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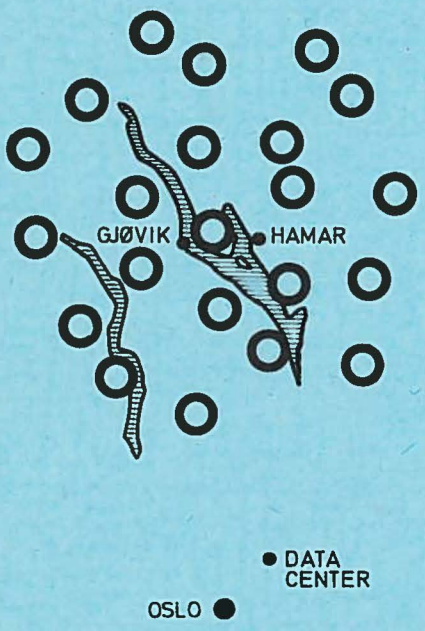
Royal Norwegian Council for Scientific and Industrial Research

PROGRESS REPORT
NORSAR Phase 3
2nd Quarter 1971



NORWEGIAN SEISMIC ARRAY

NORSAR

P. O. Box 51. 2007 Kjeller – Norway

NTNF/NORSAR
P.O.Box 51
2007 Kjeller
Norway

NORSAR REPORT NO.17
Budget Bureau No.22-R0293

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NORSAR Phase 3
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Status per 30 June 1971

The NORSAR project has been sponsored by the United States of America under the overall direction of the Advanced Research Projects Agency and the Technical Management of the Electronic Systems Division, Air Force Systems Command.

ARPA Order No. 800 Program Code No. IF10

Name of Contractor	:	Royal Norwegian Council for Scientific and Industrial Research
Date of Contract	:	May 15, 1970
Amount of Contract	:	$ 1.300.883,-
Contract No.	:	F19628-70-C-0283
Contract Termination Date	:	June 30, 1972
Project Supervisor	:	Robert Major, NTNF
Project Manager	:	Per Tveitane (temporary)
Title of Contract	:	Norwegian Seismic Array (NORSAR) Phase 3

1 INTRODUCTION

This is the first full report period with all equipment and facilities operational. While extensive work was done by NORSAR and subcontractor personnel in the field, adjusting instruments and improving performance, the IBM and NORSAR groups continued the effort towards optimal performance of the DPC equipment.

With the approaching IBM phase-out at NORSAR DPC, preparations were made for takeover by NORSAR personnel of various IBM activities.

2 ADMINISTRATION AND SUPPORT

2.1 With all equipment installed and all facilities completed, the administration group adjusted to regular operation in accordance with established procedures. Steps were taken to transfer Government equipment from previous contracts (eg IBM interim equipment, Lincoln Lab equipment) to the current NTNF contract.

Equipment registration and control continued according to schedule.

3 CONTRACTS

3.1 Agreement was reached with the NTA for the communications rent and maintenance contract. Successive contracts with the NTA will follow the same lines, i.e. fixed price type.

3.2 Agreement was reached with KCIN for the support contract (housing and services). Here also a fixed price contract

was the result, and it will form the base for future contracts with KCIN.

3.3 In anticipation of transfer of IBM-equipment (computer installation) to the NTNF contract, negotiations started with IBM-Norway for maintenance of the equipment. The resulting quotation of $ 96.000 for the services in question was presented to ESD. In the meantime, maintenance is carried out as before.

3.4 Negotiations were held with Noratom-Norcontrol A/S, subcontractor for field maintenance, for terminating the subcontract and transferring the field maintenance to NTNF itself. The results of these negotiations were a proposed extension of the present subcontract for a period of 3 months. After this extension, which expires 30 Sept 1971, the necessary personnel (8 men) will be transferred to NTNF. Some details about the contract termination and transfer of activities remain to be solved.

4 PERSONNEL

4.1 The Project Manager position is vacant, with the Operations Manager temporarily acting in the position.

One mathematician/physicist position is open. For short periods, the operator group has not been fully manned.

4.2 Visitors:

The Scientific Attaché at the US Embassy in Stockholm, Mr. H. J. Chinn, accompanied by Mr. Hagerty, US Embassy, Oslo, visited NORSAR 23 June.

Mr. H. Perl, University of Jerusalem, Israel, arrived to work for a 3 month period (NTNF grant).

Seismologists Noponen and Pirhonen, Finland, Doornbos, Holland, and Hjortenberg, Denmark, worked at the DPC parts of the period.

IBM had 11 persons at the DPC the full period, plus 2 part of the period.

5 INSTALLATION, OPERATION AND MAINTENANCE

5.1 Field Activities

Installations were considered formally completed at the start of the period. Field efforts were concentrated on adjustments, calibration and replacement of components and instruments, mainly because of out-of-tolerance operation. One particularly time-consuming job is the replacement of SP-seismometers and recalibration of the channel. This had to be done in a great number of cases.

Control and calibration of field instruments greatly improved with full application of the Array Control and Monitor feature at the NDPC. Of course, this also increased the work load for the field personnel, as a result of more frequent and extensive scheduled monitoring. Since Well Head Vault work for climatic reasons is limited to the summer months, priority has in the period been given to such work.

5.2 NDPC Activities

Preparations were made for taking over all field activities when the present subcontract (with extension) is terminated. An AM & C group was established, which will coordinate these activities.

IBM and NORSAR efforts continued to optimize the system performance. Machine time was, at an increasing rate, being allocated to event processing. The form and content of the "output", i.e. the weekly event summary to be distributed, was contemplated in detail. Distribution is expected to start in mid-summer.

5.3 Maintenance Center Activities

At the Maintenance Center, reconditioning of SP seismometers has been a major task in the period. Also, amplifier repair and adjustments are timeconsuming tasks. SLEM repairs have taken comparatively little time, although ADCs continue to cause some concern.

6 DATA COMMUNICATION

Although some of the lines are still not 100% in conformity with CCITT Specification M.102, the performance is adequate. Group delays may in some cases be slightly outside specs, this, apparently, has no significant consequence. Communications are in general stable, without excessive error rates. Occasional short breaks and error bursts occur.

Two subarray SP cables were broken in the period, of which one was announced. Cable splicing equipment is purchased to accomplish quick repair of cables.

In the period, 80 data tapes were sent to SAAC in response to requests. 5 data tapes were sent to University of Bergen (2) and University of Helsinki (3).

7 RESEARCH AND DEVELOPMENT

Research and development work in the reporting period have been focused on system debugging, detection and event processor parameterization, and array evaluation based on short periodic P-waves.

Inevitably, the just completed NORSAR software system which is very extensive and complex, is likely to contain a large number of bugs. This have proved true, and especially the Event Processor have been troublesome in this respect. We have been working hard and in close cooperations with the IBM NDPC Group on relevant problems here to ensure routine event analysis from the earliest possible data. From June 1, the editing of an internal, daily bulletin commenced, while a more general bulletin circulation will start at a later date. Our present experience with routine NORSAR analysis indicates that relative large event could be handled satisfactorily by the Event Processor while a trained analyst is invaluable in supervising the automated solution for small and marginal events. In the latter case, the amount of computer time spent is large whether the analysis is successful or not.

Detection and Event Processor parameterization is particular troublesome in our case due to the broad band spectral contents of NORSAR recorded P-waves in the teleseismic distance interval. Typically, events in Central Asia are in general characterized by a dominant signal period of around 0.6 sec, which are quite exceptional for the corresponding epicentral distances. In case of the above type we would take advantage of existing options in the software system for using

regionalized filters and event acceptance thresholds.

Work has started on updating the steering delay and mislocation corrections of DP and EP. The present version is based on only 57 high quality events and is not considered quite satisfactorily due to inadequate coverage of several seismic regions.

Recent analysis indicate a systematic pattern in the variations of relative time delays and signal power across the array. Using a one-dimentional model we find that the dominant trend azimuth is around 130 deg for both of the above parameters. We also have some indications of a secondary trend azimuth around 40-60 deg, which favor a two-dominal variations of the crustal and upper mantle structures beneath the array. This have also been proposed by Kanestrøm, Bergen University.

Our spectral analysis is presently aimed at signal losses as a function of frequency on the array beam and subarray beam level. In the former case, we find a loss between 5-10 dB in the frequency interval 2-5 Hz, while in the latter case the corresponding loss figures are 1-3 dB for subarray 03C. The above loss calculations are based on a comparison between average spectra and beam spectra. The individual signal spectra in general peaks in the frequency range 2-4 Hz, while the signal-to-noise ratio has its maxima between 3-5 Hz.

8 EXPENDITURES IN THE PERIOD 1 APR - 30 Jun 1971

1.	Operation & Maintenance		
	1.1 Data Processing Center	$ 63.452	
	1.2 Field Installations	$ 52.340	
	1.3 Data Communications	$ 171	$ 115.963
2.	Research & Development		$ 8.831
3.	Administration & Support		$ 13.050
		Total Approx.	$ 137.844