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AUTHORITY

usaf ltr, 25 jan 1972

TECHNICAL REPORT NO. 68-36

OPERATION OF THE UINTA BASIN SEISMOLOGICAL OBSERVATORY, QUARTERLY REPORT NO. 9

1 May 1968 through 31 July 1968

GEOTECH
A TELEDYNE COMPANY

TECHNICAL REPORT NO. 68-36

OPERATION OF THE UINTA BASIN SEISMOLOGICAL OBSERVATORY
Quarterly Report No. 9
1 May through 31 July 1968

Sponsored by

Advanced Research Projects Agency
Nuclear Test Detection Office
ARPA Order No. 624.

GEOTECH
A TELEDYNE COMPANY
3401 Shiloh Road
Garland, Texas

6 August 1968

IDENTIFICATION

AFTAC Project No:	VELA T/6705
Project Title:	Operation of UBSO
ARPA Order No:	624
ARPA Program Code No:	6F10
Name of Contractor:	Teledyne Industries, Geotech Division
Date of Contract:	1 May 1966
Amount of Contract and Amendment 1:	$624,897
Amount of Amendment 2:	$374,600
Contract Change Notice No. 1	$144,173
Total	$1,143,670
Contract No:	AF 33(657)-16563
Contract Expiration Date:	31 October 1968
Program Manager:	B. B. Leichliter, BR1-2561, Ext. 222

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ILLUSTRATIONS

* * * * * * * * * * *

TABLES

ABSTRACT

This report describes the operations of the Uinta Basin Seismological Observatory (UBSO) from 1 May 1968 through 31 July 1968. Modifications and additions to the observatory instrumentation are described, and tests to improve the operations of the observatory are reported. Also discussed is the status of special investigations designed to evaluate and improve the detection capability of the observatory.

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OPERATION OF THE UINTA BASIN SEISMOLOGICAL OBSERVATORY,
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1. INTRODUCTION

1.1 AUTHORITY

The work described in this report was supported by the Advanced Research Projects Agency, Nuclear Test Detection Office, and was monitored by the Air Force Technical Applications Center (AFTAC), under Contract AF 33(657)-16563. The statement of work for this contract is shown in the appendix.

1.2 HISTORY

The Uinta Basin Seismological Observatory (UBSO) was constructed under Contract AF 33(657)-7185. Site selection and noise surveys were accomplished by Geotech; the final decision on the observatory location was made by AFTAC. Texas Instruments, Incorporated (TI), was responsible for the construction of all physical facilities.

Contract AF 33(600)-43486, issued to TI, contained the authority for equipping and operating UBSO. The instrumentation was supplied by Geotech and was installed under the direction of Geotech personnel under subcontract to TI. Texas Instruments operated the observatory from November 1962 until 1 July 1963. Under Projects VT/1124 and VT/5054, Contract AF 33(657)-12373, Geotech operated UBSO from 1 July 1963 through 30 April 1966.

2. OPERATION OF UBSO

2.1 GENERAL

Data are recorded at UBSO on a 24-hour basis. The observatory is normally manned 8 to 10 hours a day, 5 days a week. On weekends and holidays a skeleton crew mans the observatory 8 hours a day; however, additional personnel are on call in case of emergency.

The UBSO array configuration is shown in figure 1.

A revised list of suggested milestones for Project VT/6705 was submitted to the Project Officer on 24 May 1968. This list superceded the list of 13 December 1967 and reflected the changes specified in Contract Change Notice No. 1. The revised list of suggested milestones was approved by the Project Officer on 17 July 1968.

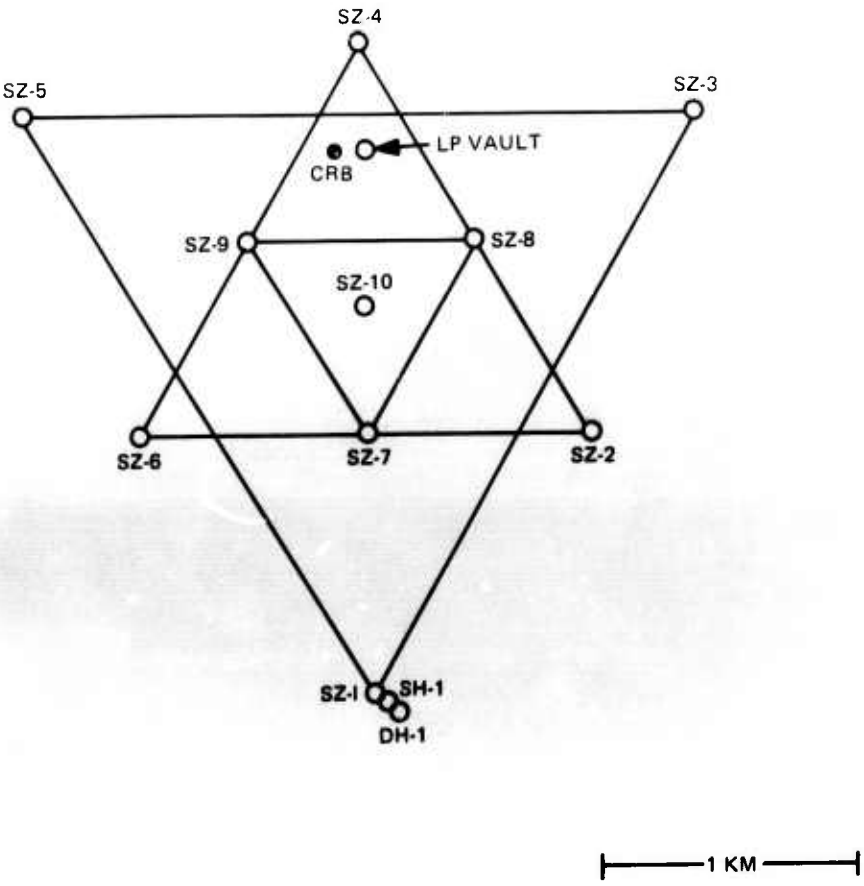

Figure 1. Orientation and configuration of UBSO arrays

Mr. Glenn W. Luster of the Salt Lake City branch of the Defense Contract Administration Security Division conducted a security inspection on 3 June 1968. All items were found to be in order.

A portion of the power transmission right-of-way belonging to the Bureau of Reclamation was included in the UBSO request to have all rights withdrawn in a 10-acre tract in the LP3 vicinity. Our withdrawal request was changed to exclude that portion of the tract covered by the Bureau of Reclamation right-of-way. The change caused no difficulty or delay in the long-period array preparation.

Because of the preparations for the installation of the long-period array, no long-period data will be available from 9 July 1968 until the long-period seismometers are returned to operation during August.

A 500-watt portable generator was received at UBSO on 30 July. The generator will be used to provide power for lighting during maintenance operations at LP5 where no commercial power is available.

2.2 SEISMOGRAPH OPERATING PARAMETERS

2.2.1 Standard Seismographs

The operating parameters and the tolerances for the standard observatory seismographs are shown in table 1. These parameters are reset if the frequency response of a seismograph is found to be out of tolerance. The frequency response norms and their respective tolerances are shown in table 2. The frequency responses of the UBSO seismographs, as normally operated, are shown in figure 2.

2.2.2 Filters for Shallow-Buried Array Summations

The summation of the ten-element shallow-buried array is filtered by a band-pass filter with the following settings: a high-cut corner frequency of 3 cps and a low-cut corner frequency of 0.8 cps, both at a cutoff rate of 18 dB per octave.

2.3 DATA CHANNEL ASSIGNMENTS

The current data-channel assignments and normal operating magnifications for all UBSO data groups are shown in table 3. The key to the designators used in the data-channel assignments is given in table 4.

2.4 SHIPMENT OF DATA TO THE SEISMIC DATA LABORATORY (SDL)

Magnetic-tape seismograms are shipped to SDL about 15 days after the end of the month during which they are recorded. The seismograms from magnetic-tape recorders 1, 2, 3, and 4 recorded at UBSO through June 1968 have been shipped to SDL.

Table 1. Operating parameters and tolerances of seismographs at UBSO

Seismograph				Operating parameters and tolerances					Filter settings	
		Seismometer								
System	Comp	Type	Model	T_s	λ_s	T_g	λ_g	σ^2	Bandpass at 3 dB cutoff (sec)	Cutoff rate at SP side (dB/oct)
SP	Z and H	Johnson-Matheson	7515 6480	1.25 ±2%	0.51 ±5%	0.33 ±5%	0.65 ±5%	0.03	0.1-100	12
SP	SZ	Geotech	18300	1.25 ±2%	0.51 ±5%	0.33 ±5%	0.65 ±5%	0.053	0.1-100	12
SP	Z	UA Benioff	1051	1.0 ±5%	1.0	0.083±5%	1.4	1.0	-	-
LP	Z	Geotech	7505A	20.0 ±5%	0.74 ±5%	110 ±10%	0.85 ±10%	0.63	25-1000	12
LP	H	Geotech	8700A	20.0 ±5%	0.74 ±5%	110 ±10%	0.85 ±10%	0.63	25-1000	12

KEY

SP Short period

LP Long period

UA Unamp'ified (i.e., earth powered)

T_s Seismometer free period (sec)

T_g Galvanometer free period (sec)

λ_s Seismometer damping constant

λ_g Galvanometer damping constant

σ^2 Coupling coefficient

Table 2. Calibration norms and operating tolerances for frequency responses of the standard seismographs at UBSO

SP Vertical 18300 and SP Johnson-Matheson Vertical and Horizontal				LP1 Vertical and Horizontal (broad response)			
f (cps)	T (sec)	R. M.	A. T. (± %)	f (cps)	T (sec)	R. M.	A. T. (± %)
0.2	5.0	0.0113	10	0.01	100	0.262	20
0.4	2.5	0.0950	7.5	0.0125	80	0.408	20
0.8	1.25	0.685	5	0.0167	60	0.595	15
1.0	1.0	1.0	-	0.02	50	0.720	15
1.5	0.67	1.52	5	0.025	40	0.870	10
2.0	0.5	1.90	5	0.033	30	1.01	5
3.0	0.33	2.12	7.5	0.04	25	1.0	-
4.0	0.25	1.87	12	0.05	20	0.844	5
6.0	0.167	1.15	20	0.0667	15	0.427	10
8.0	0.125			0.10	10	0.077	20
10.0	0.100						

LP2 Vertical and Horizontal (narrow response)			
f (cps)	T (sec)	R. M.	A. T. (± %)
0.01	100	0.063	20
0.0125	80	0.130	20
0.0167	60	0.257	15
0.02	50	0.380	15
0.025	40	0.586	10
0.033	30	0.903	5
0.04	25	1.0	0
0.05	20	0.810	5
0.0667	15	0.345	10
0.10	10	0.058	20

KEY

R. M. Relative magnification
A. T. Amplitude tolerance

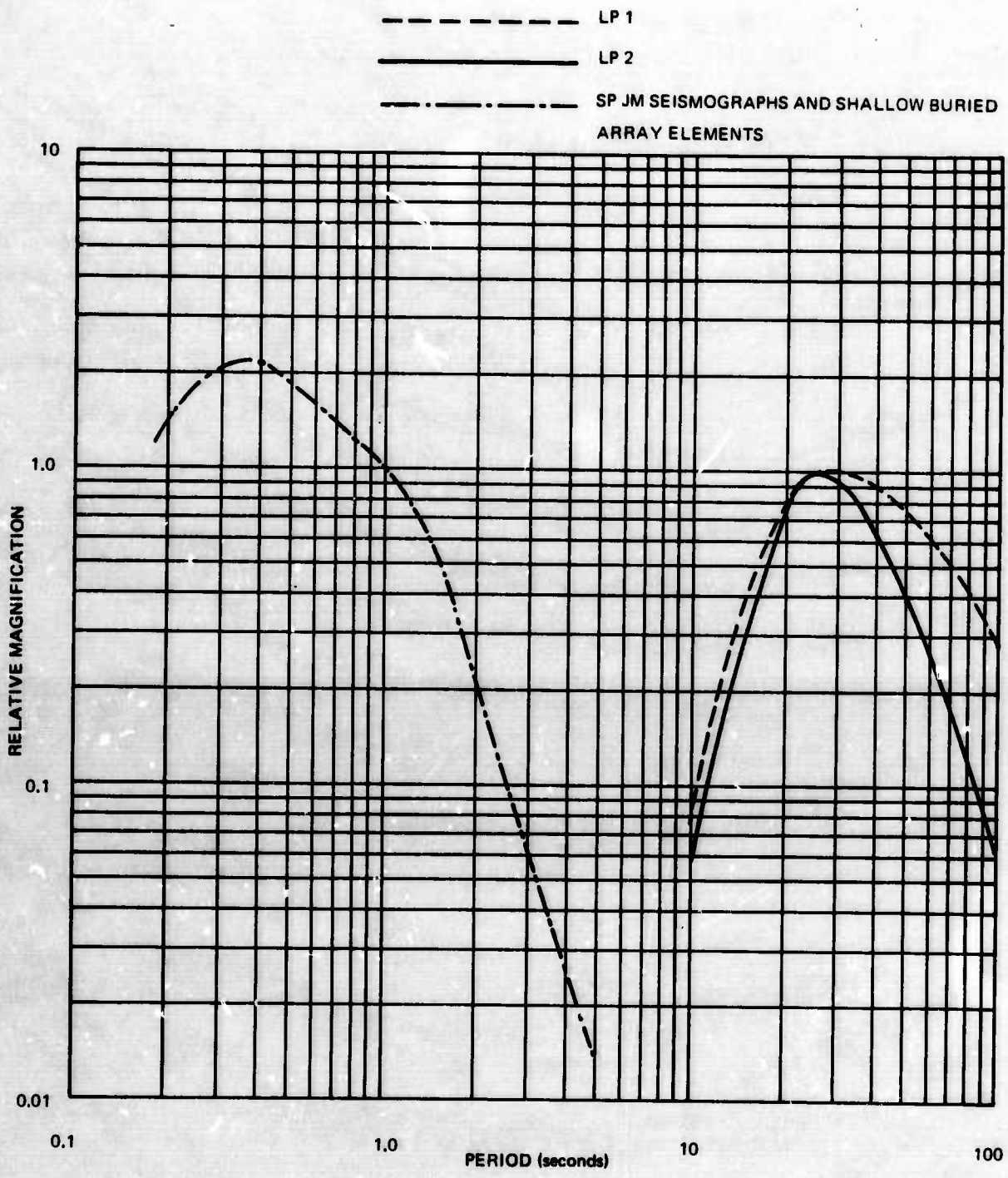

Figure 2. Normalized response characteristics of the standard seismographs at UBSO

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Table 3. Data channel assignments and normal operating magnifications at UBSO

DEVELOCORDERS

FAST SPEED 30mm/min.

DATA GROUP 5044 SP Primary

Channel	Trace	Mag.
1	V	20K
2	SZ1	600K
3	SZ3	600K
4	SZS	600K
5	SZ2	600K
6	SZ4	600K
7	SZ6	600K
8	SZ7	600K
9	SZ8	600K
10	SZ9	600K
11	ΣSSF	6000K
12	ΣSS	1500K
13	SZ10	600K
14	NSP	600K
15	ESP	600K
16	WWV	---

DATA GROUP 5084

Channel	Trace	Mag.
1	V	2K
2	MS1	0.75μb/mm
3	MS2	0.7Sμb/mm
4	DH6	---
5	DH5	---
6	DH4	---
7	DH3	---
8	DH2	---
9	DH1	---
10	ΣDHF	---
11	ΣDH	---
12	SZ1	---
13	WI	3 mph = 1 mm / S = 0/8 mm (E = 6 mm)
14	Time	
15	WWV	---

DATA GROUP 5076

Channel	Trace	Mag.
1	SZ10L	60K
2	NSPL	60K
3	ESPL	60K
4	Z10LL	5K
5	NSPLL	5K
6	ESPLL	5K
7	SZ1	600K
8	SZ3	600K
9	SZ5	600K
10	ΣSSF	6000K
11	ΣSS	1500K
12	Z10	600K
13	NSP	600K
14	ESP	600K
15	TCDMG (Tape #1)	---
16	WWV	---

SLOW SPEED 3mm/min.

DATA GROUP S086

Channel	Trace	Mag.
1	W1	3 mph = 1 mm / S = 0/8 mm (E = 6 mm)
2	SZ2	300K
3	ZLP1	25K
4	NLP1	25K
S	ELP1	25K
6	ZLP2	100K
7	NLP2	100K
8	ELP2	100K
9	ML1	3μb/mm
10	ML2	3μb/mm
11	ZBB	1.0K
12	NBB	1.0K
13	EBB	1.0K
14	WWV	
15	----	----

DATA GROUP 5082

Channel	Trace	Mag.
1	Triax 1	---
2	Triax 2	---
3	Triax 3	---
4	ML2	---
S	ZLP2	---
6	ZCT	---
7	NLP2	---
8	NCT	---
9	ELP2	---
10	ECT	---
11	WI	3 mph = 1 mm / S = 0/8 mm (E = 6 mm)
12	---	
13	---	
14	---	
15	---	
16	---	

MAGNETIC TAPE RECORDERS

DATA GROUP S049 No. 1

Channel	Trace
1	TCDMG
2	ZBB
3	NBB
4	EBB
5	NSP
6	ESP
7	Comp.
8	Z10LL
9	NSPLL
10	ESPLL
11	WWV & Voice

DATA GROUP 5047 No. 2

Channel	Trace
1	TCDMG
2	Triax 1
3	Triax 2
4	Triax 3
5	WI
6	ML2
7	Comp.
8	ZLP1
9	NLP1
10	ELP1
11	ZLP2
12	NLP2
13	ELP2
14	WWV & Voice

DATA GROUP 5025 No. 3

Channel	Trace
1	TCDMG
2	SZ1
3	SZ2
4	SZ3
S	SZ4
6	SZ5
7	Comp.
8	SZ6
9	SZ7
10	SZ8
11	SZ9
12	SZ10
13	ΣSS
14	WWV & Voice

DATA GROUP S04S No. 4

Channel	Trace
1	TCDMG
2	DH1
3	DH2
4	DH3
5	DH4
6	DH5
7	Comp.
8	DH6
9	ΣDH
10	ΣDHF
11	SZ1
12	ΣSS
13	ΣSSF
14	WWV & Voice

Table 4. Key to the designations used in the data format assignments at UBSO

Z	Amplified vertical short-period seismograph from a surface site identified by a suffix number	ELP2	East-west long-period seismograph, narrow response
SZ	Amplified vertical short-period seismograph from a shallow-buried site identified by a suffix number	ZBB	Vertical broad-band seismograph
NSP	Amplified north-south short-period seismograph	EBB	East-west broad-band seismograph
ESP	Amplified east-west short-period seismograph	ΣSS	Summation of SZ1 through SZ10
V	Unamplified vertical short-period seismograph	ΣSSF	ΣSS filtered
ZLP1	Vertical long-period seismograph, broad response	ML1	Long-period microbarograph (inside LP vault)
NLP1	North-south long-period seismograph, broad response	ML2	Long-period microbarograph (outside LP vault)
ELP1	East-west long-period seismograph, broad response	MS1	Short-period microbarograph (inside LP vault)
ZLP2	Vertical long-period seismograph, narrow response	MS2	Short-period microbarograph (outside LP vault)
NLP2	North-south long-period seismograph, narrow response	WWV	Radio time (WWV, STS, and voice on tape)
Mag.	Magnification (see note)	Test	Test instrumentation
TCDMG	Time code data management group	Comp	Wow and flutter compensation
		USO-LP	Unmanned seismological observatory long-period seismograph

Table 4, Continued

WI	Anemometer-wind speed and direction	ZCT	Coordinate transform of Triax 1, Triax 2, Triax 3 (vertical)
ECT	Coordinate transform of Triax 1, Triax 2, Triax 3 (east)	DH	Vertical array short-period seismograph
USO-SP	Unmanned seismological observatory short-period seismograph	ΣDH	Summation of DH1, DH2, DH3, DH4, DH5, and DH6
Triax	Experimental 3-module long-period triaxial seismograph	ΣDHF	ΣDH filtered
ΣTraix	Summation of Triax 1, Triax 2, and Triax 3	NCT	Coordinate transform of Triax 1, Triax 2, Triax 3 (north)

NOTE

Magnification of short-period measured at 1 cps; broad band measured at 0.8 cps; long-period measured at 0.04 cps.

All 16-millimeter film seismograms recorded at UBSO through May 1968 were sent to SDL. More recent films are currently held in Garland for special studies.

2.5 QUALITY CONTROL

Quality control checks were made on randomly selected runs of all recordings from the observatory. Results of the checks were sent to the observatory for corrective action, as necessary.

3. PROVIDE MOST EFFECTIVE OBSERVATORY POSSIBLE

3.1 PREPARATION OF THE LONG-PERIOD ARRAY

The installation of the tank vaults for the long-period array was completed during the previous quarter. During the present reporting period, the installation of power facilities, telephone lines, and seismometers was essentially completed.

On 3 May, Moon Lake Electric Association began construction of power lines to LP1, LP2, LP3, and LP4. Installation was completed by 24 May. The Uintah Power and Light Company completed installing the power lines to LP6 on June 26. The stand for the thermoelectric generator was modified and installed at the LP5 site on 31 May. The 24-volt converter was received from the Minnesota Mining and Manufacturing Company during July, and the thermoelectric generator and converter were installed and activated. In May, the electrical fixtures were welded inside the long-period vaults, and the inside of the joint between the side of the vault and the vault riser was welded.

Data transmission for the long-period array is to be provided by telephone lines from the long-period sites to Vernal and from Vernal to the UBSO central recording building (CRB). Mountain States Telephone Company constructed transmission lines to within a minimum distance of 100 feet of each vault. It was originally planned that an underground conduit would connect the vault to the telephone line termination. However, at the LP2 and LP4 sites, we found that the cable could not be drawn through the conduit because of flexures in the conduit. Eventually, use of the conduit at these two sites was abandoned, and the telephone cable was buried between the vault and terminal pole. No difficulties were encountered in using the flexible conduit at the other sites.

Installation of the telephone communications equipment was completed on 22 July. Because the Bell Model 103F Data Sets will be installed in the Hoffman boxes containing the other digital equipment, Mountain States Telephone Company has not completed the final wiring; however, all data sets are in the vaults and are operational.

During July, we discovered that the telephone line to LP2 was inoperative due to the failure of a generator located at the Warren Oil Company. Mr. Art Syme

of the Mountain States Telephone Company was notified of this unreliable power source and was requested to investigate the possibilities of either providing commercial power to the Warren Oil Company carrier site or moving the carrier equipment to the LP2 site where commercial power is available. Mountain States has not yet made a decision, but we have been assured that a reliable circuit will be provided for our use. It is probable that a commercial power line will be built over the three-fourths of a mile to the Warren Oil Company.

All seismometers have been installed in the vaults except for the vertical seismometer at LP6. This seismometer is being used in Garland to complete the testing of the digital field stations.

3.2 DEVELOPMENT AND INSTALLATION OF THE DIGITAL ACQUISITION SYSTEM

The central digital station (CDS) and digital field station 1 (DFS 1) were shipped to UBSO on 27 July. Installation of DFS 1 in LP7 was begun on 30 July; installation of the CDS in the CRB began on 31 July. At the close of the reporting period, UBSO was awaiting the arrival of the crystal for the 19000 timing system. The crystal was shipped from Garland on 30 July.

Assembly and test of DFS 2 has been completed; however, delivery of DFS 2 to UBSO has been delayed so that DFS 2 can be used as a test station for the analog sections of the remaining digital field stations. Figure 3 is a revised schedule for the completion of the assembly and test of the digital system.

3.3 NEW TELETYPE INSTALLATION

During a visit by Mountain States Telephone Company personnel on 15 and 16 July, we obtained price quotations on the installation of teletype equipment so that our daily message could be transmitted directly to the General Services Administration in Denver where it will be relayed to ESSA-USC&GS. Because of the existence of the new telephone cable from the CRB to Vernal, the cost of the Bell teletype equipment and service will be less than our present Western Union transmission service. The installation was completed on 31 July. This new service should greatly improve the quality of the data that the USC&GS receives from UBSO.

3.4 RECORDING SPEEDS OF THE MAGNETIC TAPES

During a routine quality control analysis of the May UBSO magnetic tape seismograms, we determined that the recording speeds of tape units 1 and 2 were out of tolerance. New belt rollers were installed in both units, but replacement of the rollers did not immediately correct the problem. Another set of rollers was installed, and the recording speeds were brought into tolerance on 2 July.

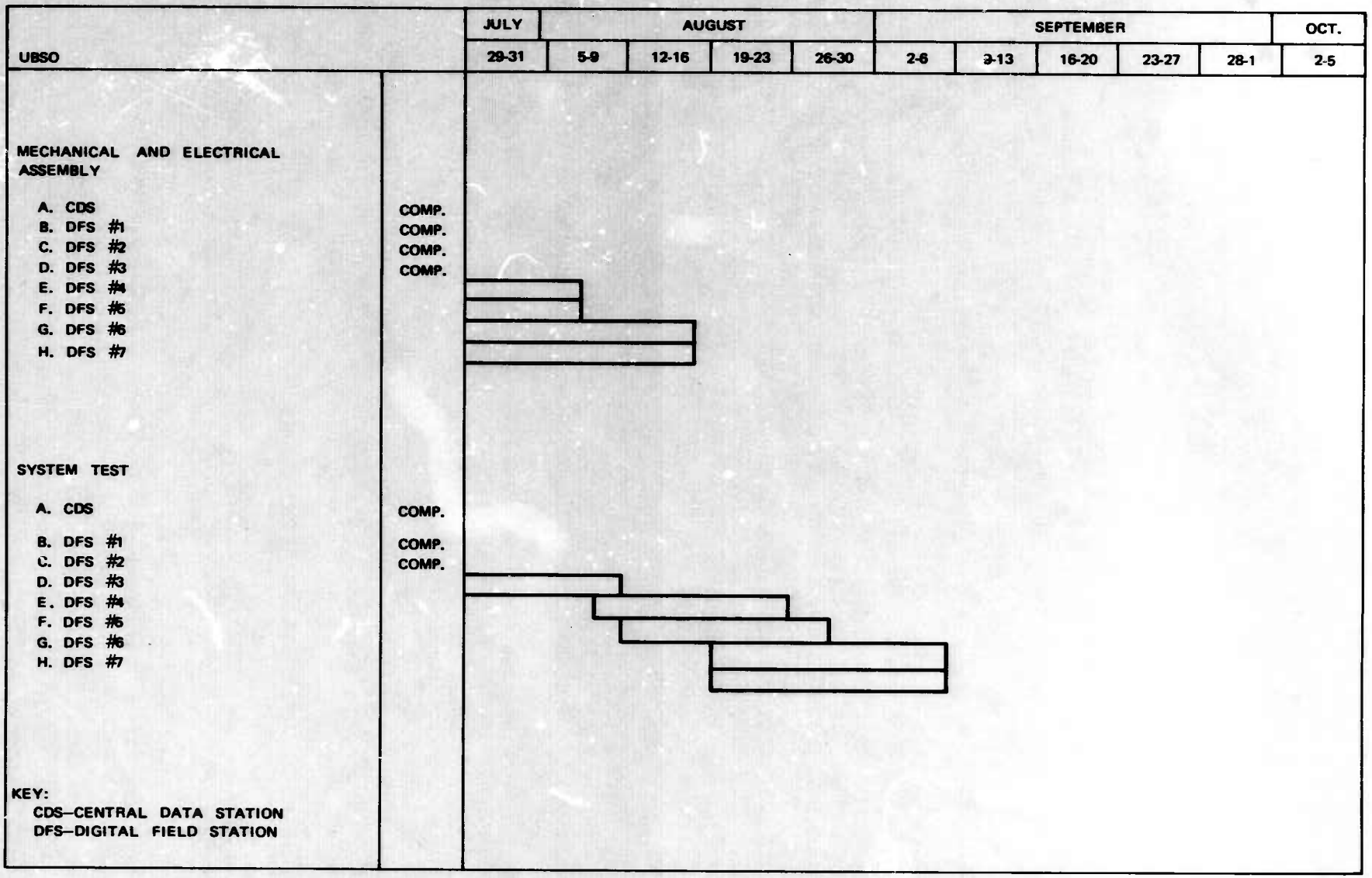

Figure 3. Assembly and test schedule for UBSO long-period digital system

4. TRANSMIT DAILY MESSAGES TO THE COAST AND GEODETIC SURVEY

The arrival time, period, and amplitude measurements for events recorded at UBSO were reported daily to the Director of the Coast and Geodetic Survey in Washington, D. C. The number of events, by type, reported by UBSO during each month in this reporting period is shown in table 5. Table 6 shows the total number of events recorded by the observatory; the number of epicenters determined by the C&GS and reported in the "Earthquake Data Report"; the percent of the C&GS hypocenters for which the C&GS report listed a UBSO P or PKP phase; the percent of C&GS hypocenters for which UBSO recorded a P or PKP phase, as determined from associated data; and the percent of C&GS hypocenters for which UBSO recorded a P, PKP, or later phase, based on updated associated data for January, February, and March 1968. Lists of more recent epicenters have not been completed by the C&GS.

Figures 4 and 5 show the world-wide distribution of the C&GS-located epicenters for January, February, and March 1968. The three types of symbols used to show the locations of the epicenters represent the detection by UBSO of a P or PKP, the detection of an event in which the first recorded arrival was not P or PKP, and no detection.

5. PUBLISH MONTHLY EARTHQUAKE BULLETIN

Data from UBSO were combined with data from TFSO and WMSO published in the December 1967 multistation earthquake bulletin. Beginning with the January 1968 bulletin, data from BMSO and CPSO are no longer included. The bulletins for December 1967, January 1968, and February 1968 were published and distributed during the reporting period. The ABP output for the May 1968 bulletin was received from the Seismic Data Laboratory on 1 July, and the March bulletin is scheduled for distribution about 7 August.

6. EVALUATION OF THE VERTICAL ARRAY

The suspensions of the galvanometers in the phototube amplifiers (PTA) of vertical array elements DH1 and DH3 were damaged during an electrical storm on 5 May. Also, the mass position adjusting circuit of the DH1 seismometer was disabled as a result of the storm. On several occasions we have attempted, unsucessfully, to move the mass of DH1 off the stop by applying excessive voltage to the motor. Since the 5 May storm, the vertical array has been operated without the DH1 seismograph.

Because of the difficulties in resolving the seismic noise recorded on the vertical array magnetic-tape seismograms, the output levels of the PTA's used in the vertical array seismographs were increased by a factor of 6 dB on 23 May. Adjustments were made to assure that the levels of the vertical array data input to the MAP and the 16-millimeter film seismograms were unchanged.

Table 5. Events reported to the C&GS by UBSØ during May, June and July 1968

Month	Local	Near regional	Regional	Teleseisms	Total
May	8	312	54	1978	2352
June	11	307	58	2499	2875
July	9	340	41	1148	1538

Table 6. Percentage of hypocenters reported in the C&GS "Earthquake Data Report" for which UBSØ data were used

Month	No. events reported by UBSØ	No. C&GS hypocenters	Percent of C&GS hypocenters for which the C&GS listed a UBSØ P or PKP arrival	Percent of C&GS hypocenters for which UBSØ recorded a P or PKP phase, based on associated data	Percent of C&GS hypocenters for which UBSØ recorded a P, PKP, or later phase, based on updated associated data
Jan	1367	410	66.9	75.1	78.2
Feb	1415	412	59.2	68.7	74.0
Mar	1254	342	55.3	67.5	71.6

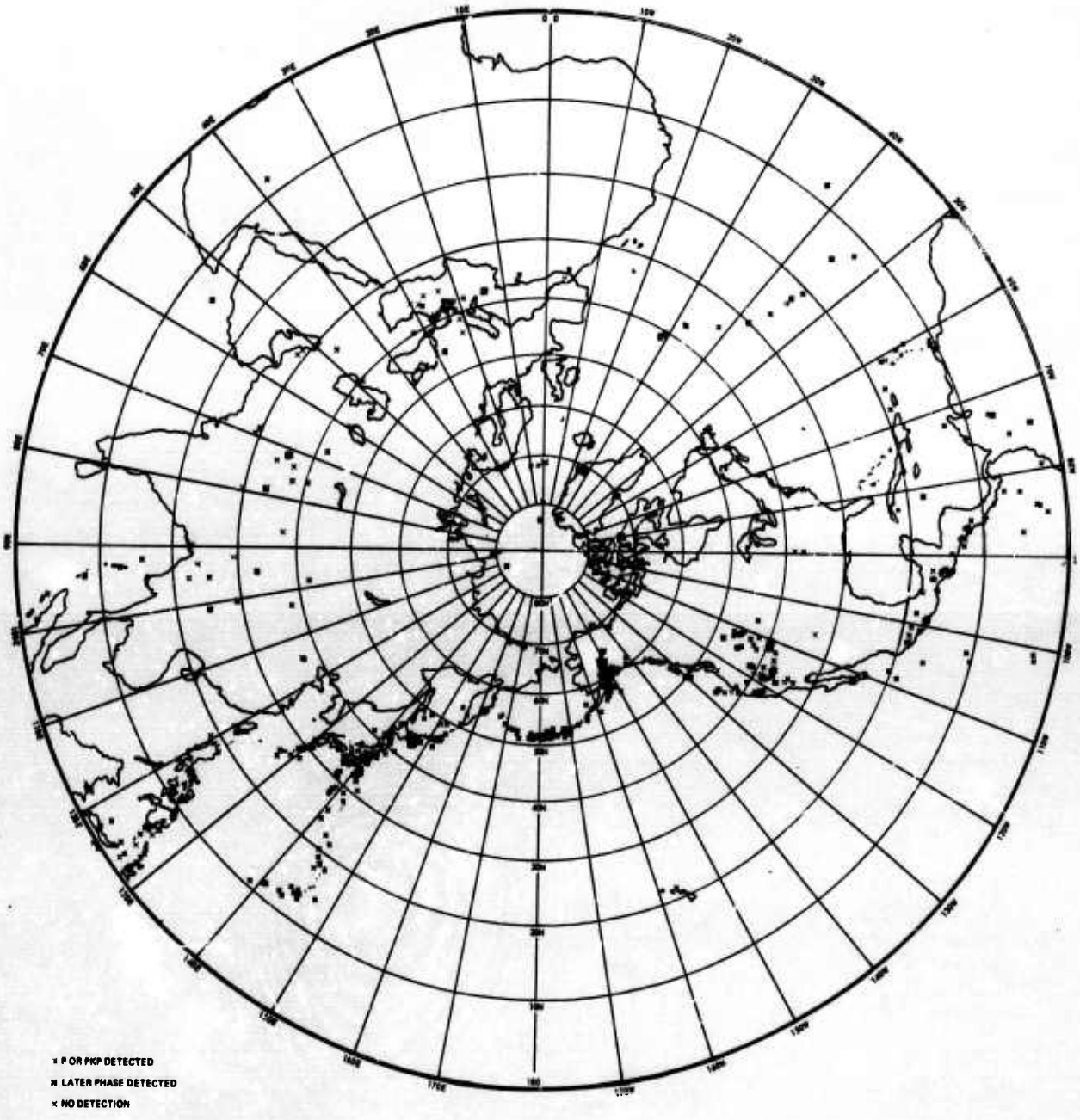

Figure 4. Distribution of Coast and Geodetic Survey located epicenters in the northern hemisphere for January, February, and March 1968

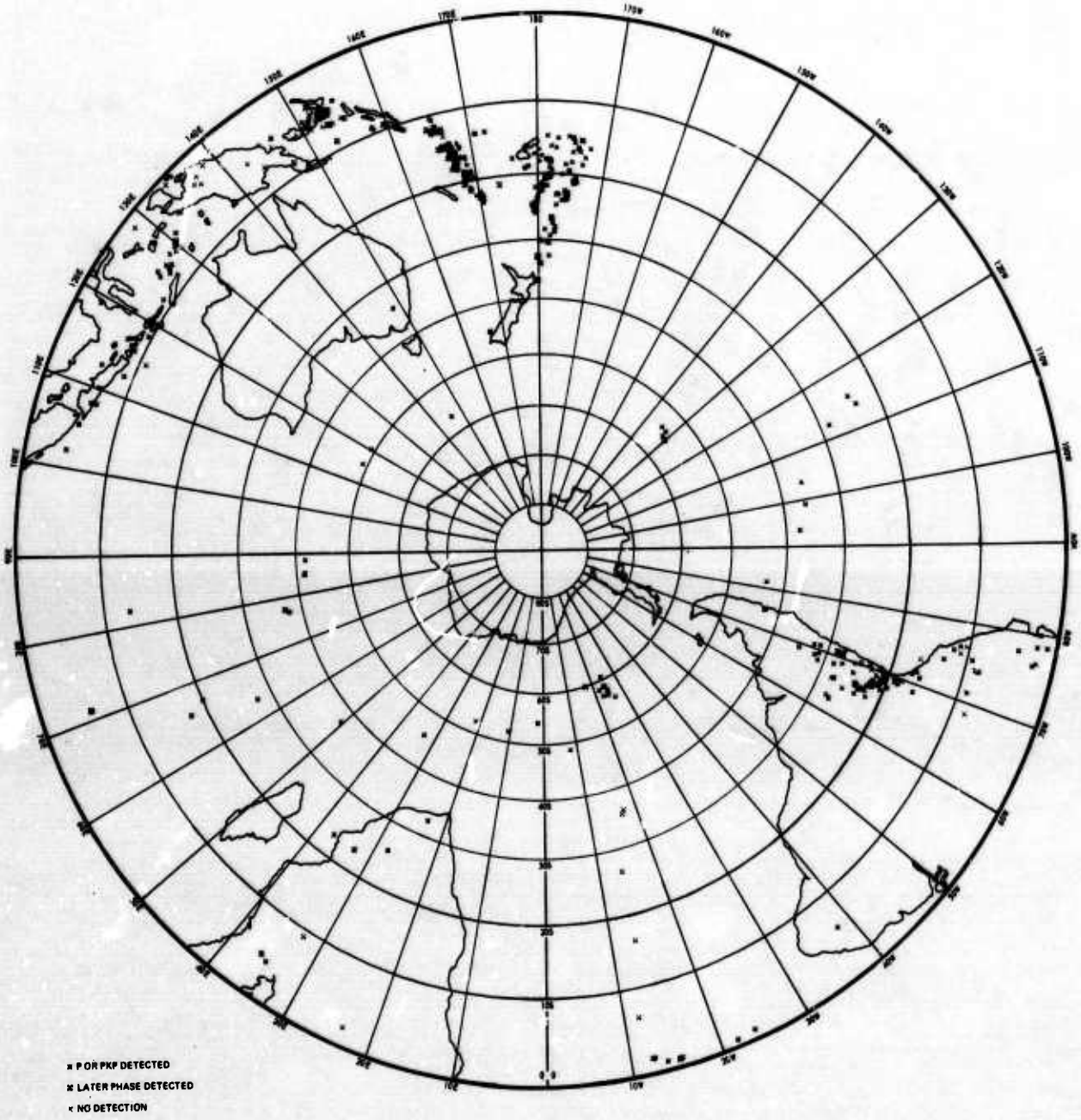

Figure 5. Distribution of Coast and Geodetic Survey located epicenters in the southern hemisphere during January, February, and March 1968

A lightning storm on 9 July destroyed several transistors and diodes in the Wanlass regulator and six tubes in the vertical array power supplies. The S&E regulator was returned to service to replace the Wanlass until repairs could be made. The S&E regulator failed on 18 July, but was overhauled and returned to service the same day. As a result of this failure, we decreased the load by placing the power supplies to the vertical array filters on line power. On 29 July, the S&E regulator failed again. At the close of the reporting period, both regulators were inoperative, and we were awaiting spare parts with which to make repairs.

7. ROUTINE NOISE MEASUREMENTS

Measurements of ambient noise in the 0.4- to 1.4-seconds period range are made daily at UBSO. Data are processed in Garland, and monthly cumulative probability curves of trace amplitude and ground displacement data are published. Noise data are reported from the SZ10, ΣSS and ΣSSF seismograms. Noise curves for March, April, and May 1968 were sent to the Project Officer during this reporting period.

8. PROVIDE OBSERVATORY FACILITIES AND ASSISTANCE TO OTHER ORGANIZATIONS

8.1 LONG-PERIOD TRIAXIAL SEISMOGRAPH

On 3 June, an attempt was made to move the triaxial seismometer to the hole previously occupied by the Unattended Seismological Observatory (USO). However, the seismometer was damaged in an accident during the attempted installation. Repairs were completed by the end of June, and the installation was successfully completed in early July.

During July, the long-period phototube amplifiers used in the triaxial system showed considerable instability. Because the UBSO long-period phototube amplifiers will not be used in the new long-period array, we have temporarily made them available to the triaxial group. UBSO personnel provided additional assistance to the triaxial group by discovering and correcting several polarity reversals after their system was operational.

8.2 DATA SENT TO THE UNIVERSITY OF UTAH

The weekly summary of local and near-regional events was furnished to the University of Utah throughout the reporting period.

9. REPORTS

a. Technical Report No. 68-23, Operation of the Uinta Basin Seismological Observatory, Quarterly Report No 8, 1 February 1968 through 30 April 1968, was mailed to the Project Officer on 20 June 1968.

b. Technical Report No. 68-1, Solion Seismometer Environmental Tests, was mailed to the Project Officer on 13 May 1968.

c. A memorandum entitled Format of UBSO Digital Data Acquisition System Magnetic Tape Seismograms was mailed to the Project Officer on 29 June 1968.

APPENDIX TO TECHNICAL REPORT NO. 68-36

STATEMENT OF WORK TO BE DONE

EXHIBIT "A"

STATEMENT OF WORK TO BE DONE

AFTAC Project Authorization No. VELA T/6705/S/ASD (32)

8 February 1966

1. **Tasks:**

a. **Operation:**

(1) Continue operation of the Uinta Basin Seismological Observatory (UBSO), normally recording data continuously.

(2) Evaluate the seismic data to determine optimum operational characteristics and make changes in the operating parameters as may be required to provide the most effective observatory possible. Addition and modification of instrumentation are within the scope of work. However, such instrument modifications and additions, data evaluation, and major parameter changes are subject to the prior approval of AFTAC.

(3) Conduct daily analysis of seismic data at the observatory and transmit daily seismic reports to the US Coast and Geodetic Survey, Wash DC 20230, using the established report format and detailed instructions.

(4) Record the results of daily analysis on magnetic tape in a format compatible with the automated bulletin program used by the Seismic Data Laboratory (SDL) in their preparation of the seismological bulletin of the VELA-UNIFORM seismological observatories. The format should be established by coordination with SDL through AFTAC. The schedule of routine shipments of these prepared magnetic tapes to SDL will be established by AFTAC.

(5) Establish quality control procedures and conduct quality control, as necessary, to assure the recording of high quality data on both magnetic tape and film. Past experience indicated that quality control review of one magnetic tape per magnetic tape recorder at the observatory each week is satisfactory unless quality control tolerances have been exceeded and the necessity of additional quality control arises. Quality control of magnetic tape should include, but need not necessarily be limited to, the following items:

(a) Completeness and accuracy of operation logs.

(b) Accuracy of observatory measurements of system noise and equivalent ground motion.

(c) Quality and completeness of voice comments.

(d) Examination of all calibrations to assure that clipping does not occur.

(e) Determination of relative phase shift on all array seismographs.

(f) Measurement of DC unbalance.

(g) Presence and accuracy of tape calibration and alignment.

(h) Check of uncompensated noise on each channel.

(i) Check of uncompensated signal-to-noise of channel 7.

(j) Check of general strength and quality of timing data derived from National Bureau of Standards Station WWV.

(k) Check of time pulse modulated 60 cps on channel 14 for adequate signal level and for presence of time pulses.

(l) Check of synchronization of digital time encoder with WWV.

(6) Provide observatory facilities, accompanying technical assistance by observatory personnel, and seismological data to requesting organizations and individuals after approval by AFTAC.

(7) Maintain, repair, protect, and preserve the facilities of the seismological observatory in good physical condition in accordance with sound industrial practice.

b. Instrument Evaluation: After approval by AFTAC, evaluate the performance characteristics of experimental or off-the-shelf equipment offering potential improvement in the performance of observatory seismograph systems. Operation and test of such instrumentation under field conditions should normally be preceded by laboratory test and evaluation.

c. Special Investigations: Conduct research investigations as approved or requested by AFTAC to obtain fundamental information which will lead to improvements in the detection capability of UBSO. These programs should take advantage of geological, meteorological, and seismological conditions at UBSO. The following special studies should be accomplished.

(1) Long term evaluation of the multiple array processor units.

(2) Installation and evaluation of a vertical array.

(3) Evaluation of the long-period vault.

(4) Provide technical assistance and monitor an unattended seismological observatory to be installed at UBSO in June 1967.

Research might pursue investigations in, but is not necessarily limited to, the following areas of interest: microseismic noise, signal characteristics, data presentation, detection threshold, and array design (surface and shallow borehole). Prior to commencing any research

investigation, AFTAC approval of the proposed investigation and of a comprehensive program outline of the intended research must be obtained.

2. Approval by AFTAC will normally be provided through the project officer.

3. Reports: Provide reports in accordance with the Data requirements outlined in DD Form 1423 and attachment 1 thereto.

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11. SUPPLEMENTARY NOTES

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13. ABSTRACT
This report describes the operation of the Uinta Basin Seismological Observatory (UBSO) from 1 May 1968 through 31 July 1968. Modifications and additions to the observatory instrumentation are described, and tests to improve the operations of the observatory are reported. Also discussed is the status of special investigations designed to evaluate and improve the detection capability of the observatory.

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