

NORSAR

ROYAL NORWEGIAN COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

Scientific Report No. 4-73/74

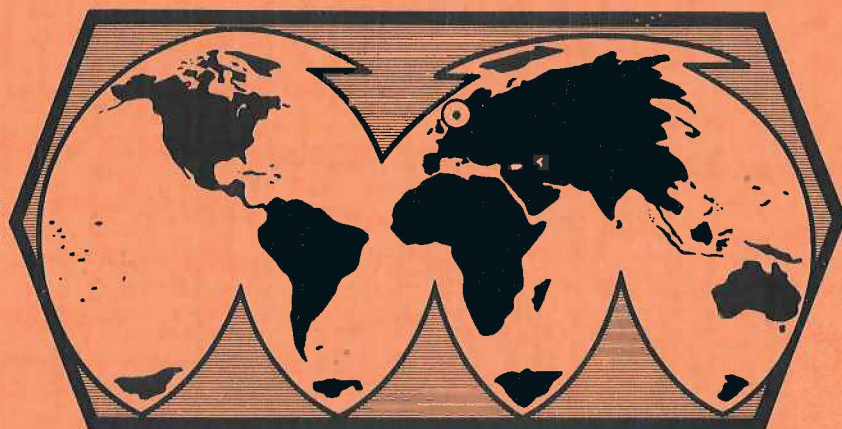
SEMIANNUAL TECHNICAL REPORT

NORSAR PHASE 3

1 July–31 December 1973

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Kjeller, 11 January 1974



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Q. ARRAY MONITORING AND FIELD MAINTENANCE

This section includes a review of actions of remote array monitoring at NDPC and maintenance accomplished at the subarrays by the field technicians.

Subarray Monitoring Schedule

The planned schedule for the remote array monitoring (AM) has been well met. Only in a few cases the monitoring routines have been delayed. A new schedule was introduced in November and is presented in Table Q1. The off-line computer requirement for AM was then reduced from an average of 34 hours per month to approx. 20 hours. The schedule for the on-line tests is unchanged.

Table Q1

Monitoring rates for AM programs.

Biweekly	Monthly	Bimonthly	Quarterly	Annually
LPCAL RSA/ADC Test	SLEMTEST	MISNO CHANEVSP SACPSP*	CHANEVLP	SACPLP
* Subarrays with newly overhauled seismograph amplifiers are analyzed every four months.				

Maintenance Visits

Figure Q1 shows the number of visits to the different subarrays in the period. Excluding visits caused by troubles in the communications system, the subarrays have in average been visited 6.5 times. The large differences

from average for some of the subarrays are explained mainly by power faults and cable breakages.

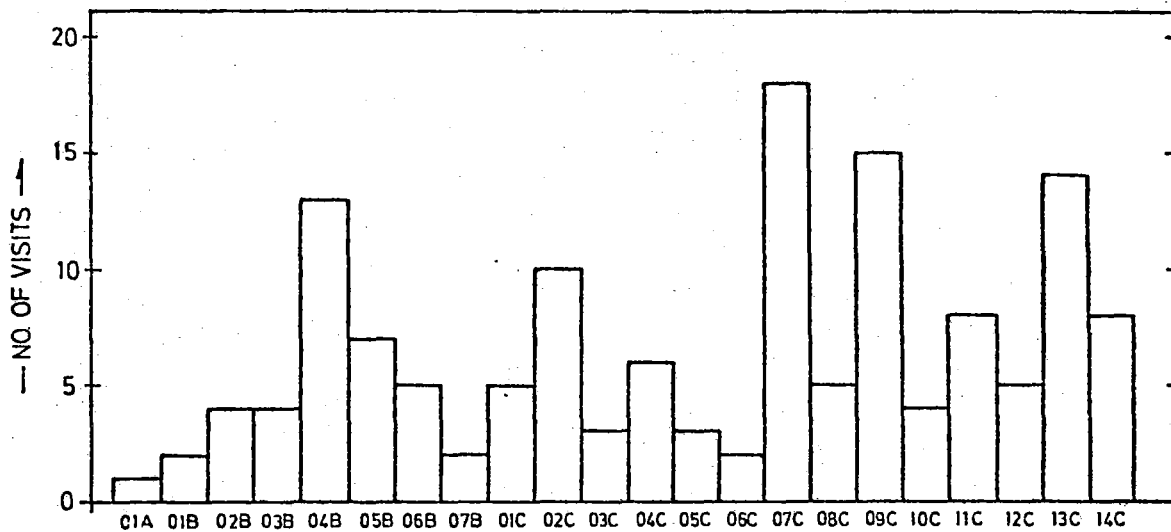


Fig. Q1 Number of maintenance visits to the NORSAR subarrays, 1 July-31 December 1973.

Preventive Maintenance Projects

Work accomplished as part of this type of the preventive maintenance of NORSAR is described in Table Q2. The work at WHVs consisted of maintenance such as painting of the wood frame, replacement of RA-5 amplifiers and control of all circuits at the site. The new RA-5s installed had been fully overhauled with new power batteries mounted.

Table Q2

Preventive maintenance accomplished at NORSAR during the period.

Unit	Action	No. of Channels/ Subarrays		Comments
		Accompl.	Remaining	
SP seism.	Replacement of sensors due to damping and/or nat. freq.	2	None	02B02,13C04
	Adjustment of damping	12	None	02B02;01C03,04; 04C01,02;07C04; 09C02,03,04; 10C03,06;13C04.
RA-5	Modification of RA-5 input card	3	10*	09C06;10C03,06
WHV & RA-5	Construction maintenance	21	50	01C;04C;09C;12C04; 13C01-04,06.
	RA-5 replacement	24	60	
* 8 of these are modified for noise suppression but variable damping resistance, R_d , is lacking.				

Disclosed Malfunctions on Instrumentation and Electronics

Table Q3 gives the number of accomplished adjustments and replacements of field equipment in the total array with the exception of those mentioned in Table Q2.

Table Q3

Total number of required adjustments and replacements in the NORSAR data channels, 1 July - 31 December 1973.

Unit	Charac- teristic	SP		LP	
		Repl.	Adj.	Repl.	Adj.
Seismometer	Damping		12		2
	Nat.Freq.	2			
	Sensitivity			1	
	Distortion				
	RCD			1	2
Seismometer Amplifier	Gain	3	2		
	Distortion	2			
	Balance		1		
	Filter	1			
LTA	Ch.gain		28		2
	Filter discr.	3			
	DCO	3	6		1
	CMR	1	4		
	K2 relay fault	4			
BE Card		53			
SLEM					
BB gen.		11	7		
SP gen.		1	3		
LP gen.		2	2		
RSA/ADC		4	8		
EPU		3	3		
DU					

Malfunctions of Rectifiers, Cable Breakages

Two malfunctions on the subarray rectifiers have been reported: at 04B (transformer M2 and timer d2 burned caused by lightning, inoperative 8-10 Aug) and 04C (defect timer relay).

Cable breakages have been numerous and have occurred 22 times all over the array in all types of cables.

Workshop Repairs

With the exception of nine RA-5s and a few SP seismometers and SLEM cards, all units removed from the field this period and the previous reporting period have been repaired. The remaining units will be repaired and checked out during the winter. At present 21 SP/LTA cards with ripple and DCO faults are to be repaired at NMC. Investigations have shown that the filter ripple varies as the card is mounted in different channels. The cause is not known, but will be investigated. LTA cards with unadjustable DCO will be modified (see Table Q5). At present 144 spare LTA cards are available in the array.

New Instruments and Facilities at NMC

A few instruments have been acquired in the period and are listed in Table Q4.

An attenuating platform for testing of LP and SP seismometers has been constructed by Teleplan A/S and is installed at NMC. An on-line communication line, 2400 baud, connecting NMC to NDPC is installed and in use,

Table Q4

NORSAR field maintenance instruments acquired
in the reporting period.

Type of Unit	Manufacturer and Type Description	No. of Units
X-Y recorder w/time base	Bryans 24400	1
Digital multi- meter (AC/and battery oper.)	Fluke 8000A01	1
Gaussmeter	Alpha Scientific Inc., Model 3104	1
Electronic galvanometer	YEW 2707 for use with "portable Wheatstone bridge" YEW 2755	1
Portable welding transformer	NORGAS 135	1

but is not finally released by NTA. The purpose of the line is to permit pre-check of components before installation in the field and performing research using the simulated array at NMC.

Improvements

A number of investigations were initiated during the previous reporting period to prepare lasting solutions to problems or time-consuming maintenance of certain units experienced during the operation of NORSAR. The status of these projects is commented in Table Q5.

Table Q5

Status of proposed improvements of NORSAR's field equipment.

Subject	Action
Depression of noise in SLEM discrete inputs (DI)	Modification is under testing at 05C (modification 3b in Larsen 1973)
Too low surge rating of BE protection card	Modified BE-cards with 5 W wire-wound resistors is under testing at 11C on all SP channels
The CTV monitor triggers at low temperatures	Modified prototype is being tested at 04B
Trends towards negative DC offset in the SP/LTA	Original offset trimpot is replaced by 360 K Ω pot, which gives adjusting range of +135 mV (previously +30 mV). Modification is under testing at 03B and 05C.

Conclusion

The array is in good standard and has operated satisfactorily throughout the period. Compared with previous periods (see Steinert and Nilsen 1973 a & b) no anomalies can be reported. Due to the observed stability in both the array's SP and LP instrumentation, the monitoring schedule has been further relaxed.

The preventive maintenance program for the WHVs and RA-5s has been accomplished according to plan and will continue and be fulfilled next summer. All access roads within the array have been surveyed and with one exception (14C) all roads were in good condition.

A trend towards negative DC offsets in the SP channels, possibly caused by a permanent change in the Tchebyscheff low pass filters, has been observed. To compensate the channels offsets will be adjusted with positive bias whenever feasible.

The large number of reported faulty test generators and low channel gains are caused by lightning. The construction of the channels' lightning protection cards is under investigation.

O. Steinert

A.K. Nilsen

REFERENCES

Larsen, P.: Noise in SLEM Discrete Input, NORSAR Technical Report No. 52, NTNF/NORSAR, Kjeller, Norway, 1973.

Steinert, O., and A.K. Nilsen: Array Monitoring and Field Maintenance Report, 1/7-31/12-1972, NORSAR Technical Report No. 51, NTNF/NORSAR, Kjeller, Norway, 1973 a.

Steinert, O., and A.K. Nilsen: Array Monitoring and Field Maintenance Report, 1/1-06/30-1973, NORSAR Technical Report No. 60, NTNF/NORSAR, Kjeller, Norway, 1973 b.