

1225
XF-4741

4 JUN 1926

E. AFRICA

XF-4741

4 JUN 1926

From
 AIR MINISTRY

CO533/359

Date
 2nd June 1926.

TOPOGRAPHICAL SURVEYS BY AIR PHOTOGRAPHY.

CLOSED
 UNIT

Previous paper	(Minutes within)	
Go-3091	R.C.A.	5/6
Ea	Ea. Thom 29	11.6
	Miller	15.6
	W. Brantley	16.6
Subsequent paper	X (R.A.)	12/7
see A.M. X. 25126/28	E.A.V.	3/8
of 2751/16		
(see Red - Springfield)		
see 25116/27	W. Royal	3/8
(see Summary)	Mr Mackenzie	4/8
	S. C. Strachan	4/8
	Room 3	10/8
	Room 1	8/10
	E.A.V.	8
	XEA	

1) Air Ministry ----- 2nd June 1926.

Furnishes obsons on C.O. letter
 and memorandum of 21st April regarding the
 possibilities of carrying-out -----

51

A copy of this letter
 has been registered
 a/m/x 3241 10A.

Mr. Allen

A copy of our letter of 21 April was
 not sent to the Air Survey Committee, but
 personally to Col. Wenterbotham (who is
 Chairman of the Committee). However,
 the Air Ministry are in communication
 with the Cttee. So we shall in due course
 get the combined wisdom of the two bodies.

Pending the obsons. of the Committee
 it would seem premature to minute
 at length on this letter. The Air Survey
 will no doubt take the A.P. case into
 conson.

we should await ^{further} obsons of the
 Air Ministry when they have had
 the Air Survey Cttee's view: but perhaps
 in the meantime, it might not be a
 bad thing to write s.o. to Mr. Bentham
 explaining that we did not send
 a copy of our letter ^{specially} to the Air Survey
 Cttee, but s.o. to Mr. Wenterbotham
 for his info. That ~~our idea was that~~ ^{our idea was that} that
 the reference to the Cttee would be

made by A.M. & that we gather from their letter that their has been done. & small amount in further letter from M.D. after they have had the views of the office.

Steel

11.6.26.

(Op. minutes on X P 3211/126 in which a draft is now marked with Bottom line)

I draft of the proposed so letter to Mr. Bartram is necessary. should be advised to leave it.

W.H.K.

15/6/26

* sending copy of minutes to Mr. A.M. & Mr. Bartram

Do not write to Mr. Bartram, but refer the same to W.A. Bartram in response of

W.A. Bartram

16.6.26.

The discussion has explained that the A.S. will consider this as a portmanteau. It is as one involving 309/1 but we have their views. Capt. Swales

W.A. Bartram

6.7.26

W.H.K.

Recd with file on 20/7/26

XE 4741/26

3

2. War Office 7 July, 1926
Geographical Section

Ind. memo on the subject of Topographical Surveys by Air Photography

M: Bostonley

Red it for him 6/27

At your request I have found out that Col Winterbottom does not propose to have the subject of Air Surveys for S.A. put on the agenda of the Air Survey etc., though he may take an opportunity of mentioning the matter at a meeting. As the observation contained in Colonel Winterbottom's memo should be taken as all that we are to expect from that quarter; no full dress session on from Air Survey etc. are to be expected notwithstanding para 2 of his limiting letter of 2nd June.

PL:winning
15.7.26.

W.A. Bartram
W.H.K.

(Delayed through pressure)

I do not think we can force Col Winterbottom to let the Air Survey Co discuss this, but I am a little surprised that he has blocked it, as

16/11/26
he believes we had asked the AFM to
get the Committee's views if they -
the Ministry - had no objection.

The answer is not very
definite, but from the C.A. point of
view I am convinced that there is no
work for which we should be justified in
giving a contract for Air Survey. Probably
there is much that could usefully be
done if ~~we had the necessary funds~~ if
we had the necessary - and the
Kharkov - Kharkov service if it is
financially established, may lead to
opportunities of this sort.

I said to Col. Walker in reply to
3071 copy of our report & with the
minutes and also copy of Col.
Walker's letter, explaining that
we understood that they may be
taken as indicating the views of the
Air Survey Committee.

W.S. Homey
3.8.26

4
Semi: Nigeria may want an air survey some time but not
just yet. The Gov. has stated to the Aircraft Co. that he cannot
propose an air survey at present. (X.F. 3241)

Quacking
4/8/26

As proposed
D.S.

G.P. 26
d. p. a.

As to X. See Capt. McCaw's note
now attached. W.S. 9.8.

3. To Gov's Conf. (copy not memo) 10 AUG 1926

km
leave with 1200 1/2 tons
to Gov. & Hudson

4. Gov's Conf. : 3 Sept, 1926
Asks when reply may be
expected.

This just crossed as: 3

Partly

W.S. Homey

8/10/26

at all

a letter dated 15/8/27 from
the Director, Aircraft Operating Co.
enclosing air photographs
of N. Rhodes - as showing
possibilities of Air Survey generally -
has been placed on

25/11/27 Genl.

W.S.
15/9/27

11.07.26 5

OFFICE OF THE
CONFERENCE OF EAST AFRICAN GOVERNORS

NAIROBI.

3rd September, 1926.

g/Sur/A.1.

SFM

S i r,

Copy Conf'd
30/9/26

I have the honour to refer to this office letter, No. C/TS/1., dated 1st March, 1926, which stated that the Governors at the Conference held in Nairobi in January and February of this year were enquiring as to the possibility of conducting topographical surveys by aeroplanes, and asked you to be so good as to make the necessary enquiries through the Air Ministry.

I am to request that you will be so good as to inform me when a reply may be expected.

I have the honour to be,
Sir,
Your obedient Servant.

C. G. Leathes

SECRETARY, GOVERNORS' CONFERENCE.

The Under-Secretary of State for the Colonies,
COLONIAL OFFICE,
LONDON, S.W. 1.
E N G L A N D.

10 August 1926

XP 4741/26

Sir,

I am directed by Mr. Secretary Amery to acknowledge the receipt of your letter C/TS/1, of the 1st March, 1926, and to transmit to you, for the information of the Governors' Conference, the accompanying copies of correspondence with the Air Ministry, together with a copy of a memorandum by Colonel H. St. J.L. Winterbotham, C.M.G., D.S.O., R.E., the Chairman of the Air Survey Committee, on the subject of the possibility of conducting topographical surveys in East Africa by means of aerial photography.

I understand that the memorandum prepared

by

THE SECRETARY,
CONFERENCE OF EAST AFRICAN GOVERNORS,
NAIROBI.

by Colonel Winterbotham may be taken as indicating the views of the Air Survey Committee on this subject.

I am,

Sir,

Your most obedient servant,

W. STRAGHEY

37

Mr. Seel 5. 8.26.

Mr. Allen

Mr. J. Harcourt

Mr. Swackey

Sir J. Shackburgh

Sir G. Ormrod

Sir G. Davis

Sir S. Wilson

Mr. Ormsby Gore

Earl of Glarendon

Mr. Amery



Downing Street,

10 August, 1926.

And

See

Sir,

I am etc., to acknowledge the receipt of your letter G/TS/1 of the 1st March, 1926, and to transmit to you, for the information of the

Governors' Conference, the accompanying copies of correspondence

with the Air Ministry, together with a copy of a memorandum by the Chairman

of the Air Survey Committee, on the subject of the possibility of

conducting topographical surveys in East Africa by means of aerial photography.

2. *I understand*
~~I am to explain that it~~

~~is understood that the memorandum prepared by Col. H. St. J. E. Winterbotham,~~

~~C.M.G., D.S.O., R.E.~~ may be taken

DRAFT.

(X.3091)

THE SECRETARY,

CONFERENCE OF EAST AFRICAN GOVERNORS, NAIROBI.

To A.M. (with enclosed memo) 21.4.26. ^(3091/6)

Fr. A.M. 2.5.26. (with encl.)

Memo. by Col. Winterbotham. (flagged red in 4741)

S.O. letter required on 11/5/26/26 also (Wa)

...locating the flows of the Air

...on this subject.

...I am, etc..

(Signed) O. STRACHEY

~~Re 99 X (EA) 8~~

29/7/26

my dear Sir,
Herewith the
extract from the
Minutes of the A.S.C.
referring to the East
African question.

Yours faithfully,
Gornel

L. Dieschinger,
Colonial Office.

X W. B. Atkinson X

—
? you have the
S.F. 128



War Office,
Whitehall,
S.W. 1.

9

Extract from Minutes of Meeting
of Air Survey Committee, held
at the War Office on July 22, 1926.

5. Air Survey in East Africa.

An inquiry was forwarded to the Colonial Office by a conference of the Governors of East Africa. The inquiry had ~~deal with the~~ reference to the question of the employment of the aeroplane for surveying and asked for the views of the Air Survey Committee. The memo. prepared by the Chairman was discussed by the Committee & met with its approval.

General,
Sec., Air Surv. Comtee,
29/7/26

M. B. Winterbotham

10

Capt. McCaus has written
on the comparative costs
of air & land surveys,
about which I spoke to you.



War Office,

Whitehall,

S.W. 1.

13 July, 1926.

attach to 4741/26, but that
as a personal expression of his views
as they are not (so far as I know) sent
with the knowledge of Col Winterbotham
My dear Liesching,

P.L. 15.7.26.

[Will you please thank the Chairman, Colonial
Survey Committee, for his letter X.F.11786/26 of 10th instant,
enclosing a 1/62,500 sheet (P.S. No.203) of Nigeria, which I
have passed to the Subsection concerned.]

Regarding our telephone conversation of Saturday,
I would confirm the figures given.

For a series of years prior to 1900, topography at
1 m./1 m. in India cost on the average £2.25 per square mile.
This does not of course include the cost of the Great
Triangulation of India, but it does, I think, include the cost
of secondary triangulation.

For a series of years prior to 1900, the cost of
the 1/62,500 map of the United States averaged £2.05 per
square mile, where in general, the main trig. was not that of
the Geological Survey (which does the topo.), but of the
Coast and Geodetic Survey.

By Colonel Winterbotham's admittedly rough rule,
£2 on the "1-inch" is 10/- on the "1/4-inch", which latter is a
figure in the "Text-Book of Topo. Survey".

We may take it, then, that a standard cost on the
1-inch scale before 1900 was £2 a square mile. I have not got
the post-war figures, but think it unlikely that the average
cost could now be less than £2.10.0. per square mile and I suspect
that £3 is more likely.

P. Liesching, Esq.

By

By standard cost I mean a fair average; we must exclude the ideal conditions of South Africa on the one hand, and the excessive cost in Malay Jungle on the other.

Now to turn to Air Survey, I think we may lay down certain principles as axiomatic.

- (1) Air survey is more rapid; perhaps by 50% in some cases to 200% in others.
- (2) The photos form a permanent record, utilizable at any time.
- (3) The photos give infinitely more detail - in general - than a planetable map. The exception is that of forest, where contours must be presumed to some extent and ground detail is frequently obscured by foliage.

The photos themselves - in the absence of any map - indicate the situation and nature of rock outcrops which, if small, often the topographer himself ~~does~~ not see and which, if seen, in any case he could not interpret. The same remark applies more or less to special trees or valuable timber, to small glades, caverns, habitations, ponds, and the like which even a good topographer may miss in undeveloped country.

- (4) In certain cases - take the Nile Sudd as an example - air photography forms the only possible economic method of mapping the area.
- (5) Even if the ground control be exiguous - say a point every 50 miles - a map may be made to show all the ground features, which, though not in exact position - may errors of position of $\frac{1}{4}$ mile at times - will be sufficiently good for all purposes

of preliminary development and which can be rendered cadastral when further controls are later introduced for the revision of the same plates, if the delay is not spread over too many decades.

You understand of course that these are personal views, subject to contradiction where they can be contradicted.

Yours very faithfully,

Somerville

I. d. Disadvantages.

- (6). Overhead charges very heavy; so heavy that in general it pays only when a large area is taken in hand; the exception is when aeroplanes are already on the spot for other purposes.
 - (7). Ground must be gone over, if only to obtain names; but an intimate examination of the ground is not required in preliminary surveys.
 - (8). It must be recognized that the accuracy of the relief in particular must be small, unless the control is fairly dense. A height control greatly improves the work.
- Somerville*

Please reply to—
Officer in charge.

B-372 (M.I.4)

XSA

*Letter to the
Chief of Staff*

RECEIVED
12 JUL 1926
GEOGRAPHICAL SECTION
GENERAL STAFF OFFICE
THE WAR OFFICE,
WHITEHALL, S.W.1.

12

7th July, 1926.

*Lee
7/17*

Dear Bottomley,

On the 21st April, 1926, you wrote me a letter enclosing a copy of one from the Secretary of the East African Governors Conference. The question was the position of taking up Survey by Aerial Photography in East Africa.

consult

At the end of that letter you said that you had asked the Air Ministry to get in touch with the Air Survey Committee about the matter and said that no doubt I would hear further from the Air Ministry. The file was therefore put away with the idea of bringing it forward when we did hear from the Air Ministry, and this we have never done.

McCall, however, let me know to-day that you were waiting for an answer, and I must apologise for the delay which has been due to the above causes.

As it is just possible you may like a report on the matter kept separate from personal correspondence, I attach to this letter a memorandum on the proposal.

Yours sincerely,

Frederick Stanbury

Colonel, G.S.

W.C. Bottomley, Esq., C.M.G.,
Colonial Office,
Downing Street,
S.W.1.

Memorandum on the proposal considered by the Governors Conference in East Africa to employ Aerial Photography in the Surveys of East Africa generally.

1. It is assumed in this memorandum that details regarding the British Companies who are prepared to photograph for Survey purposes have been supplied by the Air Ministry. No mention is made then of any specific organizations or Companies in what follows.

2. There are a considerable number of methods of surveying for maps. The best economical choice of method is determined by the following factors:

- (a) The nature of the country.
- (b) The scale at which the map is to be published.
- (c) The accuracy which is required.
- (d) The time available.

The first of these factors implies that it is impossible to discuss East Africa as a whole, and it would be unsound to specify any particular method as suitable throughout. The last three factors are those which must be dictated by the policy of the colony or country in question.

Dependent on these factors the choice of the proper method requires the experience of a trained surveyor to decide, and it is not evident how a decision can be come to in any broad sense without a thorough investigation by the technical experts concerned.

3. Survey by any of the established ground methods may be taken to run from £1.15s. to about £15. per square mile at the 1" scale. Very roughly the

/cost

10 AUG 1920

Cop. to Gov's Conf.

cost by ground methods may be taken to rise in proportion to the scale. Thus for a map at 3" to the mile the cost would be three times the above quoted amount. Speaking very broadly of East Africa there is probably a very large area which would fall within the easiest class and should, therefore, be surveyed at the scale mentioned for the sum quoted. It is to be noted that this estimate includes the cost of the triangulation necessary for the execution of the subsequent topography.

4. The cost of surveying from air photographs does not rise, as far as we can establish, directly according to the scale. Its most economical scales are probably between 3" and 9" to the mile, and although at smaller scales than the 3" and at larger scales than the 9" it may still prove economical in practice, it would only do so if the nature of the country made ground survey difficult.

5. Those points which tell especially in favour of surveying from air photographs are therefore as follows:-

- (a) The shorter the time allowed the more useful is this method.
- (b) The less accessible a country is on the ground the more does it pay to survey from air photographs.
- (c) Generally speaking, air photography will offer distinct advantages for medium scale mapping.

6. As regards the actual costs established in practice a few points may be quoted. The cost of air photography for the survey of the Irrawaddy Delta was £15 per square mile. This was not the cost of the survey and considerable additional sums were expended

in ground work and in the subsequent compilation. The survey of the Miri Oil Fields worked out between £7. and £8 per square mile, and that undertaken for the Sarawak Government will cost probably slightly less, i.e., about £5 or £6 per square mile. The smallest estimate hitherto give for any extensive operations on the 1" is £3.18s. per square mile for a survey of the coastal belt of Nigeria. The cost of photography is falling in view of better methods of navigation and better cameras, but it is not likely ever to fall below £3 per square mile, to which must be added the cost of the ground control and of any other ground work which is requisite for the map.

All the above surveys were for a scale of 1" to the mile. If we are to turn to bigger surveys, estimates of from £16 to £20 have been given for the photography per square mile for mapping at a scale of 12" to the mile. Additional to these costs must be reckoned a more extensive ground control than for smaller scales and probably more additional work upon the ground.

7. Intermediate, between the two sums quoted in the last paragraph, would lie the cost of an extremely rapid and not very precise survey of mining concessions and areas of peculiar mineral or industrial significance. Such surveys might be well worth the price on account of their speed.

8. It is evident to the technical mind that no general decision can be come to in this matter without carefully weighing the pros and cons for each particular type of country, but taken as a whole it is obvious that

a certain amount of photography would pay its way. There is no reason to limit the use of aeroplanes to the actual question of photography; they can help in survey matters in various other important ways. For example, supposing that it were required to establish the approximate positions of Scrub or forest belts, either with a view to preventing the spread of the tsetse fly, or for any other reason, this could be done from an aeroplane rapidly and satisfactorily upon any existing maps, probably without necessitating photography at all. Again, the practical experience of the surveys of Canada has shown how useful and how economical can be the use of aircraft for reconnaissance, for geodetic purposes, for the transport of observers and instruments, and for the provisioning of distant camps.

If you have any

In my opinion, therefore, it should be considered as a problem for the whole of East Africa and in the light of acquiring a certain amount of flying power to aid in the survey development of these colonies.

In my opinion it should not be considered in the more general light which has been proposed as to the definite laying down of one uniform ^{form} ~~map~~ of survey throughout East Africa, which may be quite unsuitable to individual cases.

J. H. St. John

Colonel, G.S.
Geographical Section.

ED

Recd made a copy for
address of station - it might be shown etc.
at the same time
by such party
which might
be sent for

A copy of this letter enclosure
should be made registered of
Nigeria. It is hardly
suitable to be registered
as an LA. WA. Subject file

best
copy of it
should be made
indicate that
a copy has been
sent to [unclear]

J&K

~~1/1/54~~ 3/6

Any communications on the subject of this letter should be addressed to:-

THE SECRETARY,
AIR MINISTRY,
ADmirALTY BUILDINGS,
KINGSWAY,
LONDON, W.2.

AIR MINISTRY,
LONDON, W.C.2.

and the following number quoted:-
686296/26/S.8.

Copy to W.A.
24 June
May, 1926.

XF: 4741
4 JUN 1926

Sir,

I am commanded by the Air Council to refer to Colonial Office letter of 21st ultimo forwarding a copy of a letter from the Secretary to the Conference of Governors of the British East Africa Dependencies with regard to the possibility of carrying out topographical surveys by means of air photography.

2. I am to state, for the information of Mr. Secretary Amery, that the Council have been in communication with the Air Survey Committee who have, they understand, also received a copy of the letter in question. The observations of this Committee will be transmitted in due course.

3. In the meantime, I am to offer the following remarks on points arising in connection with the Colonial Office memorandum which accompanied the letter under reference.

4. The figure of cost of the air survey of the Irawaddy Delta was exceptionally high for the reasons that the area was small, a complete expedition had to be organised ab initio for the work and a large part of its capital cost charged to this single operation. Nevertheless, the cost was only approximately half that estimated for a survey by ground methods, the results were more complete in detail and the maps were finished in about one-third of the time necessary for a ground survey. In addition valuable data as to the condition of the forest reserves, which could not otherwise have been obtained, was secured.

The survey of the Tenasserim Forests, another difficult area, was carried out by the same firm for £10 per square mile and two further air surveys in Borneo have been completed by them at progressively reduced rates.

5. It is undoubtedly true that there are territories, peculiarly suited by their nature to ground survey methods, where a topographic survey of the standard normally required in the Colonies can be produced more cheaply by ground than by air methods. The justification for an air survey then rests on two possible factors:-

- (a) that the territory is of such value as to necessitate the greater detail and more permanent record of the air photography. To obtain this detail by ground methods would cause the cost to exceed that of an air survey. In this connection it is pointed out that the photographic record remains true for some years (in some cases for a long period of years) and provides a basis for the possible future expansion of the mapping programme without additional commensurate expenditure in the field. This is particularly the case when a survey on a scale larger than the normal topographic scale is required for the purpose of mapping property boundaries.

(b)

The Under Secretary of State,
Colonial Office,
S.W.1.

Go
3091
Ca

10 AUG 1926

Copy to Gen's Conf

and that

(b) that the economic conditions are such as to necessitate the greater speed of the air survey and to warrant the additional cost involved, e.g., when development work is being undertaken.

6. An illustration of the first advantage has recently been afforded by the experimental operation, carried out for the Ordnance Survey Department, to test the practicability of revising Ordnance Survey maps by means of aerial photography.

An area of 50 square miles near Eastbourne was photographed on a scale of 1/5,000 (approximately) for the revision of the 1/2,500 Ordnance Survey Map. While it is too early yet to give definite results, there are indications of a decided advantage being afforded by the air method in surveying towns and closely developed areas containing a great amount of detail. In such cases the cost of obtaining the detail by ground methods is high while the cost by air photography remains practically the same as in open country.

In putting forward this illustration the Council realise that it relates to a type of survey rarely required in the Colonies, but the principle of relative costs remains true in any country and for scales of a different order.

7. The Council understand that the local survey staff in Nigeria consider that an air survey of the region around YANO, where it is a question of surveying property boundaries in a densely populated and highly valuable territory, would be justified on similar grounds. As Mr. Amery is aware, Major Cochran-Patrick of the Aircraft Operating Company is at present on a visit to Nigeria in this connection and on his return the Council may be in a position to offer further observations on these particular proposals.

8. The demand, which is understood to be pressing, of geologists in Nigeria for some form of topographical map on which to plot the result of their surveys would seem to point to a justification of the expense of an air survey there on the second count (para. 5 (b) above), and this may also be the case Mawere, e.g., in Nyasaland. Even an unrectified photographic print would be of value for such a purpose, showing as it would the position of outcrops, otherwise liable to escape detection, and affording the geologist a map sufficiently accurate for his purpose.

If it were impossible to carry out a triangulation at a view to utilising the photographs forthwith for precise survey purposes they could be stored for use in this way at a later convenient date and would be of considerable assistance to the ground surveyor when the actual triangulation was completed.

9. A statement is enclosed herewith for Mr. Amery's information showing the cost of various air surveys which have been undertaken. In some instances the details of cost were furnished on the understanding that they would be treated as confidential.

It will be noted that the United States Geological Survey Department have, as a result of the experience they have gained, decided to give preference in future to air photographic methods of surveying.

(b) that the economic conditions are such as to necessitate the greater speed of the air survey and to warrant the additional cost involved, e.g., when development work is being undertaken.

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8. The demand, which is understood to be pressing, of geologists in Nigeria for some form of topographical map on which to plot the result of their surveys would seem to point to a justification of the expense of an air survey there on the second count (para. 5 (b) above), and this may also be the case elsewhere, e.g., in Nyasaland. Even an unrectified photographic mosaic would be of value for such a purpose, showing as it would the position of outcrops, otherwise liable to escape detection, and affording the geologist a map sufficiently accurate for his purpose.

If it were impossible to carry out a triangulation and a view to utilising the photographs forthwith for precise survey purposes they could be stored for use in this way at a later convenient date and would be of considerable assistance to the ground surveyor when the actual triangulation was decided upon.

9. A statement is enclosed herewith for Mr. Amery's information showing the cost of various air surveys which have been undertaken. In some instances the details of cost were furnished on the understanding that they would be treated as confidential.

It will be noted that the United States Geological Survey Department have, as a result of the experience they have gained, decided to give preference in future to air photographic methods of surveying.

10. Although as explained in paragraphs 5 - 8 above the Council consider that there are conditions which render the adoption of air methods advisable on economic grounds in country of an open type, they agree with the view expressed by Mr. Amery in paragraph (1) of the Colonial Office Memorandum that the most useful role of air photography at the present stage is in the survey of country which is difficult of access to the ground surveyor.

The Irawaddy Delta, referred to in paragraph 4 above, and the large areas in Canada which are being surveyed by means of air photographs are instances of such difficult territories. It may be mentioned that in 1924 the Royal Canadian Air Force photographed approximately 40,000 square miles and in 1925 approximately 60,000 square miles of territory for survey purposes.

It appears to the Council that there are probably many areas in the Colonies of similar type and sufficiently valuable to justify their survey by the most practicable method which exists.

11. With regard to paragraph (ii) of the Colonial Office Memorandum, British air survey companies are prepared to include the work of triangulation in their tenders, if this is desired. An indication of the inclusive cost may be obtained from the figures quoted for GASPE in the enclosure hereto. As regards the estimate of £30,000 for converting the photographic mosaic into a lettered map, the Council have no data available for checking this figure, but such a sum seems extraordinarily high.

12. From foregoing observations Mr. Amery will have noted that, as regards paragraph iii of the Memorandum, the Council agree that the normal cost of ground survey in the interior of Nigeria is probably less than that of an air survey but they suggest that the special factors referred to in paragraph 5 above may justify the employment of the air method.

13. The mention of extra cost in paragraph iv of the Memorandum presupposes that the reference is to the survey of areas, such as Northern Nigeria, which are peculiarly suited to ground survey methods, and not to areas such as the Irawaddy Delta where the cost of air survey has been shown to be approximately half that by ground methods.

With regard to Canada, while the existence of the Royal Canadian Air Force and its employment on survey work may have conduced to the development of air survey in that Dominion, the fact that certain of the Provinces employ commercial aircraft firms for such work indicates that the authorities there share the views of the U.S. Geological Survey Department as to the value of using aircraft for this purpose, apart from the fact that machines are already available there for other purposes.

I am,
Sir,
Your obedient Servant,

S.D. Amery

20
END

COSTS OF AIR PHOTOGRAPHY.

Place.	Area square miles.	Company.	Cost per sq. mile.			Remarks.
			£.	s.	d.	
Irawaddy Delta (Burma)	1350	Air Survey Co. Ltd.	14	0	6	Total cost, including ground work, was £18.8.0 per square mile; estimated cost by ground methods £23 per square mile.
Tenasserim Forests	600	-do-	10	0	0	-
Miri Oilfields (Borneo)	1360	-do-	7	7	0	These figures are strictly confidential.
Rejang Delta (Sarawak)	1750	-do-	3	3	0	
			(approx.)			
Eastbourne - Ordnance Survey Revision.	50	Aircraft Operating Co. Ltd.	5	0	0	This area is much too small to allow of the price being an economical one.
Gaspe (Quebec).	2200	French firm.	9	5	0	Includes ground control and complete production of the map.
			(approx.)			
Quebec Province.	400	Fairchild Aerial Surveys (Canada) Inc.	4	2	0	-
			(approx.)			

The United States Geological Survey estimate, as a result of their experience of air and ground methods, that the former shows a saving over the latter of from 35% to 75% in cost and 50% in time. They have therefore decided to give preference in future to the air method.

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END

TOTAL EXPOSURES →

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