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A DIGITAL DATA LOGGER FOR SEAWAVES : A SURVEY

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Introduction

This report describes the background and the results of a survey of commercially available magnetic tape data logging equipment carried out with a view to identifying the next generation of wave data loggers for the Engineering Oceanography Group at IOS Taunton.

Background

At present there are three systems in use for recording wave data in the EOG. They are paper chart, FM magnetic tape and digital magnetic tape. 0fthese digital magnetic recording offers a number of advantages over the others in terms of accuracy, ease of use and compatibility for computer processing, but at the expense of greater complexity and higher capital costs. However for many applications the advantages of digital data logging are overwhelming and it was decided in 1972 to obtain a digital data logger for evaluation. It was found that there were no commercially available loggers which met all the requirements then specified (the current specification is discussed in a later section). The Epsylon field data logger was investigated but rejected because the manufacturer would not offer a backup and service facility that IOS required. The only other suitable logger system was being manufactured by Rapco Electronics. Two standard models had already been purchased by other groups within IOS and as a consequence Rapco were commissioned to modify one of their existing data loggers to suit IOS wave measurement requirements.

Our experience with Rapco loggers has been mixed. The prototype proved to be unreliable and was responsible for a delay in the introduction of digital recorders for wave data collection. But experience with it in the field enabled an improved version to be built. The remaining five loggers purchased were of this improved design and have been more reliable but the reliability has never reached 100% at any site although it has come close to this at South Uist.

In addition to its questionable reliability, the Rapco logger has a high power consumption and any new or replacement loggers purchased from Rapco Electronics would be very expensive compared with their modern competitors. All the disadvantages arise from the fact that the Rapco is an old design using out of date technology.

Table 1 shows the various wave recording sites operated by EOG as of 1 January 1978 and shows the various recording methods used at each site.

It seems likely that there will be a continuing need for data logging equipment in EOG. Indeed data collection activities are likely to expand in the coming years and even if a proportion of that work is subcontracted the group will wish to retain control of data recording and analysis. What is certain is that the success rate for this new work must be uniformly high, at least equal to the best achieved in the past, and this will not be the case if out-dated equipment is deployed.

Specification for the logger

It was decided to carry out a market survey of possible equipment and to invite all known manufacturers of digital recording equipment to submit details of their products which might be of interest. To this end a brief outline specification was included in a circular and sent out. This was written in the broadest terms, the essential requirements being:

- 1. Capacity adequate for one month using our standard sampling system (single channel)
- 2. Lower power, battery operated
- 3. Portable
- 4. Cartridge or cassette
- 5. Standard, off the shelf, requiring only minor modification

The circular was sent to 125 British companies and 50 US companies whose names and addresses were obtained from various trade directories and journals.

In addition, companies known to be able to supply some form of data logger were approached, these included Rapco who were asked to submit a proposal on how they would improve the reliability and power consumption of their logger.

Replies and short list

Replies were received from 85% of the companies approached. Of these 17% were no longer able to supply any equipment, 50% produced only computer peripherals, 20% only manufactured laboratory and process control loggers and 8% would make a logger to our exact specification. The remaining 5% represented seven companies all of which were known before the survey was carried out. The survey thus showed that there were not likely to be other companies in the British market and this is considered to be a useful initial result.

These seven companies are:

| 1. | Datel | 5. | Sea | data |
|----|-------|----|-----|------|
| | | | | |

- 2. Memodyne 6. Christie
- 3. Microdata 7. Mycalex
- 4. Rapco

Mycalex was immediately dropped because they did not have anything suitable although they are developing a logger for release sometime in 1978-79.

From the remaining six only the Rapco and the Sea Data provide sufficient capacity. Indeed the requirement for one month of recording proved to be so restrictive that it was decided to relax it so that the other loggers could be considered.

The Christie was dropped because of its low data capacity. The format of the data on the cassette conforms to ECMA 34 and this is wasteful in terms of data capacity resulting in only five days of data using the normal sampling program for one channel. It is big and bulky and would not be suitable in our opinion for field use, although this logger is used by HRS Wallingford, where it was seen in operation.

The remaining five equipments can be grouped in various ways. The Microdata and Rapco are off-the-shelf units and very little hardware development would be needed. In the case of the Rapco no software development would be required either. These two loggers are of British design and manufacture, the remaining three have American origins.

The Datel, Memodyne and Sea Data are not supplied as fully developed systems but as a series of components that are assembled by the user into a required configuration. These three systems all use the Phillips type cassette.

The Microdata is the most up-to-date and sophisticated. It uses the quarter inch 3M cartridge and its recording format is computer compatible ANSI/ECMA. It can replay recorded data and can be controlled remotely opening up possibilities of economic data transmission by public telephone line.

The Sea Data recorder has the largest data capacity. It is able to store more than 40 days' data if the normal single channel sampling rate is used. It achieves this by utilising its own special tape format. The Rapco is also able to record one month's data. The remaining loggers including the Microdata are only able to record for fourteen days although by changing the data format this could be improved by up to three days.

Table 2 gives a brief account of the relative merits of the five systems.

Conclusions

These five systems represent the current state of the art of commercially available data loggers in the UK. There were replies from other manufacturers who could supply loggers made to our particular specification but this method of procurement would be an expensive and long drawn out affair and was not considered.

It was decided that as the logger purchased would form the heart of the EOG data gathering system for the next six to eight years, a great deal of consideration should be given to the system chosen, particularly as the logger would also possibly be used by other groups in IOS Taunton. So to this end two systems were chosen on which to carry out extended field trials.

The first was the Sea Data and it was chosen for the following reasons: its high data capacity; its low power consumption; its versatility; and the fact that other groups within IOS (at Bidston and Wormley) have already purchased systems and have facilities for replaying tapes. They have found that the system performs satisfactorily.

The second system picked was the Microdata logger. It was chosen because of its advanced British design; its computer compatible recording format; its low power consumption; its "off the shelf" construction; its ability to replay and display data on site; and its future use as a remote controlled data terminal.

These two systems have been ordered. Delivery is expected during February 1978. The systems will be extensively checked out in the laboratory and will then be deployed in the field at wave recorder sites. They will collect data in parallel with existing loggers for a period up to six months before being deployed on their own.

TABLE 1 WAVE RECORDING SITES IN THE UK

| | Type of | Analog recording | Digital recording | |
|--------------------|----------------|---------------------------------------|-------------------|--|
| Site | wave recorder* | method | method | |
| · | | | | |
| South Uist | WR | Chart & FM | RAPCO | |
| Eddystone | WR | Chart | RAPCO | |
| Foula | WR | Chart & FM | RAPCO | |
| Boscombe Pier | DWR | - | 3 chan RAPCO | |
| Isles of Scilly | WR | Chart | RAPCO | |
| Admiral Fitzroy | SBWR | Chart | | |
| Admiral Beaufort | SBWR | Chart | | |
| Seven Stones | SBWR | Chart | | |
| St Gowan | SBWR | Chart | | |
| Dowsing | SBWR | Chart | - | |
| Discovery | SBWR | Chart | _ | |
| John Murray | SBWR | Chart | _ | |
| Port Talbot | EM | FM Mag tape | - | |
| Scarweather | WR | FM Mag tape | _ | |
| Hallsands | FM | FM Mag tape | _ | |
| Hallsands | WR | FM Mag tape | _ | |
| Budleigh Salterton | FM | FM Mag tape | | |
| West Bexington | FМ | FM Mag tape | _ | |
| Aldeburgh | FM | FM Mag tape | _ | |
| Dunwich | FM | FM Mag tape | <u> </u> | |
| Southwold | FM | FM Mag tape | - | |
| Dunwich | WR | FM Mag tape | _ | |
| The Wash | FM x 2 | Chart | | |
| | · | · · · · · · · · · · · · · · · · · · · | L,,,,,,, | |

* WR = Wave rider

DWR = Directional Wave Recorder

SBWR = Shipborne Wave Recorder

FM = IOS FM Pressure Recorder

TABLE 2 DATA LOGGERS

| Feature | DATEL | MEMODYNE | MICRODATA | RAPCO | SEADATA |
|--------------------------------|-------------------|-------------------|----------------------|---------------------|---------------------|
| Recording MEDIA | Cassette | Cassette | 3M Cartridge | Open Reel | Cassette |
| Recording Density (BPI) | | | 1600 | 600 | 1600 |
| Recording Format (Physical) | 2-track | 2-track | 4-track | 4-track | 4-track |
| Recording Format (Logical) | NRZ1 | NRZ1 | ANZI/ECMA | BCD | Special |
| Number of Channels (Max) | 20 | 20 | 20 | 4 | 20 |
| Absolute Capacity (Bits) | 2x10 ⁶ | 2x10 ⁶ | 20x10 ⁶ | - | 53x10 ⁶ |
| Usable capacity (readings) | | - | 264x10 ³ | 504x10 ³ | 703x10 ³ |
| Usable capacity (EOG days) | 14 | 14 | 15 | 33 | 40 |
| Replay | No | No | Yes | No | No |
| Remote control | No | No | Yes | No | No |
| Power consumption | Low | Low | Low | High | Low |
| Power supply | - | - | Battery | Battery | - |
| Replay system | Special | Special | Standard | Special | Special |
| IOS compatibility | No | No | No | Yes | Yes |
| Country of origin | USA | USA | UK | UK | USA |
| Cost of Logger (£) | 2000 | 2000 | 4000 | 5000 | 3000 |
| Cost of replay unit (£) | 2000 | 2000 | 1600 | 3500 | 5000 |
| Word length | 10 bit | 10 bit | 3 1 digit | 12 bit | 10 bit |
| Accuracy | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |