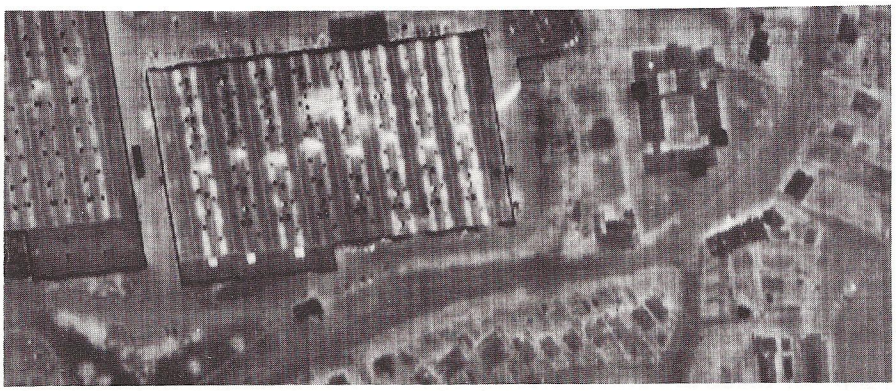
Fairey Surveys

Newsletter 22

News of developments in the world of surveying and mapping JANUARY 1980

AIRBORNE THERMAL SURVEY



Thermal imagery of an industrial site.

THE Environment and Resource Consultancy Division within Fairey Surveys has recently begun its second full season of operations within the UK, marketing heat-loss studies for energy conservation. The current survey follows on from the successful 1978/79 winter sorties when over 150 surveys were completed. To improve the service offered we have recently acquired new linescan equipment and qualified staff, both to market and interpret the data.

The equipment now in use is a Daedulus DS-1230 dual channel thermal linescanner purchased in August of 1979. This equipment is basically similar to that described in Newsletter 20 but with important new design features. The most important are improvements to the spatial and temperature resolution of the scanner. A 30% improvement in spatial resolution has been achieved by changing the detector size from 2.5 milliradians to 1.7 milliradians, whilst the temperature resolution is now 0.2°C, a 20% improvement. The image above clearly shows the improved quality of the scanner resulting in a detailed plan view of the relative heat losses across the site. However, to extract maximum information the image does require skilled interpretation.

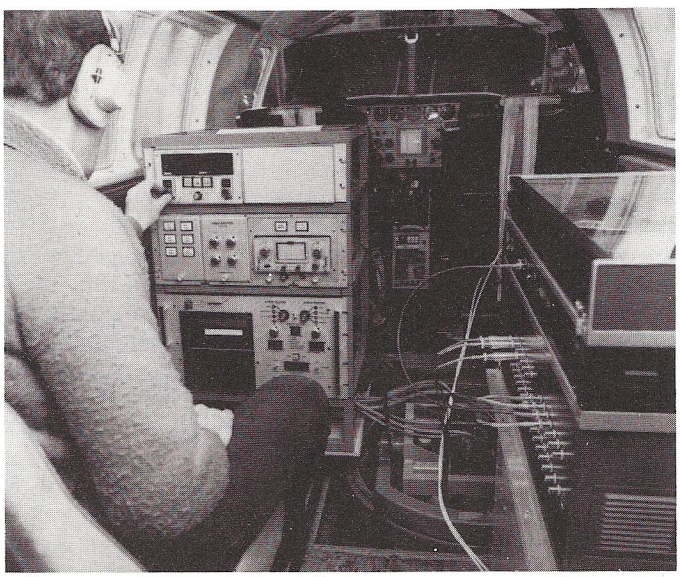
Thus in addition to presenting a client with the imagery we also produce a detailed report locating and explaining all areas of excessive heat loss. This involves a site check to verify that a thermal anomaly is due to inadequate insulation, to safeguard against those processes operating within a building which can cause spurious anomalies. The final product is thermal imagery, a detailed report and a site plan overlay locating all the anomalies.

Although the major use of the scanner in the winter months has been for building and factory heat-loss studies, this is by no means the limit of its applications.

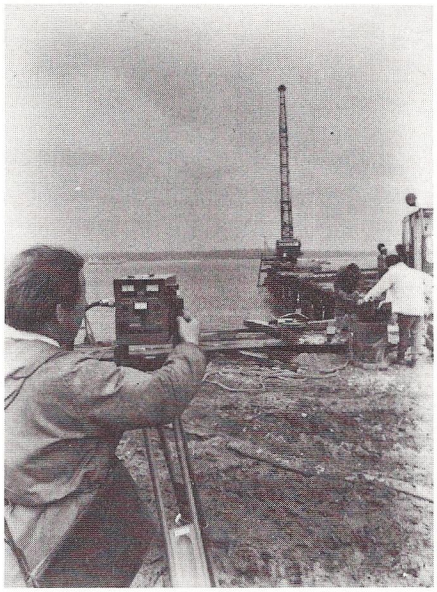
Thermal scanning has already proved to be an accurate and reliable system for monitoring pollutant effects in rivers, estuaries and coastal waters from power stations, mines, industrial complexes and sewerage outfalls.

Offshore fresh-water springs have been successfully located in various areas of the world, an application of great interest in arid and semi-arid countries where on-shore water supplies are limited and conservation vital.

Infra-red imagery is used in many developed countries to supply accurate baseline information for environmental studies on such diverse elements as vegetation, soils, atmosphere, water and animal life. Thermal data has also proved a reliable indicator in the search for sub-surface geological faults, abandoned mine shafts and in the monitoring of activity in volcanic regions. Further applications in the wider field of geology are being currently researched.



Operating Linescan equipment in a Beechcraft Queenair.



Measuring the centre line for a section of the Humber Bridge.

SURVEY CONTROL FOR BRIDGES

FAIREY SURVEYS' Ground Survey Section is involved in setting out roads and motorways and consequently have set out the associated structures. Many of these are straightforward jobs not requiring any special equipment or expertise. If not much is written about this type of work it is just that they are everyday jobs and seldom noteworthy.

The most frequent requirement for road and motorway bridges is to set out control to enable initial construction to take place, ie: set out the position of the bridge in relation to the road and according to a set of design co-ordinates.

During construction the engineers will require, at various stages, control for the main structure abutment walls and to monitor the progress of the work. There is also the need to re-establish control that has been destroyed during construction.

In recent years we have noted a trend for increasingly rigorous specification. As professional surveyors we welcome the challenge in many respects. We are confident that we can comply with the client's requirements, after all we have acquired a high reputation for precise surveys. However, specifications should be realistic and not just quoted as $\frac{1}{8}$" or 1mm because it happens to be the smallest unit of measurement at the time. If ± 1mm precision is required it has to be paid for and often it is more than just 5 times as expensive as providing ±5mm accuracy. Over specifying is an inflationary and unnecessary safeguard where the professional surveyor is involved.

Any surveyor who has experience of construction sites, can appreciate the engineer's concern for high specification when pre-cast structures have to be assembled. Insufficient precision in the survey data provided can lead to expensive delays. For this reason it is better to provide the control for each structure as a separate entity from the main survey control of, say, the road, that is, the bridge control should be a network of its own but connected to the main network (see Dornoch Crossing).

Even if the point connecting the bridge control to the main network is removed at a later date, the relationship between the remaining control points of the bridge is maintained.

Other factors which effect the smooth running of a setting out survey include circumstances where it is no longer possible to repeat the method used to establish the survey control. After the construction has started lines of sight can become obscured by embankments, site plant and partly built structures. Also control stations are destroyed and cannot be re-established in the same place. Frequently two different types of EDM are in use on site and this can cause disputes. Many manufacturers of EDM quote their accuracy to ± 5mm neglecting the parts per million for short range work. It is not uncommon to have two EDMs differing by 1cm, ie: one is +5mm and the other -5mm. An agreed site base length can help in this matter. Some problems over co-ordinate variances arise from different methods of traverse adjustment.

When setting out structures it is necessary to work to a greater precision than when setting out earthworks, but neither task would warrant the techniques and equipment of high precision surveys. The best approach can be applied, only if at an early stage, engineers discuss with experienced professional surveyors the most suitable techniques, equipment and the real accuracies needed. This way best value will also be obtained.

Two recent cases when high precision has been demanded concern the Humber River Bridge and the Dornoch Crossing, each requiring one-off equipment to be designed as well as using the most accurate techniques and instruments available. A brief description of each follows:

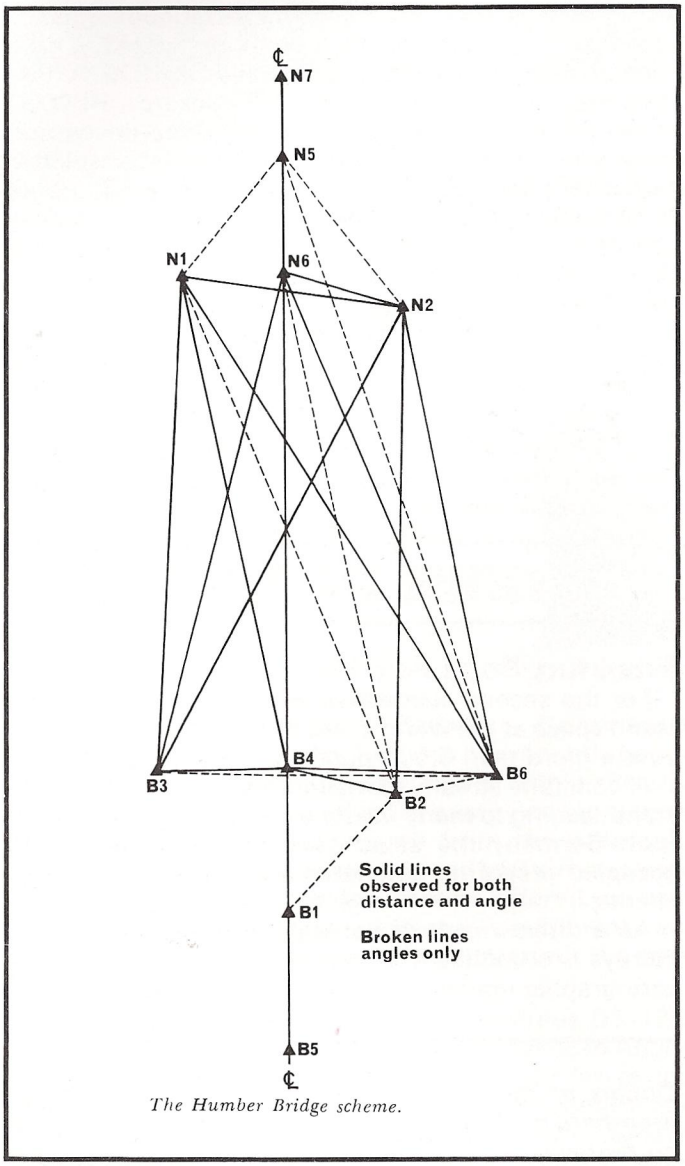
Humber Bridge

The width of the river Humber at the bridge site is approximately 1,800 metres. For construction purposes ends of the centreline of the bridge had been defined on each bank and there were also a number of survey stations positioned to monitor the construction of the towers.

Fairey Surveys were called upon to supply co-ordinates of additional points along the centre line, measure the distance along the centre line, co-ordinate the additional survey stations plus those used in the initial design work, connect the levelling of the south bank to that of the north, transform the co-ordinates from the local grid based on the centre line to National

Grid co-ordinates for comparison with the original survey and to measure the heights of the towers.

The survey network was observed using a Wild T2 for the angles and the Kern Mekometer for the distances.



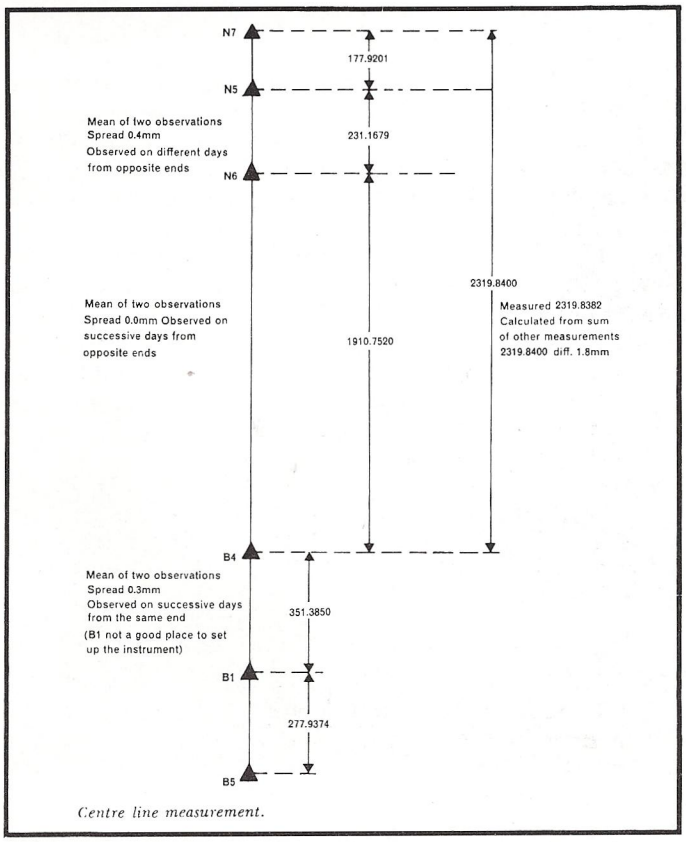
The Humber Bridge scheme.

The resulting distances along the centre line, as shown above right, indicate the high precision of the survey.

When the network was adjusted by least squares, using both angles and distances, the maximum adjustment for any one line was 9mm, representing a proportional error of 1/214,000. If the distances only were used for the adjustment the maximum residual was only 1.3mm. The maximum difference in co-ordinated position between the two adjustments was 10.4mm and the average difference in the co-ordinated position between the two adjustments was 2.5mm.

The reason for using both angles and distance, was that the network produced was very much stronger than if just distances were used. When considering the reasons for the differences between the adjustments it is important to remember that over the distances across the Humber one second of arc subtends one centimetre, therefore the precision of a theodolite fix at those ranges is lower than that of a Mekometer fix.

In spite of the poor network shape the Mekometer provided precise data for the centre line and the monitoring stations.



Centre line measurement.

On both sides of the river bank the stations had been connected to the nearest Ordnance Survey bench marks. By using computed Mekometer distances and simultaneous reciprocal vertical angles it was possible to show that the South Bank levelling was 16mm higher than the North Bank.

Dornoch Crossing

A new bridge is to be built across the Dornoch Firth to carry the re-routed A9 road across the Firth, near the village of Edderton, where it narrows to about 1300 metres.

Consulting Engineers, Crouch and Hogg, decided that the accuracy with which the bridge centre line needed to be established between banks should be ±5mms. In order to achieve this they further specified that five large survey monuments were to be established, two on the North bank and three on the South bank. In addition on the North bank there is an existing 3rd Order Ordnance Survey Triangulation Station which was to be incorporated into the scheme.

The network of six stations was measured by Fairey Surveys using their Mekometer 3000 by trilateration. The scheme was orientated to the line joining the OS Triangulation Station to the spire of Dornoch Cathedral. The network was adjusted by variation of co-ordinates holding the OS Triangulation and the initial bearing fixed.

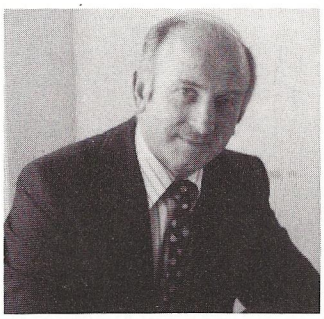
The shortest line was 1.3 kilometres and the longest 2.6 kilometres. The maximum residual in the adjustment of the 14 lines was 4.4 millimetres. Angles were not used in the network as it was so well conditioned and the sides so long, that angular measurements could not have improved the result.

The entire network was slotted into the traverse for the setting out of the approach roads as a fixed length and direction. This in effect meant that the control for the bridge was held fixed while the road network survey was adjusted to the bridge control.

MARKETING APPOINTMENTS

A WELCOME newcomer to our sales team is Roger Finch who having spent his early years studying law decided he preferred the more lively career of marketing. Throughout the last fifteen years he has moved through retail selling, travelling sales representative and contract supervisor to Architectural Technical Representative. This involved selling by specification to architects and local authorities, working always within the building trade. With this detailed background knowledge of building materials, insulation and ventilation products, Mr. Finch is ideally qualified as a sales specialist for our Heat-Loss Surveys within the Environment and Resources Consultancy.

Roger Finch.



Kenneth Ullersperger.

A TRANSFER from Production to Marketing brings the twenty-six years mapping experience of Kenneth Ullersperger to further increase our sales team. His career in map production began on leaving school when he trained as a cartographer with the Directorate of Overseas Surveys. Mr. Ullersperger joined Fairey Surveys in 1956 initially as a draughtsman, then moving to map compilation and later to the Photogrammetric section where he became a fully experienced operator and supervisor on all types of plotting instruments including the production of orthophoto maps.

Mr. Ullersperger has successfully completed a course in Management Studies, is an active member of the Photogrammetric Society, the British Cartographic Society and the Society of Surveying Technicians.

IBADAN UN/FAO SEMINAR

JUST back from Nigeria where he delivered a lecture and made two technical presentations, Trevor Beaumont, Head of the Surveying Engineering Section of Fairey Surveys reported an enthusiastic response from the delegates to the UN/FAO Training Seminar on Remote Sensing of Earth's Resources.

The purpose of the Seminar was to provide a broad knowledge of the techniques, methods and benefits which result from using remote sensing technology for resource surveys, national development planning and environmental monitoring.

Mr. Beaumont spoke on the subjects of Data Interpretation and Resource Information Gathering Systems.

DIGITAL INVESTMENT

IN a move to upgrade current computer capability and further develop digital mapping techniques a major investment programme has been instigated. Three items of equipment have been installed in 1979. A high performance computer (Hewlett-Packard HP1000 Model 45 with 256 k bytes memory, disc drives and multi-user operating system), a precision flat bed plotter (Kongsberg Twin Drive 1216) plus a 36" x 48" Perex 3600 digitising table. Additional equipment for graphics data capture and manipulation will be phased in during 1980. The aims are firstly to optimise performance in our traditional mapping activities and secondly to provide a nucleus for the development of additional activities. Fields of particular interest are in land use management and earth resources, based on semi-automated and fully automated data capture and reduction, using the most up-to-date technology to provide a service in the form most suitable for our client's requirements.

NEWS IN BRIEF

Frankfurt Book Fair 1979

For the second successive year Fairey Surveys took stand space at the world's largest book fair in Frankfurt, where more than 5,000 publishers were represented.

A constant stream of visitors were attracted to the stand leading to many useful contacts. Since returning from Germany the sales department has been fully occupied preparing estimates and meeting with new clients.

As a direct result of participating in the Book Fair, Faireys are confident of increasing their share of the cartographic market.

Copies of the following papers recently written by members of the staff of Fairey Surveys are available on request.

T. E. Beaumont:
"Remote Sensing for the location and mapping of engineering construction materials in developing countries"—Quarterly Journal of Engineering Geology, 1979 Vol. 12

Beaumont T. E. and Charman J. H.
"Remote Sensing techniques applied to highway engineering and transportation planning in developing countries"—PTRC Summer Annual Meeting, University of Warwick (Planning and Transport Research and Computation Co. Ltd.) London 1979

Vass P. A.
"Satellites seek subsurface sources"—World Water, Aug. 1979

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