

JUNE 1974

News of developments in the world of surveying and mapping

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Orthophoto or Conventional Rectification?

Mr. W.A.S. Clark, General Manager of Fairey Surveys Scotland, read a paper to the members of the Photogrammetric Society in London recently in which he talked about the use of orthophotographs as a tool for use by planners. He spoke particularly of a job in which he has recently been involved, namely the survey of a new town location at Stonehouse, Scotland. In this case photomaps were used very widely as a source of planning information and the orthophoto process was used in order to ensure that all photographic detail could be referenced directly and true-to-scale to the National Grid.

During the discussion a member asked when it was necessary to use an orthophotograph rather than a photographic rectification. This is a question of some importance, because orthophotographs are more expensive than rectifications and it is obviously wrong for the surveyors/cartographers to recommend one method if another less expensive one would serve the purpose equally well.

The answer to the question lies in simple geometry. Although the conventionally rectified print will remove any positional distortion or scale errors in the photograph which are due to the camera not being exactly vertical at the time the photograph was taken, it can do nothing about the distortions which result from variations in ground height. In other words, only if the ground were flat could all the errors be removed by conventional rectification. In all other cases the errors caused by ground relief, remain and can be quantified according to the following formula:

$$d = r \frac{h}{H}$$

where H is the height of the aircraft above a datum level, h is the difference in height of the point of detail from that level and r is the distance from the centre of the photograph to the point in question.

All that needs to be decided is how much displacement can be accepted. If relief is present and conventional rectification is used, then there are bound to be discontinuities between photographs. These discontinuities are disturbing to the user and, of course, reflect positional inaccuracies of the points concerned. To take an example, if the photograph is to be at 1/5,000 scale and we wish to limit discontinuities to 0.5mm for points which are say, 75mm from the centre of the photograph, then the relief must not exceed ± 5 metres. Tables can be easily constructed showing the effects of relief for varying scales and distances from the photo centre and it is for the surveyor/cartographer to ascertain from his client how much error in position or discontinuity of detail between adjacent photographs can be accepted. Using his knowledge of the scale of the photograph and the amount of relief existing, we can then advise whether or not an orthophoto (or differential rectification) should be used in preference to conventional methods.

COL. R.T.L. ROGERS RETIRES



Col. 'Bob' Rogers, Overseas Marketing Director of Fairey Surveys officially retires later this year. That is not to say that we shall lose contact with him, nor even that he will stop working for us, because he will act as consultant to the company, but it does mark the end of an era for us.

Col. Rogers was born in Canada, but joined the British Royal Corps of Engineers as an officer in 1930. In 1937, he was attached to the Survey of India, after obtaining his M.A. in Engineering from Cambridge University, and served with them until 1952, when he joined the Air Survey Company of India as Managing Director. In 1954, he returned to England to the parent Company, Fairey Surveys.

During his twenty years with Fairey Surveys, he has spent much of his time travelling abroad, but not too much to avoid the national and international recognition of his very great contribution

to all forms of surveying. He is a Fellow of the Royal Geographical Society, and of the Royal Institute of Chartered Surveyors of which he is also a General Council member. He has been Vice-President of the International Federation of Surveyors, President of the British Photogrammetric Society, and Secretary-General of the International Society of Photogrammetry.

His principal marketing areas have been West Africa and the Middle East, and there will be many people in these areas to whom the Canadian accent and the cigar will be very familiar. But his travelling days are not over, and very probably Col. Rogers will be revisiting some of his old haunts on our behalf.

Although we shall no doubt see him at regular intervals, "The Colonel", in his hazy office on the top floor, with a "Good Morning" for everybody, will be sorely missed as a permanent resident.

Map Accuracy

"The fault that the layman is most likely to make when commissioning a survey is to ask for too great an accuracy, either to be on the safe side or because he has not fully considered what he really needs. The result will be that he will pay a high price to a conscientious contractor who gives him what he asks for; or an inflated price to one less conscientious who, knowing that such a customer will not discover the shortcomings, may give him inferior work. The public is very ill informed about the price of accuracy. The following example taken from the catalogues of a well-known firm of instrument makers is instructive. A glass scale which can be used to measure lengths, with the aid of a small magnifying glass, to within 0.01mm costs £7.50. A measuring instrument capable of giving a result to within 0.001mm costs £1550. The accuracy ratio is 10 to 1, but the price ratio is 200 to 1.

Much the same considerations will apply to mapping; and it is by applying himself seriously to the problem and by asking only for the accuracy he requires that anyone putting out tenders can most easily save himself money". (The Work of the Chartered Land Surveyor, Pub. R.I.C.S. June '67).

The definition and interpretation of map accuracy is of great importance. Since an absolutely correct product, whether it be a map or a motor car cylinder, is impossible to achieve, it is desirable that the customer should stipulate the accuracy which will be adequate for his purpose. He might be tempted to specify the maxima which he is prepared to tolerate; for example, that "no point of well defined detail shown on the map shall have a co-ordinate error greater than 0.5mm at publication scale". Taken literally, this statement means that 100% of points must be within the stated tolerance and according to statistical laws, a root mean square error (rmse) of one quarter of 0.5mm, i.e. ± 0.125 mm must be achieved to guarantee this. If, however, it had been specified that 95% of well defined points were to have co-ordinate errors no greater than 0.5mm, then the rmse to be achieved would have been ± 0.25 mm, or twice the tolerance of the former case. It can be shown quite easily that when the accuracy demanded of a map is made twice as stringent then the cost of the product could rise by a factor of four.

It is not always easy for a client to decide what accuracy he needs, but it is a fact which bears heavily on the cost of the survey and some trouble taken in this respect is always worth while.

Once the map has been received the client may (and indeed should), wish to satisfy himself that it meets the specification. In order to test the overall accuracy, it is clearly impracticable for him to re-survey every point of detail on the maps. It is necessary to adopt a method of intelligent sampling. To be reliable, such sampling must be done carefully and logically. Firstly, the methods used and instruments used for checking the map must be at least as precise as those used originally for plotting; secondly, the points selected for checking must be sufficiently well distributed over a given map sheet to provide a good representation of the survey; and thirdly, a large enough number of points must be tested in order to satisfy statistical laws. Ideally, each sample should comprise approximately 120 points, although a minimum of 30 points of well defined detail is considered sufficient to give a fairly reliable analysis.

This is a subject of interest to all, surveyors and clients alike, and we welcome the British Air Survey Association plan to discuss the subject in some detail at a private meeting which they will be holding in September next. They will be inviting a distinguished teacher of surveying to lead the discussion, and we shall look forward to reporting further in due course.

Consultancy Services and Special Products

We preface our Newsletter with the words 'News of Developments in the World of Surveying and Mapping'. When visitors to Maidenhead tour our technical departments they are frequently surprised at how diverse that world is. Our profession is the collection of earth-science data and the presentation of that data in whatever form is best suited to the needs of our customer, so that there are many other things happening at Fairey Surveys in addition to major mapping contracts. We are devoting a large part of this issue of the Newsletter to describing in some detail the less publicised products and services that are an integral part of our surveying and mapping business.

Photo-interpretation

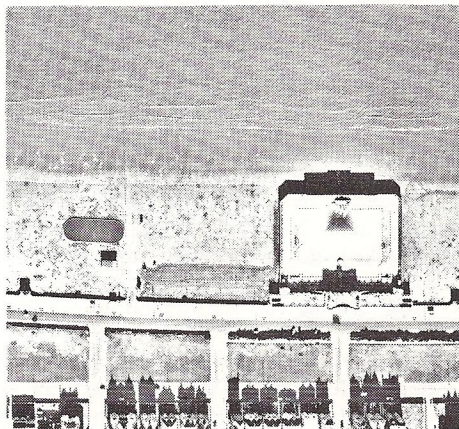
Photo-interpretation has been an integral part of photogrammetric mapping ever since the aeroplane and the camera came together. Military intelligence has always extracted the maximum mileage from this art/science but it is doubtful whether civilian administrators and planners are sufficiently aware of this potential source of data.

The skills of the photo-interpreter develop slowly and best by continuous exposure to aerial photography of all types and covering all regions of the world. Recently, data derived by remote sensing has been available to the photo-interpreter, and certain specialised

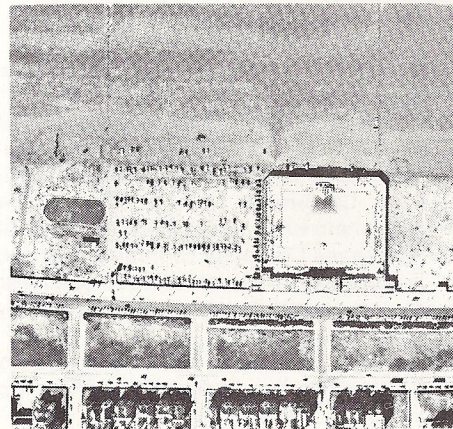
projects have become practical. Multi-spectral photography, employing different combinations of emulsions and filters, will produce simultaneous coverage of an area in, for example, true colour, false colour, panchromatic infra-red and panchromatic. The enormous volume of data collected from satellites in orbit has spawned new automatic processes for interpreting the information.

Resources surveys, for water, agriculture, geology and soil can be carried out using selected film, or an appropriate combination of films, thus eliminating much of the need for ground sampling. In a recent contract the use of colour photography for a natural resources inventory survey reduced the requirement for field visits in the ratio 100:1.

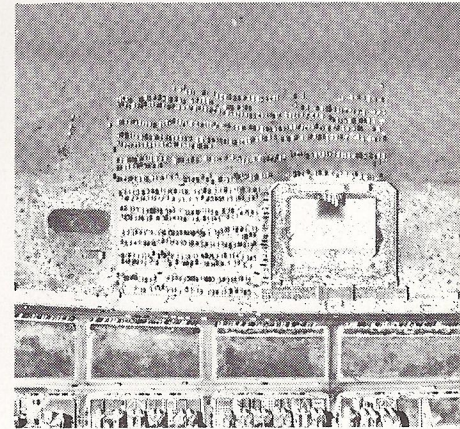
Parking analysis, Weston-super-Mare during August



08.35 hrs



11.03 hrs



14.34 hrs

Other urban phenomena, traffic and parking problems, can be monitored and analysed simply and efficiently by use of timed sets of photography. Interpretation cannot solve the problems, but knowing precisely what's wrong can go a long way to producing a cure.

In the United Kingdom a great deal of aerial photography exists at scales suited to photo-interpretation studies. The use of this data for land-use, reclamation and environmental management studies, would provide government departments and local authorities with the basic information they sorely need to deal with the pressing threats to the ecology, be it dying trees, hedge removal, mineral extraction or unauthorised tipping.

AIR PHOTO LIBRARY

Since the formation of our company in India 50 years ago, our photographic aircraft have amassed over a million square miles of aerial photography in practically every part of the world. The coverage achieved on each sortie is carefully plotted on a map-based flight diagram and the film stored in cans on the rows and rows of shelving in the film library.

The staff in the film library operate a service which enables them quickly to verify whether or not existing cover is available, at what scale and when flown, for any area map reference. If photography exists then contact prints, enlargements or mosaics can be produced to order on almost a trade counter basis. Price lists are issued annually and this department deals with over a hundred enquiries a week.

In the United Kingdom alone, Fairey Surveys has recent photo coverage of Berkshire, Derbyshire, Glamorgan, Northamptonshire, Nottinghamshire, Wiltshire and large blocks of central Scotland, at scales suited to 1/2500 and 1/1250 scale mapping and to the production of photo-enlargements and mosaics. More than 1600 miles of the coastline of Scotland is to be covered in true colour photography. Blocks of photography in the coal mining regions are held on behalf of the National Coal Board who are extremely co-operative in allowing other organisations to make use of this data.

Copies of all flight diagrams over the United Kingdom are also held at the air photographs library of the Department of the Environment, London, The Scottish Development Department, Edinburgh, and the Welsh Office, Cardiff. The uses to which aerial photography can be adapted are described elsewhere, however it is evident that all agencies, government and private sectors are co-operating in an attempt to make aerial photography more widely available in order to improve the quality of information on which our planners rely.



Fairey Stereoviewer, a useful tool for the photo-interpreter

Educational Series

Many enquiries are received by our photo library staff from lecturers and teachers wishing to use aerial photography in the classroom. During the last ten years a series of three educational sets has evolved dealing with world geography, geology and geomorphology.

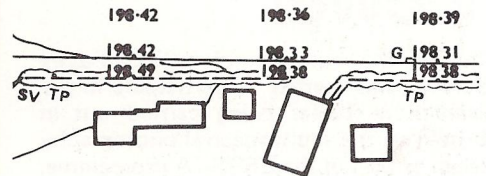
Experts have selected suitable photographs from our library to illustrate features important to the communication of their academic treatise.

These photographs are in the form of stereo-pairs and offer maximum realism when viewed stereoscopically with a simple mirror stereoviewer. Our Research and Instruments Group has also developed the Fairey Stereoviewer to use in conjunction with these or other aerial photographs at a price which is considerably lower than that for normal stereoscopes manufactured for photogrammetric measurement studies. This instrument is particularly suited to photo-geological studies in the field, as it is complete with a neat bench surface which can provide a desk top facility when balanced on the knees or on an upturned box.

Reprographic Services

The demands on the private sector mapping company in terms of reproduction capacity have changed quite substantially in recent years.

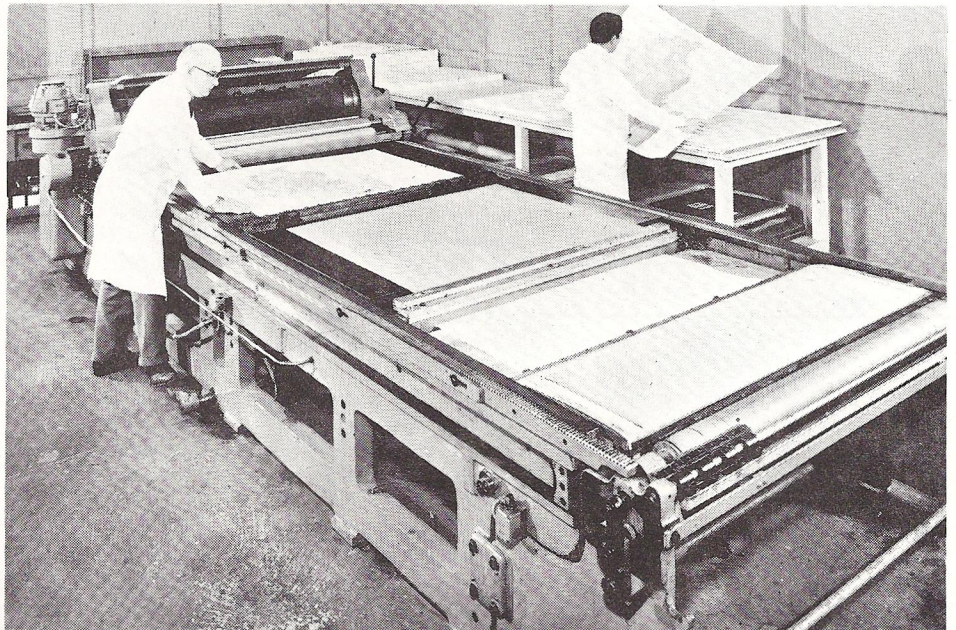
The mapping required is at larger scales and the sheet sizes vary in order to cope with strip mapping, hence the emphasis now on single colour transparencies and the limited requirement for long runs of multi-colour map printing. We no longer have need for a rotary offset printing machine and all our multi-colour productions are printed on the Mailander semi-automatic proving press with a throughput of approx. 100 sheets an hour. Most of the other trades and skills still survive. Lithographic camera operators and plate makers plus the traditional photo-mechanical processes produce the bulk of the work. Camera sizes handled are up to 40 inches square and originals of documents can be copied in lengths up to 12 feet 6 inches. The type of material dealt with by the department varies from the production of gridded transparencies of printed circuit designs, to 1/500 fair drawings of proposed highway schemes, to town plans in six colours for our small scale atlas section and four colour Leisure Maps.



1:500 engineering plan

The Department has moved with the times in both use of materials and equipment and is about to welcome its latest recruit, in the form of a Kodak 242 automatic processor for processing of a wide range of films up to 48" wide x 9' long.

Mailander proving press



NEWS IN BRIEF

- * A 9 Luncarty-Birnam. 14 kilometres of 1/500 with 0.5m contours and DGM. All surveying completed by Ground Survey team.
- * Devon C.C. Barnstaple By-pass. 1/2500 and 1/500 mapping. 7 km in length to be completed by August 1974.
- * Small scale cartographic section is now producing specialised cartography for publishers in many European countries and the Far East.
- * Delivery of the first three additive viewers has been completed and four of the first batch of five are now ordered.
- * Leisure Maps for Jamaica and Cyprus in addition to Corfu and Rhodes, are now available.
- * 1/500 survey of a 1000 acre housing development near Reading, Berkshire, has been ordered. Work started in April for completion November 1974.
- * Geophysics group will be participating in the annual congress and exhibition of the European Association of Exploration Geophysicists, which this year is to be held in Madrid.



Mr E N Harris, President of the Royal Institution of Chartered Surveyors, inspecting a 1/1250 machine plot of a reclamation site in Lanark during a visit to Fairey Surveys on 5th June. Pictured from the left are Mr P Gilbert, Administrative Secretary, R.I.C.S. Land Surveyors Division, Mr Harris, Mr L Scott, a Director of Fairey Surveys, and Mr D C Wright, a Senior Photogrammetric Operator.

Additive Colour Viewer

During the summer of 1972, Fairey Surveys was invited to participate in the evaluation studies being carried out in Britain of the multi-spectral photography taken as part of the ERTS-A programme. In order to fulfill this role satisfactorily, our photo-interpreters forecast their need for a viewer which would enable them to study up to four sets of imagery separately or in registration. Another firm request was for a horizontal display screen so that maps, overlays, tracings etc. could be used and produced with comparative ease and accuracy. We could not locate an existing instrument which

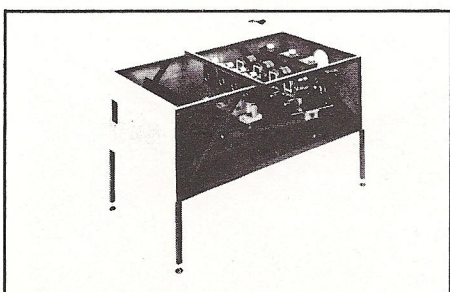
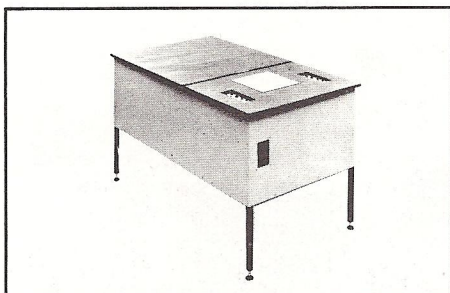
suitied our main requirements and decided therefore to make one.

Our Research and Instruments Group designed and produced a prototype instrument by May 1973 and user evaluation trials were carried out by our Photographic Research Officer. An open invitation was issued to other potential users in the UK to come in and view the prototype so that we could incorporate any improvements and suggestions and in order that the instrument could be of value outside Fairey Surveys.

A production specification was issued in August 1973 for a batch of five instruments. The first production models were available in March 1974 in spite of materials shortages and a very unpredictable delivery situation from outside suppliers.

The instrument is designed as an aid to the interpretation of multi-spectral photography, by superimposing up to four images on a back-projected viewing screen. True and false colour enhancement is provided by means of variable filters and the illumination level of each projected image can be independently varied. The projectors take 70mm x 70mm slides and project onto a 260mm x 260mm screen. Each image can be rotated about the optical axis and displaced in both 'x' and 'y' directions for perfect image registration. The illumination control is through the motor driven iris diaphragm. Colour selection is effected by rotation of the filter disc containing the required filters. The other important part of the specification that has been fulfilled is that the instrument should sell for under three thousand pounds sterling.

In addition to the requirements at Fairey Surveys we have received orders from three research departments and plans are well advanced for further production batches.



Interior of Viewer

LOCAL GOVERNMENT REORGANISATION

This is the first issue of the Newsletter since the radical changes in the organisation of local government authorities in England and Wales, which came into effect on 1st April. The boundary changes have created quite new counties and have eliminated others. The administrative problems involved in the changeover are considerable, and we should like to take this opportunity to offer our best wishes to all concerned in the new local government offices. We have had to update our mailing list at fairly short notice, so if we have made any mistakes with names or addresses, please let us know.

If you require further information on items featured in Fairey Surveys Newsletter or would like to be added to the Mailing List for future issues, please contact:

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