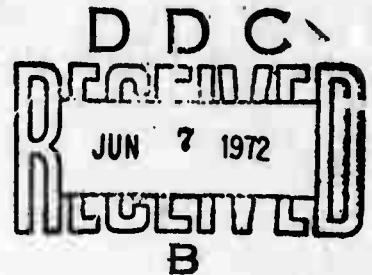


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SEISMIC ARRAY ANALYSIS CENTER QUARTERLY TECHNICAL SUMMARY REPORT JANUARY - MARCH 1972

26 APRIL 1972

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13

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 **TELEDYNE GEOTECH**

ALEXANDRIA LABORATORIES

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QUARTERLY TECHNICAL SUMMARY REPORT
January - March 1972

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Contract No.: F33657-72-C-0471
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Amount of Contract: \$1,583,049
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the report describes the

Operations

operation

During January, February and March 1972, we operated the Detection Processor (DP-ISRSPS) routinely with the following set of parameters: beam deployment; (300 LASA fine beams of 17 subarrays, A-ring through the E-ring, and 299 LASA coarse beams of 9 subarrays, A-ring through the C-ring); filter (0.9 to 1.4 Hz); detection logic; (3 threshold crossings in 3 successive 0.6 second intervals with a detection threshold of 10 db in each of the three intervals); and a spatial stability constant, (the detection must occur on the same or neighboring beam for 4 successive intervals). *-> P5*

Table I shows the DP uptime and downtime for LASA data during the first quarter as well as the general problem categories causing the downtime. This table is for the DP-ISRSPS only. During most of the downtimes listed, LASA data were recorded at SAAC on interim system (IISPS) or at the LASA Data Center.

During January, February and March 1972, we operated the Event Processor (EP-ISRSPS) routinely so that it accepts only those DP detections which exceed 14 db (S/N = 5.02:1). Table II shows EP and analyst time required to review and edit DP detections.

On the 25th of January a parameter change was effected in the EP to improve the capability of the beam packing

<u>Month</u>	January	February	March	Total
	(in hours)			
<u>Problems</u>				
Hardware	1.3	5.7	37.2	44.2
Software & Testing	0.0	0.0	6.5	6.5
Power Failure	0.0	7.0	.3	7.3
50 KB Phone Line	29.6	22.2	4.4	56.2
Preventative Maint.	2.7	6.1	4.0	12.8
Total DP Downtime	33.6	41.0	52.4	127.0
Total DP Uptime	710.4	655.0	691.6	2057.0
% Uptime	96%	94%	93%	94%
Total Possible Recording Time	744.0	696.0	744.0	2184.0

Table I. DP ISRSPS Up-Downtime for LASA Data
in 1st Quarter 1972

<u>Month</u>	January	February (in hours)	March	Total
DP Recording Time Covered by EP Analysis	706.7	665.0	691.6	2053.3
Analyst Time Required on EOC	123.9	118.4	126.2	368.5
IBM 360/40B Time Required on EP (estimate)	491.0	440.7	447.9	1379.6

No. of Detections	14344	14786	13521	42651
No. of Events Listed in Summary	664	679	705	2048

Table II. DP-EP Analysis Time in 1st Quarter 1972

algorithm in the location of events. Previously the algorithm had rarely produced a stable solution, but by reducing the beam spacing by one half for each iteration, stable solutions are now obtained in a few iterations. Several events which had previously been located using the cross-correlation scheme were rerun through EP using the new beam packing. The beam pack locations were in closer agreement with NOS locations on the average and the processing required 35% less CPU time.

During the first quarter the travel time anomalies used in the Detection Processor were found to be in error. The cause of the error lay in the fact that the listing of the travel time anomalies applying to each LASA subarray did not correspond to the ordering of the subarrays on the core image tape. This error, present in the system throughout 1971, was corrected on February 4, 1972 when a new core image tape was generated with the anomalies in the correct order. The travel time anomalies in the Event Processor were found to be in correct order so all events passed by the EP were not affected by the error in DP. However, many small events may not have passed EP because the DP beam which actually reported the detection of a particular event could seriously mislead the EP as to the approximate location and hence the EP could not produce a more stable and refined location. This would lead to rejection of the event by EP.

It does appear that more small events are now being passed by the EP but our analysis is incomplete at this time.

→ SP Network Evaluation

During this quarter a study has been initiated whereby the detection and identification results of SAAC/LASA and NORSAR are compared for regions which are within the P-wave detection range of both arrays. Programs have been written to read the NORSAR detection log, the detection bulletin file and the EP bulletin which are transmitted via the TAL and recorded on the SAAC low rate tape. Objectives of the study include measuring the ability of the two arrays to verify each other's detections, indicate each other's detection thresholds, improve locations, and verify depth phases.

→ LP Processing

The LP processing package is now fully developed and can process all the long period data from LASA, ALFA and NORSAR in real time. This program has been used to evaluate the capability of the LP array network to detect and identify Rayleigh waves from selected seismic regions, particularly the Kurile Islands and central Asia. Novel wavenumber filtering techniques have been developed which allow separation of interfering signals and the extraction of small amplitude waves from seismic noise. The emphasis of our LP analysis programs

has been on speedy access to the raw data and the application of techniques which allow both effective and fast analysis of seismic events.

SAAC Reports for Project Number 1709

A second evaluation report of the SAAC/LASA system has been completed and will appear as SAAC Report No. 5. This report is an evaluation of the SAAC automated data acquisition and processing systems as developed by the Federal Systems Division of IBM contracts F19628-67-C-0198 and F19628-68-C-0400 and based upon our operations of SAAC on a 24-hour day, 7-day week schedule from February 1 to December 31, 1971.

The preliminary evaluation of the detection capability of the large array network will be described in SAAC Report No. 6.

SAAC Report No. 7 will be an evaluation of SAAC (LASA) equipment and software.

A comparative study of Rayleigh wave spatial coherence at the three large arrays has been completed and will appear as SAAC Report No. 8.

Documentation and Programming

The Detection Processor has been running routinely. No new errors have been located in the system during the first quarter of 1972.

Modification 5 to the EP system was installed during the month of January. These changes up-graded the operation system to DOS Release 25, corrected some known errors, and improved several operational difficulties that were observed in 1971 by making the following enhancements:

1. The addition of ten new event data sets on disk. During periods of high activity the Event Data Sets sometimes fill up preventing further processing. This can result in a loss of detection data.
2. Enlargement of the Signal Arrival Queue on the DP-EP shared disk. During periods of high activity the Signal Arrival Queue would sometimes overflow, resulting in loss of detection data.
3. Installation of an option enabling the operator to determine the EP workload. Before, when taking the system down, the operator had no way of knowing how long EP could be down without building up too great a backlog.
4. Improved the beampacking algorithm. The old beam packing algorithm allowed a maximum error of 3° for detections in the range of 30° to 90° away from LASA. This deficiency in the EP system was corrected by allowing the beam packing to iteratively close in on a more

accurate solution. Accuracy was improved by calculating regional corrections for each packed beam instead of just for the center beam as was being done.

5. Elimination of forced publish when the Event Data Sets were full. When the EDS's were full the system automatically invoked a publish (SP03) and published 5 events regardless of whether the analyst has processed them. This action forced the analyst to retrieve the events from the Event Tape to process them with resulting inefficiencies and the loss of time. By increasing the number of Event Data sets and size of the Signal Arrival Queue it became safe for the system to wait for the analyst to process events before publishing them.

Additional support programs were required to expand SAAC capabilities. A program for maintaining an accurate record of SAAC events and associated parameters was completed. It maintains a master set of events by allowing one to add events, delete events, change or add parameters associated with an event, and create a tape of events through parameter sorting (such as date selection). Its output is FORTRAN readable.

The data retention program was changed to produce a listing of the data times saved and associated tape numbers. In addition it was changed to run 50% faster.

The first update to SAAC manuals was completed. This update to REF 101S will be distributed when the printing of additional sets of SAAC manuals is complete.

The necessary programs for data transmission from NDPC to SAAC via the TAL were supplied by IBM. These programs are being modified to allow data transmission from SAAC to NDPC. The work is proceeding according to schedule and should be completed on or before June 1, 1972.

Data Requests

During the quarter a total of 966 data requests were received from external users. By March 31, 483 of these requests were fulfilled. No data were available for a further 50, leaving a total of 433 to be completed.

Task Change Proposals

Two TCP's have been negotiated and incorporated into the contract. TCP P-2002 allows the programming efforts necessary to convert FORTRAN 63 programs used on the CDC 1604-B to FORTRAN IV language for use on the IBM 360/44 and the PDP-15. The second, TCP P-1984, provides the service of a senior programmer to interface with computer oriented people of the ARPANET and the seismic oriented members of the SAAC staff.