NOTES

HIGH-ALTITUDE PHOTOGRAPHY FOR CONTROL OF AERIAL SEEDING OPERATIONS

A. I. PAGE*

This note describes a development of the aerial-photo mosaic technique for planning and control of air-seeding operations at Kaingaroa State Forest, described earlier (Page, 1969). The technique was basically a flying aid consisting of recent aerial-photo mosaics of cut-over areas to be flown, with the boundaries of the areas to be sown and flight lines marked on the photos. This method of control considerably aided the accuracy of flying, as well as having other advantages (which were listed in the earlier article). There were, however, some disadvantages.

(1) Flying at low altitudes necessitated taking a large number of photographs to cover any one compartment. Using a hand-held camera in a light aircraft without any specialized equipment, it was difficult to obtain the correct amount of overlap between adjacent photographs and adjacent flight lines. Complete photo coverage means taka greater number of photographs than necessary, which increases costs and the amount of work involved in subsequent sorting and mosaic compilation. Having too few photographs increases the possibility of incomplete coverage.

(2) Flying at a constant height, and photographing areas of differing altitudes, yielded photographs of different scales. This complicates the work of accurately marking on flight lines and measuring areas to be sown.

It was decided to investigate the possibilities of an alternative high-altitude, one-shot technique — *i.e.*, photographing each cut-over area from a sufficient altitude to include its total area, plus some surrounding country, within one print. This would considerably decrease the work involved in subsequent processing of the prints in that no compilation of mosaics would be required and, if the scale of the photographs could be kept the same, it would simplify the estimation of areas and marking of flight lines on the photographs.

The following formula was used to compile the table below:

$$f/H = l/L$$

f = focal length of camera lens.
l = length of one side of negative
L = length of one side of area to be phtographed
H = height of camera above ground

All the above to be in the same unit of measurement.

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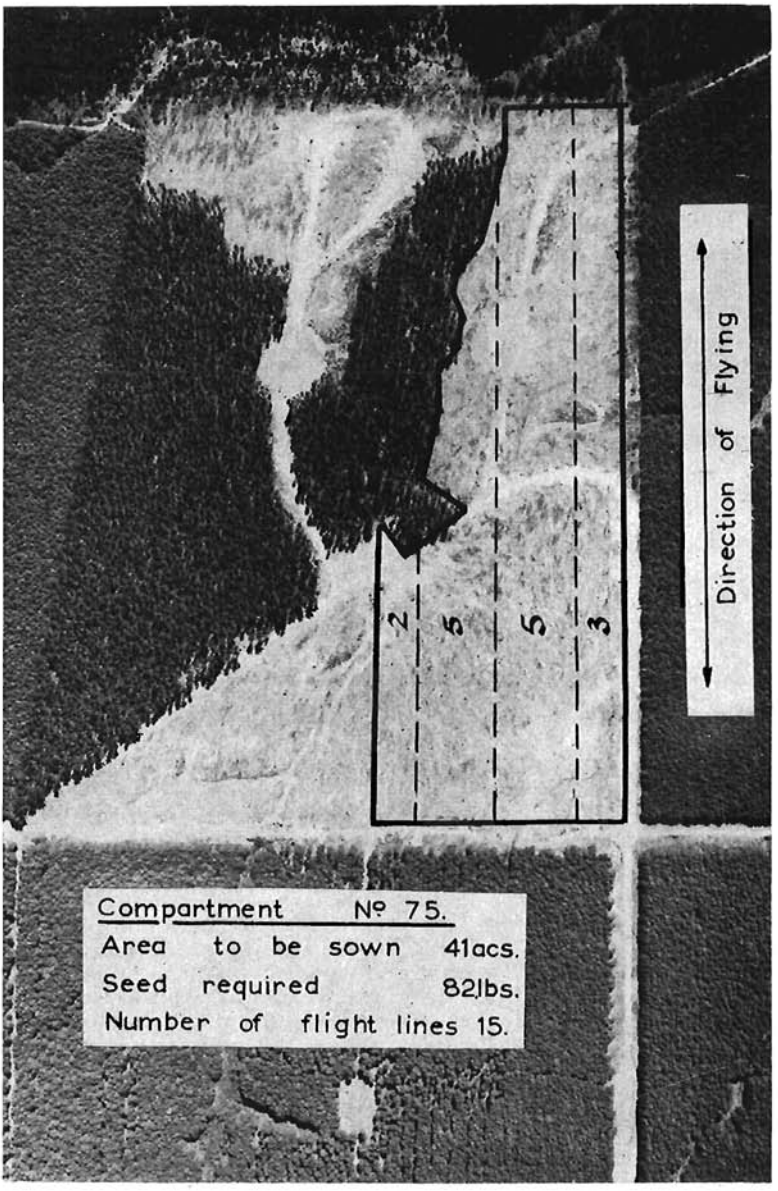
2
5
5
3
Direction of Flying
Compartment Nº 75.
Area to be sown 41acs.
Seed required 82lbs.
Number of flight lines 15.

FIG. 1.

TABLE OF FLYING HEIGHTS, ETC. FOR HASSALBLAD CAMERA WITH 3.15 IN. (80 MM) FOCAL LENGTH LENS

Dimension of area to photograph (chains)	*Height above ground of camera (ft)*	*Scale of 2.2 in. × 2.2 in. format (ch./in.)*	*Size of enlargement (in.) to give scale of:* 5 ch./in.	10 ch./in.	20 ch./in.
40 × 40	3,780	18.2	8 × 8	4 × 4	—
50 × 50	4,725	22.7	10 × 10	5 × 5	2½ × 2½
60 × 60	5,670	27.3	12 × 12	6 × 6	3 × 3
70 × 70	6,620	31.8	14 × 14	7 × 7	3½ × 3½
80 × 80	7,560	36.4	16 × 16	8 × 8	4 × 4
90 × 90	8,505	40.9	—	9 × 9	4½ × 4½
100 × 100	9,450	45.5	—	10 × 10	5 × 5
110 × 110	10,400	50.0	—	11 × 11	5½ × 5½
120 × 120	11,340	54.5	—	12 × 12	6 × 6
130 × 130	12,290	59.1	—	13 × 13	6½ × 6½
140 × 140	13,230	63.6	—	14-× 14	7 × 7
150 × 150	14,175	68.2	—	15 × 15	7½ × 7½

The table indicates the height *above ground* from which a photograph must be taken to cover areas of the sizes shown in the first column. It also gives enlargement sizes, in inches, to obtain scales of 5, 10, and 20 chains to the inch.

It was found that most Kaingaroa cut-over areas to be sown could easily fit into an area of 80 chains by 80 chains. Ten chains to the inch was considered the most suitable scale, thus 8 in. × 8 in. enlargements would be required, a convenient size for the pilot to use.

Before flying, the average altitude of each compartment is obtained from topographic maps. This is then added to the hight above ground (obtained from table) to give height a.s.l. from which each area must be photographed. The only problem encountered in the actual photographing operation was indicating to the photographer which areas were to be photographed. This is a small problem which can be overcome by laying out large crosses of survey cloth in each area to be photographed before flying. The resulting 10-chains-to-the-inch print is marked with:

(i) Boundaries of the area to be sown.

(ii) Seeding rate and amount of seed required.

(iii) Every fifth flight line plus total number of flight lines.

Figure 1 is an example of the markings .

Total cost of this photographic coverage in a 2,000-acre sowing programme involving 15 separate areas is estimated at approximately $0.02 an acre in a total operational cost of approximately $7.00 an acre.

REFERENCE

Page, A. I., 1969. The use of large-scale aerial photo mosaics for planning and control of aerial seeding. *N.Z. J. For., 14* (1): 96-7.