

NORSAR

ROYAL NORWEGIAN COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

Scientific Report No. 5-74/75

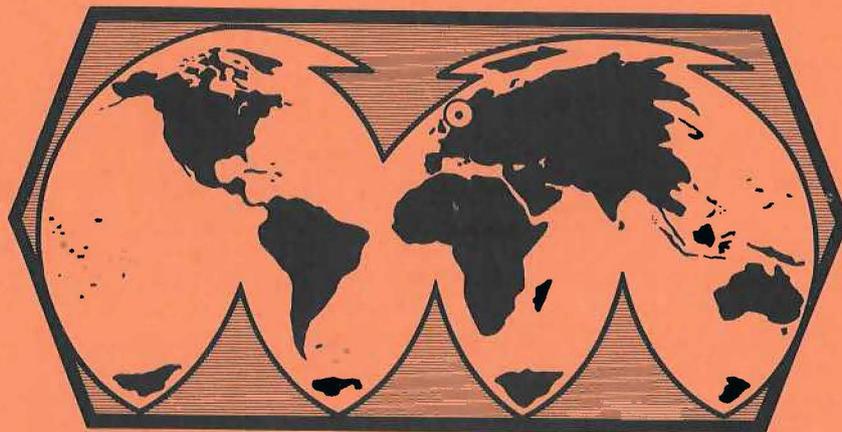
FINAL TECHNICAL REPORT NORSAR PHASE 3

1 July 1974 – 30 June 1975

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Kjeller, 8. August 1975

Sponsored by
Advanced Research Projects Agency
ARPA Order No. 2551



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Y. ARRAY MONITORING AND FIELD MAINTENANCE

This section includes a review of actions of remote array monitoring at NORSAR Data Processing Center (NDPC) and maintenance accomplished at the subarrays and the NORSAR Maintenance Center (NMC) by the field technicians.

Y.1 Subarray Monitoring Schedule

The planned schedule for the remote array monitoring (AM) has been well met. No changes have been made in the schedule in the reporting period. The schedule is presented in Table Y.1. The off-line computer requirement for AM is on the average approximately 20 hours per month. Including the on-line tests, the on-line computer time requirement is approximately 77 hours.

TABLE Y.1
Monitoring rates for AM programs.

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

Y.2 Maintenance Visits

Fig. Y.1 shows the number of visits to the different subarrays in the period. Excluding visits caused by troubles in the communications system, the subarrays have on the average been visited 7.5 times. The large difference from average for subarrays 03B, 04B, 06C, 07C and 10C is explained in Table Y.2.

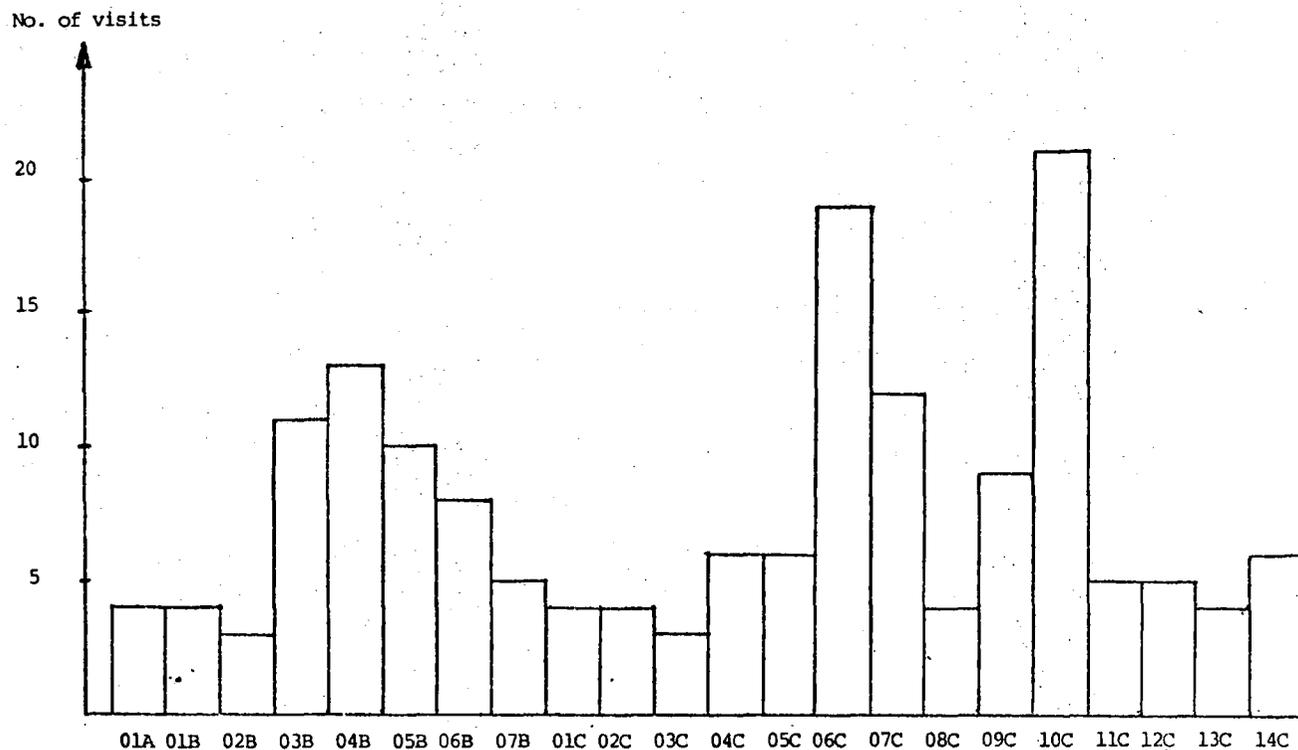


Fig. Y.1 Number of maintenance visits to the NORRAR subarrays
1 July 1974 - 30 June 1975.

TABLE Y.2

Tasks accomplished at 03B, 04B, 06C, 07C and 10C

Sub-array	No. of Visits	Maintenance Visits on:					Comments
		Power/rectifier	Cable breakage	LP ch's incl. RCD	BE Card	Other Maint.	
03B	11			8		3*	* LTA discrepancies and ch. gain adj.
04B	13		4	3	1	5*	* 2 RA-5's with distortion (3 visits) and CMR/ch. gain.
06C	19	2	5	3	5	4*	* Faulty RA-5's (3 visits) EM cal. circuit faulty
07C	12	1	4		3	4*	* RSA/ADC faulty (1 visit) DCO unadjustable and ch gain (2 visits). RA-5 faulty.
10C	21		16		2	3*	* Routine replacement of RA-5's to prevent power decay (2 visits). Test generator faulty.

Y.3 Preventive Maintenance Projects

Work accomplished as part of this type of the preventive maintenance of NORSAR is described in Table Y.3. 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-5's installed had been fully overhauled with new power batteries mounted.

TABLE Y.3

Preventive maintenance accomplished at NORSAR during the period.

Unit	Action	No. of Channels		Comments
		Accomp.	Remaining	
SP Seism.	Adjustment of damping	3	-	10C06,02C05,06 (10C03 remaining from last period has drifted within tolerance limits).
RA-5	Modification of RA-5 input card	1	1 ¹⁾	10C04 (remaining 12C05)
LTA	Adjustment of SP DC offset to positive bias ²⁾	94	-	Whereof 4 LP ch.
	Modification of DC offset adjustment range (R12) ²⁾	102	30	Remaining: 04B, 01C,08C,13C,14C.
WHV and RA-5	Construction maintenance	11	9	04C03,04;10C01,02, 03,04,06; 02C03,04, 05,06
	RA-5 replacement	10	11	10C01-06; 02C03, 04,05,06 (remaining:12C01-03,05,06; 14C)

1) Modified for noise suppression, but variable damping resistance is lacking.

2) Refer Larsen and Nilsen, 1974.

Y.4 Disclosed Malfunctions on Instrumentation and Electronics

Table Y.4 gives the number of accomplished adjustments and replacements of field equipment in the total array with the exception of those mentioned in Table Y.3.

TABLE Y.4

Total number of required adjustments and replacements in the NORSAR data channels, 1 July 1974 to 30 June 1975.

Unit	Characteristic	SP		LP	
		Repl.	Adj.	Repl.	Adj.
Seismometer	Damping		3		7
	Nat. Freq.	2			
	Sensitivity	1			
	Distortion				
	RCD			18	4
Seismometer Amplifier RA-5	Gain	2	2		
	Distortion	2			
	Cal.amp.inop.	2			
LTA	Ch. gain	1	45		3
	Filter discr.	12			
	DCO	4	12		
	CMR	2	9		
	K2 relay fault	4			
BE card		43			
SLEM					
BB gen.		3	2		
SP gen.		1			
LP gen.		1			
RSA/ADC		2	5		
EPU		1			
DU			1		

Y.5 Malfunction of Rectifiers, Power Loss, Cable Breakages

Malfunction of the rectifiers and power loss requiring action of the field technicians are reported in Table Y.5.

TABLE Y.5
Faults disclosed in subarray rectifiers
and power loss.

Sub-array	Fault	Period of inoperation	Comments
02B	Main AC power break	8-9 Dec	
01C	Rectifier failed to go into "High Charge" battery power low.		Restarted manually
06C	Main AC power break		Main fuses replaced
	---	4-5 Mar	
07C	Rectifier continuous in "High Charge"		Timer coil burned
10C	Main AC power break		Main fuses replaced
14C	Rectifier trafo M2 burned, diode failure on M2 card.	10-13 Aug	

In the period 27 cable breakages have occurred in all types of cables. The field maintenance personnel spent 77 days' work on 17 of the breakages, the rest were repaired by NTA. The status as of 30 June was:

01C: Power cable broken 31 March 75. Repair will be completed in August 75 including modification from 10 KV to 1 KV network.

07C: 04 cable broken 24 March. Repair has been delayed due to agricultural activity. Approximately 600 meters of cable have to be spliced in and buried in a depth of two meters.

09C: 03 cable broken by lightning 16 June 75.

10C: 04 cable was broken again 30 April after repair 14 March 75. 05 cable has been broken since 2 October 74. After 8 days' work the repair had to be postponed due to bad snow conditions. The cable repair is expected to be time-consuming, but should be completed in July 75.

Y.6 Workshop Repairs

All units removed from the field (refer Repl. columns in Table Y.4 and Table Y.3 - RA-5 replacement) this and previous reporting period have been repaired, with the exception of a few SP seismometers. Also remaining un-repaired at NMC are:

- 1 DC/DC converter
- 6 RA-5 input cards
- 11 BE protection cards
- 1 Code Converter 02

Thirteen LTA cards with presampling filter faults are stored at NMC. Repair (replacement of the presampling filter) is not planned in the near future, as the number of spare LTA cards is good.

Y.7 NMC Facilities and New Instruments

The NMC workshop and storage were slightly damaged by fire 24 November 1974. The cleaning up and repair work engaged the field technicians several weeks. The communication line between NDPC and NMC was broken during the fire and has not been re-established. In order to save funds investigations were initiated to achieve alternative solutions to the permanent line. After installation of the short period analog SP station at NMC/04B05 there is a two-pair line connection between NMC and the CTV at 04B through 04B05. The experiments and measurements made are promising, but line equilizers should be constructed before the line may be taken in regular use.

One Hewlett-Packard 5035T logic lab including logic test probes were acquired in April 1975.

Y.8 Improvements

The status of a number of investigations to prepare lasting solutions to problems or time-consuming maintenance of certain units experienced during the operation of NORSAR is as follows:

- | | |
|---|---|
| - Depression of noise in SLEM discrete inputs and | Proposed modifications have been tested and are |
| - Too low surge rating of BE protection card | described in Larsen, Falch and Pettersen, 1975. We are now awaiting approval. |
| - False triggering of CTV water monitor | Investigations have shown that only marginal improvements can be gained by a modification. Recheck of the "turn on" point is expected to be completed on all subarrays this year. |
| - Trends towards negative DC offset in the SP/LTA | Modification (refer Larsen and Nilsen, 1974) is accomplished on 77% of the channels. |

Y.9 Short Period Analog

The short period analog station located at subarray 05C with the recording drum in the NORSAR Data Processing Center (NDPC) was moved to the subarray 04B/NORSAR Maintenance Center (NMC) in November 1974. The recording station is placed in a room in the office building at NMC, the seismic signals are received from seismometer 04B05 with a separate RA-5 seismometer amplifier through a buried cable. The

station is operated continuously and the seismograms are forwarded to NDPC once a week. The technical layout is given in Larsen, 1975. Note that explanations to the Figs. 1 and 2 in the report are interchanged.

Y.10 Experimental Broadband Analog (Kirnos)

The cooperative Nordic research project involving the operation of a Kirnos station at NORSAR concluded 20 September 1974, and the instrumentation was re-shipped to Finland 30 October. The installation and calibration of the instrument are described in detail by Pettersen and Larsen (1974). An evaluation of the station is given in section M in this report.

Y.11 Conclusion

Except for one remark described below, the field instrumentation has operated satisfactorily throughout the period and the facilities are in good standard. Compared with the previous year (refer Bungum, 1974a and b) an increasing number of replaced LP RCD's is observed. The most common fault is corrosion and rust on the RCD's caused by moisture in the LP tanks making the RCD's immovable. But otherwise there has been less moisture in the LPV's after implementation of the routine of not visiting the LPV's except for corrective maintenance. The cause of the damping ratio of the LP channels which have an increasing trend is planned investigated next year. The SLEM units have been more stable this period compared with the previous period, also the number of burned out BE protection cards has been less (43 compared with 68).

The preventive maintenance program for the WHV's and RA-5's has been delayed as priority has been given to the corrective maintenance. Eleven channels are now remaining and will be completed this summer.

The array average DC offset of the SP channels which was nominal one year ago is now plus one quantum unit and is explained by the fact that the modification program of the DC offset trim range of the LTA's is nearly completed. The offset is adjusted to a positive bias of three millivolts to compensate for the negative trend. Because of relatively high noise level the short period data from subarray 14C has been masked since 16 May.

Alf Kr. Nilsen

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