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QUARTERLY TECHNICAL REPORT

01 July 1987 - 30 September 1987

for project

DEVELOPMENT AND EVALUATION OF A REGIONAL SEISMIC ARRAY IN NORWAY

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Edited by

Svein Mykkeltveit

Kjeller, 30 October 1987

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I. SUMMARY

This report gives an account of the work conducted by NORSAR in conjunction with development and evaluation of a regional array in Norway during the period July - September 1987 under Contract No. F49620-85-C-0016.

The purpose of the development of an experimental regional array in Norway has been to take advantage of the extremely good propagation of high-frequency energy for regional seismic phases in Eurasia. Since Norway is located within the same geologic plate boundary as the Soviet Union, the deployment of such an array in Norway provides important new insight with respect to the projected performance of possible future in-country stations in the U.S.S.R.

There were no modifications nor changes to the field installations during the reporting period. The performance of the field equipment has been good, as usual.

Seismic data were made available to the communication links 99.84% of the time. The uptime of the NORESS Earth station for satellite transmission to the U.S. was 99.73%. The downtime was mainly due to power failures at the array site.

Recording of NORESS data at the NORSAR Data Processing Center at Kjeller had the following uptimes: July 98.9%, August 99.4% and September 99.4%. Factors affecting these uptimes were field system and transmission line (land line between the NORESS array site and Kjeller) outages, and hardware failures and service as well as software tests and power breaks at the Kjeller data processing center.

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The purpose of the development of an experimental regional array in Norway has been to take advantage of the extremely good propagation of high-frequency energy for regional seismic phases in Eurasia. Since Norway is located within the same geologic plate boundary as the Soviet Union, the deployment of such an array in Norway provides important new insight with respect to the projected performance of possible future in-country stations in the U.S.S.R.

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All data received at Kjeller during the reporting period have been permanently stored on magnetic tapes. Processing results in the form of a seismic bulletin have been transmitted via the ARPANET to the Center for Seismic Studies in Rosslyn, Virginia. Altogether 13,512 detections were declared by the real time processing of NORESS data during April - June.

S. Mykkeltveit

II. GENERAL BACKGROUND

The purpose of the development of the regional NORESS array in Norway has been to take advantage of the extremely good propagation of high-frequency energy for regional seismic phases in Eurasia. Since Norway is located within the same geologic plate boundary as the Soviet Union, the deployment of such an array in Norway provides important new insight with respect to the projected performance of possible future in-country stations in the U.S.S.R.

The array was constructed in Norway as a joint enterprise between Sandia National Laboratories, Albuquerque, U.S., and NORSAR, and initial data from the array were available from September 1984. Seismic data are being transmitted via satellite to several recipients in the U.S., and from January 1985 via a 64 kbits/s digital land line to the NORSAR Data Processing Center at Kjeller.

Since 1979, NORSAR has conducted extensive field experiments to assess the potential of regional arrays in detection and location of regional seismic events. Results obtained from this work were utilized in the planning and design work for NORESS. The current and previous NORSAR research contracts with DARPA have contained several tasks that relate directly to the processing of data from regional arrays like NORESS. In particular, a processing package (RONAPP) for on-line detection and location of regional seismic events was developed and tested. The data from NORESS have been subjected to real-time processing using the RONAPP algorithm since data from NORESS became available at the NORSAR Data Processing Center in January 1985.

Under a FY84 contract, DARPA provided funds for the initial deployment of the NORESS array. This involved funds for site preparation work and also initial purchases for the data processing center at Kjeller.

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Additional items for the data processing center have been acquired under the current contract which also provides funds for further developments, refinements and evaluation of NORESS.

The current contract includes options for extending the research one year at a time. These options have been exercised, so that the research under this contract has been extended to 30 November 1987, which is the expiration date of this three-year research effort.

S. Mykkeltveit

III. FIELD INSTALLATIONS

III.1 Modifications and changes

There have been no modifications nor changes to the field installations during the reporting period.

III.2 Maintenance and repair

The NORESS field installations have been operating reliably during the reporting period. Some outages were related to power failures at the field site. The battery backup normally keeps the field system alive during these power failures, but we have experienced problems affecting the data transmission from a few (particularly the station C4) of the seismometer sites, following such power outages. The problem appears to be related to difficulties in synchronizing the data stream upon restarting after power outages. The problem is being investigated in cooperation with Sandia. Since 18 September we have had no data from the element D5, due to problems with the fiber optical transmitter. The field system downtime for the reporting period was as follows:

<u>Number of downtime intervals</u>	<u>Cause of downtime</u>	<u>Total downtime</u>
4	Power breaks	3 hrs 25 mins
1	Scheduled maintenance	8 mins

This implies that seismic data were made available to the communication lines 99.84% of the time.

P.W. Larsen
S. Mykkeltveit

IV. DATA TRANSMISSION

IV.1 Satellite transmission of data to the U.S.

The satellite transmission of data to the U.S. from the NORESS field installation was interrupted on seven occasions during the reporting period. These outage periods were as follows:

August	13,	0608-0622 GMT,	due to power failure
August	13,	1219-1229 GMT,	- " -
August	14,	0704-0716 GMT,	- " -
August	14,	0825-0835 GMT,	- " -
September	13,	0558-0809 GMT,	- " -
September	20,	0556-0830 GMT,	- " -
September	29,	0942-0952 GMT,	due to control line failure

The total uptime for the NORESS Earth Station for satellite transmission of data to the U.S. was then 99.73%.

J. Torstveit
P.W. Larsen
S. Mykkeltveit

IV.2 Land line to Kjeller

The 64 kbits/s transmission line from the NORESS array site to the data processing center at Kjeller failed on four occasions, with a resulting total downtime of 4 hrs 43 mins during the reporting period. This implies that the total uptime for the transmission line was 99.79%.

O.A. Hansen
J. Torstveit
S. Mykkeltveit

V. DATA CENTER OPERATION

V.1 Data recording

The breaks in the NORESS recording task arising from problems at the Kjeller data center can be grouped as follows:

<u>Number of breaks</u>	<u>Cause of break</u>	<u>Total downtime</u>
5	Hardware failure	6 hrs 47 mins
2	Hardware service	52 mins
8	Software tests	1 hr 22 mins
1	Power break	17 mins

Monthly uptimes for the NORESS online data recording task, taking into account all factors (field installations, transmission line, data center operation) affecting this task were as follows:

July : 98.9%
 August : 99.4%
 September : 99.4%

Fig. V.1.1 shows the uptime for the data recording task, or equivalently, the availability of NORESS data in our tape archive, on a day-by-day basis, for the reporting period.

J. Torstveit
 O.A. Hansen
 S. Mykkeltveit

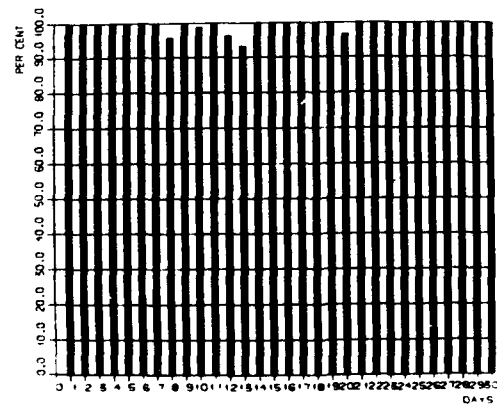
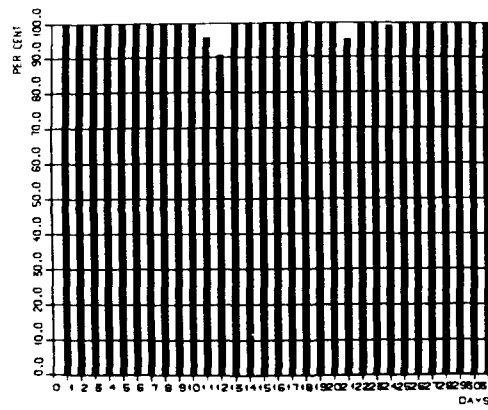
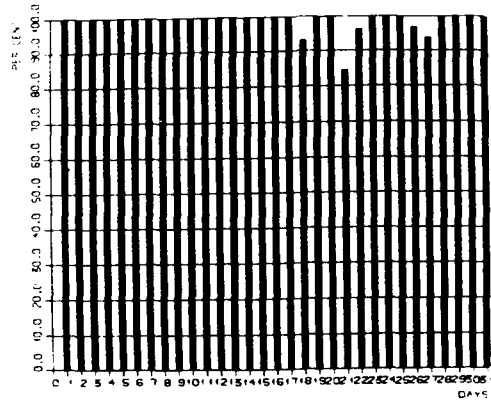


Fig. V.1.1 NORESS data recording uptime for July (top), August (middle) and September 1987 (bottom).

V.2 Data processing and bulletin transfer

The real time processing of NORESS data, using the RONAPP processing package, has continued during the reporting period. 13,512 detections were declared by the automatic processor during July - September.

The bulletin with the processing results has been transmitted daily to the Center for Seismic Studies in Rosslyn, Virginia, via the ARPANET.

S. Mykkeltveit

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VI. EQUIPMENT PURCHASED, INSTALLATIONS AND MODIFICATIONS

No equipment was purchased during the reporting period.