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“Air Wars”
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The Society publishes a wide range of books and booklets on historic OS map series and its journal, *Sheetlines*, is recognised internationally for its specialist articles on Ordnance Survey-related topics.

Air wars

John Cole

No, not those where aircraft shot pieces out of each other but a little known (outside OS) inter-departmental fracas which was an aspect of the somewhat troubled history of the overhauled 1:2500 map, and a probably one-sided view of the conflict. I briefly alluded to my experiences in *Sheetlines 53* and this article deals with the subject in greater depth.

The somewhat tortured Ordnance Survey experiences of early day air photo revision are described quite vividly on page 106 of *Map Makers to Britain since 1791* and in greater detail in the *History* edited by W A Seymour.¹ Suffice to say here that revision of the overhaul by means of air photography was being plotted and penned at Southampton headquarters from the late 1950s onwards.

Although I was not employed in the area, my first sighting of such maps was a batch covering the town of Droitwich and I was immediately struck by the fact that the vast majority of the hard work – estates of new houses etc. – were neatly penned up in red ink and it seemed that all that was required was to complete any loose ends (there seemed very few), revise any detail covered by vegetation, or which might have been in shadow, and collect house numbers and names.

My eagerness to look at the results of this method at first hand came about a few years later, just to the south of Reading's 1:1250 mapping area. The main features of the $2 \times 1 \text{ km}^2$ 1:2500 map were a horticultural station and an institute for research in dairying, both run by Reading University, and a government run cattle breeding centre. Both were new since the previous revision and so indeed was a considerable amount of housing, a couple of areas of which caused me some disquiet. The first was an estate of fifty odd houses for Royal Air Force officers. There were four distinct varieties of house, and two or three for garages and outhouses, and it was obvious to the eye that dimensional discrepancies and unequal divisions were commonplace. I asked my immediate superior what if anything I should do about this and was told to 'leave it alone'. But his reaction to the treatment of another pair of cul-de-sacs totalling about forty houses was somewhat different. These had previously been surveyed for Land Registration purposes before the air revision took place and the whole lot had been positionally 'shifted' (in pencil) for anything up to one metre. My suggestion that the air revision should be accepted was overruled and we duly set about a resurvey, which produced a position about half way between the two previous answers – a not particularly unexpected outcome.

My perambulation of the three main establishments was confined to a brief look at the detail, and annotation of that which needed annotating. Certainly I did not measure much or otherwise check anything – I did not for one moment assume it needed any treatment. However when it came to the supervisor's validation I was highly disturbed to find that a very large percentage of the red had been altered by his green ink. This I felt was a reflection on me but his view that 'this is bad work and needs to be highlighted' was almost certainly the right one. Quite apart from the RAF officers' quarters, alarm bells might also have been rung by an earlier incident soon after I transferred to the area. My very first job had been a pair of surveys for HM Land Registry in the town of Henley-on-Thames. The document

¹ Tim Owen and Elaine Pilbeam, *Ordnance Survey: map makers to Britain since 1791*, Southampton: Ordnance Survey, 1992. W A Seymour (editor), *A history of the Ordnance Survey*, Folkestone: Dawson, 1980.

available was an up-to-date one, as the town had been revised some three years earlier and, as I learned later, by air photo revision plotted at Southampton. Both cases resulted in measuring difficulties and in one instance, affecting the bank of the River Thames, I doubted that any modern revision had been carried out at all.

Thus far I had no conception of how survey or revision from air photos was carried out, but at least at the next encounter, which took place at Newquay in Cornwall, the photographic enlargements were made available.

Briefly mentioned in my *Sheetlines* 53 article, this episode again roused misgivings. There was evidence from somewhere that the job had been rushed and mainly confined to adding new detail rather than revising old, especially in the older built up area. That said, the shortcomings ranged from annoying to alarming, especially in one instance involving a trigonometrical point on a hotel roof. Omissions of detail clearly visible on the photograph, particularly in instances where ground work would be a problem, further undermined confidence. And the net result was a page of observations on the mapping exercise forwarded to the Chief Surveyor.

At the end of the 1960s came the long awaited event: training in simple graphic techniques in plotting in order to carry out revision of the overhaul map at field offices. An experienced man from Air Revision Group at HQ was sent to our section to instruct us and initially supervise any early work. I still have the instructional notes which accompanied the course and although they run to thirty five pages, the process can be quite simply explained. Briefly it all hinged on the 'Arundel assumption' whereby 'angular measurements taken at the principal point (the position where the optical axis cuts the plane of the photo i.e. the centre) of a nearly vertical photograph are equal to the horizontal angles between the corresponding points on the ground, provided the tilt does not exceed 2° and the variation of ground height does not exceed 10% of the flying height.' What this boiled down to was that detail points lying along a line from the principal point² toward the edge of the photo would be displaced along the line (if in a hilly area) but not to either side of the line. So if using overlapping photos such lines went through the same point of detail and the plumb points properly established on the map(s) for each photo, the point of inter- (or better tri-) section would supply the point on the map. The direction for lines in each case would be a point of identifiable old detail, the reliability of which could be more or less proved by the best of three methods of transferring the plumb point from the photo contact print to the map. The method also relied on rectification of the photograph to remove tilt. One instrument used was a Zeiss SEG V rectifier, which had data obtained from the Blogg Tilt Finder fed into it. All this of course was carried out at HQ. In a minority of instances the photo did not contain tilt and the plumb and principal points would be coincident.

With this system due to be adopted to tackle (and speed up considerably) the rest of the overhaul, the HQ plotting capability was ostensibly retained for any difficult jobs, though the basic method used was largely the same – at least to start with. Judged suitably trained I was let loose on my initial area which was the coastal town of Fowey and the village of Polruan on the other side of the estuary. Slightly up river from Fowey is a dockyard area largely for the china clay industry. Work was slow, nervous and painstaking. 'Pitched in at the deep end' is a phrase which comes quickly to mind! It was soon obvious that it was indeed too deep for me and indeed our instructor, who took the lot back with him for HQ to puzzle over whilst I

² Or better still the nadir or plumb point – that directly beneath the camera when the photo was taken.

was given another task. This turned out to be the other china clay port of Par and another heavily built up area – certainly not the sort of terrain originally envisaged for field staff. Farms and open country with the odd small village would have been more suitable.

A steep learning curve is sometimes the best and a reasonably good result in the Par area helped build confidence. Meanwhile Fowey duly returned and I completed the eight maps involved without further incident. At least I cannot recall any and it was just about the only HQ plotted locality where I did not write out some sort of report.

A very strong contender for areas where it might be advisable for HQ to plot the revision was that occupied by the china clay industry mainly to the north and north west of St Austell. An initial block of six maps, which included two villages and a hamlet plus considerable industrial detail and a railway, was decided upon. And this turned out to be by far the worst HQ plotting encountered to date. I was instructed to put my vigorous complaints in writing, which the Chief Surveyor forwarded with his comments to Southampton. It seemed they were glad to have the feedback but far from happy about what I had to say. The response was defensive and non-committal: a grudging admission I was right in some cases but also a claim that I was not conversant with the rule book and that I had wasted time bringing matters to light. This provoked a counter charge from me that there seemed to be an official admission of two metre errors as commonplace even after the revision, and I declined to accept most of their other responses. At a later date I learned that what was known as a ‘micrometer plot’ had been used in the area. To this day I do not know what that entailed, but could only judge by the results on the ground. And at a very much later date my standpoint was to be unexpectedly vindicated by a new breed of HQ plotters.

Still taking events in order, the next area to be HQ revised was a much larger tract of china clay land of which I was to undertake most, apart from four maps at the northern extreme, including a large village with modern development, given to a colleague, whose first reaction was to suggest that it be sent back for a replot!

Fair-minded readers may by this time be looking a little askance at my attitude and ability, so a comparison with my colleague may be of interest. He was, in my eyes and almost certainly in those of our immediate superior, a more conscientious and indeed more accurate surveyor. Given the opportunity to validate some of his work I was always hard pressed to find anything remotely wrong. He eventually sought promotion (which he quickly obtained) by, rather ironically, moving to air survey at HQ. When he returned to the field some years later, I was rather surprised to find he had moved no further upwards. He sent me some details of one of his interviews whereby it became obvious to me (if not to him) that his tendency toward scrupulous honesty rather than telling people ‘what they wanted to hear’ had counted against him. What was not so much a surprise was that, outside work, he was a pillar of his community and church, and latterly lord mayor of his town.

Returning to the mapping, his claim that the HQ effort was only fit for a replot was not upheld after some stormy argument and he completed the work, making no effort to correct the HQ revision whatsoever i.e. leaving it alone even when he had to add some of his own. It was thus left to the poor validator (me on a couple of occasions) to iron out some of the more obvious embarrassments.

My colleague also left visiting superior officers in no doubt about his view of the quality of the HQ effort, resulting in further angry exchanges and, apparently, our obtaining a reputation as unpleasant people to visit. I felt this was most unfair regarding myself, but since I had degenerated into a rather sulky indifference, it was probably deserved.

After a few more years and experiences (a couple of villages in my case), graphic air revision as practised at HQ and the overhaul of the 1:2500 passed into history. The new phase came just before I joined the continuous revision office in Cornwall, and took place during a year's work on Dartmoor. The main 1:10,000 scale resurvey work had presented no accuracy problems. Doubtless because the HQ plotting (by machine) had been supervised by my ex-colleague! But this survey did not cover complete maps, and the infilling 1:2500, nearly twenty years out of date, had to be looked at. Most of it was easily up-dated but there existed a real problem area of some 12 km² of active china clay workings and a brand new road. Plans were already in hand to tackle the area by ground methods which would have taken months but by a considerable slice of luck I discovered that the china clay company had obtained air photography covering their area and the new road which ran through it. Having established that it was suitable for stereo machine plotting at 1:2500 scale, the photography was purchased, together with that for the St Austell china clay area which by this time had gone undergone considerable alteration.

There could be no doubt the machine plotted revision gave a greater accuracy overall but suffered from a loss of flexibility where small alterations, especially in built up areas, were apparent. This could lead to difficulty where old detail in error had been erased and a new position inked in but only partially completed. In the Dartmoor instance I had, unfortunately, to return to higher priority work and hand over the remaining block, containing the majority of the china clay active workings, the new road and a small village, to the Plymouth continuous revision office. The surveyor in charge was far from happy when he saw the incompleteness of the HQ work around the village and other problems arising from detail in densely vegetated areas where alterations to old detail around the perimeter were likely to cause embarrassment. In graphic plotting days, with commonsense these could be mitigated or even avoided – but even in those days, HQ plotting seemed never to be carried out with that thought in mind.

During the next fifteen years, continuous revision work involved 1:2500 air machine HQ plotted revision on half a dozen projects including the china clay area mentioned. Two of these included new by-passes (with a consequent revision of the villages by-passed); one a new reservoir; one a complete rural area sweep, and the last to cover a number of small or awkward areas where the revision was considerably behind. Apart from the roads and reservoir the general (local) opinion was that work varied from just about adequate, to bad, to very bad – and the whole a major disappointment. Were we expecting too much? My simple criterion, which I had expressed to various superiors, was that hopefully HQ work would be as good and preferably better than we could do ourselves. And reducing things to the particular: if a one metre gap existed between features, then neither should the features be joined together nor should the gap be exaggerated to more than two metres – things clearly visible to a map user and causing a whole lot more trouble on continuous revision or Land Registry work in particular. I never had those aims disputed!

The china clay district photographed in 1980 was only partially completed but an office examination of the update revealed some startling facts. A supplementary trace had been drawn up for the village map which had been the subject of my complaint ten years earlier. The machine plotter's explanation was that there was no way he could revise it properly and that we were somehow to add any updates from the trace the best way we could. I was not sure whether to be delighted at this proof from HQ that I was right to complain – or angry

that it was even worse than I thought at the time!³

Whilst even simple graphic plotting methods had proved quite capable of clearing up localised and relatively obvious original errors, a handful of much larger and more complex problems which were not altogether obvious on the ground had to be left. A couple of these had frustrated my conscientious colleague to the extent that he had to be ordered to waste no further time on them. In these cases the HQ machine plotter had pencilled in the actual shifts for our information if nothing else. One, which I recall quite vividly, was a three kilometre 'shift' which became progressively worse moving from west to east. It ended abruptly in two very large (by Cornish standards) fields with an error of about four to six metres. An absolute correction of the error would have entailed the replot of industrial detail plus a river and railway running north to south (and in dense vegetation in many places) for about a consistent two metres in the area concerned. Quite how the error had originally come about was the subject of much speculation. It most certainly was not the fault of 'Cotswold cuts'⁴ in the compilation. The other error is less easily recalled, but in this case it is believed the junction of four County Series sheets was a significant factor, and dense vegetation was again the deterrent to pursuing relatively small but very annoying discrepancies.

The next instance again involved the purchase of photography from a non-OS source, in this case the Potato Marketing Board's last coverage of an original revision area dated about 1961. Widespread field boundary deletion was a major factor in the area. HQ turned out the plans in batches as they were revised but this procedure came to an abrupt halt when it was discovered that quite major changes (including a road alteration) had been missed. This led to a somewhat frosty exchange between the section supervisor and HQ, resulting in traces being supplied rather than the maps revised and inked in. This expedient proved to be much the best, but was never repeated. Nor was there a repeat of an incident away from the area concerned, using similar dated photography but a different HQ plotter. Three maps were involved, the detail being three small villages, a tin mine (now a museum) and some modern industrial buildings. The work here gave us a shock but in the best possible way. Apart from the neatness and presentation, there was not a thing to complain about on ground completion, the accuracy being exemplary (as I personally found). This was indeed the standard we had hoped for when the first HQ plotting appeared but sadly we saw nothing like it again.

Possibly the reservoir survey, including an adjacent china clay quarry and about fifteen maps in all, came closest. The two by-passes seemed to be well done but shortcomings away from the roads were disturbing. Much the worst of these was a group of three houses removed from the map due to a local accuracy problem but not reinstated even though still extant. This was in the course of the very last HQ plotting exercise, but just before this occurred one of the most disturbing incidents of all. In 1988 the County Council ordered the photography of the whole county and I believe originally there was talk of OS purchasing and using the lot. But in the event (and in the light of events very fortunately) only some selected areas were picked.⁵

Lands End and the shopping centre (near Liskeard) fell in the 'bad and very bad' category – and Polzeath and Rock almost beggared belief. The eventual explanation certainly

³ It appeared there was both a north-south and east-west displacement.

⁴ Phil Budd, 'The Cotswold method: a personal recollection', *Sheetlines* 62, 57.

⁵ These were, with numbers of 1 × 1 km² maps involved: Lands End complex, 2; an out of town shopping centre in a wooded valley, 2; RAF St Mawgan and St Mawgan village, 21; St Mabyn, 7; Tintagel, 4; St Breward, 1; Harlyn Bay and Trevone, 8; Polzeath and Rock, 9; Praddon and Indian Queens, 11.

did. The first two were deemed suitable for a digitising experiment. I cannot answer for this being a success but the facts that the Lands End maps were twice returned to HQ for correction and that at a much later date the others had to be completely re-digitised hardly inspired confidence. I carried out the field completion of all but the Tintagel, St Breward and Lands End maps, and got off to a thoroughly bad start with the shopping centre pair. It appeared that since the map had to be digitised no detail should be left hanging. This inevitably led to guesswork where part of a building (including the main very awkwardly shaped building) was under trees or in deep shadow. Attempting to make sense of this was anything but easy, but worse was to come when it was discovered that alterations had been made to one side of the dangerous main road and the original section (under trees) left as it was complete for digitising purposes.

Three of the other areas had been in the hands of what appeared to be the most reliable of the plotters and I described this work as at least adequate. But Rock and Polzeath which contained about six maps' worth of built up area was a disaster from the word go. Certain areas seemed to have been generalised almost as if it had been a 1:10,000 scale survey and I could do little more than correct the most glaringly visible errors. I was instructed to make out traces for everything I had attempted to correct. And once again representations were made to HQ though the explanation tended to leave everyone a bit open mouthed. It transpired that due to staffing shortages a plotter with no experience of large scale work had been employed ... Well, anyway, that explained the 'generalisation'!

There is just one further piece which might be added to this jig-saw. My *Sheetlines 53* article mentioned the setting up of a revision section whose speed of output was held up as an example to all. The fact that I (and others) were far from happy about their standards is neither here nor there. A couple of HQ revised towns fell within their remit and continuous revision at both made it crystal clear that they left the HQ work as it was. By the time one of these towns (Wadebridge) was reached the section supervisor had changed. The first (incredibly) had been the HQ plotter of the original china clay block which had so offended. Equally incredibly the next supervisor had been the instructor on our air survey course. He retired to his holiday home in the area some time in the early 1980s and one day a colleague of mine was struggling with revision at Wadebridge when the two met. Survey problems in the town came up and this astonishing (or maybe not so astonishing) comment followed: 'Yes we knew it was bad but we hadn't the time to do anything about it'!

The rights and wrongs of all this have also passed into history as a result of the accuracy enhancement program.⁶ Certainly the improvement of the 1:2500 to 1:1250 accuracy must have made life much easier where this has been carried out. And similarly for the rest of the rural revision, at least as far as National Grid position is concerned. For the rest, my own experience plus some of what I have heard may raise a few question marks but overall it should be better than what has gone before.

The very best war stories I have read always contain the viewpoint and experience from both sides of the line. After all it is the politician, and not the soldier, sailor or airman, who sparks things off. Regrettably I can only tell my tale from one side. On one occasion a visiting senior officer (in the 1970s) patiently listened to our negative views and remarked that he knew of a section supervisor sending a letter of thanks to HQ plotters for their work in his area and that this was by no means an isolated incident. The other side of the coin seemed

⁶ *Sheetlines 72 and 74.*

to be that when I discussed the subject with people in other parts of the country (then and long since) their experience largely mirrored mine. I think the field photographic reviser had a considerable psychological advantage in that there was a far greater interest and incentive when he would be completing the maps himself. But that is certainly not to claim that all such work in the field was faultless. I found that out by doing a stint of work validating and, at a later date, revision and Land Registry surveys in areas where I was aware of the original method and the surveyors. The department itself had certainly wanted a middle course between those who would try to move everything in sight by photographic means⁷ and others who would to put it very simply, count the number of features on the photograph and make sure the same number appeared on the map – and with little regard to the accuracy of existing detail!

The object of this account then, apart from putting the history, as I saw it, on the record, is to draw a response from ‘the other side’ should this exist amongst the membership. One such has indeed been heard (privately) already but his experience was with the Chelmsford air survey.⁸

⁷ *Sheetlines* 62.

⁸ *Sheetlines* 64 gives a brief account of this method.