Zambezia (1988), XV (ii).

AERIAL PHOTOGRAPHY IN ZIMBABWE, 1935–1986

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ONE OF THE earliest references to the potential of aerial photography in surveying in this country is attributed to C. F. Webb who, in 1912, noted that by means of aeroplanes 'huge tracts of country could be surveyed and rivers accurately mapped in one tenth of the time and not half the expense involved at present'.[1] The first aerial survey in South Central Africa was in July 1925, when a reconnaissance study was carried out on the Okavango Delta.[2] During 1926 the British-based Aircraft Operating Company (AOC) undertook a contract for extensive aerial surveys in the then Northern Rhodesia[3] and, to assist in its 'Africa Expedition', it built a base at Bulawayo in 1928 but this only operated until 1931.[4] In that year it seems that test aerial surveys were done over Bulawayo and Gwelo by a Captain R. E. Castigan, but no formalized mapping resulted from these experimental flights.

It was not until 1934 that

> the Government of Southern Rhodesia decided to allocate annually a sum of £3 000 to allow for aerial survey of an equivalent number of square miles of terrain, and from 1935 until the outbreak of war in 1939 a contract was put out to tender. While another company capable of undertaking small air surveys existed in South Africa, it was almost a foregone conclusion that AOC, with its extensive experience in Northern Rhodesia and elsewhere, would be awarded the contract.[5]

Thus in May–June 1935 the Lomagundi area was flown at a scale 1:20 000 and in 1936 two further blocks were flown in the Belingwe and Gwanda areas (see Fig. 1). Initially, the aerial films were processed in Johannesburg but in 1936 a photographic laboratory was built at the Bulawayo field base of AOC. In the following year a similar facility was established in Salisbury to assist in an aerial survey of the Umvukwes area. Subsequently, extensive aerial photography at a variety of scales was carried out throughout the country by AOC, other commercial survey companies and the national air force.

The aerial photography that has been carried out in Zimbabwe since 1935 constitutes a valuable and unique record of the country's landscape. Whilst a

[1] J. McAdam, 'The Flying Mapmakers — Some Notes on the Early Development of Air Survey in Central and Southern Africa' (no details, MSS in Library of National Archives of Zimbabwe), 1.

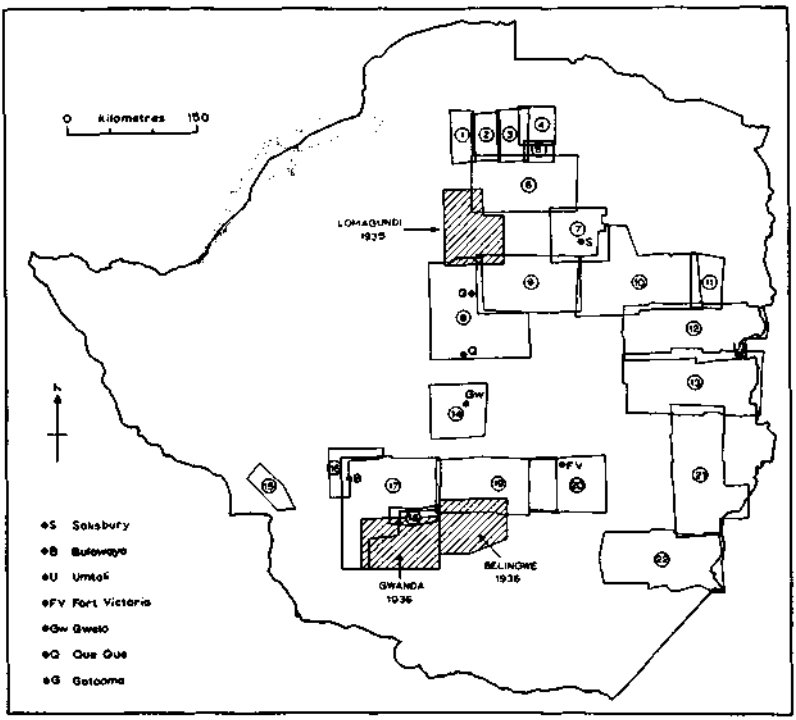
[2] Ibid.

[3] R. A. Pullan, 'The history and use of aerial photography in Zambia', *Zambia Geographical Journal* (1976), XXXI, 33–52.

[4] McAdam, 'The Flying Mapmakers'.

[5] Ibid., 29.

Figure 1: **AERIAL PHOTOGRAPHY PRE-1950**



primary motive in doing this photography was systematic topographical mapping by the Surveyor-General's Department and, at a later stage, land-use planning, sequential aerial photographs are of immense value to environmental and, perhaps to a lesser extent, social scientists concerned with changing patterns in the landscape. For example, changes in settlement and cropland in Zimunya Communal Land have been evaluated on the basis of photography taken in 1949, 1955, 1963 and 1981,[6] whilst detailed analysis of the growth of gullies near St Michael's Mission in Ngezi Communal Land has been done using five different sets of photography dating from 1956.[7] It appears that the potential of aerial

[6] R. Whitlow and L. Zinyama, 'Up hill and down vale: Farming and settlement patterns in Zimunya Communal Land', *Zimbabwe Agricultural Journal* (in press).

[7] R. Whitlow and C. Firth, 'Gully distribution and development on Karoo sediments in central Zimbabwe: A preliminary survey', *Zambezia* (in press).

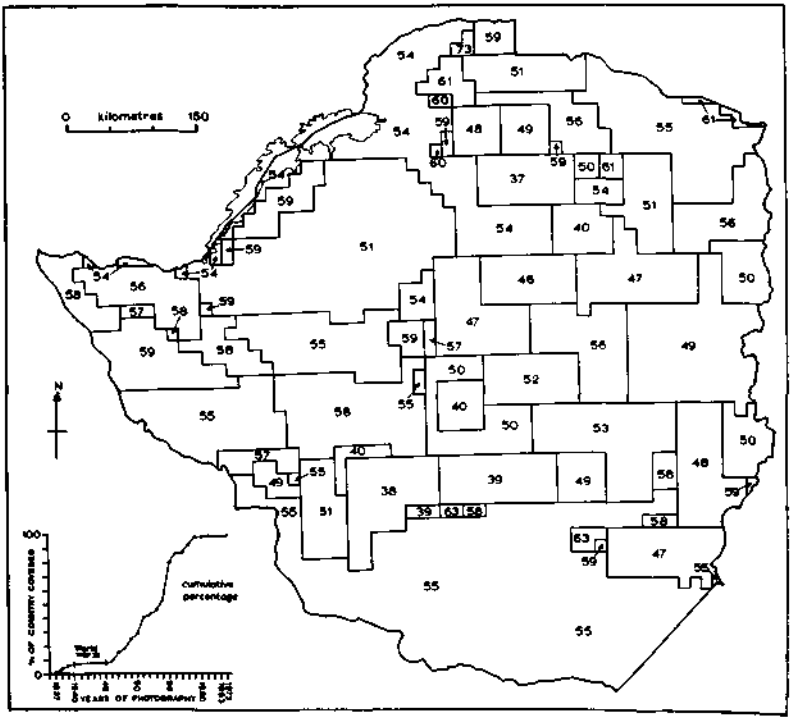
photographs in such research is not realized by many scientists. This is partly because training in the use of aerial photography is restricted to only a few academic disciplines, but more so it is because many scientists are simply unaware of the existence of this data source.

Moreover, there are numerous logistic problems related to the use of certain aerial photography, especially that done prior to 1963. These include the difficulties of identifying and procuring photographs for specified areas and, in the general absence of proper indexes, locating the particular photographs that are of value in a given study. In addition, in my experience over the last twelve years of using older photography in this country, cases may arise where the negatives of photographs cannot be located or have been damaged through improper handling, poor storage or extensive cracking and tearing of film emulsions. It is hardly surprising, therefore, that limited use is made of older aerial photography!

The primary aim of this article is to document the coverage of aerial photography in Zimbabwe over the period 1935 to 1986 for the benefit of those who, hitherto, have made little or no use of photographs as a tool in the study of landscapes. The review is concerned mainly with 1:20 000 and 1:25 000 aerial photography, but scales within the range 1:10 000 to 1:50 000 are mentioned in several places. The article is divided into three main sections. Firstly, an overview of the earliest dates and frequency of aerial photography on a national level is given. Secondly, the extent of aerial photography prior to 1963 is described. Thirdly, the photography since 1963 is outlined. In the last two sections, wherever appropriate, the circumstances related to the execution and applications of aerial photography are discussed. This is done to provide a complete picture on the nature of the aerial photography which may be of assistance in the contemporary use of this material in research.

The article was compiled using information given in the annual reports of the Department of the Surveyor-General since 1925, the annual reports of the Department of Federal Surveys (1956–63), records in the present offices of the Department of the Surveyor-General and two master indexes at 1:1 000 000 of pre-1963 photographs held by the Chief Topographer in that Department. Whilst every effort has been made to check the existence of the aerial photography cited in this review, incomplete records on the nature and fate of the pre-1963 photography make it impossible to verify that all this material is still accessible and in a usable condition. Regrettably, given the limited uses currently made of the older photography, there is little to motivate the responsible authorities to improve the status of this unique record of the Zimbabwean landscape. A secondary aim of this article, therefore, is to stimulate greater use of this older aerial photography in pure and applied research so that a stronger case can be made for upgrading the status of this reference material.

Figure 2: AERIAL PHOTOGRAPHIC COVERAGE OF ZIMBABWE: EARLIEST DATES OF PHOTOGRAPHS

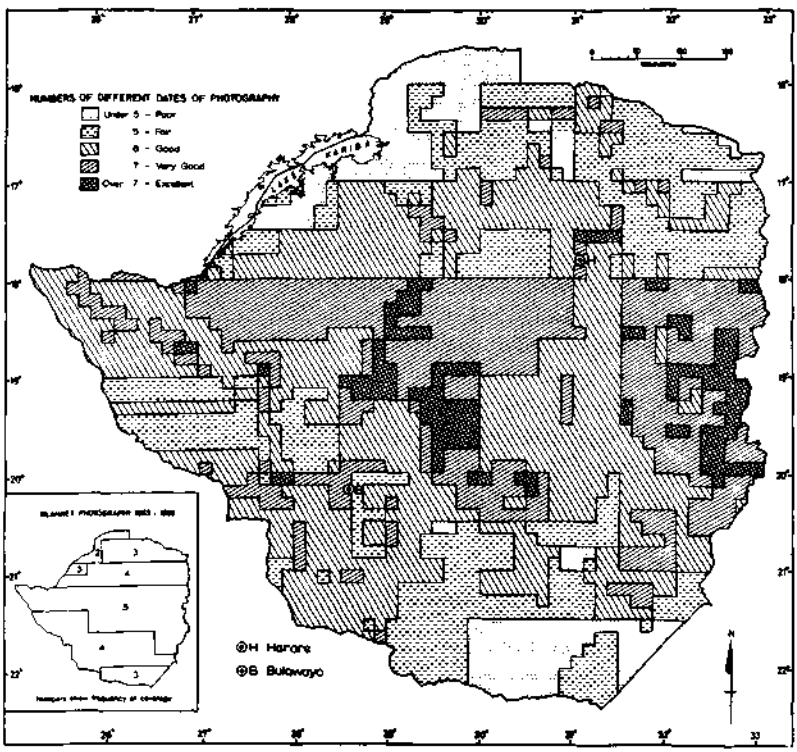


EARLIEST DATES AND FREQUENCY OF AERIAL PHOTOGRAPHY

Two interpretive maps showing the earliest dates (Fig. 2) and frequency of different dates (Fig. 3) of photography for a given area were compiled using the two 1:1 000 000 master indexes for the pre-1963 photos and records of the 'blanket photography' since 1963.[8] Given the fragmentary, patchwork character of the older aerial photography a spatial framework of grid squares, equivalent to one quarter divisions of a standard 1:50 000 map sheet, was used to extract and combine data on the aerial photographic coverage. During the examination of annual reports of the Surveyor-General it became apparent that the master 1:1 000 000 indexes used in this compilation exercise were by no means complete. For example, many of the Reserves in the 1950s were

[8] Chief Topographer, personal communication.

Figure 3: NUMBERS OF DIFFERENT DATES OF PHOTOGRAPHY



photographed as part of the land reform programme initiated in these areas at that time; few of these are indicated on the master indexes. Similarly, the three earliest blocks of photography, notably Lomagundi (1935), Belingwe (1936) and Gwanda (1936), do not appear on the indexes. Overall, however, the interpretive maps do include the greater part of the photographic coverage carried out since 1937. They are intended as guides on the progressive extension of large-scale aerial photography as a basis for identifying the status of coverage for any given part of the country.

By the beginning of the Second World War some 7,7 per cent of the country had been surveyed, mainly around Salisbury, Gwelo and Bulawayo (Fig. 2). The personnel and equipment of AOC were incorporated into the air force during the 1940–5 period, but normal photography resumed in 1946. By the end of the 1940s nearly one quarter of the country had been flown, primarily in the

north-central and eastern regions. Between 1950 and 1954 photography was extended over a further 28,1 per cent of the country, including a large portion of the Zambezi Valley and blocks in the Eastern Highlands. A major phase of aerial photography took place in 1955 during which well over one quarter of the country was flown, especially in the southern regions but also in the extreme south-west and north-east (Fig. 2). The motivation behind this volume of aerial photography in 1955 relates, in part, to the implementation of the Native Land Husbandry Act, some aspects of which are outlined later. During the remainder of the 1950s small blocks of photographs were done throughout the country such that by 1963, with one exception, virtually all areas had been covered by aerial surveys. The exception is a small area in the extreme north of Zimbabwe which was not photographed until 1973 (Fig. 2).

Figure 2, therefore, provides an indication of the earliest dates of photography available for given areas. Details on the actual blocks of photography are discussed later. It is also of value to know how many different dates of photography are available as a basis for monitoring changes in the landscape. This has been attempted in Figure 3 but, in view of the omissions of certain phases of photography mentioned earlier, the frequency of coverage is likely to be better than that portrayed in this map. For descriptive purposes five categories of aerial photography have been defined as follows:

under 5 dates: poor	(9,5%)
5 dates: fair	(24,7%)
6 dates: good	(37,5%)
7 dates: very good	(23,0%)
over 7 dates: excellent	(5,3%)

The percentage values relate to the proportion of the country within a designated category. Prior to 1963 aerial photography was done on an *ad hoc* basis but in 1963 a more systematic scheme of what became known as 'blanket photography' was initiated. The inset map in Figure 3 shows the frequency of coverage of this photography over the period 1963–86. Comparison of this inset with the main map shows that for most parts of Zimbabwe it is possible to have at least one and sometimes two or three dates of photography prior to 1963.

Areas with poor coverage are located mainly in the Zambezi Valley bordering and downstream of Lake Kariba, in the extreme south in the Gwanda and Chiredzi districts, and in the south-west, including parts of Hwange National Park (Fig. 3). About one quarter of the country has fair coverage (5 dates of photos), mainly in the north-east, south-east and south-west border regions. Over one third of Zimbabwe was rated as having 6 different dates of photography, that is

'good' coverage in Figure 3. Large parts of Masvingo, Matabeleland North and Matabeleland South provinces are within this category. Areas with very good coverage (7 dates) are of more limited extent and scattered widely, but do include large blocks in the central and eastern parts of Zimbabwe. The areas of excellent coverage, with up to 10 different dates of photography, are centred on present-day Gweru and in the eastern districts, including parts of Save Valley (Fig. 3).

Additional photography is available for restricted areas, particularly the urban centres, and details on some of this material is outlined later. Overall, therefore, Zimbabwe is fortunate in having extensive aerial photography, although coverage is better in some parts of the country than others. This is unusual in Africa where relatively few areas have sequential photography dating from the 1940s and 1950s, whilst some parts of the continent have never been subject to aerial surveys. There are some exceptions to this, notably Zambia, where extensive photography has been carried out.[9]

AERIAL PHOTOGRAPHY PRE-1963

The pre-1963 aerial photography comprises a patchwork of sometimes irregular-shaped blocks at various scales. The locations of these blocks are indicated in Figures 1 and 4–6 compiled from the two 1:1 000 000 master indexes noted earlier. The pre-1963 period, mainly for cartographic convenience in depicting the locations of blocks of photography, has been divided into four phases as follows:

pre-1950:	25 blocks of photos (Fig. 1)
1950–1954:	19 blocks of photos (Fig. 4)
1955–1959:	34 blocks of photos (Fig. 5)
1960–1962:	25 blocks of photos (Fig. 6)

Further details on this photography are summarized in Tables I, II, III, and IV. Requests for the consultation of this material should be routed through the Surveyor-General's Department but the film negatives and prints are kept by the National Archives. In terms of the actual examination of this material it should be noted that under 40 per cent of the photography is recorded on indexes, mainly in the form of linen base maps which are not easy to work with, and that in some cases, in the absence of contact prints, it is necessary to examine rolls of aerial film, which is also a difficult task for those unfamiliar with such material. Selected aspects concerning the applications of aerial photography are given in the description which follows on the four phases of photography.

[9] Pullan, 'The history and use of aerial photography in Zambia'.

Table I

PRE-1950 PHOTOGRAPHY ON INDEX

Location	*Date*	*Scale*	*Area (sq. miles)*	*Agency/Comment*
[b] Umvukwes (6)	1937	1:20 000	-	Routine mapping?
[b] Bulawayo (17)	1938	1:20 000	2 975	Surveyor-General – mapping
[b] Shabani (18)	1939		370	
[b] Shabani (19)	1939		2 791	Areas marked on master index but no full details
[b] Bulawayo (16)	1940		-	available in annual reports of the Surveyor-General
[b] Gwelo (14)	1940		-	Photos probably at scale of 1:20 000
Salisbury (7)	1940			
[b] Gatooma/Hartley (9)	1946	1:20 000	6 300?	Requested by Surveyor-General, flown by RRAF — poor
[b] Gatooma/Que Que (8)	1946/7	1:20 000		quality photos.
[b] Marandellas (10)	1947	1:20 000	2 800	
[b] Ndanga Sabi (22)	1947/8	1:20 000	1 785	No details available on purpose of this photography
[b] Sabi (21)	1948	1:20 000	4 742	but likely to be routine mapping
[b] Miami Block A (A)	1948	1:20 000	600	Surveyor-General mapping
[b] Miami Block B (2)	1948	1:20 000	600	Surveyor-General mapping
[b] Doma (3)	1949	1 20 000	600	Surveyor-General mapping
[b] Sipolilo (4)	1949/50	1:20 000	355	Surveyor-General mapping
Victory (5)	1949	1:20 000		Routine mapping?
Inyanga West (11)	1949	1:20 000	600	Surveyor-General mapping
[b] Inyazura (12)	1949?	1:20 000	3 300	Surveyor-General mapping
[b] Umtali South (13)	1949	1:20 000	3 200	Surveyor-General mapping
[b] Nata Reserve (15)	1949	1:20 000	483	Department of Native Agriculture
[b] Fort Victoria (20)	1949	1:20 000	1 200	Surveyor-General – mapping

[a] Numbers in brackets relate to numbers of blocks in Photo Index, Figure 1.
[b] Old indexes available upon request from the Chief Topographer, Department of the Surveyor-General.

Table II

1950–1954 PHOTOGRAPHY ON INDEX

Location [a]	*Date*	*Scale*	*Area (sq. miles)*	*Agency/Comment*
[b] Glendale North (4)	1950	1:20 000	360	Surveyor-General mapping
[c] Inyanga (13)	1950	1:20 000	1 200	Surveyor-General mapping
[c] Gwelo (14)	1950	1:20 000	3 360	Surveyor-General mapping
[c] Melsetter (17)	1950	1:20 000	1 580	Surveyor-General mapping
Lomagundi (2)	1951	1:20 000	2 380	–
[c] Shamva (6)	1951	1:20 000	2 500	–
Sebungwe (8)	1951	1:20 000	10 620	Select Committee on Assignment of Unassigned Lands
[b] Salisbury (12)	1951	1:12 000 and 1:20 000	660	–
[c] Figtree (18)	1951	1:20 000	2 500	–
[c] Umvuma (15)	1952	1:20 000	2 400	–
[c] Gutu (16)	1953	1:20 000	3 190	–
[c] Zaka (19)	1953	1:20 000	1 450	–
Zambezi Valley (1)	1954	1:44 000	4 435	Kariba Hydroelectric Project
[c] Sinoia West Block 1 (3)	1954	1:20 000	3 225 (includes Block 2)	
[b] Bindura (5)	1954	1:20 000	575	
Zambezi (7)	1954	1:12 000 and 1:25 000	see Zambezi Valley	Kariba Hydroelectric Project
[c] Mafungabuzi (9)	1954	1:20 000	650	–
[c] Sinoia West Block 2 (10)	1954	1:20 000	see Block 1	
[c] Norton (11)	1954	1:20 000	1 150	–

[a] Numbers in brackets relate to numbers of blocks in Photo Index, Figure 4.
[b] Index available in Air Photo Sales, Department of the Surveyor-General.
[c] Old indexes available upon request from the Chief Topographer, Department of the Surveyor-General.

Table III

1955–1959 PHOTOGRAPHY ON INDEX

Location [a]	*Date*	*Scale*	*Area (sq. miles)*	*Agency/Comment*
Mount Darwin (4)	1955	1:20 000	–	Department of Native Affairs
Mtoko (6)	1955	1:20 000	–	Department of Native Affairs
Gokwe (10)	1955	1:20 000	–	Department of Native Affairs
Gwaai (20)	1955	1:20 000	–	Department of Native Affairs
Lower (24)	1955	1:20 000	–	Department of Native Affairs
[b] Plumtree (24)	1955	1:20 000	430	Intensive Conservation Area Committee
[b] Shashi River (29)	1955	1:20 000	6 988	–
Belingwe (30)	1955	1:20 000	–	–
Limpopo (32)	1955	1:20 000	13 058	–
Shangani (as marked)	1955	1:20 000	–	–
[c] Mtepatepa (3)	1956	1:20 000	3 800	–
Nyagadsi (7)	1956	1:20 000	3 670	–
Nyamaropa (8)	1956	1:20 000	–	–
[b] Wankie (14)	1956	1:20 000	–	–
Charter (19)	1956	1:20 000	3 480	–
[c] Banket (5)	1957	1:20 000	2 280	–
[c] Gatooma (11)	1957	1:20 000	5 640	–
Sabi Catchment (12)	1956/7	1:20 000	7 300	–

Wankie (15)	1957	1:20 000	194	-
Nata Reserve (as marked)	1957	1:20 000	-	-
[b] Matetsi (13)	1958	1:20 000	3 035	-
Dett/Gwaai (1)	1958	1:20 000		-
Essexvale/Filabusi/ Matopo South (25)	1958	1:20 000	4 120	-
Bikita (27)	1958	1:20 000	-	-
Inyati (21)	1958/9	1:20 000	-	-
Sipolilo North (1)	1959	1:40 000	2 150	Native Affairs and Resettlement
Doma (2)	1959	1:40 000	1 892	Department of Conservation and Extension
Sebungwe (9)	1959	1:40 000	14 700	Native Affairs and Resettlement
[b] Wankie Game Reserve (16)	1959	1:40 000	4 079	National Parks
Gwelo River (18)	1959	1:40 000	1 062	Department of Conservation and Extension
Gwelo (23)	1959	1:40 000	2 236	Department of Conservation and Extension
Fort Victoria (26)	1959	1:40 000	868	Department of Conservation and Extension
Chipinga (28)	1959	1:40 000	830	Department of Conservation and Extension
Ndanga (31)	1959	1:40 000	1 659	Department of Conservation and Extension

[a] Numbers in brackets relate to number of blocks in Photo Index, Figure 5.
[b] Old indexes available upon request from the Chief Topographer, Department of the Surveyor-General.
[c] Index available in Air Photo Sales, Department of the Surveyor-General.

Table IV

1960–1962 PHOTOGRAPHY ON INDEX

Location [a]	*Date*	*Scale*
Mzarabani (2)	1960	1:20 000
Karoi (3)	1960	1:40 000
Wedza/Mutema (9)	1960	1:20 000
Weya Reserve (10)	1960	1:20 000
Rowa (12)	1960	1:20 000
Musikavanhu (17)	1960	1:29 000
Gwanda (19)	1960	1:20 000
Shashi River (21)	1960	1:10 000
Umzingwane River (22)	1960	1:10 000
Maranda (23)	1960	1:29 000
Matibi (24)	1960	1:40 000
Limpopo River (25)	1960	1:10 000
Chewore (1)	1961	1:40 000
[b] Bindura (4)	1961	1:40 000
[b] Mount Darwin (5)	1961	1:40 000
Gwaai (6)	1961	1:40 000
Nkosikasi (7)	1961	1:40 000
Silobela (8)	1961	1:40 000
Tsonzo (11)	1961	1:40 000
Plumtree/Figtree (13)	1961	1:40 000
Ramaquabane (14)	1961	1:40 000
Mzinyatini (15)	1961	1:40 000
Jenya (16)	1961	1:40 000
Gwanda/Shashi (18)	1961	1:40 000
Shobi (20)	1961	1:40 000

[a] Numbers in brackets relate to numbers of blocks in Photo Index, Figure 6.
[b] Index available in Air Photo Sales, Department of the Surveyor-General.

Pre-1950 photography

The Lomagundi aerial survey (Fig. 1) carried out in 1935 was primarily to assist in topographical mapping and, in the following year, surveys were done in the Belingwe and Gwanda areas (Fig. 1). The annual report of the Surveyor-General in 1937 comments that 'areas to be mapped are selected according to their economic importance, and due regard is paid to the requirements of the Geological Survey Department which must of necessity be supplied with topographical maps on which to show geological information'.[10] It is also noted that aerial surveys assist in reducing time spent in the field on ground survey.

[10] 'Abstract of the Report of the Surveyor-General', in Southern Rhodesia, *Report of the Secretary, Department of Agriculture and Lands for the Year 1937* (C.S.R. 13, 1938), 40.

Certainly, a major reason for the subsequent extension of aerial photography in this country relates to the use of this material in the compilation and updating of topographical maps.

Prior to the outbreak of war in Europe in 1939 four further blocks of photography were flown — Umvukwes in 1937, Bulawayo in 1938 and two areas in the Shabani district in 1939 (Fig. 1; Table I). This aerial photography proved to be of great interest and value in fields apart from topographical mapping. For example, in 1938 public sales of photographs amounted to nearly 900 prints, plans were made to establish a lending library of duplicate aerial photos in the Surveyor-General's Department, and an inter-departmental meeting in government resolved to promote the use of aerial photographs.[11] Other applications of aerial photographs before 1940 include the surveying of farm and road layouts in Purchase Areas by the Department of Lands and the definition of boundaries of the Matopo National Park by the Conservator of Forests.[12] At the outbreak of war in 1939 the Rhodesian Air Training Group (RATG) was formed, incorporating the personnel and equipment of AOC as noted earlier. Air bases were established at Salisbury, Gwelo and Bulawayo. Aerial surveys at 1:20 000 scale were carried out around these three centres (Fig. 1; Table I) to facilitate planning of the bases.

The routine mapping programme of the Surveyor-General's Department was curtailed because of the 1939–45 war, but in 1946 aerial surveys resumed in the Gatooma–Hartley area where the RATG covered some 6 300 square miles with 'indifferent photography'[13] and only printed 1 350 out of the 5 000 photographs in the block. In 1946 the RATG was disbanded and Central African Airways (CAA) was formed. Most of the aerial surveys in the 1947–9 period were done by CAA on behalf of the Surveyor-General's Department. One factor promoting aerial surveys at this time was the increasing use of photomosaics and prints by European farmers (Table V). Many of these were ex-servicemen who had 'gained practical experience of the value of photographs during the war'.[14] To facilitate the opening up of farms for ex-servicemen, aerial surveys were undertaken to the north-west of Salisbury including the Miami (1948), Doma (1949), Sipolilo (1949–50) and Victory (1949) blocks (Fig. 1; Table I).

In 1948 some 13 000 square miles in the Zambezi Valley were surveyed by

[11] Southern Rhodesia, *Report of the Surveyor-General for the Year 1938* (C.S.R. 10, 1939).

[12] 'Report of the Surveyor-General for the Year 1939', and 'Report of the Surveyor-General for the Year 1940', in Southern Rhodesia, *Reports of the Surveyor-General for the Years 1939, 1940, 1941, 1942, 1943, 1944 and 1945* (C.S.R. 2, 1947).

[13] Southern Rhodesia, *Report of the Surveyor-General for the Year 1946* (C.S.R. 20, 1947).

[14] 'Report of the Surveyor-General for the Year 1945', in Southern Rhodesia, *Reports of the Surveyor-General for the Years 1939, 1940, 1941, 1942, 1943, 1944 and 1945*, 41.

the Directorate of Colonial Surveys for a proposed dam site in the Kariba Gorge area, but the Surveyor-General's report in that year does not indicate whether this involved the use of aerial photography. Apart from topographical mapping, aerial photography was employed for a variety of purposes during the late 1940s. These included surveys by a Sabi Development Commission, the Roads Department, the Irrigation Department (for dam sites) and the preparation of photomosaics of Wedza, Matobo, Shiota and Nata Reserves for the Department of Agriculture to assist in the demarcation of arable and grazing areas in accordance with the 'centralization' process introduced by Alvord, the founder director of that department. Demand for farm mosaics continued to rise during this period and into the early 1950s (Table V) as commercial farming operations extended and conservation works were developed.[15] By 1949, some 24,8 per cent of the country had been covered by aerial surveys and in the period 1946–9 over 26 565 square miles of land were photographed at a scale of 1:20 000, mainly in the central and eastern districts (Fig. 1; Table I).

Table V

PURCHASE OF AERIAL PHOTOGRAPHY BY FARMERS AND INTENSIVE CONSERVATION AREA COMMITTEES, 1945–1955

Year	*Mosaics*	*Prints*	*Year*	*Mosaics*	*Prints*
1945	90	–	1951	97	660
1946	25	–	1952	85	715
1947	37	–	1953	93	848
1948	94	–	1954	51	702
1949	260	–	1955	210	1 430
1950	220	–	1945–55	1 262	4 355

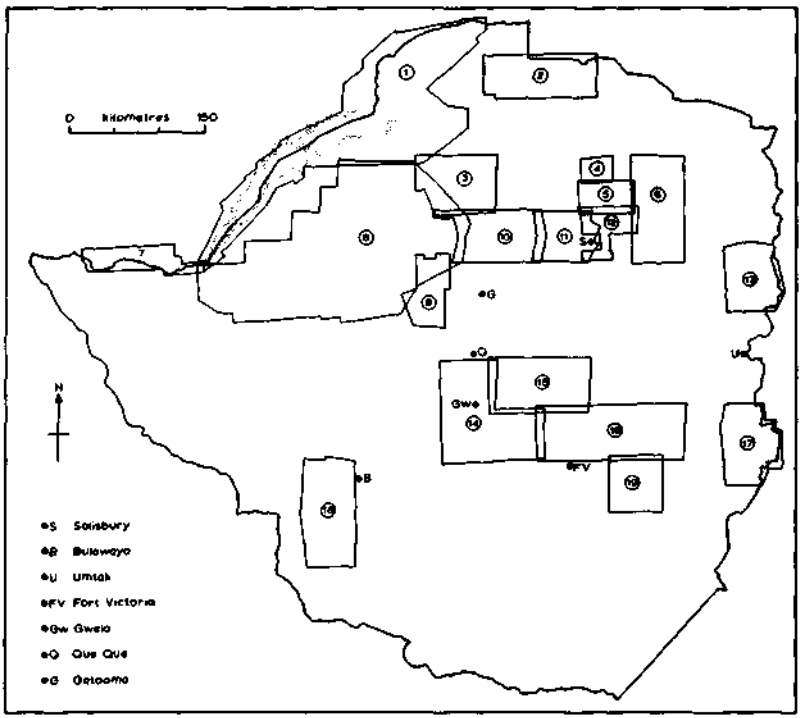
Source: Compiled from annual reports of the Surveyor-General.

1950–54 photography

During this period aerial surveys, mainly at 1:20 000 scale, were carried out in the central and north-western districts (Fig. 4) and covered an estimated area of 42 235 square miles (Table II). There were considerable overlaps between some of the aerial surveys and, in general, the early 1950s blocks were located adjacent to areas that had been photographed previously (compare Figs. 1 and 4), thereby extending photo coverage over a further 28,1 per cent of the country by the end of 1954. This photography was used mainly to develop the 1:50 000 topographical

[15] R. Whitlow, 'Soil conservation history in Zimbabwe: Part 1: Large-scale commercial farming areas', *Zimbabwe Agricultural Journal* (in press).

Figure 4: AERIAL PHOTOGRAPHY 1950–1954



mapping series which had been initiated in 1937.[16] In turn, these 1:50 000 maps were of use in development activities of various kinds. However, many government departments (particularly Irrigation and Forestry) and farmers (Table V) preferred to use prints or photomosaics in their planning activities.

Special photography was undertaken for different purposes during the 1950–4 period. For example, a Select Committee on Assignment of Land commissioned an aerial survey of 13 000 square miles in the Sebungwe and Lomagundi districts in 1951 (Fig. 4; Table II). In the following year the Surveyor-General's report mentions a survey of 2 195 square miles in an area between the western boundary of Gwaai Reserve and the Panda-ma-Tenka (1952 spelling) road for use by the

[16] R. S. Cole, 'Surveys and Mapping in Zimbabwe' (Harare, Department of the Surveyor-General, unpublished report, 1984).

epartment.[17] However, specific details on the location of this photography given and it did not appear on the 1:1 000 000 master index from which was compiled. Similarly, portions of Sabi, Selukwe, Que Que and Reserves were subject to aerial surveys in this period (see Table VI) for rtment of Native Affairs during the early stages of the implementation of e Land Husbandry Act of 1951. These areas are also omitted from the dex, and so do not appear in Figure 4. In 1954 an area of 4 435 square the Zambezi Valley was flown at a scale of 1:44 000 to assist in the of the Kariba Hydroelectric Project (Fig. 4). The Department of tion and Extension (Conex), founded in 1950 to service the needs of farmers,[18] provided further stimulus for aerial surveys through the n of photographs in agricultural planning.

photography

a period of widespread aerial surveys (Fig. 5), with nearly 80 per cent of ry being covered by 34 blocks of photography varying in size from 194 les in the Wankie area in 1957 to 13 058 square miles in the Limpopo 55. The blocks are, in some cases, highly irregular in shape and there is ble overlap between adjacent blocks. This wasteful duplication of phy was one of the reasons that led to the introduction of a systematic ne of aerial surveying in 1963. In July 1956 the Department of Federal was created under the directorship of Brigadier M. O. Collins. With an mapping programme, Collins initiated the preparation of 1:50 000 ical maps using 1:40 000 aerial photography in 1958.[19] This proved to more economical in terms of manpower inputs and aerial survey costs,[20] esult, the aerial photography between 1959 and 1961 was done mainly 00 scale (Tables III and IV).

ompilation of topographical maps remained a major use of aerial hy during the late 1950s. However, considerable use was made of hy by government departments and the public (notably farmers and Conservation Area Committees). For example, sales of contact prints -enlargements increased from about 23 000 photos in 1955 to over

rn Rhodesia, *Report of the Surveyor-General for the Year Ended 31st December 1952* 953).

Kennan, 'The development of the extension service among the European farmers in *hodesia Agricultural Journal* (1971), LXVIII, 116–20.

ution of Rhodesia and Nyasaland, *Report of the Director, Federal Department of ical and Topographical Surveys for the Year Ended 31st December 1959* (C. Fed. 140).

cobs, 'The development of the survey of the Rhodesian 1:50,000 map series', *Rhodesia* s (1969), III, 140–3.

Table VI

'NATIVE RESERVES' PHOTOGRAPHED DURING IMPLEMENTATION OF NATIVE LAND HUSBANDRY ACT DURING 1950s AND EARLY 1960s

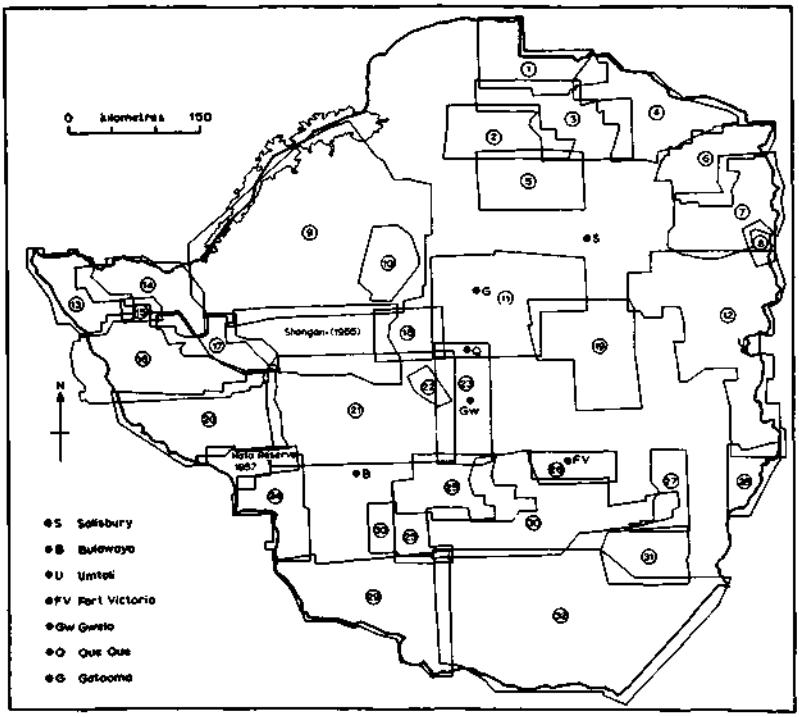
Date	*Area*	*Number of photos*	*Total number of photos*
1954	Chinyika	35	
	Selukwe	139	
	Que Que	75	
	Fungwe	126 (1:25 000)	375
1955	Chiweshe	181	
	Weya	74	
	Masunzwe	44	
	Mangeni	44	
	Gutu	26	
	Gokwe*	810	
	Mtoko*	952	
	Maranke	450	
	Lower Gwelo*	176	
	Zimunya	36	
	Bushu	37	
	Inyati	15	
	Umzingwane	13	
	Ntabazinduna	42	
	Bikita	129	
	Mutasa/Jenya	59	
	Mondoro	379	3 467
1957	Nata*	531	531
1958	Chiduku	261	
	Sebungwe area within Gokwe (?)	231	492
1959	Sabi North	172	
	Sangwe/Ndanga East	158	330
1960	Bushu	43	
	Chiwamora	225	
	Soswe	46	
	Mangeni	44	
	Weya*	77	435
1961	Ntabazinduna	236 (1:10 000)	236

* Areas marked on indexes in Figures 5 and 6.

Photography at 1:20 000 unless otherwise stated.

Source: Compiled from index held by Chief Topographer in the Department of the Surveyor-General.

Figure 5: AERIAL PHOTOGRAPHY 1955–1959



40 000 by 1959.[21] Two major users of this photography were Conex and the Department of Native Affairs. Conex, in 1956, introduced a system of farm planning. This relied heavily on the use of aerial photography in the assessment of land capability and the design of field layouts, access roads and conservation works.[22] Conex commissioned at least six major blocks of 1:40 000 photography covering over 8 500 square miles during 1959 (Table III). The present-day successor to this department, Agritex, remains a major user of aerial photography today, building on many years of experience in the field of aerial photo interpretation.[23]

[21] Southern Rhodesia, *Report of the Surveyor-General for the Year Ended 31st December 1955* (C.S.R. 16, 1956); Federation of Rhodesia and Nyasaland, *Report of the Director, Federal Department of Trigonometrical and Topographical Surveys for the Year Ended 31st December 1959.*

[22] See, for example, P. Ivy, *A Guide to Soil Coding and Land Capability for Land Use Planners* (Salisbury, Department of Agricultural, Technical and Extension Services, 1981).

[23] See, for example, A. J. Carver, *Air Photography for Land Use Planners* (Salisbury, Department of Conservation and Extension, 1981).

In an attempt to improve agricultural output and conservation measures in the Reserves, legislation was passed in 1951 in the form of the Native Land Husbandry Act. The implementation of this legislation involved detailed mapping of existing land use and settlement within the Reserves and the subsequent development of alternative patterns of land use and holdings. Aerial photography was a vital part of this work. The Secretary for Native Affairs reports that it 'was further decided that only photographs after 1950 would be sufficiently up to date to be of use, and it was found that photographs covering some 17 500 square miles of Native Reserves and Native Areas were immediately available. This left a total area of 24 350 square miles still to be photographed'.[24] In 1959 the Under-Secretary of Native Agriculture commented that 'one of the outstanding features of the process of implementing the Land Husbandry Act has been the extensive and intensive use of aerial photographs and mosaics which has saved many laborious hours of map-making, surveying and field observations'.[25] Photography commissioned for this agrarian reform programme in 1955 includes Mount Darwin, Mtoko, Gokwe, Gwaai and Lower Gwelo (Table III). Between 1954 and 1961 at least thirty-two Reserves were surveyed in whole or part (Table VI), but most of this photography does not appear on the 1:1 000 000 master index held by the Surveyor-General, nor is it certain that this material still exists.

1960–62 photography

Approximately 30 per cent of the country was surveyed during this period at scales varying from 1:10 000 to 1:40 000 (Table IV; Fig. 6). A tender for aerial photography of 10 000 square miles was cancelled in 1962 owing to the high prices quoted by the air survey companies.[26] Consequently, details on the 1960 and 1961 photography only are provided here.

The blocks of photography in 1960–1 occur mainly in the northern, eastern and south-western border regions, but do include some areas in the central parts of the country (Fig. 6). Some 24 700 square miles were covered in these surveys.[27] As in previous years most of the photography was intended for topographical mapping. However, 1:20 000 photography in 1960 (Table IV)

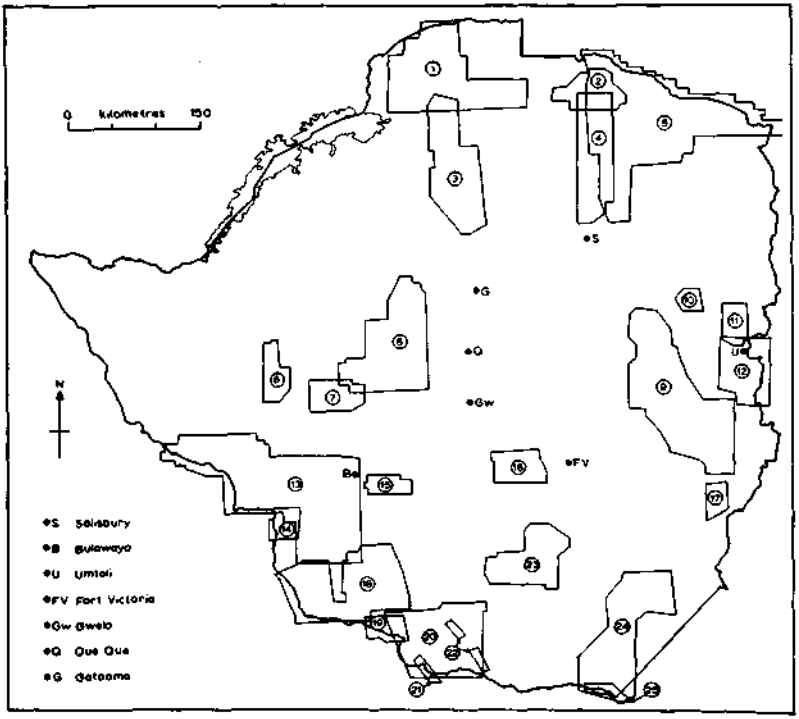
[24] Southern Rhodesia, *Report of the Secretary for Native Affairs, Chief Native Commissioner and Director of Native Development for the Year 1955* (Sess. Pap. C.S.R. 12, 1956), 15.

[25] Southern Rhodesia, *Report of the Secretary for Native Affairs and Chief Native Commissioner for the Year 1959* (Sess. Pap. C.S.R. 18, 1960), 22.

[26] Southern Rhodesia, *Report of the Surveyor-General for the Year Ended 31st December 1962* (C.S.R. 12, 1963).

[27] Federation of Rhodesia and Nyasaland, *Report of the Director, Federal Department of Trigonometrical and Topographical Surveys for the Year Ended 31st December 1960* (C. Fed. 170); Federation of Rhodesia and Nyasaland, *Report of the Director, Federal Department of Trigonometrical and Topographical Surveys for the Year Ended 31st December 1961* (C. Fed. 206).

Figure 6: AERIAL PHOTOGRAPHY 1960–1962



covers areas of Reserves for the Department of Native Affairs. In addition, 1:10 000 coverage of the Shashi, Umzingwane and Limpopo Rivers (Blocks 21, 22 and 25 in Fig. 6) appears to have been commissioned for definition of boundaries along selected stretches of these rivers.

With reference to the pre-1963 photography as a whole, the Surveyor-General's records indicate that there is additional aerial photography excluded from the indexes presented here. This includes large-scale photography, generally at 1:10 000 or 1:12 500, of the major urban centres and some of the smaller ones dating from 1948 (Table VII). Salisbury, for example, was flown in whole or part at least six times since 1949 whilst Bulawayo has been covered at least five times. This photography was carried out for large-scale mapping in the 1:5 000 map series, for example, as well as to assist in planning of urban development by municipal authorities. In addition, there are records of 32 blocks of more general

Table VII

PHOTOGRAPHY OF URBAN CENTRES PRIOR TO 1963

Date	*Centre*	*Scale*
1948	Bindura	1:10 000
	Glendale	1:10 000
1949	Que Que	1:10 000 and 1:24 000
	Bulawayo	1:10 000
	Salisbury	1:10 000
1950	Bulawayo	1:10 000
	Salisbury	1:12 000
1951	Salisbury	1:12 000
	Que Que	1:12 000
1952	Gwelo	1:12 000
	Penhalonga	1:12 000
1953	Umtali	1:12 000
1954	Marandellas?	1:25 000
	Inyanga	1:12 000 and 1:25 000
	Gwelo	1:12 000 and 1:24 000
1955	Sinoia	1:14 000 and 1:28 000
	Bulawayo	1:12 500 and 1:10 000
	Salisbury	1:10 000
1959	Salisbury	1:25 000 and 1:10 000
	Selukwe	1:10 000
	Gwelo	1:10 000
	Rusape	1:15 000 and 1:25 000
	Shabani	1:15 000 and 1:25 000
	Penhalonga	1:15 000 and 1:25 000
	Umtali	1:15 000 and 1:25 000
1960	Gwelo?	1:25 000
	Salisbury?	1:25 000
	Gatooma?	1:25 000
	Kariba	1:10 000
	Beitbridge	1:10 000
	Mashaba	1:10 000
	Gwanda	1:10 000
	Plumtree	1:10 000
	Dett	1:10 000
	Victoria Falls	1:10 000
1961	Gwelo	1:10 000
	Bulawayo	1:15 000
	Kariba?	1:25 000
1962	Chipinga?	1:25 000
	Umtali	1:25 000
	Bulawayo?	1:25 000

? = Photography may cover urban area or general area near urban centre.
Source: Compiled from index held by Chief Topographer in the Department of the Surveyor-General.

photography at scales varying from 1:10 000 to 1:50 000 scattered throughout the country (Table VIII). Some of this coverage was commissioned to assist in agricultural development, notably irrigation schemes in cases such as the Sabi River East Bank Pilot Scheme (1950) and Nyamaropa (1952), but little information is available on the precise locations and purpose of this photography.

Table VIII

GENERAL PHOTOGRAPHY PRIOR TO 1963

Date	*Area*	*Scale*
1948	Melsetter	1:20 000
1949	Fort Victoria	1:20 000
	Sebakwe River	1:10 000
1950	Sabi River	1:12 000
	Sabi River East Bank Pilot Scheme	1:12 000
	Wankie	1:20 000
	Norton	1:20 000
	Hartley	1:42 000
1951	Sabi Native Division	1:32 000
	Triangle	1:32 000
	Gatooma	1:32 000
	Lundi	1:32 000
	Stapleford	1:24 000
	Cashel	1:24 000
	Tarka Martin and Border Farms	1:32 000
1952	Gwaai	1:20 000
	Hunyani	1:40 000
	Odzi	1:12 000
	Gatooma	1:32 000
	Nyamaropa	1:24 000
1953*	Buhera*	1:20 000
	Gwelo*	1:20 000
1958	Salisbury	1:50 000
1959	Arcturus	1:40 000
	Matopos	1:20 000
1960	Tuli	1:12 000
	Umvuma	1:40 000
	Karoi	1:40 000
1961	Kariba	1:25 000
	Binga	1:25 000
	Lundi	1:40 000

* Possibly part of photography initiated to cover the Reserves in these areas.

Source: Compiled from index held by Chief Topographer, Department of the Surveyor-General.

AERIAL PHOTOGRAPHY SINCE 1963

The year 1963 was a turning point as far as aerial surveys were concerned since it saw the initiation of what is known locally as 'blanket photography'. In the 1963 report of the Surveyor-General it is noted that previously

> aerial photography, mainly for interpretation purposes, has been undertaken for a number of [government] departments, and this has proved to be expensive owing to the scattered nature of the areas to be photographed and the irregular shape of the areas. This year it was decided to embark on a plan of covering the whole of Southern Rhodesia with 1:25 000 scale of photography within five years.[28]

The rationale behind this was to avoid duplication of photography, facilitate more economical flying in large rectangular blocks and to enable user departments to make plans around the pre-arranged 'blanket programme'. The 1:25 000 scale chosen for this photography appears to have been a compromise between basic economics and user requirements. For example, the 1:40 000 photography done by the Department of Federal Surveys was regarded as too small a scale by most users, yet the costs of blanket coverage at 1:20 000 would have been excessive.

In practice, six series of blanket photography have been carried out in this country since 1963, the general details being as follows:

First series:	1963–1968
Second series:	1969–1970
Third series:	1971–1975
Fourth series:	1976–1980
Fifth series:	1981–1983
Sixth series:	1984–1986

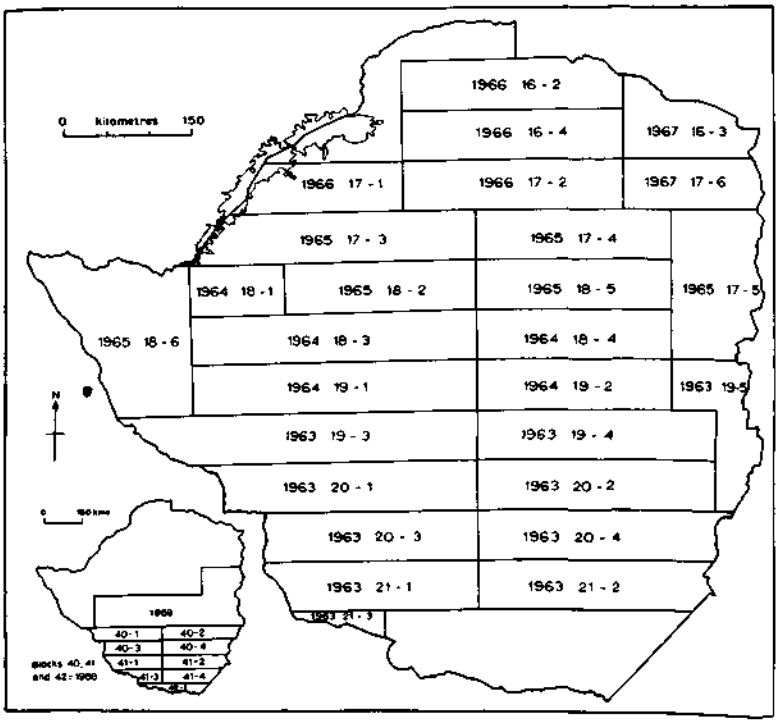
The second series was planned originally to cover the entire country between 1969 and 1973, but difficulties arose during 1970 that resulted in the termination of this programme. During the fourth series a decision was taken, after consultation with major users of photography, to reduce the extent of coverage such that the country would be completely covered in a ten-year cycle rather than a five-year cycle.[29] Prior to the start of the fifth series the contract period of blanket photography was reduced from five to three years at the request of the survey companies faced with unpredictable and escalating operating costs.

The dates and locations of the blocks of blanket photography are shown in

[28] 'Report of the Surveyor-General for the Year Ended 31st December 1963', in Southern Rhodesia, *Annual Report of the Secretary for Lands and Natural Resources 1963* (C.S.R. 12, 1964), 2.

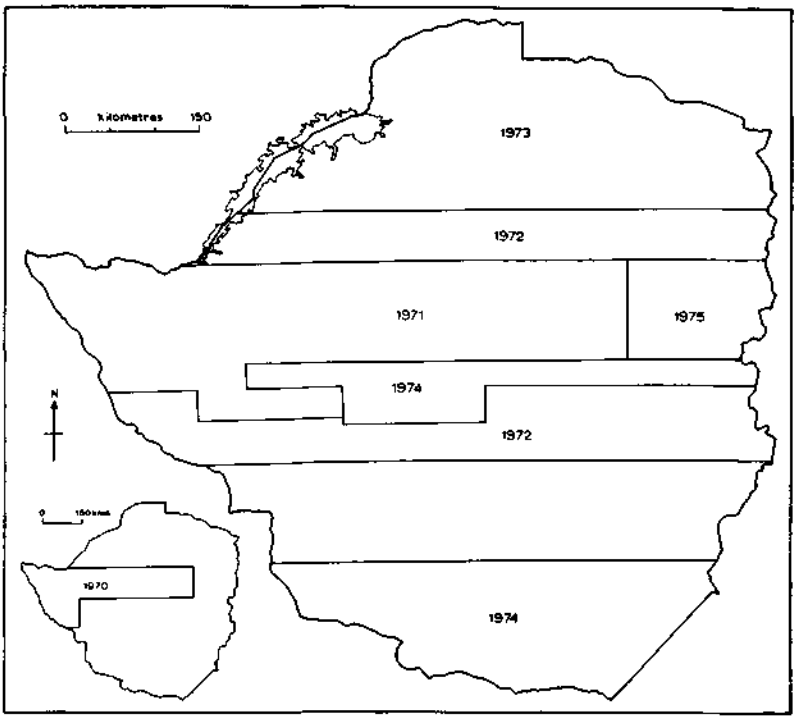
[29] Chief Topographer, personal communication.

Figure 7: BLANKET AERIAL PHOTOGRAPHY 1963–1969



Figures 7 to 10 covering the periods 1963–9, 1970–4, 1975–9 and 1980–6. This photography is somewhat easier to use than that done prior to 1963 for several reasons. Firstly, there are proper flight diagrams plotted on to 1:250 000 overlays attached to the appropriate topographical map of the same scale; this makes it possible to locate photography for areas of interest relatively easily. Secondly, with the exception of some of the first series, the photographic prints are available for examination in the Air Photo Sales section in the Surveyor-General's Department in Harare; this obviates the time-consuming, bureaucratic procedures involved in the examination of prints of the pre-1963 photography housed in the National Archives. Thirdly, with the exception of the 1963–5 photography, the film negatives are kept by the Surveyor-General's Department, thus reducing the time required to organize prints for users; in contrast, there are sometimes long delays involved in getting prints for the pre-1963 photography, assuming that one can locate the film negatives and that these are in a usable state.

Figure 8: BLANKET AERIAL PHOTOGRAPHY 1970–1974

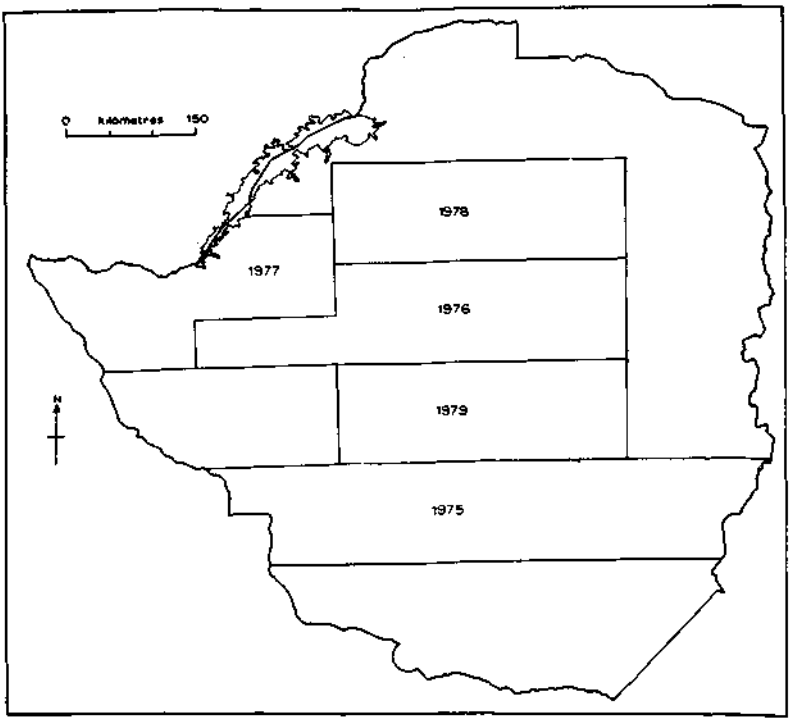


The blanket aerial photography has been used extensively in the compilation and updating of topographical maps, especially the 1:50 000 series. In addition, it has been employed in the fields of agriculture, forestry, wildlife management, rural and urban planning, as well as in a variety of road and civil engineering projects.[30] The Surveyor-General in 1968, for example, noted that the blanket photography had been of assistance in many fields of development and was 'the envy of many other countries'.[31] Some indication of the economic significance of the first series of blanket photography can be gauged from sales of aerial photography during the 1963–8 period (Table IX). Over 275 000 contact prints were sold during this period, sufficient to cover the country five times over! In

[30] See, for example, A. Holden, 'Development in the use of aerial photography in the Ministry of Roads and Road Traffic in Rhodesia', *The Rhodesian Engineer* (1971), IX, 943–8; J. C. M. Molyn, 'Airphoto interpretation in civil engineering', *Rhodesia Science News* (1973), VII, 66–7.

[31] 'Report of the Surveyor-General for the Year Ended 31st December 1968', in Rhodesia, *Report of the Secretary for Lands for 1968* (C.S.R. 20, 1969), Appendix B, 2.

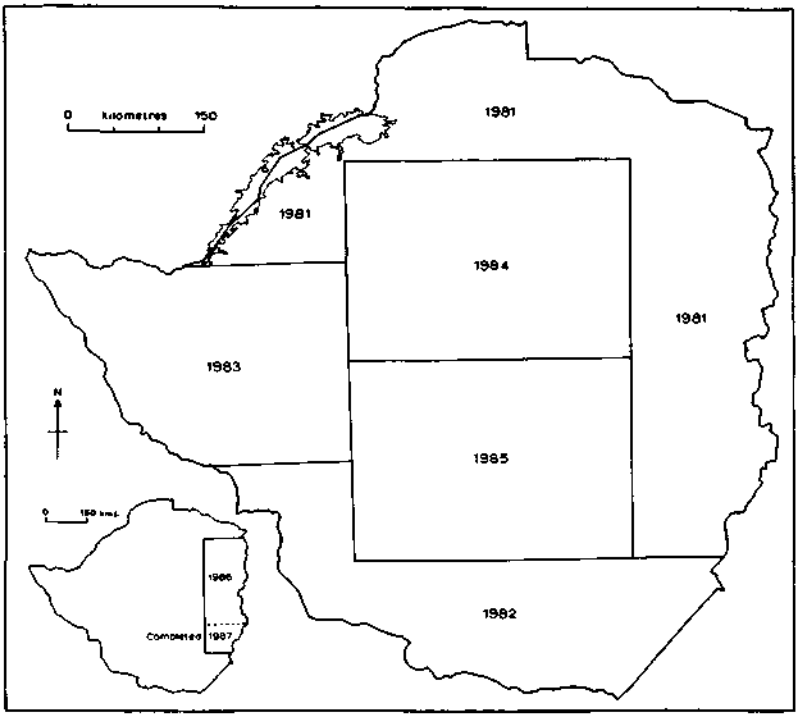
Figure 9: BLANKET AERIAL PHOTOGRAPHY 1975–1979



addition, a substantial number of enlarged photographs and diapositives were supplied. Peak sales of contact prints were reached in 1969 when 64 429 photographs were supplied to government departments and the public. Since then sales have declined and, in recent years, between 30 000 to 35 000 contact prints and enlargements are done annually.

All the blanket photography is in panchromatic form, more commonly known as 'black and white' photos. The question arises, therefore, as to the possibilities of using colour rather than panchromatic film in the blanket programme. In fact, towards the end of the first blanket series and following consultation with Conex, Geological Survey and the Roads Department, the Surveyor-General's Department commissioned two blocks of colour photography to be flown in 1969. One area, the Eldorado block, was 'covered by four runs of photographs at a scale of 1:25 000, [was] approximately 160 km in length and [extended] from the Urungwe Reserve in the west to a line north of Glendale

Figure 10: BLANKET AERIAL PHOTOGRAPHY 1980–1986



in the east'.[32] The other area, the Diti block, was located to the north of Beitbridge and was flown at a scale of 1:12 500. Both areas were approximately 3 550 square kilometres in extent. The utility of this colour photography was debated in a symposium in 1970, and the opinions of users varied from a highly favourable response through to generally unenthusiastic, depending on the specific features of interest and how easily such features could be identified on colour as opposed to panchromatic prints.[33] In practice, the major argument against colour photography is cost! With current prices of materials, assuming these can be imported, colour photography is in the order of fifteen times the price of the more conventional panchromatic photography.

One further project that is worth noting in relation to the blanket series is the

[32] J. G. Stagman and I. M. Kirkpatrick, 'The use of aerial colour photography in regional geological mapping', *Rhodesia Science News* (1971), V, 247–8.

[33] *Rhodesia Science News* (1971), V, viii.

Table IX

SALES OF AERIAL PHOTOGRAPHY 1963–1968

Year	*Contact prints*	*Enlargements*	*Diapositives**
1963	33 075	1 085	717
1964	69 185	803	147
1965	51 397	1 986	608
1966	27 830	1 904	703
1967	34 697	1 615	766
1968	58 965	3 239	570
Totals	275 149	10 632	3 511

* Used for detailed surveying.

Sources: Annual reports of the Surveyor-General.

Canadian-assisted Zimbabwe Aerial Survey Project. The aim of this project is to produce 1:25 000 ortho-photo maps of the country, these being in the form of rectified photomosaics with a 10 m contour interval and basic cadastral details. Photography for the production of these ortho-photo maps was carried out in 1982 with areas to the east of the Bulawayo–Harare axis being flown at 1:65 000 scale and areas to the west of the axis being flown at 1:80 000. Long delays have been experienced in making this photography readily available to users in Zimbabwe and, to date, only a limited portion of the country in the northern and eastern districts has been completed in the ortho-photo series. Since 1982, the 1:25 000 blanket photography has covered over 65 per cent of the country and, being more recent and readily available, has been of greater interest and value to users than the photography carried out in the Zimbabwe Aerial Survey Project.

CONCLUSION

Zimbabwe is fortunate in having extensive large-scale aerial photography dating back to the mid-1930s in some parts of the country. It is impossible to quantify the contribution of this photography to the economic development of the country, partly because of the wide range of applications of aerial photography. The high standards and good coverage of topographical maps produced by the Surveyor-General's Department are one major benefit of aerial photography. Similarly, agricultural development and conservation extension have been assisted considerably, in both the commercial and peasant farming sectors, by the application of aerial photography. Other important uses of photography include road route planning and location of road-building materials,

identification and development of dam sites and in urban planning. There are, therefore, strong arguments to maintain the blanket photography programme as an important component in economic planning and development in Zimbabwe.

As noted in the introduction, the primary aim of this review of aerial photo coverage in Zimbabwe was to inform present and potential users about the nature of aerial photography. It is hoped that the information contained in this review will stimulate greater use of aerial photography in pure and applied research, as well as being of interest to those who already make use of aerial surveys in their various professions.

Acknowledgements

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I would appreciate comments on the usefulness of this review, especially from those who have made little use of aerial photography in the past owing to lack of information on the nature and availability of this material.