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MONTANA LASA (LARGE APERTURE SEISMIC ARRAY) OPERATION
(U) FORD AEROSPACE AND COMMUNICATIONS CORP BILLINGS MT
ENGINEERING SERVICES DIV 06 FEB 78 2145-78-104
F08606-78-C-0003

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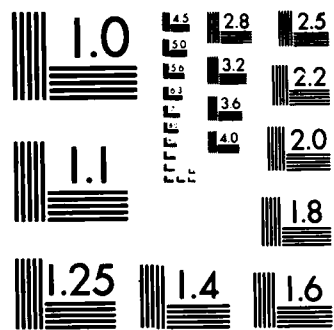


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MONTANA LASA OPERATION TECHNICAL REPORT
FOR JANUARY 1978



February 6, 1978

Report No. 2145-78-104

AFTAC Project Authorization No.: VT/8708
Contractor: Ford Aerospace & Communications Corporation
Date of Contract: 01 October 1977
Amount of Contract: \$525,479.00
Time Period Covered by Report: January 1978
Contract No.: F08606-78-C-0003
Contract Expiration Date: 30 September 1978
Program Manager: R. E. Matkins (406)245-6332
Title: Montana LASA Operation

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MONTANA LASA OPERATION

The Montana Large Aperture Seismic Array (LASA) Operations under project VELA T/8708 during January 1978, are described in this report. Operation of the LASA provides data to the seismic community through the Seismic Data Analysis Center (SDAC) and supports the Defense Advanced Research Projects Agency (DARPA) objective to demonstrate the utility of large seismic arrays in the detection and discrimination of earthquakes and underground explosions. Ford Aerospace and Communications' Engineering Services Division (ESD) personnel in Montana are responsible for the LASA project's objectives.

I. Operations Summary

The LDC's 360 computer system was on-line 97.9% of January. Problems with the disc drive control accounted for all the corrective and awaiting maintenance time this month. A faulty microswitch is the suspected trouble in these initial program loading failures. A replacement is on order.

Array digital data recording using the 10 sample/second format covered 96.9% of January. These 7-tract recordings will be available for request during the 60-day retention period. Continuation of the edited recordings of the SP subarray summation signals now provides over 8700 event periods recorded since 1 November 1975 at the LASA Data Center (LDC).

Heavy snow cover continues to make travel into the array very difficult and slow. All field trips required the use of our "sno cat". Winter weather conditions contributed to increased array communications outages this month.

The LP Develocorder input signal programmer has been designed and the parts ordered. When installed this modification will eliminate the need for the galvanometer circuits in the LP Develocorder.

The 651 teleseismic events and phases shown on our daily reports exceeded the 556 monthly average for the past 19 months by 17.2%. A study of the teleseismic event reporting of South American events during 1976 showed that our reports contained 96.7% of 367 events reported by USGS monthly summaries of Preliminary Determination of Epicenters (PDE) with magnitude of 4.6 and greater and 90.3% of all 497 events. The body-wave magnitude detection threshold for South America during 1977 is estimated at 4.61 (90%) and 4.24 (50%).

Completing the set of station corrections used in the LDC's event location program is in progress. Program DGAV has been written to provide site delays for given azimuths and wave velocities as a part of this effort.

II. Areas of Concern

None

III. Problems Encountered

None

IV. Future Plans

Activities being planned include:

- 1) estimating array detection thresholds vs distance,
- 2) improving teleseismic event data handling procedures,
- 3) fabricating the LP Develocorder input signal programmer
- 4) reporting on the array noise measurements being made at the LDC

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Attachment I

MONTANA LASA
SPECIAL OPERATING REPORTS
FOR
JANUARY 1978

Special Operating Reports of the activities and operations at the Montana LASA have been prepared in accordance with CDRL Data Item A003 and are attached. This month's reports include:

- 1) LDC Operations Summary with the
Data Interruption Log,
Subarray Data Communications Outages
- 2) LASA Maintenance Activities with the
Defective Signal Channel Status Report
- 3) LDC Seismic Data Analysis Activity
Teleseismic Event Confirmation Status, 1977

LDC OPERATIONS SUMMARY FOR JANUARY 1978

A. LASAPS Operational Statistics

	January 1978		VT/8708	
	hrs.	%	hrs.	%
Data Available	728.6	97.93	2888.2	97.84
4.8 Kb Line Down	0.2	0.02	1.9	0.06
Preventive Maint.	2.2	0.29	5.4	0.18
Awaiting Maint.	7.7	1.03	21.0	0.71
Corrective Maint.	3.1	0.42	25.1	0.85
Awaiting Parts	0.0	0.00	0.0	0.00
Halt/Power Outages	1.8	0.24	7.1	0.24
Other	0.4	0.05	3.5	0.12
Other LDC Equip. Down	0.0	0.00	0.0	0.00
TOTALS	744.0	100.00	2952.00	100.00

SUMMARY

LDC On-Line	728.9	97.97	2890.4	97.91
4.8 Kb Line Operation	743.8	99.97	2950.1	99.94
360 Operational	731.4	98.31	2898.3	98.18

B. PDP-7 Computer System

Data recording covered 96.9% of the month by 721.0 hr of LIARS slow-mode (s-m) recordings generating 1082 s-m tapes. Our library now has LIARS data tapes dated from November 30, 1977.

AUTO-EDIT program operation continued throughout the month. Two master edit tapes were generated this month. Now 84 master-edit tapes contain 8775 event periods recorded by the system during the 779 days between November 1, 1975, and January 31, 1978 or an average of 9.27 days/tape.

Array off-line operations required 21.3 hr (2.86%) and downtime totalled 1.7 hr (0.23%). The PDP-7 computer was operational 742.3 hr (99.7%).

C.

Programming

JANUARY 1978

VT/8708

New Programs Initiated
New Programs Completed

2
1

4
2

Completed

EDIT/DUP/VER VL2, 11/77
DGAV V1, 1/78

In Progress

NOISE PROGRAM (VL1)
STACK (VL1)

JANUARY 1978

DATA INTERRUPTION LOG

CODE: 1-TELCO, 2-SITE FAILURE, 3-LMC MAINT., 4-LDC CHECKING, 5-POWER, 6-LDC FAILURE, 7-OTHER

DATE	SITE	GMT TIME		DURATION		TICK #	TELCO INIT.	LASA INIT.	REMARKS
		OUT	IN	HRS.	MIN.				
1/1	C2	1535	1725	1	50	1-024			1 Lost Data
1/3	C2	1520	1533	0	13				4 LP Adj. SP ok
1/5	D3	1430	1800	3	30	1-066			1 Bad Data
1/5	C2	1530	1800	2	30	1-068			1 Bad Data
1/5	C3	1700	1800	1	00	1-069			1 Bad Data
1/5	C2	1712	1720	0	08				3 SP Adj.
1/5	C2	1835	1958	1	23	1-070			1 Lost Data
1/5	B1	1953	2003	0	10				3 SP Adj.
1/10	C2	2245	2301	0	16	1-079			1 Lost Data
1/11	C2	1130	1245	1	15	1-080			1 Bad Data
1/11	C2	1255	1650	3	55	1-081			1 Bad Data
1/11	C3	2002	2009	0	07				3 SP Adj.
1/11	C2	2356	0249	2	53	1-084			1 Bad Data (Borken) (Bridle wire into Vault)
1/12	C2	1501	1556	0	55				4 LP Adj. SP ok
1/14	D3	1400	2200	8	00	1-093			1 Bad Data - Frost on Lines
1/14	D4	1400	2115	7	15	1-094			1 Bad Data - Frost on Lines
1/14	D1	1500	2257	7	57	1-096			1 Bad Data - Frost on Lines
1/14	C3	1500	2145	6	45	1-095			1 Bad Data - Frost on Lines
1/14	A0	1500	2115	6	15	1-097			1 Bad Data - Frost on Lines
1/15	C2	0845	0900	0	15	1-102			1 Bad Data - Frost on Lines
1/16	D4	1505	1526	0	21				3 LP Adj. SP ok

MONTANA LASA SUBARRAY DATA COMMUNICATIONS OUTAGE REPORT

FOR JANUARY 1978

The following outages for the month of January 1978 that exceeded two hours are:

<u>DATE</u>	<u>SITE</u>	<u>CIRCUIT</u>	<u>GMT OUT</u>	<u>GMT IN</u>	<u>DURATION</u>	<u>TELCO REASON FOR OUTAGE</u>
01/05/78	D3	2712	1430	1800	3:30	Bad Data
01/05/78	C2	2709	1530	1800	2:30	Bad Data
01/11/78	C2	2709	1255	1650	3:55	Bad Data
01/11/78	C2	2709	2356	0249	2:53	Bad Data
01/14/78	D3	2712	1400	2200	8:00	Frost on Lines
01/14/78	D4	2713	1400	2115	7:15	Frost on Lines
01/14/78	D1	2714	1500	2257	7:57	Frost on Lines
01/14/78	C3	2711	1500	2145	6:45	Frost on Lines
01/14/78	AO	2704	1500	2115	6:15	Frost on Lines
01/16/78	B3	2705	1905	2245	3:40	Frost on Lines
01/28/78	D1	2714	1554	1810	2:16	Frost on Lines
01/30/78	AO	2704	1630	2108	4:38	Power Supply Prob. Angela
01/30/78	B1	2701	1630	2108	4:38	" " " "
01/30/78	B2	2710	1630	2108	4:38	" " " "
01/30/78	B3	2705	1630	2108	4:38	" " " "
01/30/78	B4	2707	1630	2108	4:38	" " " "
01/30/78	C1	2708	1630	2108	4:38	" " " "
01/30/78	C2	2709	1630	2108	4:38	" " " "
01/30/78	C3	2711	1630	2108	4:38	" " " "
01/30/78	C4	2706	1630	2108	4:38	" " " "
01/30/78	D1	2714	1630	2108	4:38	" " " "
01/30/78	D3	2712	1630	2108	4:38	" " " "
01/30/78	D4	2713	1630	2108	4:38	" " " "

LASA MAINTENANCE ACTIVITIES FOR JANUARY 1978

A. LDC Systems

	<u>360</u>	<u>PDP-7</u>	<u>DIGITAL</u>	<u>ANALOG</u>	<u>TEST/SUPPORT</u>	<u>TOTALS</u>
Corrective	3	5	1	1	11	21
Preventive	1	25	4	0	2	32

Work Orders: 41 initiated, 40 completed, 51 backlog

Maintenance Actions Completed: 54

B. Array Systems

	<u>SP</u>	<u>LP</u>	<u>SEM</u>	<u>POWER</u>	<u>MET</u>	<u>TOTALS</u>
Corrective	2	0	0	0	0	2
Preventive	13	0	6	6	0	25

The 4 field trips into the array covered 9 subarrays visits.

Work Orders: 25 initiated, 35 completed, 63 backlog

Maintenance actions completed: 57

C. Modifications

Modifications completed: None

D. Shop Repairs: RA-5 amplifiers, 12; HS-10-1B seismometers, 2; heater, 1.

TOTAL: 15

E. Utility

Work Orders Completed: 0 land, 0 facility and 1 vehicle.

Landowner visits: 4

Vehicle mileage: 757 miles

MONTANA LASA DEFECTIVE SIGNAL CHANNEL STATUS

SITE	WORD SENSOR	SYSTEM				DAY							REMARKS
		SP	LP	LIBAR	MET	S	M	T	W	T	F	S	
						WEEK ENDING 07 JANUARY 1978							
C4	2185	X				B	B	B	*	*	*	B	SNOWED IN
D2	1410	X				L	L	L	L	L		L	SNOWED IN
C2	0982	X				H	H	H	H	*		*	
C2	2586	X							B	B			SNOWED IN
						WEEK ENDING 14 JANUARY 1978							
C4	2185	X				B	B	B	B	B	B	*	SNOWED IN
D2	1410	X				L	L	L	L	L	L	L	SNOWED IN
C2	2586	X				*	*	B	B	B	B	B	SNOWED IN
C4	2576	X				L	L	*	L	L	*	*	
						WEEK ENDING 21 JANUARY 1978							
C4	2185	X				B	B	*	B	B	B	B	SNOWED IN
D2	1410	X				L	L	L	L	L	L	L	SNOWED IN
C2	2586	X				B	B	B	B	B	B	B	SNOWED IN
C4	2576	X				*				L	L	L	
B4	1664	X								L	L	L	
C1	0742	X								B	B	B	
C4	0581	X								H	H	H	

LEGEND

B = DISTORTED
 D = DEAD
 H = HIGH GAIN
 I = INTERMITTENT
 L = LOW GAIN
 N = NOISY
 O = OFFSET
 X = SEE REMARKS

NOTES

I. CONSULT LATEST ARRAY STATUS REPORT (AS) FOR IDENTIFICATION OF CHANNEL EQUIPMENT.

MONTANA LASA DEFECTIVE SIGNAL CHANNEL STATUS

SITE	WORD SENSOR	SYSTEM				DAY							REMARKS
		SP	LP	UBAR	MET	S	M	T	W	T	F	S	
		WEEK ENDING 21				JANUARY 1978 (CONTINUED)							
C4	1143	X								H	H	H	
D2	0310	X								L	L	L	
		WEEK ENDING 28				JANUARY 1978							
C4	2185	X				B	B	B	B	B	B	B	SNOWED IN
D2	1410	X				L	L	L	L	L	L	L	SNOWED IN
C2	2586	X				B	B	B	B	B	B	B	SNOWED IN
C4	2576	X				*	*	*					
B4	1664	X				*	*	*					
C1	0742	X				*	*	*					
C4	0581	X				*	*	*					
C4	1143	X				*	*	*					
D2	0310	X				L	*	L	*	*	*		
		WEEK ENDING 04				FEBRUARY 1978							
C4	2185	X				B	B	B					SNOWED IN
D2	1410	X				L	L	L					SNOWED IN
C2	2586	X				B	B	B					SNOWED IN
B4	1664	X					L	L					

LEGEND

B = DISTORTED
 D = DEAD
 H = HIGH GAIN
 I = INTERMITTENT
 L = LOW GAIN
 N = NOISY
 O = OFFSET
 X = SEE REMARKS

NOTES

I. CONSULT LATEST ARRAY STATUS REPORT (AS) FOR IDENTIFICATION OF CHANNEL EQUIPMENT.

MONTANA LASA DEFECTIVE SIGNAL CHANNEL STATUS

SITE	WORD SENSOR	SYSTEM				DAY							REMARKS
		SP	LP	UBAR	MET	S	M	T	W	T	F	S	
WEEK ENDING 04 FEBRUARY 1978 (CONTINUED)													
C1	0742	X					B	B					
AO	2456	X					B	B					

- LEGEND**
 B= DISTORTED
 D= DEAD
 H= HIGH GAIN
 I= INTERMITTENT
 L= LOW GAIN
 N= NOISY
 O= OFFSET
 X= SEE REMARKS

NOTES
 I. CONSULT LATEST ARRAY STATUS REPORT (AS) FOR IDENTIFICATION OF CHANNEL EQUIPMENT.

LDC SEISMIC DATA ANALYSIS ACTIVITY FOR JANUARY 1978

I. Event Classification and Reporting

A. Teleseismic Processing

During January 31 daily teleseismic reports indicated the LASA seismic activity as classified below:

	<u>JANUARY 78</u>	<u>VT/8708</u>	<u>SINCE JAN 78</u>
Located Events, <104°	187	758	187
Located Events, >104°	13	38	13
Unlocated Regional	0	3	0
PKP	31	214	31
Poor Arrivals	80	252	80
pP	34	104	34
Other Phases	18	80	18
Unprocessed Detections	288	1027	288
TOTALS	651	2476	651

B. Near-regional Processing

During January 5 reports indicated the seismic activity shown below:

	<u>NEAR-REGIONALS</u>	<u>STRIP-MINE BLASTS</u>
LDR -01 12/30-01/06	2	-
LDRs-01 12/23-01/06	-	93
LDR -02 01/06-01/20	8	-
LDRs-02 01/06-01/20	-	117
LDR -03 01/20-01/27	10	-
JANUARY 1978 TOTAL	20	210
VT/8708 TOTAL	62	952

TELESEISMIC EVENT CONFIRMATION STATUS, 1977

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NO MAGNITUDE REPORTED												
PDE	115	89	95	74	71	85	58	37	13	12		
LDC & PDE	13	15	10	10	20	12	8	3	0	0		
% LDC REPORTED	10.2%	14.4%	9.5%	11.9%	22.0%	12.4%	12.1%	7.5%	0.0%	0.0%		
Mb ≤ 4.5												
PDE	28	20	28	30	37	21	17	10	4	1		
LDC & PDE	36	22	25	37	28	31	32	27	5	0		
% LDC REPORTED	56.3%	52.4%	47.2%	55.2%	43.1%	59.6%	65.3%	73.0%	55.6%	0.0%		
Mb ≥ 4.6												
PDE	86	78	132	147	82	64	69	19	2	-		
LDC & PDE	174	130	144	147	170	166	128	134	47	-		
% LDC REPORTED	66.9%	62.5%	52.2%	50.0%	67.5%	72.2%	65.0%	87.6%	95.9%	-		
PDE TOTAL	229	187	255	251	190	171	144	66	19	13		
PDE & LDC TOTAL	223	167	179	194	218	209	168	164	52	0		
% LDC REPORTED	49.3%	47.2%	41.2%	43.6%	53.4%	55.0%	53.8%	71.3%	73.2%	0.0%		

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