

Maj. Cochran-Patrick described the operations of this survey in detail, and as his account contains much of considerable interest, and lack of space prevents our quoting him in full in the present issue of FLIGHT, we propose to publish this portion of his paper, separately, in a future issue. However, it may be stated here that operations started on January 10, and after many exciting adventures they returned to Rangoon on April 14, during which time they had stock-mapped 15,178 square miles in 57 hours 14 mins. of actual reconnaissance flying—or 265 square miles per hour! In conversation with forest officers and others, the author gathered that the work they had accomplished in three months would have taken about twenty years if done by the forest staff usually allotted to an area of that size.

Concluding his interesting paper, Maj. Cochran-Patrick stated that the practical experience gained in Burma, Venezuela, and British Guiana had emphasised many points which, for the sake of economy, had to be studied in carrying out a survey. Many of these points were not immediately obvious when the subject was approached from a purely technical point of view, but by adopting new and different methods to those described, they were confident that they could reduce the cost while improving the accuracy of small-scale aerial survey.

With this end in view he was at present carrying out research work with the Aircraft Operating Co., and they were proposing to put the results of this work into operation at an early date.

## AIR SURVEYING\*

By Major H. HEMMING, A.F.C.

MAJOR HEMMING opened his address by stating that he had been asked to read this paper on Air Survey by the Air League of the British Empire, of which he was a member of the Executive Committee. He said he did not propose to deal with the scientific side of aerial survey, but as he had, together with his colleagues, been intimately connected with some of the actual operations, he would confine himself to the practical side of this work. Air surveying had, and still had, its battles to fight, but it had now passed through the purely experimental stage and one could point to work that had been carried out successfully and received the approbation of the ground surveyor.

As progress had been retarded by a tendency to confuse air mapping with air photography and reconnaissance of forest areas, Major Hemming said he proposed to divide into their respective departments all these branches which had been described under the common heading of "Air Surveying," as follows: (1) Commercial air photography, which included the photographing of factories, towns, roads, railways, docks and estates, etc., for which the oblique method was usually employed. Major Hemming then mentioned a few examples of the various uses to which commercial air photography had been put, showing that the public were greatly appreciating the new viewpoint provided by the aerial photograph, by the steady increase of business and the inclusion of air photography in contractors' catalogues and in the public Press.

A considerable amount of unrectified photo-mosaic work had also been done by commercial air photography concerns which did not call for any knowledge of ground surveying, as it merely consisted of a series of vertical overlapping photographs fitted accurately together to coincide with the map or plan on which they were subsequently mounted. This had proved very useful in the development of estates, drainage power schemes, and for making pictorial maps generally.

Under the second heading, Major Hemming classed reconnaissance and forest surveying. This employed various methods, the ground surveyor or forest officer flying over the area and filling in the detail required on the existing map whilst in the air, and supplemented by vertical and oblique photographs. In certain cases these observations were supplemented by ground observations. This class of work had been found to be of great value in development work in the Colonies. Air reconnaissance and photography was also a valuable aid to the preliminary considerations of colonisation and settlement schemes, whilst another application was the survey of crops, enabling an estimate to be made of the likely yield.

Major Hemming then came to the third heading, which was air mapping or air survey proper. Although, said Major Hemming, thoroughly satisfactory methods had been employed, the science was still in its infancy and scientists in various parts of the world were engaged in producing instruments which should make air mapping part of the normal function of the ground surveyor.

Air mapping could, however, immediately confer valuable benefits in many cases, rendering possible the surveying of countries on an economical basis which had hitherto defied the ground surveyor. Work done within the British Empire included small scale work over large tracts of unsurveyed and open country, and large scale work of a very high order of accuracy for town planning, map revision, tax assessment,

etc. In the former, the oblique or vertical method could be employed or a combination of both. For fairly flat, heavily wooded or swampy country the saving in cost between the air and ground methods might be enormous.

Major Hemming said he could not read a paper on air surveying without touching upon the subject of contouring. At present, so far as he knew, no real economical and satisfactory method had been devised for accurate contouring from the air. Various methods were found which gave a very high order of accuracy, but they depended for their accuracy on a close handwork of control points which for financial reasons alone put them beyond the reach of the air surveyor engaged in mapping. He was confident, however, that it was only a matter of time before contouring from the air would become a commercial proposition.

In order to illustrate the utility of air surveying further, Maj. Hemming then gave some examples of work carried out within the British Empire. Unfortunately, space will not allow us to quote these examples in full, especially as a great part of the information regarding the work done in Canada has already been published in FLIGHT, whilst the work accomplished in Burma is described in Maj. Cochran-Patrick's paper, read before the Aeronautical Society, which will be found elsewhere in this issue. Maj. Hemming stated, however, that, besides the work done in Canada and Burma, a considerable amount of air-survey work had been carried out by the Royal Air Force, although it had now been recognised by the authorities that such work should merely be used for military purposes, and that the commercial side of air survey would in future be left to private enterprise. He was not in a position to give details of the actual work carried out, but he would mention that considerable areas had been mapped in Iraq, Palestine, and Singapore, as well as portions of the Nile. In addition to this, the Royal Air Force (India) had, during the last few years, completed a number of air surveys in the North-West frontier region and had also carried out several surveys of Indian cities, for both strategic and tax-assessment purposes. Another place where an interesting air survey had been carried out was on the north-east coast of Australia, where the Australian Air Force, in co-operation with the Australian Navy, had helped in the survey of the Great Barrier Reef. He understood that, as a result of this preliminary work, a survey of the entire reef would be undertaken.

As regards the British Isles, Maj. Hemming said that most of the work done had been of a commercial nature in connection with town development and planning schemes, factory advertising, engineering propositions, etc. Some interesting archaeological studies had also been carried out by aerial photography. A contract had lately been given to the Aircraft Operating Company for an experiment in connection with the revision of the Ordnance map of Great Britain by the use of aerial photography, and work in this connection was now proceeding.

In conclusion, Maj. Hemming said that it was now generally recognised by the authorities that aerial surveying had a great future in the British Empire, and he looked forward with confidence to the extension of this work all over the world, for he saw in aerial surveying a means of making civil aviation pay, as it was independent of subsidies on the one hand, while the valuable research work that was being carried out by the different nations who were represented at the Congress held out great promise for the future.

\* *Résumé* of a paper read at the Third International Air Congress, Brussels.