THE TELLUROMETER MRD1 SYSTEM

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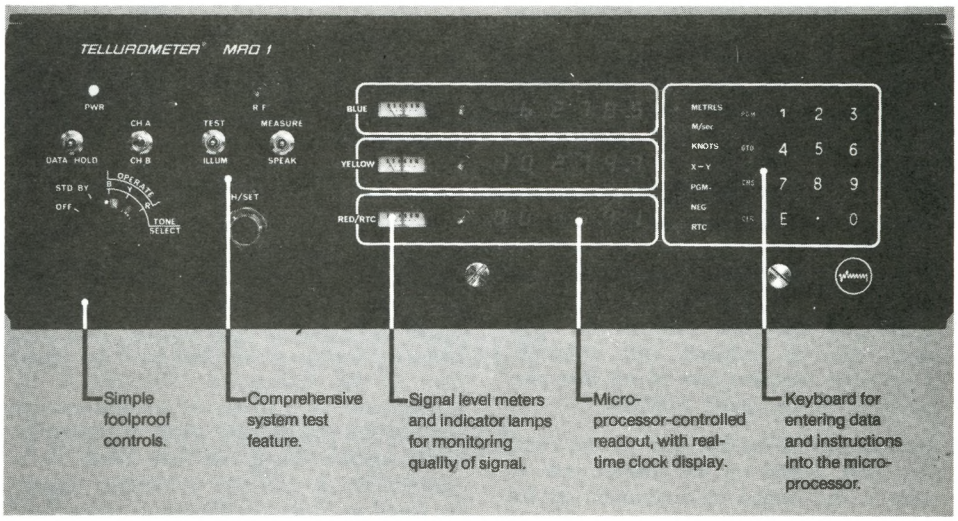
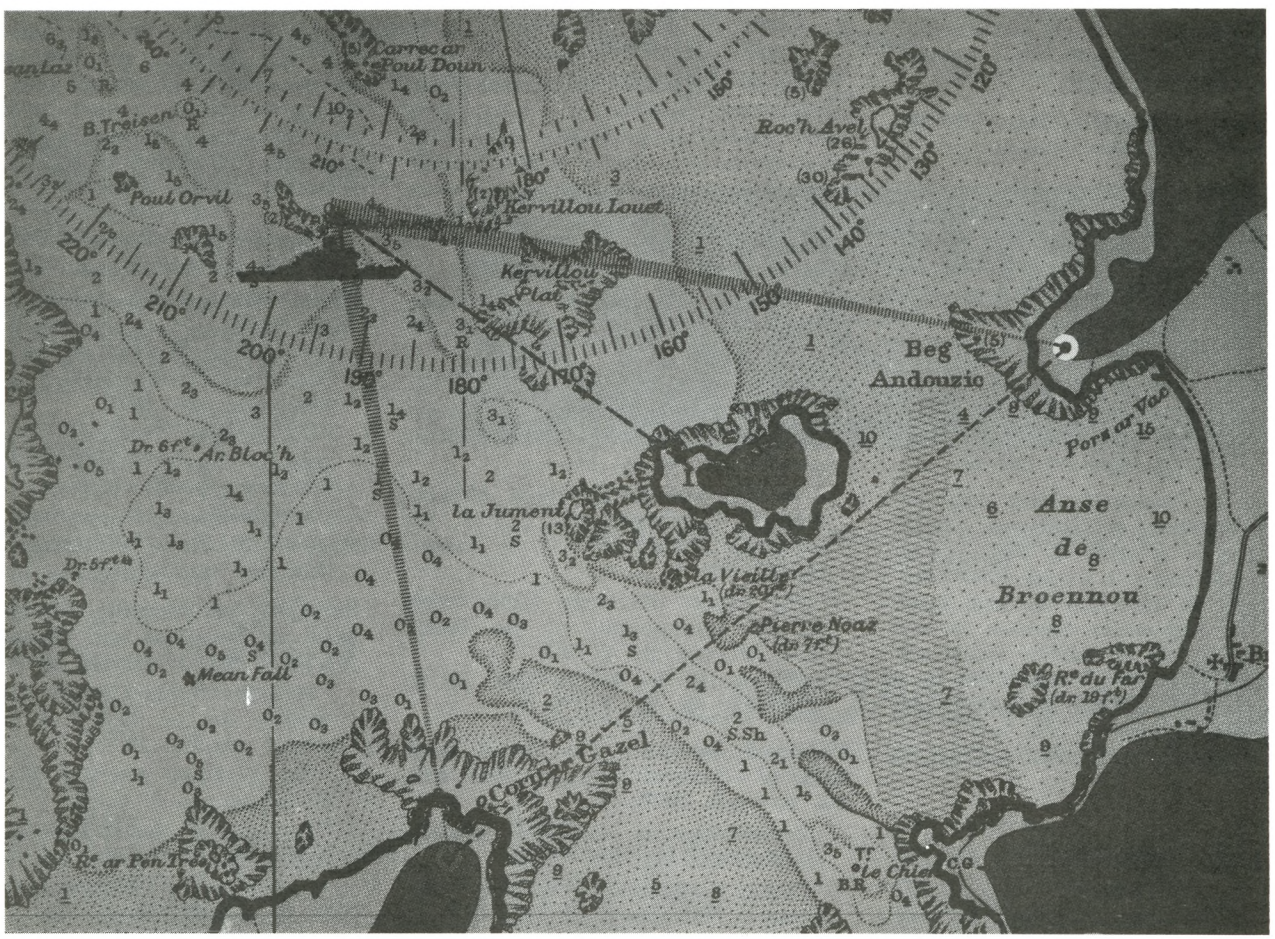
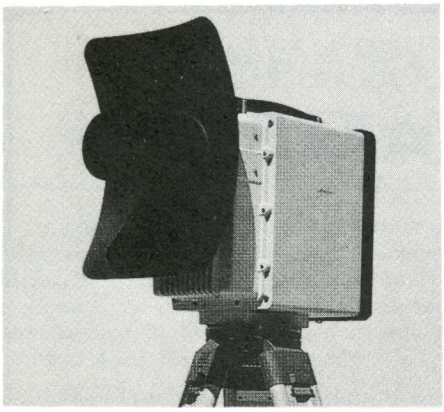
Among the recent advances in the electronics technology are the introduction of complex microprocessors and extensive memory banks in very small packages. The new dynamic Tellurometer system, the MRD1, which has been produced for hydrographic and airborne positioning, takes full advantage of these developments. It has a built-in minicomputor and entry keyboard which enable the operator to select one or more built-in programmes and enter any required data into the system. To give one example, the operator can enter the X Y and Z co-ordinates of the shore stations and select the programme for co-ordinate output. The MRD1 will then drive a track plotter, but in addition to that, the operator can enter the scale at which the plot is to be produced. This in turn enables the user to plot directly on to a chart rather than plain paper.



The Master Instrument





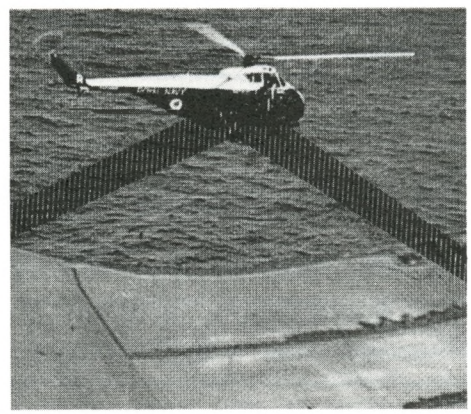
Weatherproof remote instrument for unattended operation

The MRD1 consists of a Master unit which consists of a triple display unit, the mini-computer and keyboard, and single omni-directional antenna. The latter contains the all-solid-state transmitter as well as a pre-amplifier for the receiver, which enables it to be located up to 100 feet from the Master chassis with no signal loss. The triple display unit if used as a two-range system displays the "yellow" range, the "blue" range, and time. If three ranges are being used the third "red" range is displayed instead of time, but time is still available in the system and can be recorded if required.

The microwave carriers are produced by solid-state sources which are crystal controlled and they eliminate any need for tuning by the operator. However, two complete bands of carrier frequencies are available, Channel A and Channel B. This has two major advantages in that it enables two systems to be used in the same area, one on Channel A and one on Channel B, and it also enables one to operate in a large area. In the latter case a user can begin operating work with two Remote shore units on Channel A, and on moving up a coastline or river change over to another pair of Remotes on Channel B. This is achieved merely by operating one switch on the Master Unit.

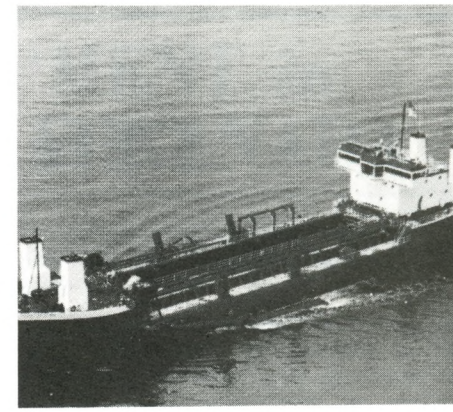
In addition to being able to operate on two channels, up to six Master systems can be used with the same two Remotes. However, regardless of the configuration used, the Remote units can be left unattended and are "called up" by the Master as required. If there is an operator at a Remote Unit, the Master can talk to him via the built-in two-way FM voice link. The Remote units are intended for mounting on standard tripods with the datum point being directly over the plumbing point. This coupled with the precise datum point on the omni-antenna at the Master, enables one to know precisely where one is measuring from and to which are somewhat nebulous factors on some systems. The resulting accuracy of the system is +— 1 metre +— 3PPM, with a resolution of 10 cm.

Being a microwave system the maximum range is limited by the radio horizon but in the airborne mode ranges in excess of 100KM are possible, with a minimum range of 100 metres. When used in the airborne mode the maximum of change of range is 100 metres per second or 194 knots. This is a change or range, not the maximum speed of the aircraft and, for example line-crossing operations can be carried out at much higher speed because the aircraft is then on a tangent to the Remote. Line crossing is a means of measuring long ground - to - ground distances whereby a Remote is placed at each end of the line (which could be 200 KM long) and the aircraft flies between them preferably about mid-way along the line. The minimum sum of the two distances measured to the aircraft is the point at which the aircraft crosses the line. Yet another programme is built into the system which will display the sum of the two distances which makes it easy for the operator to see that the line has been crossed, particularly when the crossing is not exactly at right-angles.



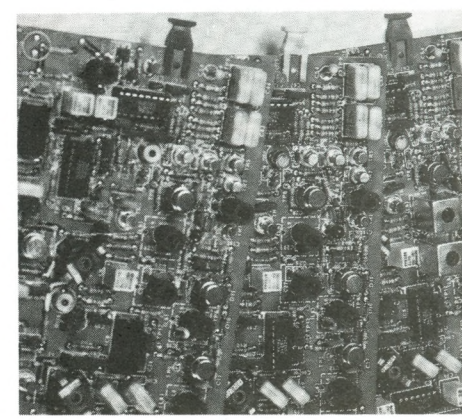
There are also facilities on the Master Unit for connecting other digital data inputs from such peripheral instruments as digital radar altimeters and digital echo-sounders. The MRD1 can therefore control quite a complex system providing computed data with a minimum of operator control. To give a specific example an MRD1 Master can be connected to a digital echo sounder, a track plotter and an alpha numeric printer. The system can then be programmed to display two ranges and real time, compute coordinates, drive the track plotter at a pre-determined scale, and print all the data, including the echo-sounder depth, at a predetermined rate.

It is possible with such complex equipment to be completely at the mercy of electronics and many self-check and self-calibration facilities are built in. Unlike many systems hundreds, thousands and ten-thousands of metres are not evaluated by "decading" resulting in "lane-skipping". Each individual digit in each display is checked at least every two seconds by means of separate measuring frequencies. If the system is not quite sure of a digit, that digit flashes until it has been double checked and verified.



Also it is possible for there to be temporary loss of signal caused by, for example, a ship crossing the line. If this happens, the shore stations do not "close down" to "standby" but are held on for two minutes and based on the previous data the system will continue to estimate the position. If the same heading and speed are maintained the accuracy is very high but on the printout a question mark is printed beside each estimate.

The on board computing and plotting result in verification of the coverage on the spot with considerable time and money savings, and with a minimum of operator headaches. The accuracy is such that one has now to consider where on the boat or aircraft the antenna is mounted as we are measuring to one specific point. Precise positioning has come a long way in twenty years.



Interchangeable circuit board