CENR 55-2
Volume XII

OPERATIONAL PROCEDURES FOR GLOBAL SUBSURFACE SYSTEM (GSS) FIELD DATA ACQUISITION (FDA) LOCATIONS

14 November 1986

Operations

OPERATIONAL PROCEDURES FOR GLOBAL SUBSURFACE SYSTEM (GSS) FIELD DATA ACQUISITION (FDA) LOCATIONS

This regulation establishes the procedures for performing standard operations and analysis functions at GSS FDA stations. This regulation is to be used in conjunction with CENR 55-2 Vol I and addresses instructions for the GSS FDA locations only. Instructions to alter any requirements of this regulation from any source other than Headquarters/DO will not be implemented until approved by Headquarters/DOSB.

1. General:

a. Data Channel Designator. In order to differentiate the GSS FDA channels from the existing channels, the following changes to the Frequency Response section of the channel designator system described in Volume I are required:

(1) Short Period. The number 2 will be used at FDA stations using 23900 and KS36000 instruments.

(2) Long Period. The number 5 will be used at FDA stations using KS36000 instrument(s).

b. Operations Room Environment:

(1) The normal operating tolerances are 50-90 degrees Fahrenheit and 10-80% humidity.

(2) Should the temperature exceed 90 degrees Fahrenheit or humidity fall below 10%, power the CT down to preclude equipment damage.

c. Power. The CT will be operated within specifications contained in TI 2-CT-1.

d. Operations Area:

(1) No magnet or radio will be brought within 3 feet of the CT at any time.

(2) Containers of photographic chemicals will not be placed on the MOT table.

2. Operation Procedures.

a. Summation Channel Operations. Individual vertical array channel(s) may be deleted from the STPR, using the Channel Use commands, whenever channel state-of-health is in question, and during maintenance actions to preclude spurious spikes and/or offsets from affecting the summation. Individual channel(s) will not be deleted from processed traces because of cultural or wind noise.

b. Outages Authorized for Training Purposes. The Specific Station Requirement details each station's authorized training time. An analysis capability must be maintained (i.e., individual high gain vertical, infinite velocity beam) either on site or at the headquarters. If an analysis capability cannot be maintained (i.e. the CT or CPU1 (and CPU2 for high-speed stations) will be inoperative), transmit a request for outage using the criteria established in Volume I, paragraph 2-6. This requirement is to ensure the headquarters is informed of any impending loss of data from that station and can approve or disapprove the outage as dictated by mission requirements.

3. Software Changes/Control. Centralized control of all FDA software and supportive documentation is the responsibility of Depot/LG. All procedures for using and maintaining the software supporting the FDA (CT and RTs) will be provided to the detachment maintenance personnel by Depot/LG.

4. Recording Procedures:

a. Develocorder Timing. In order to provide the correct time output to the develocorders (compensating for the CT and RT processing delays) the DATACHRON timers will be retarded 37.001 seconds from GMT (ZULU).

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b. Real Time Visual Recorder(RTVR). The RTVR will be used for signal monitoring, equipment checks and data reporting (by use of the eight CT analog channels) during periods of develocorder or CPU1 outages. When used for data reporting, a sensitivity check will be accomplished to verify channel gain.

c. Station Processor. The STPR will record all channels supplied by the CT and processed traces on a continuous basis. When CPU1 is anticipated to be inoperative in excess of eight hours, and a spare is not available, CPU1 and CPU2 will be physically interchanged, by maintenance personnel, to maintain data processing and signal outputs to the develocorders. CPU1 and CPU2 will not be physically interchanged when CPU2 is inoperative.

5. Calibrations and Operating Tolerances. All data channel calibrations (EQUATE, SSITE, FREQ RESP) will be performed using the CT and the amplitude factor specified in the SSR (for amplitude factor to millimicron conversion, reference attachment 1). The STPR will be used for channel sensitivity checks.

a. When an array channel must be removed from the STPR input, the Channel Use command will be used, which will automatically adjust the processed data gains to compensate for the removed channel(s). Following maintenance, and after the maintenance personnel have verified the correct operation and tolerance of the channel (CT SSITE cal), add the channel to the STPR with the Channel Use command. Additionally, because the CT automatically equalizes all channels, STPR CGAINS are not changed from the values entered at configuration (when the initialized operational program is constructed, the CGAIN for each channel is included).

b. Develocorder Sensitivity Checks. Develocorder sensitivity checks will be performed on all display channels using the Assign command at CPU1 and the values specified in the SSR.

c. Calibration Schedule:

(1) Each CT channel is required to be calibrated each Wednesday at the time specified in the SSR. When a CT calibration with channel analysis (parameter 2 equals SA or EQ) is performed, and results are not within CT tolerances (i.e., scale factor not replaced), delete the channel from processing (if contributing to a summation) and/or record the channel as unknown (if individual display channel) until maintenance personnel can verify the correct operation of the suspect channel.

(2) Develocorder sensitivity checks will be performed on each display channel during the first and third week of every month. Develocorder sensitivity checks may be performed at a date and time convenient to the location.

(3) Frequency responses will be performed, the values normalized, and the results compared to established tolerances in January, April, July and October. Frequency responses are not required to be recorded on film. The quarterly or final frequency response MOT printer printouts (analysis results table) will be forwarded in accordance with paragraph 8.

d. Unscheduled Checks and Calibrations:

(1) Frequency Response - Required whenever components affecting data response curve characteristics are adjusted or replaced to include sensor repair, free period or damping adjustments, and/or RT replacement.

(2) SSITE CAL with scale replacement (SA) - Required to determine correct channel operations following maintenance action, and before channel is added to summation traces (for array channels) or determined to be at known gain (for individual channels).

(3) Stations will perform unscheduled calibrations whenever channel malfunctions affecting data reliability are suspected. Remove from the STPR, any suspect channels contributing to summation traces (for array channels) or record as gain unknown (for individual display channels) until the channel state-of-health can be verified.

e. Station Timing:

(1) Stations will use the satellite receiver output for a timing standard

(2) The DATACHRON timers will be retarded 37.001 seconds (+/- 0.0005 sec) from ZULU time to compensate for the CT and RT processing delays.

6. Operational Records, Logs, and Reports. All data records, logs, and reports will be maintained as specified in Volume I with the following exceptions:

a. Develocorder Records. The DATA columns will reflect channel gain or status changes. Since all display channels are equalized to nominal gain by the CT, calibration entries need not be annotated on the CEN Form 49.

b. Edits. Calibration edits will consist of the final SPAL and the final LPAL/BBAL equate calibrations (merged in chronlogical order with the edit requests) for the first Wednesday of each requested 10 day period. All calibration edits should be long enough in duration to include all channels calibrated for any given calibration (i.e., the CT, even for an EQUATE calibration, will only calibrate one RT at a time. The duration of the calibration edit will be dependent on how many instruments each location has).

c. Station Logs. In addition to the items specified in Volume I, all CT resets and reconfigurations require documentation in the station log.

7. Aralysis Procedures. In addition to the instructions contained in Volume I, the MMU/SEC value for FDA channels will be computed using the period correction factors in Attachment 2 and 3 of this document.

8. Documentation and Disposition Instructions. MOT printer outputs will be forwarded using the following guide:

TYPE OUTPUT	FORWARD TO	AND
CT Configuration Output	Depot/LGEB cy to HQ/TGX/LGM/DOSB	Retain 1 copy until next configuration, then destroy
Freq Resp Print-out (GET AR Table)	Depot/LGEB cy to HQ/TGX/LGM/DOSB	Retain 1 copy until next valid frequency response
Command and Response Data	N/A	Destroy 3 months after STPR edits have been accomplished

9. Terms and Abbreviations:

BBRT - Broadband Remote Terminal
CT - Central Terminal
DDS - Digital Data Subsystem
FDA - Field Data Aquisition
FSF - Field Site Facility
GSS - Global Subsurface System
LPRT - Long Period Remote Terminal
MOT - Maintenance Operating Terminal
Msec - Milliseconds
RT - Remote Terminal
SA - Sine wave generation with CT analysis with scaling factor replacement
SI - Sine wave generation, no CT analysis
SN - Sine wave generation with CT analysis, no scaling factor replacement
SPRT - Short Period Remote Terminal
STPR - Station Processor

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1. Command Value Conversion Table
2. Normalized Frequency Response Tolerances
3. Period Correction Factors for 23900 and KS36000 Short Period Sensors
4. Long Period System Period Correction Factors
5. GSS STPR Input Sensitivity (INSENSE)

COMMAND VALUE CONVERSION TABLE

	Command Amplitude Factor	Calibration Driving Force	Approximate counts Expected
SPRT	Blank or 1	800 Mu	80,000
	2	400 Mu	40,000
	3	200 Mu	20,000
	4	100 Mu	10,000
BBRT KS-SP	Blank or 1	800 Mu	60,000
	2	400 Mu	30,000
	3	200 Mu	15,000
	4	100 Mu	7,500
BBRT KS-LP	Blank or 1	20 U	60,000
	2	10 U	30,000
	3	5 U	15,000
	4	2.5 U	7,500
LPRT	Blank or 1	20 U	60,000
	2	10 U	30,000
	3	5 U	15,000
	4	2.5 U	7,500

NORMALIZED FREQUENCY RESPONSE TOLERANCES

23900/SPRT							
	.5 Hz	.8 Hz	1.0 Hz	1.4[illegible]3 Hz	2.0 Hz	2.857 Hz	4.0 Hz
MAX	.3454	.836	1.0	1.0933	1.0547	.9968	.836
NOM	.314	.7962	1.0	1.0412	1.0045	.9062	.7273
MIN	.2826	.7564	1.0	.989	.9543	.8156	.618

RS36000 SP/BBRT							
	.5 Hz	.8 Hz	1.0 Hz	1.428 Hz	2.0 Hz	2.857 Hz	4.0 Hz
MAX	.3344	.832	1.0	1.082	1.0642	1.041	.8470
NOM	.304	.7925	1.0	1.0305	1.0135	.9464	.7365
MIN	.2736	.753	1.0	.979	.9628	.8518	.626

KS36000 LP/BBRT or LPRT							
	.02 Hz	.025 Hz	.0333 Hz	.04 Hz	.05 Hz	.0667 Hz	.1 Hz
MAX	1.4467	1.4300	1.2516	1.0	.7157	.3229	.0603
NOM	1.258	1.300	1.1920	1.0	.6816	.2936	.0524
MIN	1.0693	1.1700	1.1324	1.0	.6475	.2642	.0445

PERIOD CORRECTION FACTORS FOR 23900 and KS36000 SHORT PERIOD SENSORS

$$G_t = \frac{\text{Magnification at a given period}}{\text{Magnification at 1 Hz}}$$

Period	G_t	$\frac{1}{G_t}$	$\frac{1}{G_t T}$
0.2	3.20	0.31	1.56
0.3	2.90	0.34	1.15
0.4	2.50	0.40	1.10
0.5	2.00	0.50	1.00
0.6	1.67	0.60	1.00
0.7	1.43	0.70	1.00
0.8	1.25	0.80	1.00
0.9	1.11	0.90	1.00
1.0	1.00	1.00	1.00
1.1	0.89	1.12	1.02
1.2	0.70	1.43	1.19
1.3	0.55	1.82	1.40
1.4	0.44	2.27	1.62
1.5	0.36	2.78	1.85
1.6	0.30	3.33	2.08
1.7	0.250	4.00	2.35
1.8	0.208	4.81	2.67
1.9	0.177	5.65	2.98
2.0	0.154	6.49	3.25
2.1	0.130	7.69	3.66
2.2	0.115	8.70	3.95
2.3	0.100	10.0	4.35
2.4	0.087	11.5	4.79
2.5	0.078	12.82	5.13
2.6	0.070	14.3	5.50
2.7	0.062	16.13	5.97
2.8	0.055	18.19	6.49
2.9	0.050	20.00	6.90
3.0	0.045	22.22	7.42

LONG PERIOD SYSTEM PERIOD CORRECTION FACTORS

$$G_t = \frac{\text{Magnification at a given period}}{\text{Magnification at 25 SPC}}$$

KS36000 SENSOR

Period	G_t	$1/G_t$	$1/G_tT$
10	.1200	8.333	.8333
11	.1932	5.176	.4705
12	.2664	3.754	.3128
13	.3396	2.945	.2265
14	.4128	2.422	.1730
15	.4860	2.058	.1372
16	.5524	1.810	.1131
17	.6188	1.616	.0951
18	.6852	1.459	.0811
19	.7516	1.330	.0700
20	.8180	1.222	.0611
21	.8544	1.170	.0557
22	.8908	1.123	.0510
23	.9272	1.079	.0469
24	.9636	1.038	.0432
25	1.000	1.000	.0400
26	.9954	1.005	.0386
27	.9908	1.009	.0374
28	.9862	1.014	.0362
29	.9816	1.019	.0351
30	.9770	1.024	.0341
31	.9600	1.042	.0336
32	.9430	1.060	.0331
33	.9260	1.090	.0327
34	.9090	1.100	.0324
35	.8920	1.121	.0320
36	.8750	1.143	.0317
37	.8580	1.166	.0315
38	.8410	1.189	.0313
39	.8240	1.214	.0311
40	.8070	1.239	.0310
41	.7836	1.276	.0311
42	.7602	1.315	.0313
43	.7368	1.357	.0316
44	.7134	1.402	.0319
45	.6900	1.449	.0322
46	.6666	1.500	.0326
47	.6432	1.555	.0331
48	.6198	1.613	.0336
49	.5964	1.677	.0342
50	.5730	1.745	.0349

GSS STPR INPUT SENSITIVITY (ISENSE)

SHORT PERIOD (SP)

DDS ADA GAIN	ISENSE MU/COUNT	ISENSE VOLTS EQUIVALENT (P/P) at 100MU	
		CGAIN = 1	CGAIN = 0.8
0	20.48	0.0244	0.0191
6	10.24	0.0488	0.0381
12	5.12	0.0976	0.07625
18	2.56	0.1952	0.1525
24	1.28	0.3904	0.305
30	0.64	0.7808	0.61
36	0.32	1.5616	1.22
42	0.16	3.1232	2.44
48	0.08	6.2464	4.88
54	0.04	12.4928	9.76
60	0.02	24.9856	19.52
66	0.01	49.9712	39.04
72	0.005	99.9424	78.08

LPDARTS PORT (LP)

DDS ADA GAIN	ISENSE MU/COUNT	ISENSE VOLTS EQUIVALENT (P/P) at 10U
		CGAIN = 1
N/A	0.333	0.286

SAMPLE DEV SENS VOLTAGE TABLE: CGAIN = 1.0

DEV GAIN / DDS:	2000	1000	500	250	100	50	10	5	1
0	.002	.003	.006	.012	.031	.061	.305	.610	3.050
6	.003	.006	.012	.024	.061	.122	.610	1.22	6.100
12	.006	.012	.024	.049	.122	.244	1.22	2.44	12.2
18	.012	.024	.049	.098	.244	.488	2.44	4.88	24.4
24	.024	.049	.098	.195	.488	.976	4.88	9.76	48.8
30	.049	.098	.195	.390	.976	1.95	9.76	19.5	97.6
36	.098	.195	.390	.781	1.95	3.90	19.5	39.0	195.2
42	.195	.390	.781	1.56	3.90	7.81	39.04	78.08	390.4
48	.390	.781	1.56	3.12	7.81	15.6	78.08	156.2	780.8
54	.781	1.56	3.12	6.24	15.6	31.2	156.2	312.3	1561.6
60	1.56	3.12	6.25	12.5	31.2	62.5	312.3	624.6	3123.2
66	3.12	6.25	12.5	25.0	62.5	124.9	624.6	1249.3	6246.4
72	6.25	12.5	25.0	50.0	124.9	249.9	1249.3	2498.6	12492.8

SAMPLE DEV SENS VOLTAGE TABLE: CGAIN = 0.8

DEV GAIN DDS:	2000	1000	500	250	100	50	10	5	1
0	.001	.002	.005	.010	.024	.048	.239	.478	2.388
6	.002	.005	.010	.019	.048	.095	.476	.953	4.763
12	.005	.010	.019	.038	.095	.191	.953	1.91	9.531
18	.010	.019	.038	.076	.191	.381	1.91	3.81	19.06
24	.019	.038	.076	.153	.381	.763	3.81	7.63	38.13
30	.038	.076	.153	.305	.763	1.53	7.63	15.3	76.25
36	.076	.153	.305	.610	1.53	3.05	15.3	30.5	152.5
42	.153	.305	.610	1.22	3.05	6.10	30.5	61.0	305.0
48	.305	.610	1.22	2.44	6.10	12.2	61.0	122.0	610.0
54	.610	1.22	2.44	4.88	12.2	24.4	122.0	244.0	1220.0
60	1.22	2.44	4.88	9.76	24.4	48.8	244.0	488.0	2440.0
66	2.44	4.88	9.76	19.5	48.8	97.6	488.0	976.0	4880.0
72	4.88	9.76	19.5	39.0	97.6	195.2	976.0	1952.0	9760.0