due to system movement/motion as well as location error caused by temporal time lag or spatial correction due to waypoint placement. For the first two line tests, data was collected along the line in each direction (Lines 1 and 2) at a normal pace. An item was then placed near the middle of the line and data was collected along the line in each direction (Lines 3 and 4) at a normal pace. Line 5 was collected (with the item in place) at a fast pace followed by line 6 collected at a slow pace. There was no appreciable noise increase from the tests nor was there appreciable position lag errors.

5.7 POSITIONING TESTS

To test the positioning, the navigation unit recorded data in a clover-leaf pattern around a known point (see Appendix F), with the operator crossing over the known points from 4 different directions. The line path was then plotted over the known point. The results showed an offset of less then 2 inches between the known points and the operators "cross-over" intersection. There was no loss of signal during the test and the overall quality of the line path was good.

5.8 SUMMARY

All members of both Team #1 and Team #2 demonstrated the ability to successfully meet the project objectives. Utilizing the EM61 MK2, both teams confidentially detected all of the seeded items with zero false positives. Figures located in Appendix G show each of the three time-gates for the bottom coil. The interpretation of this data was based on all the time-gates as well as the top coil for Team#2. The pick location can be found on the figure on page G-5 in Appendix G. The noise level on the Bottom Coil in both cases was in the order of 0.25mV. The Constellation demonstrated accuracy well within the project requirements. The Setup time was approximately 30 minutes for the 90ft X 70ft grid.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The GPO was conducted to demonstrate and document the performance of the proposed data acquisition methodology (including personnel) and spatial sampling protocols, sensor(s) and positioning equipment, data analysis and management systems, data transfer procedures, and the geophysical Quality Control (QC) system.

Based on the results described previously in this report, the EM61 MK2 demonstrated the ability to meet the program objectives and should be approved for continual work. The Constellation system was straightforward to setup and provided highly accurate positioning data.

6.2 RECOMMENDATIONS

The GPO test grid at Fort McClellan is a very good indication of the types of areas that will be surveyed during the Eastern Bypass Y Area Removal Project. It is anticipated that buildings, trees, cultural features, and open areas will all be encountered on a daily basis. The items seeded in the prove-out are also representative of the items to be encountered during the investigation and have accurate depth and location calculations.

6.3 DETECTION METHOD

Using the early time-gate on the EM61 MK2 will allow for the detection of smaller, deeper items, however, the late time gates should be used to aid in discrimination

6.4 POSITIONING

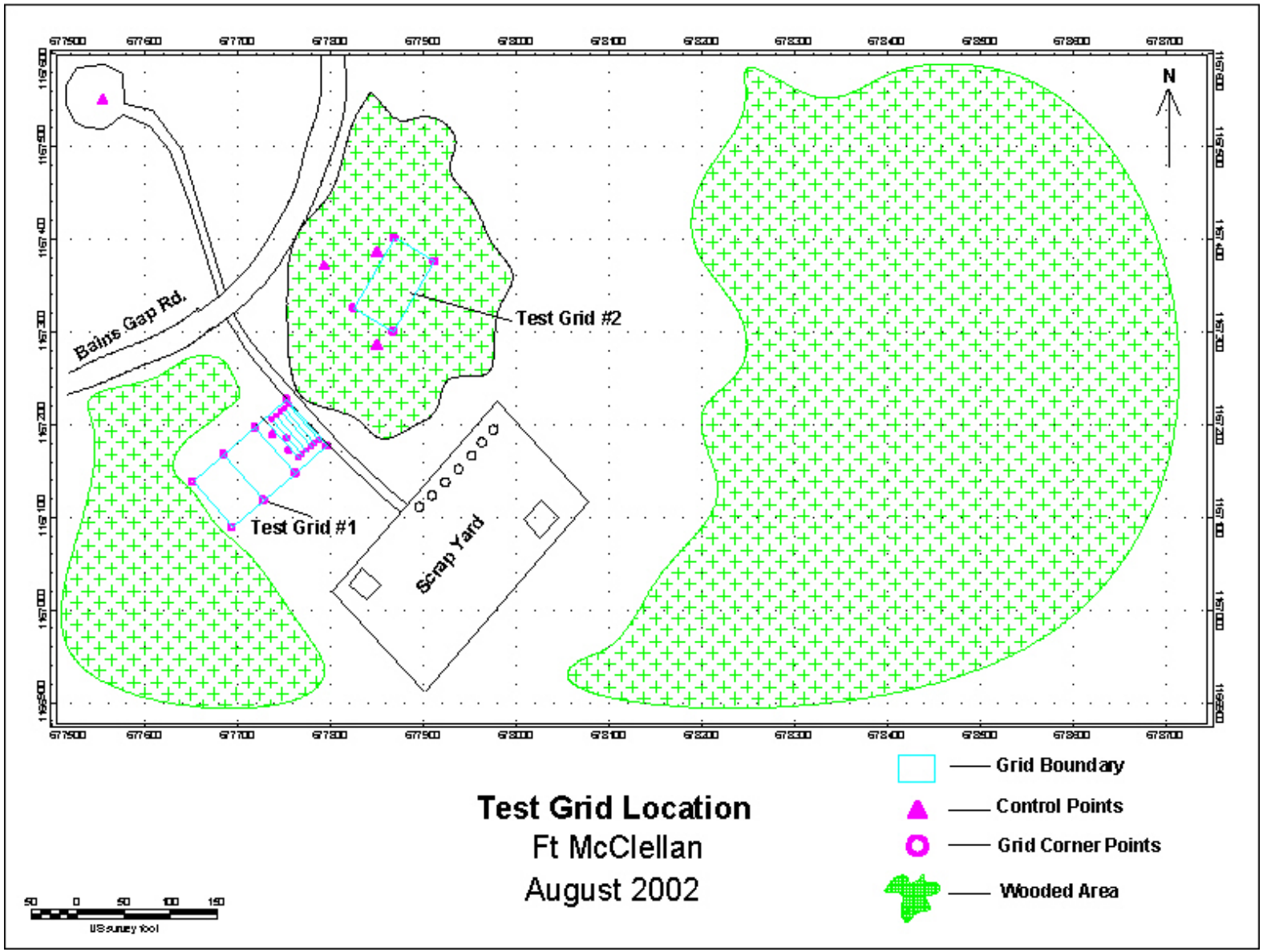
The Constellation Positioning System is recommended as the primary positioning system in wooded areas and is well suited for the conditions to be encountered during the upcoming investigation. The setup is very straightforward and the accuracy is well within the project requirements.

6.5 LINE SPACING

A line spacing of 2.5 ft is recommended. This spacing allows for overlap (1m by 1m coil) while reducing acquisition time.

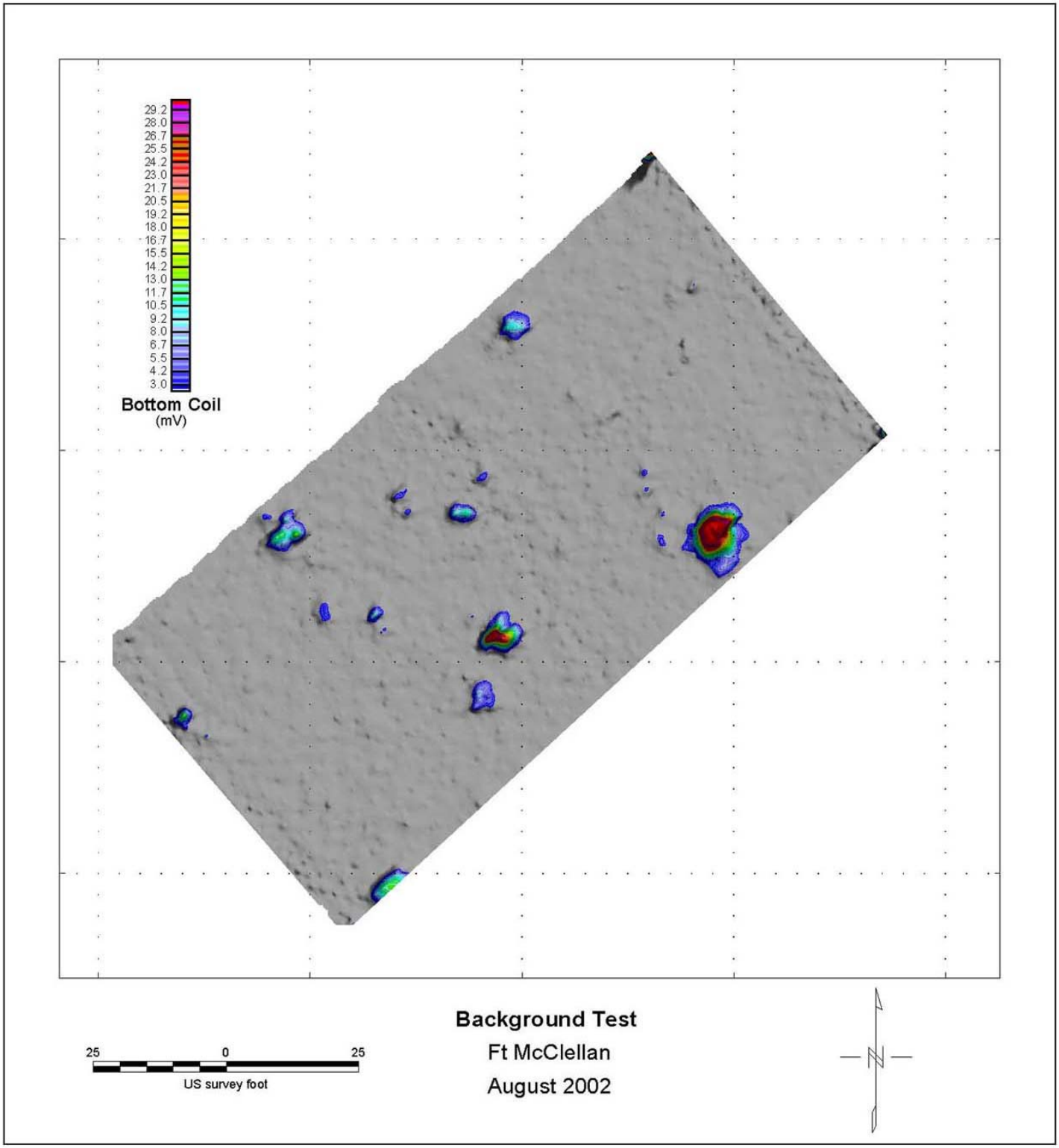
APPENDIX A

TEST GRID LOCATION


Test Grid Location
Ft McClellan
August 2002
Grid Boundary
Control Points
Grid Corner Points
Wooded Area
Test Grid #1
Test Grid #2
Bains Gap Rd.
Scrap Yard
N

APPENDIX B

BACKGROUND TEST GRID


29.2
28.0
26.7
25.5
24.2
23.0
21.7
20.5
19.2
18.0
16.7
15.5
14.2
13.0
11.7
10.5
9.2
8.0
6.7
5.5
4.2
3.0
Bottom Coil
(mV)
25
0
25
US survey foot
Background Test
Ft McClellan
August 2002

APPENDIX C

TABLES

TABLE 1

ANOMALY TABLE

X	Y	TARGET ID	ITEM	DEPTH(IN)	ORIENTATION
677699.94	1167164.58	a1	37mm	4.00	Horizontal
677708.37	1167173.14	a2	37mm	4.00	Vertical
677719.73	1167188.12	a3	81mm	34.00	Horizontal
677721.10	1167175.99	a4	2.36" rocket	26.00	Horizontal
677730.10	1167179.32	a5	rocket motor	12.00	Horizontal
677723.37	1167167.69	a6	37mm	16.00	Horizontal
677735.00	1167169.03	a7	60mm	12.00	Vertical
677735.62	1167156.66	a8	MKII HG	8.00	Vertical
677745.30	1167155.03	a9	2.36" rocket	6.00	Vertical
677743.41	1167136.92	a10	Anti Tank Mine	6.00	Horizontal
677726.67	1167132.67	a11	60mm	6.00	Vertical
677718.25	1167118.37	a12	MKII HG	4.00	Horizontal
677719.58	1167146.36	a13	37mm	0.00	Horizontal
677688.23	1167097.99	a14	3 "stokes	20.00	Horizontal
677704.27	1167108.58	a15	3 "stokes	32.00	Horizontal
677694.61	1167113.24	a16	75mm	30.00	Horizontal
677709.18	1167133.61	a17	60mm	25.00	45 degrees
677691.87	1167128.25	a18	75mm	12.00	Vertical
677681.35	1167118.85	a19	MKII HG	14.00	Horizontal
677673.49	1167132.86	a20	75mm	18.00	45 degrees
677666.45	1167141.88	a21	37mm	4.00	45 degrees
677680.90	1167152.03	a22	slap flare	4.00	45 degrees
677706.20	1167151.98	a23	105mm	45.00	45 degrees
677753.84	1167216.57	a24	37mm	4.00	Horizontal
677765.13	1167208.06	a25	37mm	4.00	Vertical
677771.70	1167196.19	a26	81mm	17.00	Horizontal
677771.95	1167190.79	a27	2.36" rocket	26.00	Horizontal
677781.41	1167187.60	a28	rocket motor	12.00	Horizontal
677794.28	1167178.14	a29	37mm	16.00	Horizontal
677775.16	1167162.11	a30	60mm	12.00	Vertical
677767.82	1167173.71	a31	MKII HG	8.00	Vertical
677763.33	1167167.94	a32	2.36" rocket	6.00	Vertical
677750.42	1167179.97	a33	60mm	6.00	Horizontal
677756.51	1167195.77	a34	60mm	6.00	Vertical
677740.94	1167197.48	a35	MKII HG	4.00	Horizontal
677741.04	1167180.67	a36	37mm	0.00	Horizontal
677728.58	1167178.52	a37	3 "stokes	20.00	Horizontal
677733.40	1167171.79	a38	3 "stokes	32.00	Horizontal

TABLE 1

ANOMALY TABLE

X	Y	TARGET ID	ITEM	DEPTH(IN)	ORIENTATION
677743.27	1167161.79	a39	75mm	30.00	Horizontal
677758.76	1167148.27	a40	81mm	25.00	45 degrees
677697.46	1167163.21	a41	75mm	12.00	Vertical
677699.23	1167155.70	a42	MKII HG	0.00	Horizontal
677700.11	1167144.91	a43	75mm	18.00	45 degrees
677715.77	1167137.08	a44	37mm	4.00	45 degrees
677715.85	1167112.69	a45	slap flare	4.00	Vertical
677706.94	1167104.36	a46	105mm	10.00	Vertical
677693.62	1167134.69	a47	81mm	34.00	Vertical
677683.47	1167133.54	a48	rocket motor	12.00	Vertical
677680.56	1167145.54	a49	3 "stokes	20.00	Vertical
677674.37	1167119.69	a50	37mm	2.00	Horizontal
677753.19	1167226.71	NE	corner point		
677651.45	1167138.05	NW	corner point		
677762.26	1167147.30	M1	mid point		
677728.18	1167117.92	M2	mid point		
677685.25	1167167.49	M3	mid point		
677719.52	1167196.53	M4	mid point		

TABLE 2

CORNER POINTS

CORNER POINT	X	Y
SW	677693.96	1167088.76
SE	677796.54	1167176.86
NE	677753.19	1167226.71
NW	677651.45	1167138.05
M1	677762.26	1167147.30
M2	677728.18	1167117.92
M3	677685.25	1167167.49
M4	677719.52	1167196.53

TABLE 3

TEAM 2 DIG SHEETS

TARGET ID	X	Y	EST. SIZE CM	TOP	BOTTOM	C1C2 RATIO	PRIORITY	COMMENTS	DATE	REACQUIRED
1	677753.25	1167217.71	7.95	22.19	32.84	0.68	dig	ok	05/15/2003	yes
2	677765.42	1167207.73	8.98	27.72	44.03	0.63	dig	ok	05/15/2003	yes
3	677771.67	1167195.91	7.44	13.11	28.38	0.46	dig	ok	05/15/2003	yes
4	677771.67	1167189.98	6.39	19.69	21.05	0.94	dig	ok	05/15/2003	yes
5	677781.64	1167187.79	2.16	5.18	6.29	0.82	dig	ok	05/15/2003	yes
6	677775.05	1167161.25	6.69	7.14	22.91	0.31	dig	ok	05/15/2003	yes
7	677767.78	1167173.59	6.67	10.83	22.79	0.48	dig	ok	05/15/2003	yes
8	677762.71	1167168.02	12.79	88.35	130.7	0.68	dig	ok	05/15/2003	yes
9	677750.37	1167179.68	10.39	28.22	65.8	0.43	dig	ok	05/15/2003	yes
10	677741.25	1167180.69	8.59	12.81	39.35	0.33	dig	ok	05/15/2003	yes
11	677756.8	1167195.91	10.49	42.82	67.83	0.63	dig	ok	05/15/2003	yes
12	677740.74	1167197.77	4.88	7.13	13.65	0.52	dig	ok	05/15/2003	yes
13	677718.94	1167187.79	13.66	10.78	8.88	1.21	dig	ok	05/15/2003	yes
14	677727.72	1167178.33	10.24	34.83	63.03	0.55	dig	ok	05/15/2003	yes
15	677730.77	1167180.35	10.14	33.43	61.24	0.55	dig	ok	05/15/2003	yes
16	677733.47	1167171.9	6.41	13.7	21.15	0.65	dig	ok	05/15/2003	yes
17	677735.16	1167169.03	9.93	33.23	57.71	0.58	dig	ok	05/15/2003	yes
18	677743.27	1167161.76	43.31	8.51	4.54	1.87	dig	ok	05/15/2003	yes
19	677745.3	1167155.67	12.11	69.7	107.46	0.65	dig	ok	05/15/2003	yes
20	677758.82	1167148.23	6.59	18.55	22.23	0.83	dig	ok	05/15/2003	yes
21	677743.52	1167137.01	21.45	858.55	1547.85	0.55	dig	ok	05/15/2003	yes
22	677726.78	1167132.78	11.55	49.78	91.73	0.54	dig	ok	05/15/2003	yes
23	677719.51	1167146.48	7.19	17.73	26.4	0.67	dig	ok	05/15/2003	yes
24	677735.58	1167156.96	5.31	11.8	15.43	0.76	dig	ok	05/15/2003	yes
25	677723.4	1167167.11	2.75	-0.09	7.43	-0.01	dig	ok	05/15/2003	yes
26	677720.19	1167174.72	2.73	5.7	7.39	0.77	dig	ok	05/15/2003	yes

TABLE 3

TEAM 2 DIG SHEETS

TARGET ID	X	Y	EST. SIZE CM	TOP	BOTTOM	C1C2 RATIO	PRIORITY	COMMENTS	DATE	REACQUIRED
27	677708.36	1167173.02	7.26	17.8	26.94	0.66	dig	ok	05/15/2003	yes
28	677696.86	1167163.9	8.27	28.19	35.92	0.78	dig	ok	05/15/2003	yes
29	677701.25	1167164.74	5.92	10.5	18.4	0.57	dig	ok	05/15/2003	yes
30	677699.39	1167155.45	6.98	9.73	24.88	0.39	dig	ok	05/15/2003	yes
31	677706.5	1167151.89	1.54	0.83	5.26	0.16	dig	ok	05/15/2003	yes
32	677699.9	1167145.3	6.87	14.17	24.14	0.59	dig	ok	05/15/2003	yes
33	677714.78	1167136.67	7.22	17.71	26.63	0.67	dig	ok	05/15/2003	yes
34	677709.03	1167135.49	18.76	9.01	6.47	1.39	dig	ok	05/15/2003	yes
35	677717.99	1167118.41	1.82	-4.64	5.7	-0.81	dig	ok	05/15/2003	yes
36	677714.95	1167112.66	2.06	5.41	6.1	0.89	dig	ok	05/15/2003	yes
37	677706.16	1167104.72	6.49	14.34	21.64	0.66	dig	ok	05/15/2003	yes
38	677703.28	1167108.44	2.17	-2.55	6.3	-0.4	dig	ok	05/15/2003	yes
39	677694.32	1167113.34	2.76	3.21	7.46	0.43	dig	ok	05/15/2003	yes
40	677692.46	1167128.05	9.56	45.44	51.91	0.88	dig	ok	05/15/2003	yes
41	677693.82	1167134.98	13.51	104.69	160.29	0.65	dig	ok	05/15/2003	yes
42	677681.18	1167118.98	95.09	10.43	4.04	2.58	dig	ok	05/15/2003	yes
43	677674.42	1167119.82	8.86	14.38	42.53	0.34	dig	ok	05/15/2003	yes
44	677682.87	1167133.69	9.8	39.82	55.56	0.72	dig	ok	05/15/2003	yes
45	677673.57	1167133.01	7.27	15.94	27.01	0.59	dig	ok	05/15/2003	yes
46	677666.3	1167141.8	7.64	20.93	30.05	0.7	dig	ok	05/15/2003	yes
47	677680.33	1167145.86	6.7	7.28	22.97	0.32	dig	ok	05/15/2003	yes
48	677681.35	1167152.8	7.95	15.33	32.84	0.47	dig	ok	05/15/2003	yes
49	677688.52	1167097.7	7.63	11.65	29.94	0.39	dig	ok	05/15/2003	yes
50	677688.85	1167154.17	1.75	3.35	5.59	0.6	no dig	ok	05/15/2003	NA
51	677716.08	1167162.29	4.05	1.45	10.77	0.13	dig	ok	05/15/2003	yes
52	677710.95	1167189.5	94.77	9.65	3.69	2.62	dig	ok	05/15/2003	yes
53	677759.31	1167204.05	2.2	2.6	6.36	0.41	no dig	ok	05/15/2003	NA

TABLE 4

REAQUIRE RESULTS

X	Y	TARGET ID	ITEM	DEPTH (IN)	ORIENTATION	REAQUIRE X	REAQUIRE Y	OFFSET X (IN)	OFFSET Y (IN)
677699.94	1167164.58	a1	37mm	4.00	Horizontal	677700.26	1167164.97	-3.84	-4.63
677708.37	1167173.14	a2	37mm	4.00	Vertical	677708.69	1167173.31	-3.86	-1.97
677719.73	1167188.12	a3	81mm	34.00	Horizontal	677719.99	1167188.70	-3.14	-6.95
677721.10	1167175.99	a4	2.36" rocket	26.00	Horizontal	677720.89	1167176.01	2.55	-0.22
677730.10	1167179.32	a5	rocket motor	12.00	Horizontal	677730.07	1167179.30	0.41	0.27
677723.37	1167167.69	a6	37mm	16.00	Horizontal	677723.64	1167167.99	-3.23	-3.68
677735.00	1167169.03	a7	60mm	12.00	Vertical	677735.04	1167169.19	-0.48	-2.01
677735.62	1167156.66	a8	MKII HG	8.00	Vertical	677735.58	1167156.83	0.52	-1.94
677745.30	1167155.03	a9	2.36" rocket	6.00	Vertical	677745.30	1167155.17	0.09	-1.61
677743.41	1167136.92	a10	Anti Tank Mine	6.00	Horizontal	677743.74	1167136.91	-3.92	0.07
677726.67	1167132.67	a11	60mm	6.00	Vertical	677727.03	1167133.21	-4.22	-6.41
677718.25	1167118.37	a12	MKII HG	4.00	Horizontal	677718.39	1167118.51	-1.66	-1.70
677719.58	1167146.36	a13	37mm	0.00	Horizontal	677719.26	1167146.39	3.85	-0.44
677688.23	1167097.99	a14	3 "stokes	20.00	Horizontal	677688.23	1167097.99	-0.04	-0.02
677704.27	1167108.58	a15	3 "stokes	32.00	Horizontal	677704.11	1167108.74	1.86	-1.95
677694.61	1167113.24	a16	75mm	30.00	Horizontal	677694.73	1167113.44	-1.46	-2.44
677709.18	1167133.61	a17	60mm	25.00	45 degrees	677709.33	1167133.75	-1.82	-1.76
677691.87	1167128.25	a18	75mm	12.00	Vertical	677691.98	1167128.45	-1.26	-2.43
677681.35	1167118.85	a19	MKII HG	14.00	Horizontal	677681.46	1167118.96	-1.35	-1.39
677673.49	1167132.86	a20	75mm	18.00	45 degrees	677673.59	1167133.00	-1.20	-1.76
677666.45	1167141.88	a21	37mm	4.00	45 degrees	677666.58	1167141.98	-1.63	-1.18
677680.90	1167152.03	a22	slap flare	4.00	45 degrees	677681.05	1167152.11	-1.89	-0.85
677706.20	1167151.98	a23	105mm	45.00	45 degrees	677706.21	1167151.95	-0.15	0.32
677753.84	1167216.57	a24	37mm	4.00	Horizontal	677753.93	1167216.69	-1.07	-1.37
677765.13	1167208.06	a25	37mm	4.00	Vertical	677765.16	1167208.15	-0.43	-0.98
677771.70	1167196.19	a26	81mm	17.00	Horizontal	677771.76	1167196.28	-0.67	-0.99

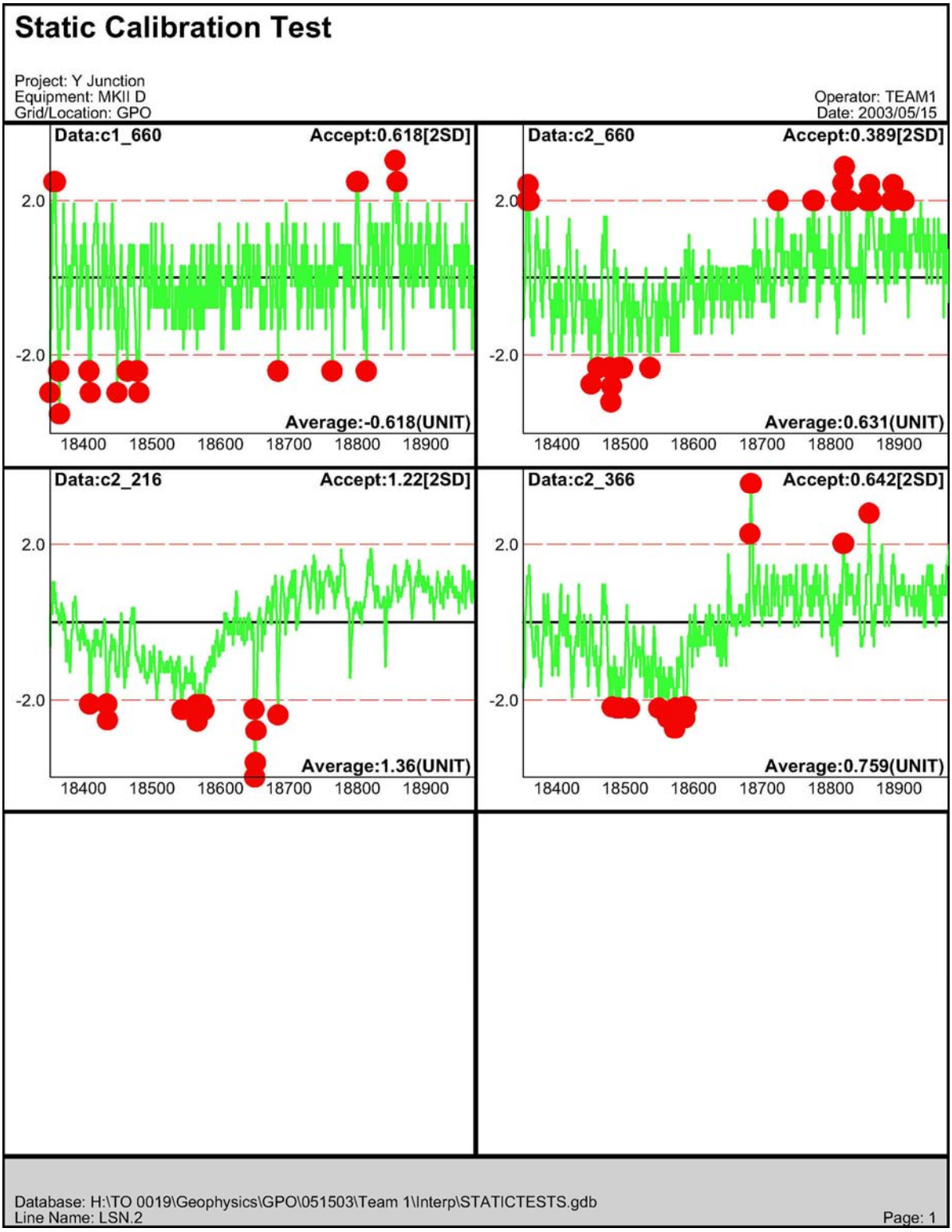
TABLE 4

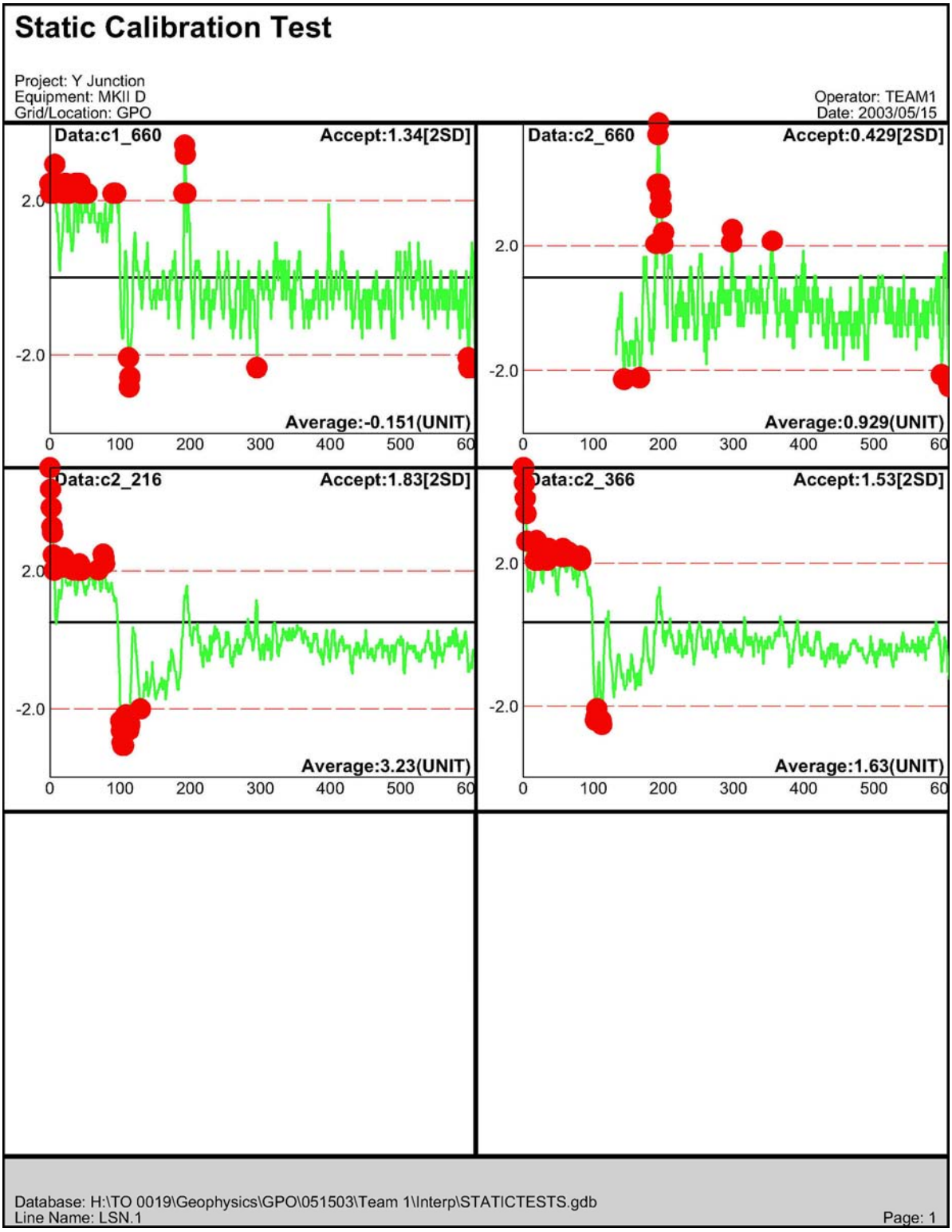
REAQUIRE RESULTS

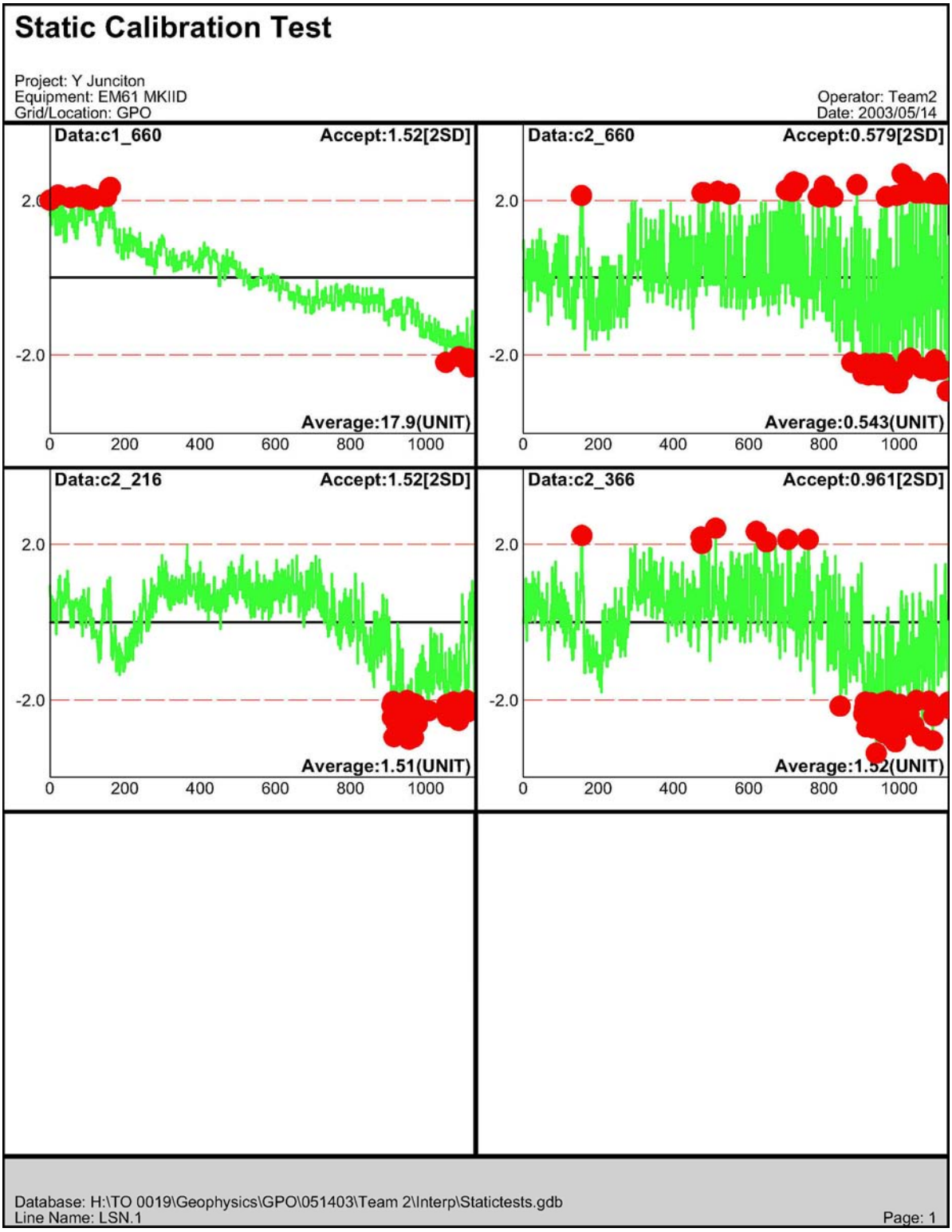
X	Y	TARGET ID	ITEM	DEPTH (IN)	ORIENTATION	REAQUIRE X	REAQUIRE Y	OFFSET X (IN)	OFFSET Y (IN)
677771.95	1167190.79	a27	2.36" rocket	26.00	Horizontal	677771.99	1167190.97	-0.52	-2.17
677781.41	1167187.60	a28	rocket motor	12.00	Horizontal	677781.47	1167187.74	-0.72	-1.70
677794.28	1167178.14	a29	37mm	16.00	Horizontal	677794.30	1167178.20	-0.22	-0.69
677775.16	1167162.11	a30	60mm	12.00	Vertical	677775.18	1167162.32	-0.15	-2.45
677767.82	1167173.71	a31	MKII HG	8.00	Vertical	677767.86	1167173.90	-0.57	-2.31
677763.33	1167167.94	a32	2.36" rocket	6.00	Vertical	677763.30	1167168.05	0.41	-1.29
677750.42	1167179.97	a33	60mm	6.00	Horizontal	677750.43	1167180.12	-0.11	-1.69
677756.51	1167195.77	a34	60mm	6.00	Vertical	677756.53	1167195.89	-0.25	-1.42
677740.94	1167197.48	a35	MKII HG	4.00	Horizontal	677740.98	1167197.62	-0.55	-1.61
677741.04	1167180.67	a36	37mm	0.00	Horizontal	677741.11	1167180.82	-0.73	-1.87
677728.58	1167178.52	a37	3 "stokes	20.00	Horizontal	677728.55	1167178.68	0.35	-1.85
677733.40	1167171.79	a38	3 "stokes	32.00	Horizontal	677733.29	1167172.05	1.26	-3.06
677743.27	1167161.79	a39	75mm	30.00	Horizontal	677743.09	1167162.09	2.19	-3.60
677758.76	1167148.27	a40	81mm	25.00	45 degrees	677759.11	1167148.27	-4.20	0.02
677697.46	1167163.21	a41	75mm	12.00	Vertical	677697.65	1167163.38	-2.19	-2.12
677699.23	1167155.70	a42	MKII HG	0.00	Horizontal	677699.34	1167155.76	-1.37	-0.69
677700.11	1167144.91	a43	75mm	18.00	45 degrees	677700.27	1167145.07	-1.91	-1.85
677715.77	1167137.08	a44	37mm	4.00	45 degrees	677715.90	1167137.20	-1.51	-1.43
677715.85	1167112.69	a45	slap flare	4.00	Vertical	677715.88	1167112.86	-0.43	-2.03
677706.94	1167104.36	a46	105mm	10.00	Vertical	677707.08	1167104.53	-1.61	-2.03
677693.62	1167134.69	a47	81mm	34.00	Vertical	677693.73	1167134.87	-1.23	-2.18
677683.47	1167133.54	a48	rocket motor	12.00	Vertical	677683.65	1167133.64	-2.22	-1.28
677680.56	1167145.54	a49	3 "stokes	20.00	Vertical	677680.65	1167145.68	-1.10	-1.74
677674.37	1167119.69	a50	37mm	2.00	Horizontal	677674.52	1167119.84	-1.76	-1.73

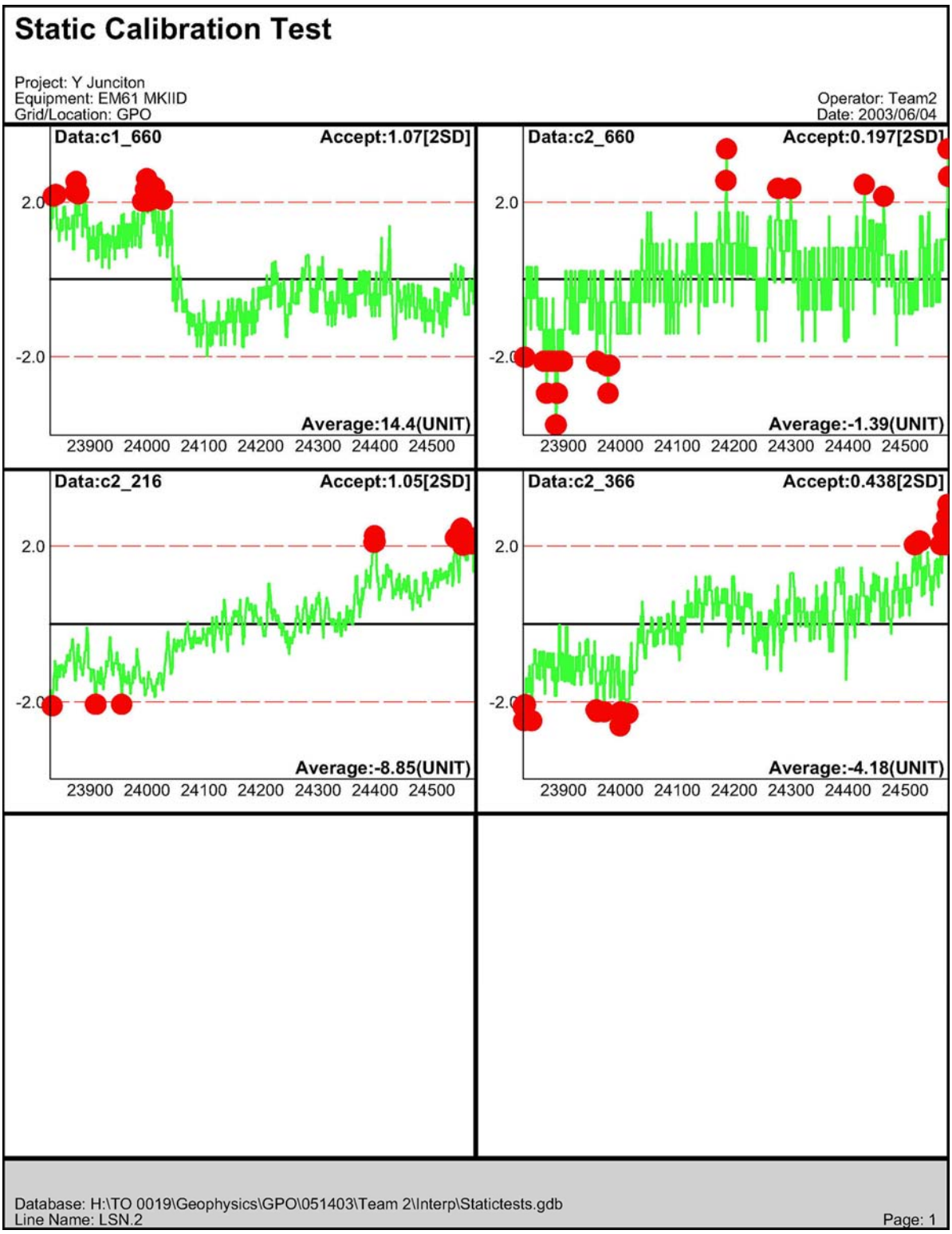
APPENDIX D

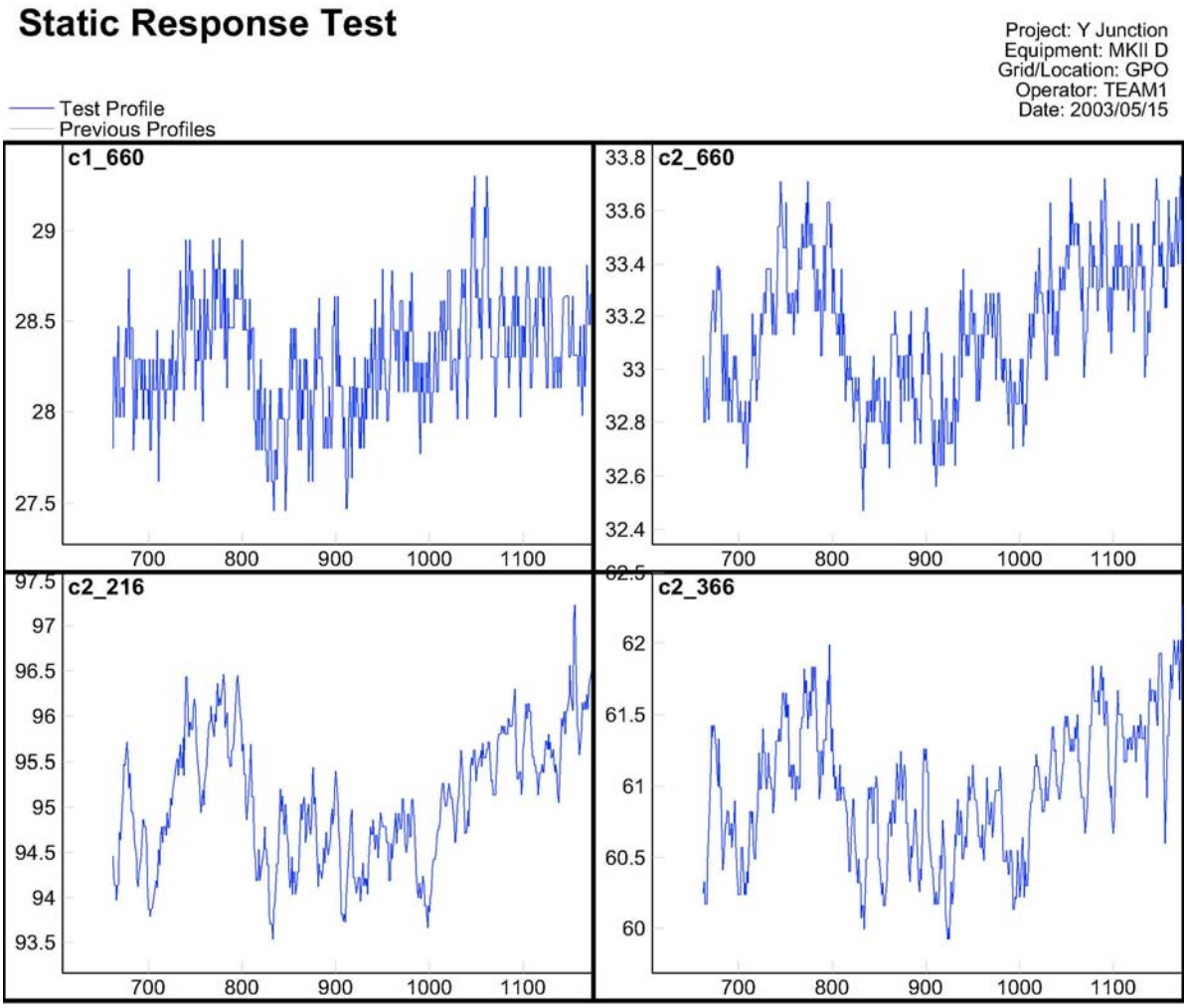
STATIC CALIBRATION AND STATIC RESPONSE TEST


Static Calibration Test
Project: Y Junction
Equipment: MKII D
Grid/Location: GPO
Operator: TEAM1
Date: 2003/05/15
Data:c1_660
Accept:0.618[2SD]
Average:-0.618(UNIT)
Data:c2_660
Accept:0.389[2SD]
Average:0.631(UNIT)
Data:c2_216
Accept:1.22[2SD]
Average:1.36(UNIT)
Data:c2_366
Accept:0.642[2SD]
Average:0.759(UNIT)
2.0
-2.0
18400 18500 18600 18700 18800 18900
Database: H:\TO 0019\Geophysics\GPO\051503\Team 1\Interp\STATICTESTS.gdb
Line Name: LSN.2
Page: 1

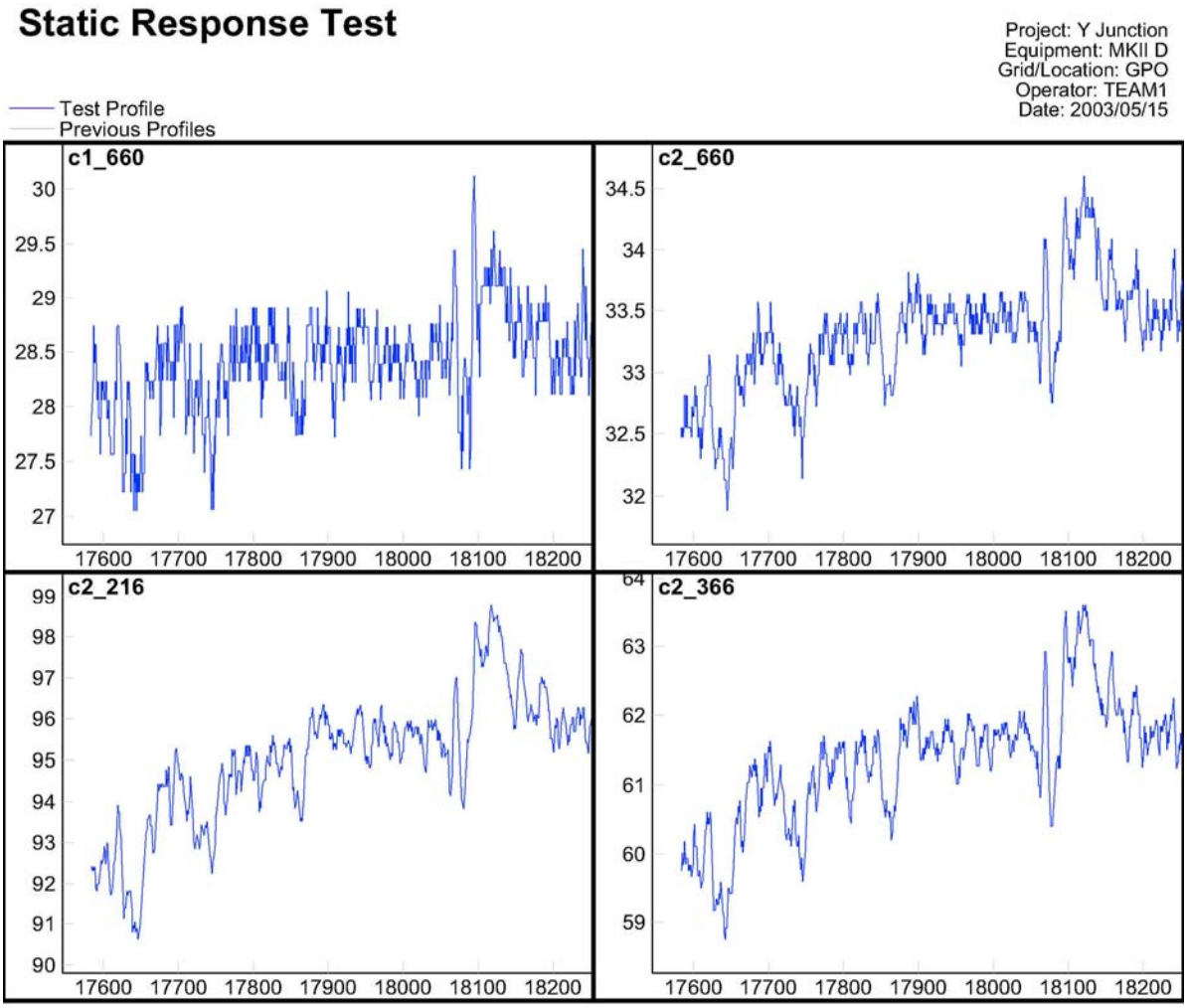

Static Calibration Test
Project: Y Junction
Equipment: MKII D
Grid/Location: GPO
Operator: TEAM1
Date: 2003/05/15
Data:c1_660
Accept:1.34[2SD]
Average:-0.151(UNIT)
Data:c2_660
Accept:0.429[2SD]
Average:0.929(UNIT)
Data:c2_216
Accept:1.83[2SD]
Average:3.23(UNIT)
Data:c2_366
Accept:1.53[2SD]
Average:1.63(UNIT)
2.0
-2.0
0
100
200
300
400
500
60
Database: H:\TO 0019\Geophysics\GPO\051503\Team 1\Interp\STATICTESTS.gdb
Line Name: LSN.1
Page: 1


Static Calibration Test
Project: Y Junciton
Equipment: EM61 MKIID
Grid/Location: GPO
Operator: Team2
Date: 2003/05/14
Data:c1_660
Accept:1.52[2SD]
Average:17.9(UNIT)
Data:c2_660
Accept:0.579[2SD]
Average:0.543(UNIT)
Data:c2_216
Accept:1.52[2SD]
Average:1.51(UNIT)
Data:c2_366
Accept:0.961[2SD]
Average:1.52(UNIT)
2.0
-2.0
0
200
400
600
800
1000
Database: H:\TO 0019\Geophysics\GPO\051403\Team 2\Interp\Statictests.gdb
Line Name: LSN.1
Page: 1

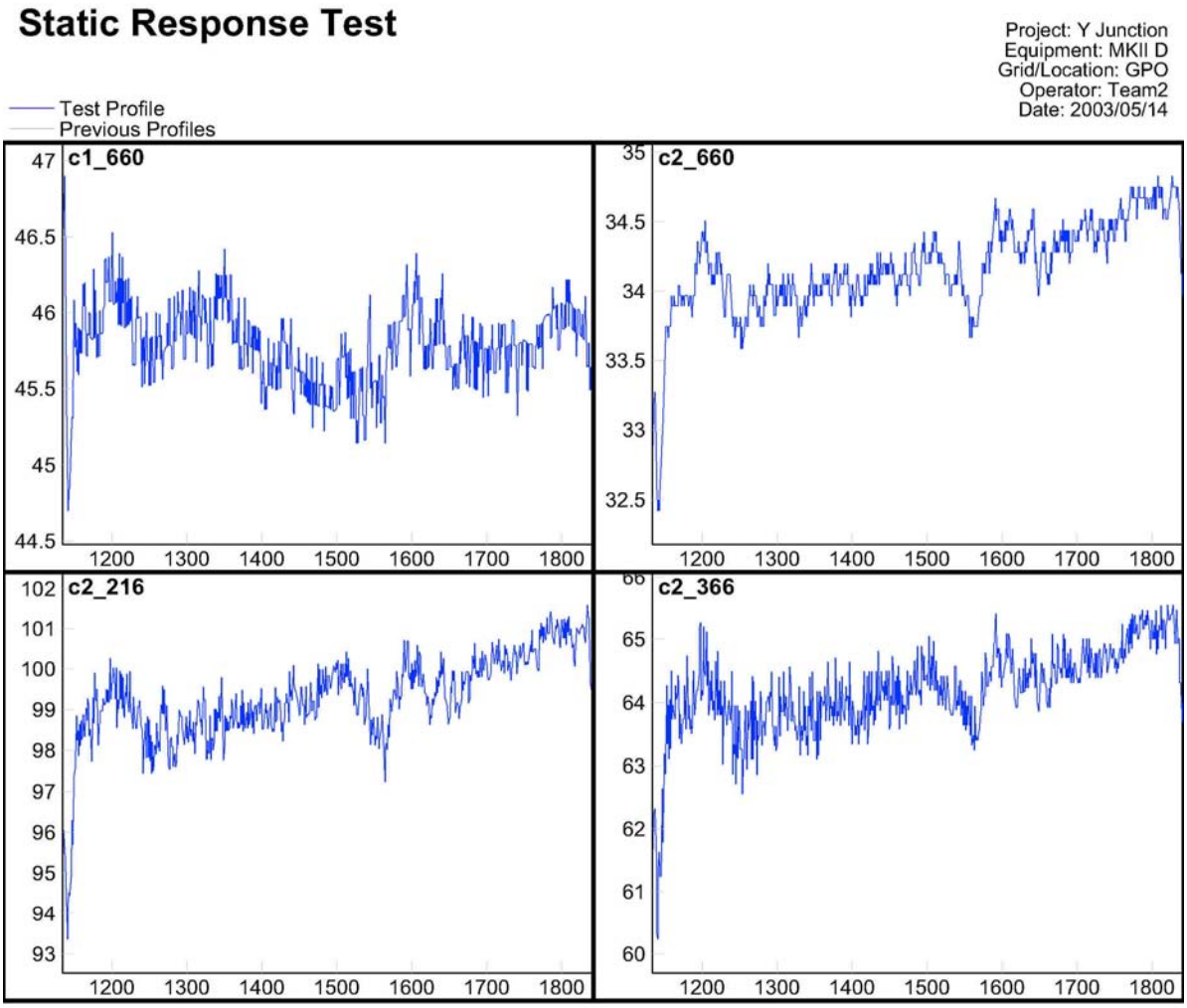

Static Calibration Test
Project: Y Junciton
Equipment: EM61 MKIID
Grid/Location: GPO
Operator: Team2
Date: 2003/06/04
Data:c1_660
Accept:1.07[2SD]
Average:14.4(UNIT)
Data:c2_660
Accept:0.197[2SD]
Average:-1.39(UNIT)
Data:c2_216
Accept:1.05[2SD]
Average:-8.85(UNIT)
Data:c2_366
Accept:0.438[2SD]
Average:-4.18(UNIT)
2.0
-2.0
23900 24000 24100 24200 24300 24400 24500
Database: H:\TO 0019\Geophysics\GPO\051403\Team 2\Interp\Statictests.gdb
Line Name: LSN.2
Page: 1



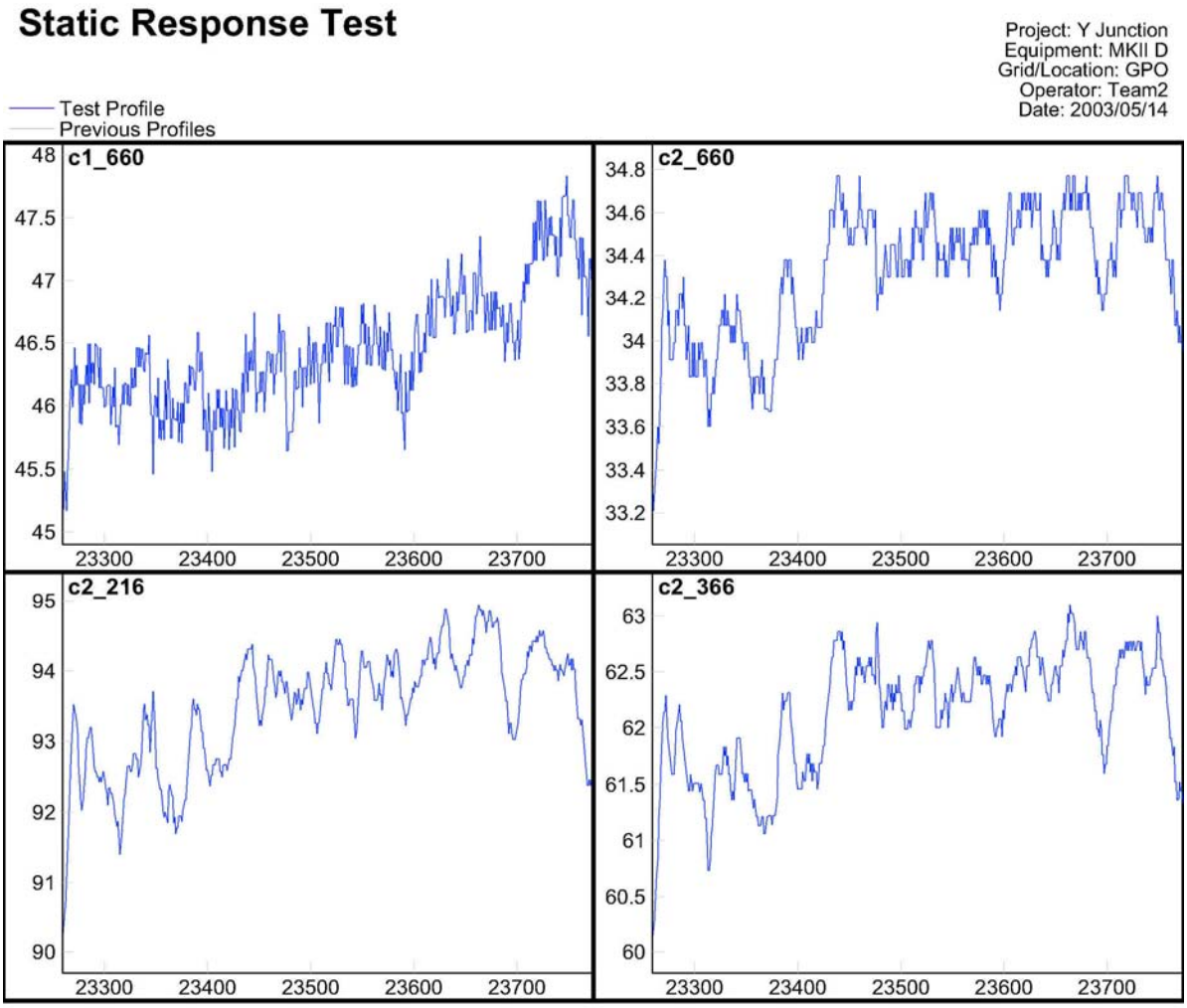
Database: H:\TO 0019\Geophysics\GPO\051503\Team 1\Interp\STATICTESTS.gdb
Line Name: LSR.1 Page: 1



Database: H:\TO 0019\Geophysics\GPO\051503\Team 1\Interp\STATICTESTS.gdb
Line Name: LSR.2 Page: 1



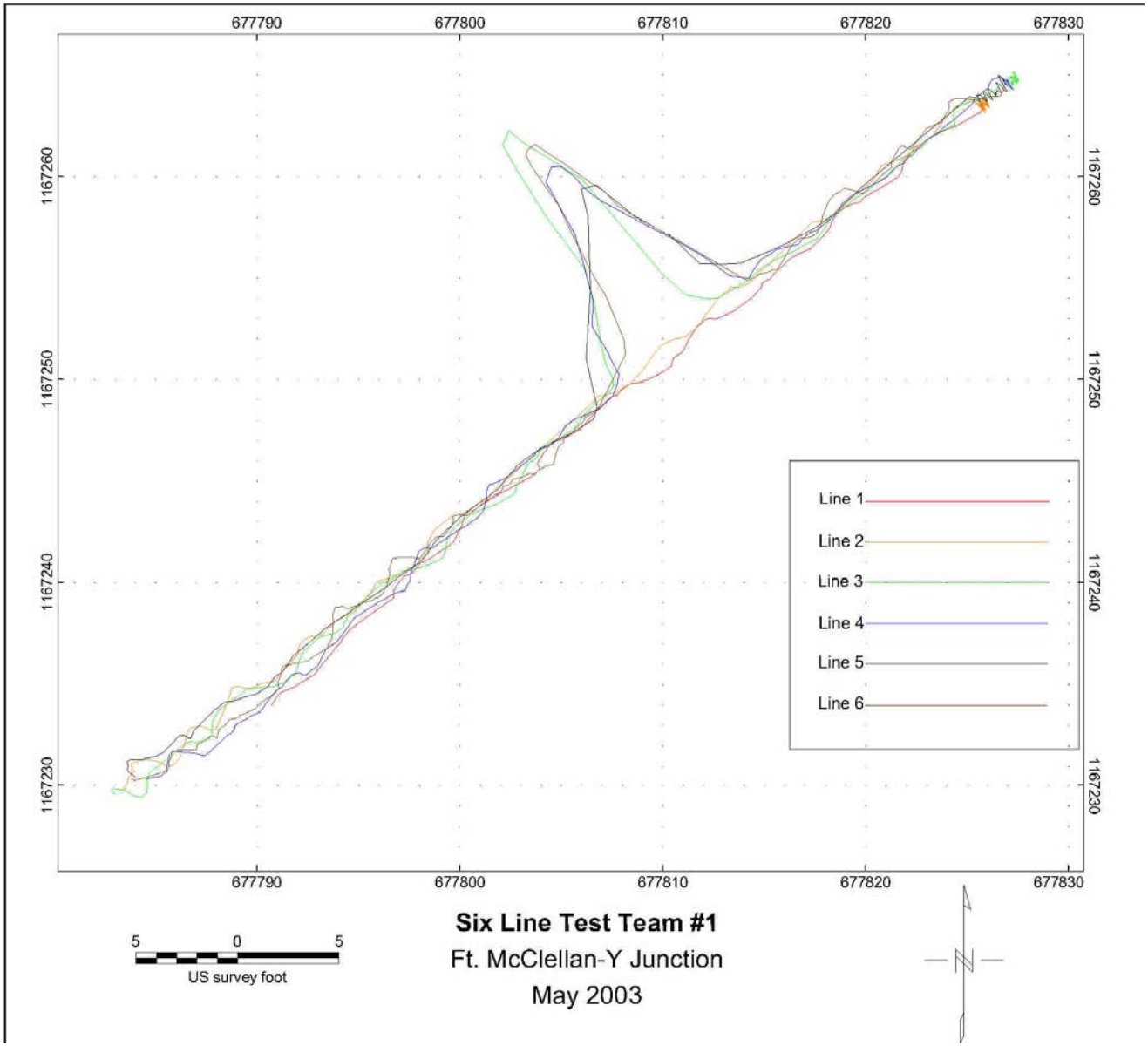
Database: H:\TO 0019\Geophysics\GPO\051403\Team 2\Interp\Statictests.gdb
Line Name: LSR.1 Page: 1

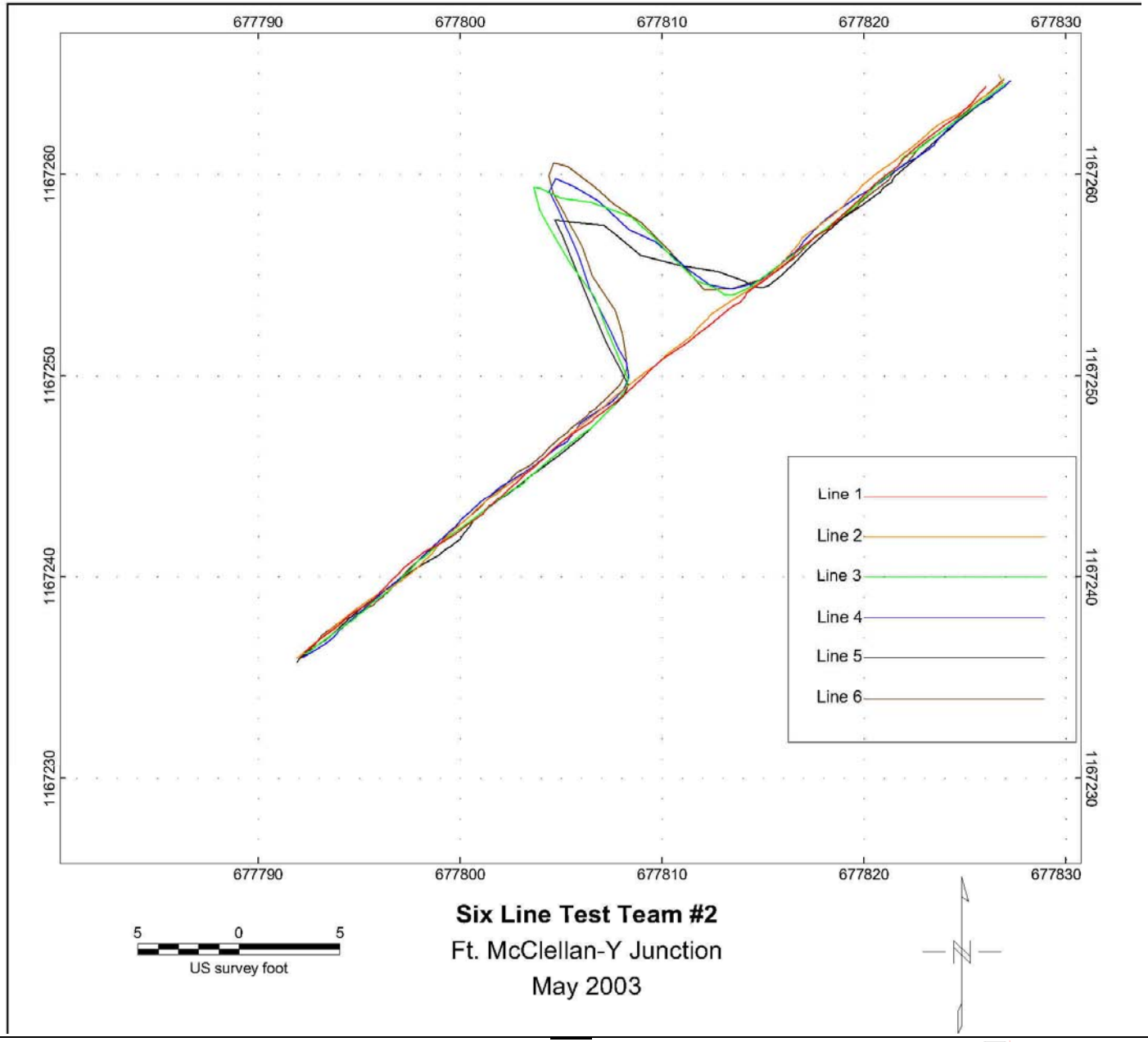


Database: H:\TO 0019\Geophysics\GPO\051403\Team 2\Interp\Statictests.gdb
Line Name: LSR.2 Page: 1

APPENDIX E

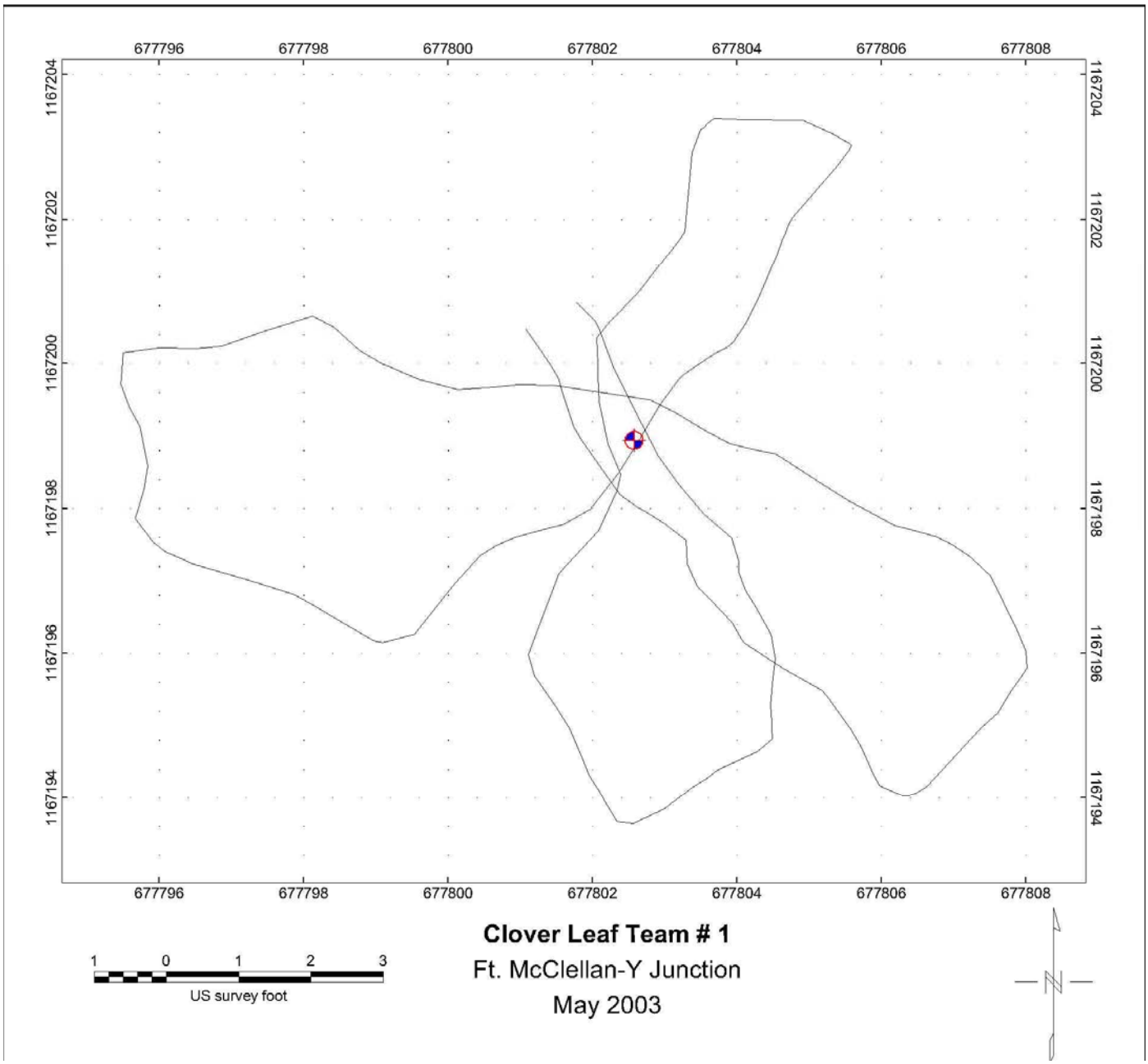
SIX LINE TEST

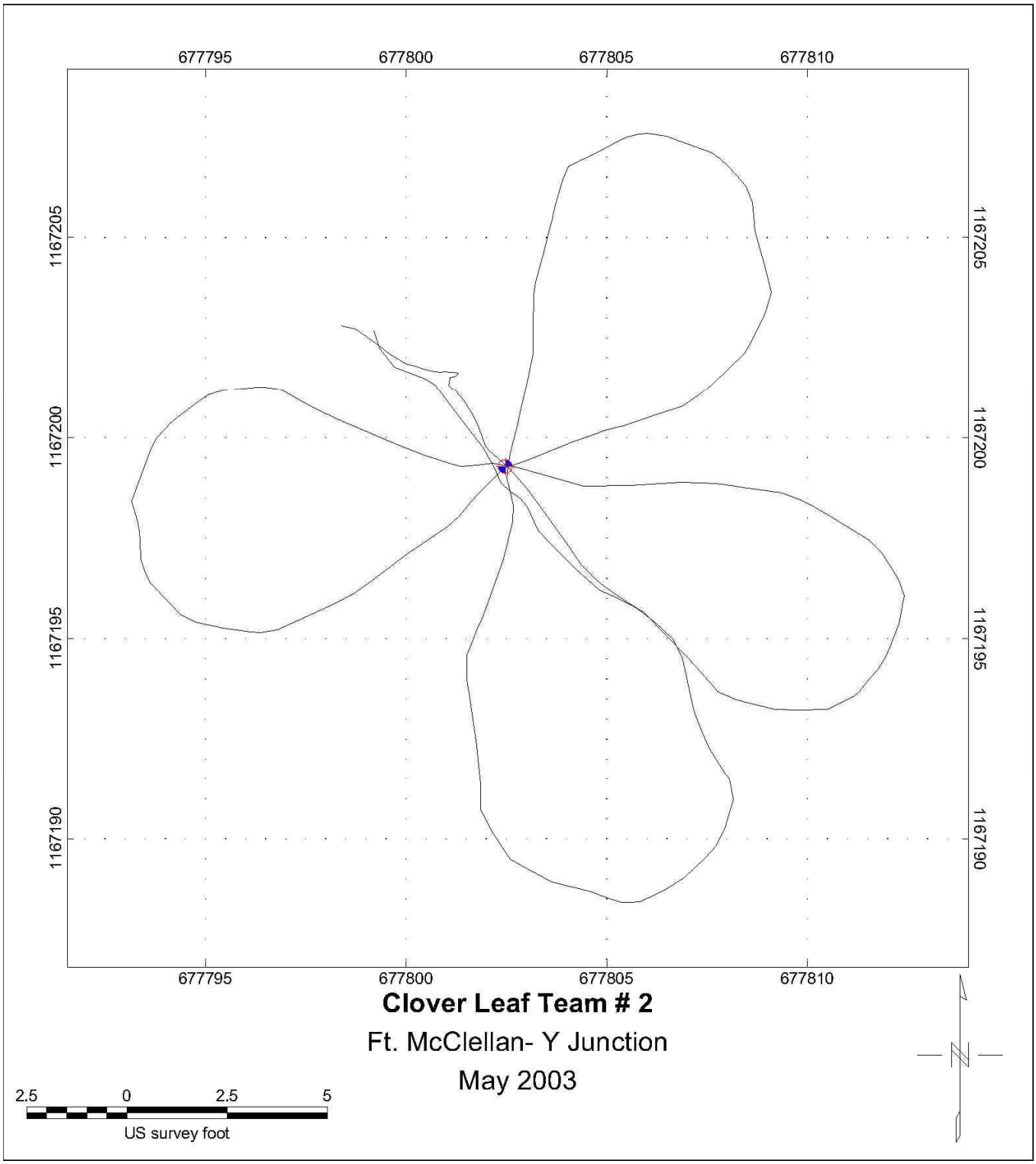

677790
677800
677810
677820
677830
1167260
1167250
1167240
1167230
Line 1
Line 2
Line 3
Line 4
Line 5
Line 6
5 0 5
US survey foot
Six Line Test Team #1
Ft. McClellan-Y Junction
May 2003


677790
677800
677810
677820
677830
1167260
1167250
1167240
1167230
Line 1
Line 2
Line 3
Line 4
Line 5
Line 6
5
0
5
US survey foot
Six Line Test Team #2
Ft. McClellan-Y Junction
May 2003

APPENDIX F

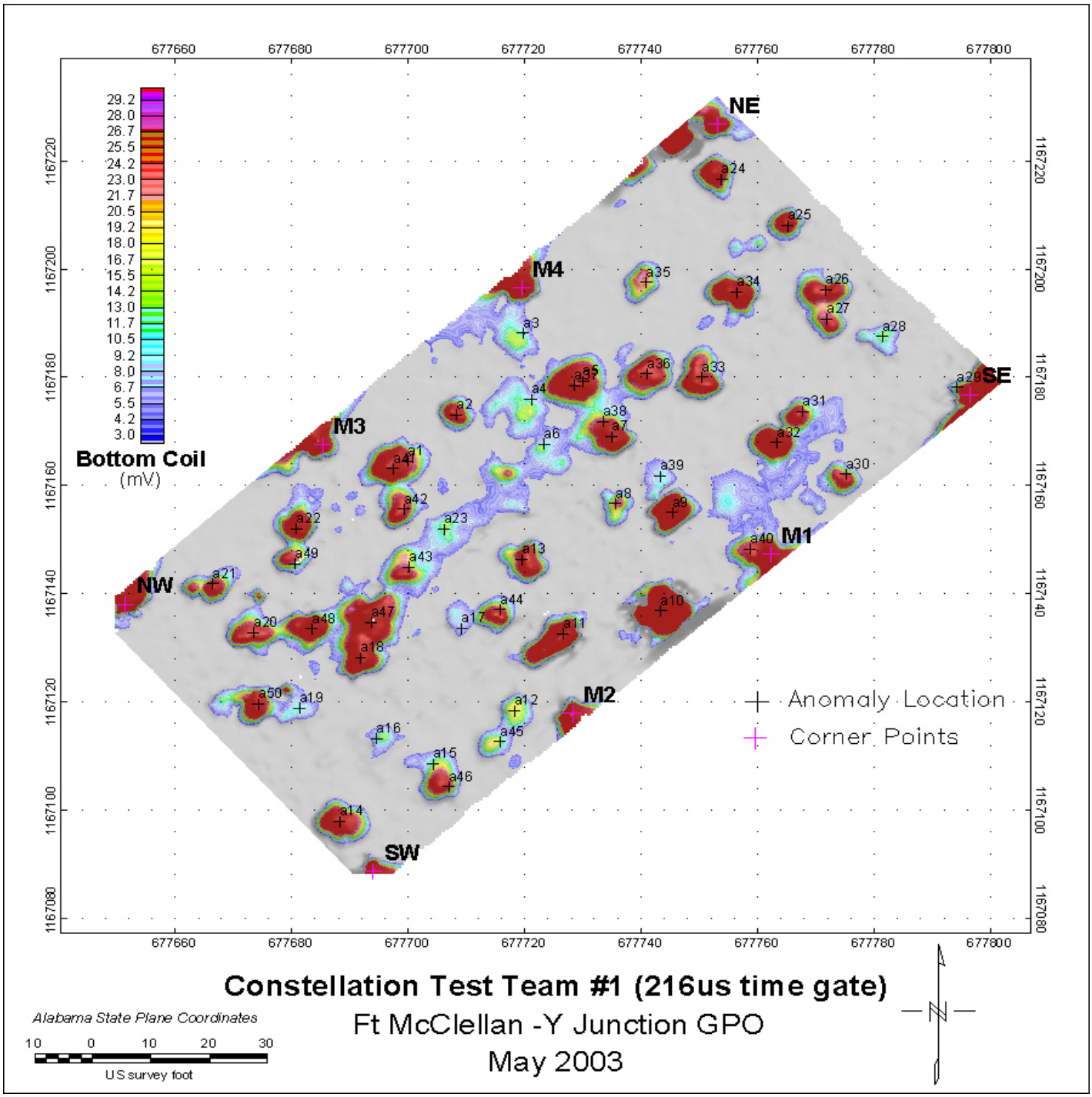
CLOVER LEAF

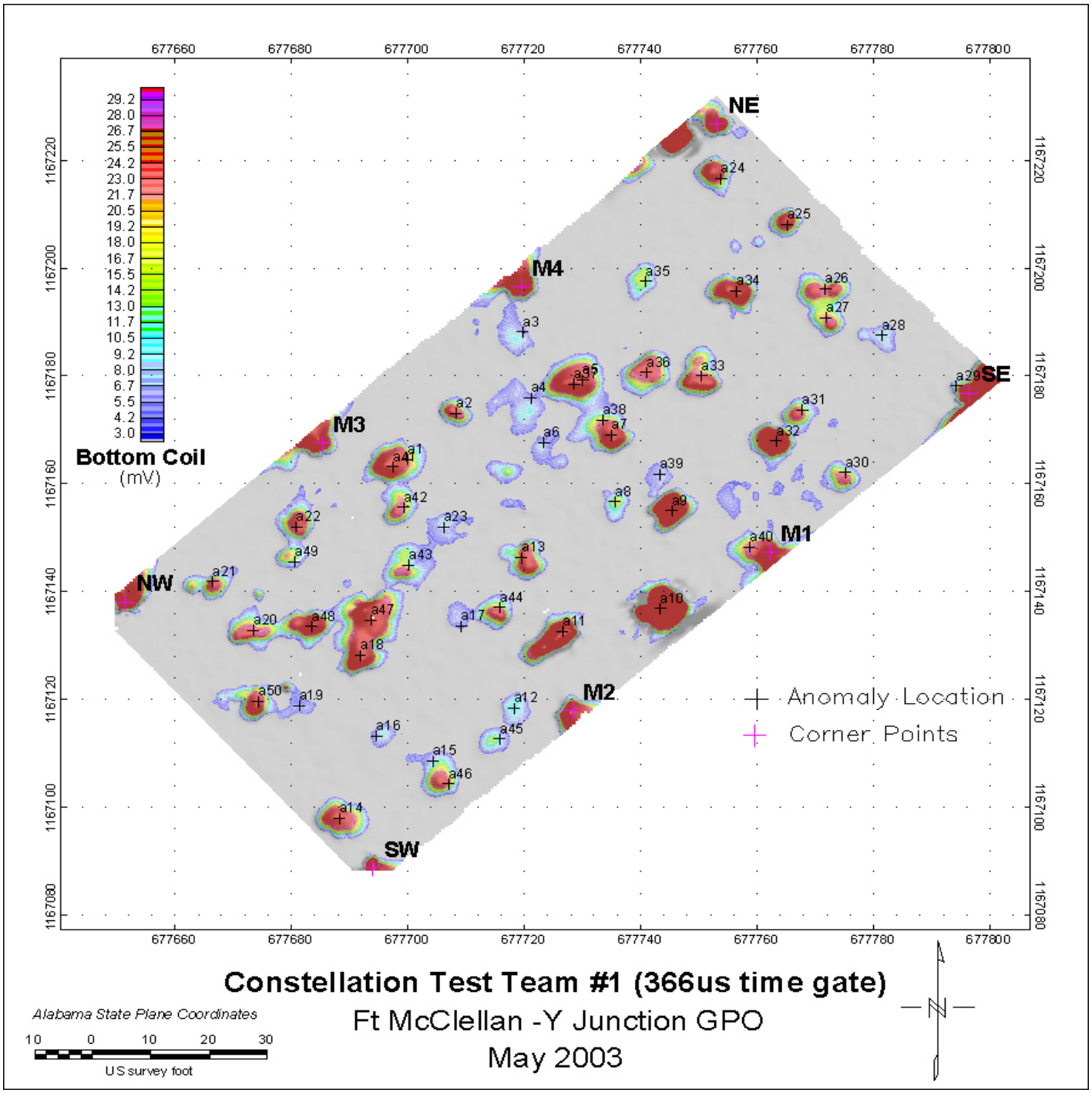

677796
677798
677800
677802
677804
677806
677808
1167204
1167202
1167200
1167198
1167196
1167194
Clover Leaf Team # 1
Ft. McClellan-Y Junction
May 2003
1 0 1 2 3
US survey foot
N

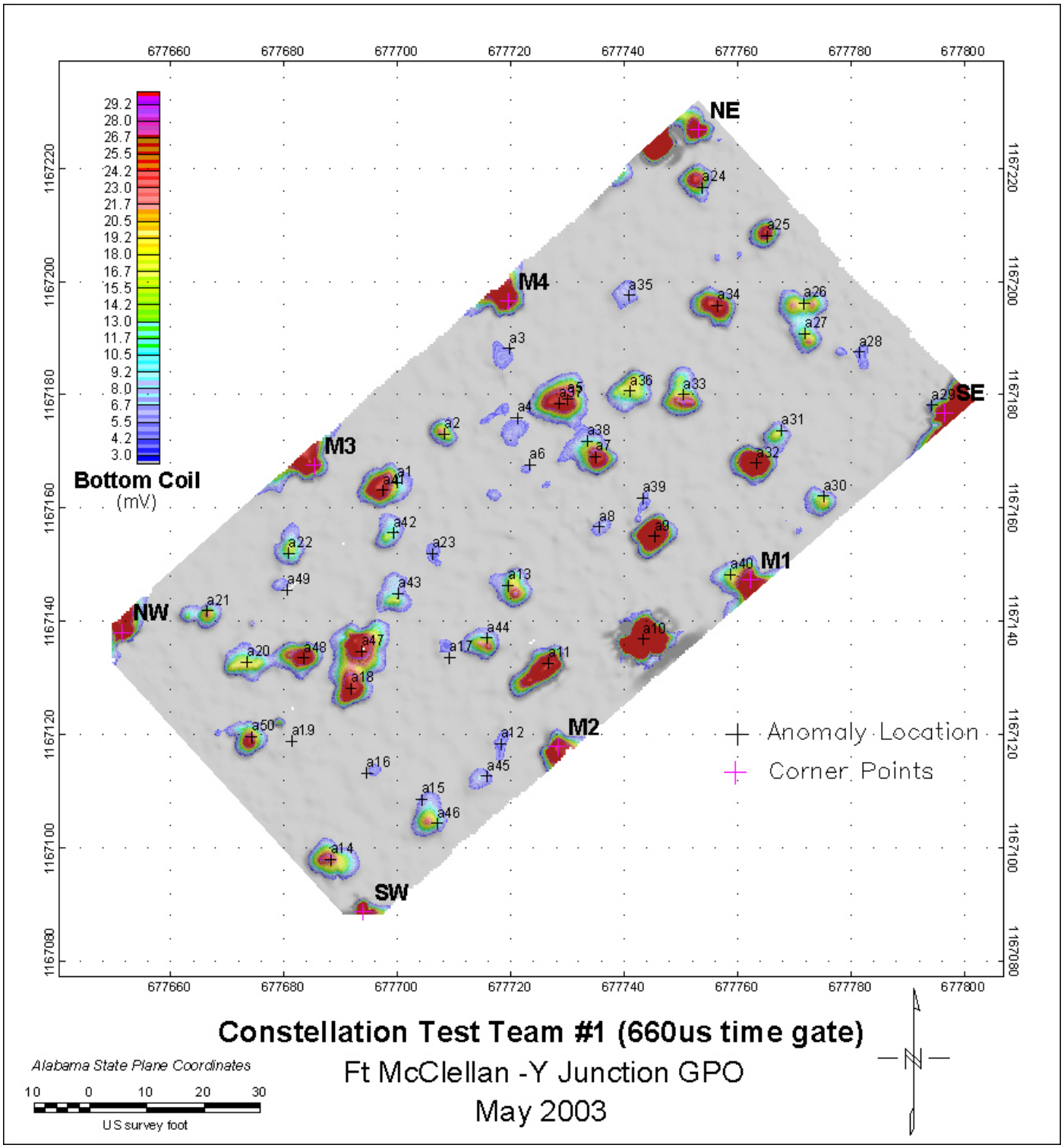

677795
677800
677805
677810
1167205
1167200
1167195
1167190
Clover Leaf Team # 2
Ft. McClellan- Y Junction
May 2003
2.5
0
2.5
5
US survey foot

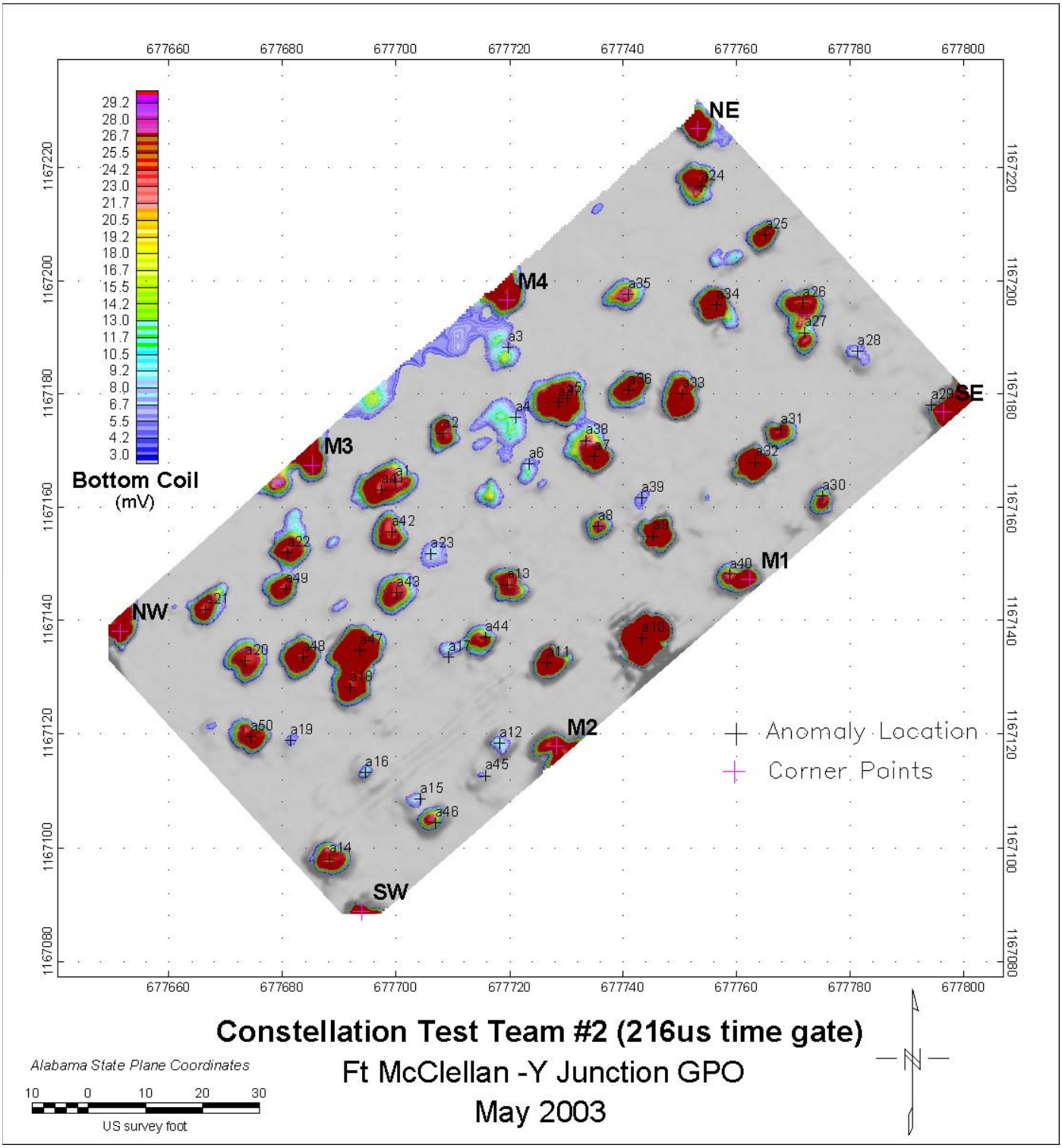
APPENDIX G

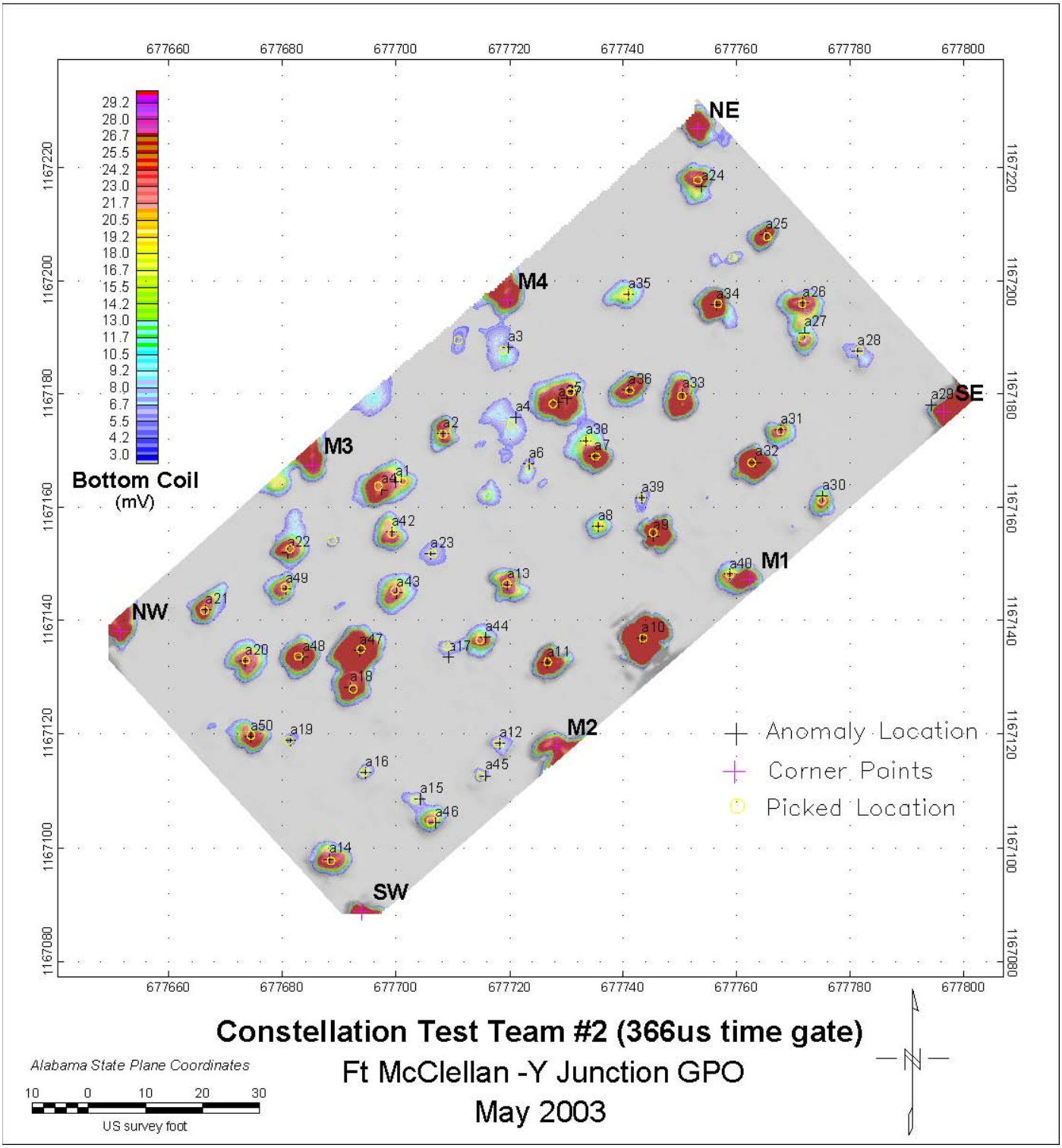
CONSTELLATION TEST

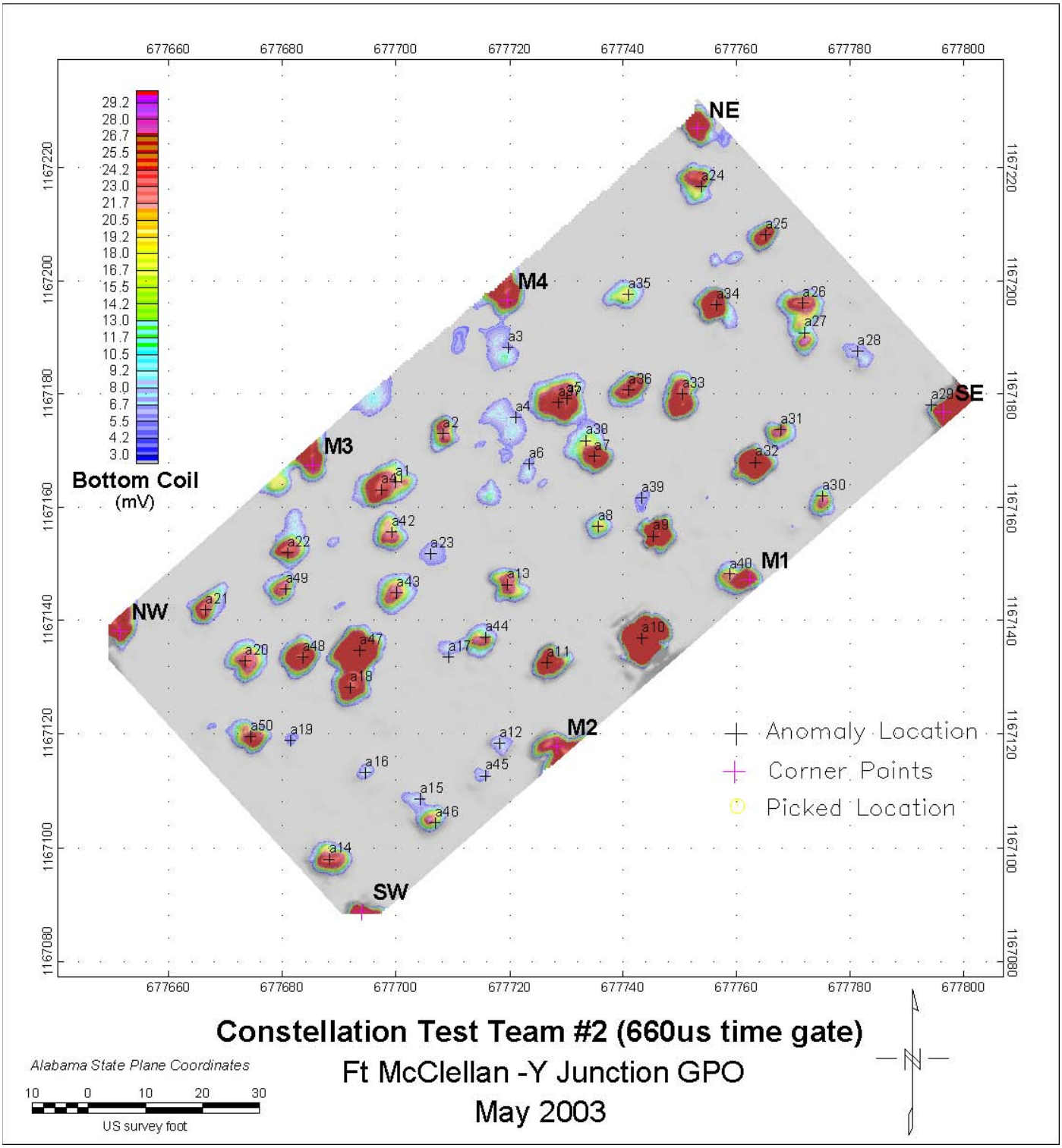

Bottom Coil
(mV)
29.2
28.0
26.7
25.5
24.2
23.0
21.7
20.5
19.2
18.0
16.7
15.5
14.2
13.0
11.7
10.5
9.2
8.0
6.7
5.5
4.2
3.0
NE
SE
SW
NW
M1
M2
M3
M4
Anomaly Location
Corner Points
Constellation Test Team #1 (216us time gate)
Ft McClellan -Y Junction GPO
May 2003
Alabama State Plane Coordinates
US survey foot


Bottom Coil
(mV)
29.2
28.0
26.7
25.5
24.2
23.0
21.7
20.5
19.2
18.0
16.7
15.5
14.2
13.0
11.7
10.5
9.2
8.0
6.7
5.5
4.2
3.0
NE
SE
SW
NW
M1
M2
M3
M4
Anomaly Location
Corner Points
Constellation Test Team #1 (366us time gate)
Ft McClellan -Y Junction GPO
May 2003
Alabama State Plane Coordinates
US survey foot


Bottom Coil
(mV)
29.2
28.0
26.7
25.5
24.2
23.0
21.7
20.5
19.2
18.0
16.7
15.5
14.2
13.0
11.7
10.5
9.2
8.0
6.7
5.5
4.2
3.0
NE
SE
SW
NW
M1
M2
M3
M4
Anomaly Location
Corner Points
Constellation Test Team #1 (660us time gate)
Ft McClellan -Y Junction GPO
May 2003
Alabama State Plane Coordinates
US survey foot


Bottom Coil
(mV)
29.2
28.0
26.7
25.5
24.2
23.0
21.7
20.5
19.2
18.0
16.7
15.5
14.2
13.0
11.7
10.5
9.2
8.0
6.7
5.5
4.2
3.0
NE
SE
NW
SW
M1
M2
M3
M4
Anomaly Location
Corner Points
Constellation Test Team #2 (216us time gate)
Ft McClellan -Y Junction GPO
May 2003
Alabama State Plane Coordinates
US survey foot


Bottom Coil
(mV)
29.2
28.0
26.7
25.5
24.2
23.0
21.7
20.5
19.2
18.0
16.7
15.5
14.2
13.0
11.7
10.5
9.2
8.0
6.7
5.5
4.2
3.0
NE
SE
NW
SW
M1
M2
M3
M4
Anomaly Location
Corner Points
Picked Location
Constellation Test Team #2 (366us time gate)
Ft McClellan -Y Junction GPO
May 2003
Alabama State Plane Coordinates
US survey foot


Bottom Coil
(mV)
29.2
28.0
26.7
25.5
24.2
23.0
21.7
20.5
19.2
18.0
16.7
15.5
14.2
13.0
11.7
10.5
9.2
8.0
6.7
5.5
4.2
3.0
NE
SE
NW
SW
M1
M2
M3
M4
Anomaly Location
Corner Points
Picked Location
Constellation Test Team #2 (660us time gate)
Ft McClellan -Y Junction GPO
May 2003
Alabama State Plane Coordinates
US survey foot