From Bunger Hills Report
Edgeworth David Base Jan - Mar 1986
Rod Ledingham and Bob Tingey

4. SURVEYING AND MAPPING PROGRAM

BUNGER HILLS 1985/86 SUMMER SEASON

Report
by
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1. AIM

The aim of the surveying and mapping program undertaken by the Division of National Mapping in the Bunger Hills during the 1986 summer field season was three-fold, namely:

1. Aerial Photography

In direct support of the geological program, to provide air-photo coverage of the following areas:

- The Bunger Hills and all adjacent ice-free islands in the Highjump Archipelago.
- The Obruchev Hills
- Possession Rocks
- The ice-free areas of rock adjacent to Cape Jones and Cape Harrison.
- All ice-free areas of rock bounded in the north by latitude 66 degrees, 20 minutes South, in the east by the western side of the Denman Glacier, in the south by latitude 66 degrees 40 minutes South, and in the west by longitude 97 degrees 30 minutes East.

- All ice-free areas of rock bounded by latitudes 67 and 68 degrees South and longitudes 98 and 101 degrees East.

A vital aspect of this particular aim was that both black and white and colour air-photo coverage were required for the subject areas. Selected areas of the black and white coverage were to be processed immediately after exposure to enable "on-the-spot" production of black and white paper print enlargements for field use by summer party geologists. The colour coverage was to be processed and printed upon return to Australia.

2 Landsat Imagery Rectification

By means of Doppler satellite or other techniques, co-ordinate a sufficient number of points of ground detail which were positively and unambiguously identifiable on relevant Landsat imagery in order to enable accurate rectification of that imagery.

3 Glaciology

If time and other factors permitted, mark and co-ordinate the ice-movement monitoring stations as priority-listed in the brief prepared by Mr N Young, Glaciology Section, dated 2 January 1986 (copy submitted to ANARE Co-ordinator through ADSCI)

2. PERSONNEL

The following officers from the Survey Operations Branch of the Division of National Mapping, Canberra, participated:

Mr Brian Murphy, Surveyor Clas 2
Mr John Corcoran, Surveyor Class 1
Mr Tiernan McNamara, Technical Assistant (Surveying) Grade 2

3. ACHIEVEMENT OF AIMS

1. Aerial Photography

The primary aim of the National Mapping program, namely the air-photo coverage, was more or less completely achieved. Simultaneous black and white and colour photography was exposed over all planned areas using two Hasselblad Model EL 500 (70 mm format) cameras tandem - mounted in the camera port of a Bell 206 Jetranger helicopter, registration VH-PMR, on charter to Antarctic Division from Vowell Air Services Pty Ltd., Victoria, and piloted by Mr D. Crossan. Both camera shutters were synchronised through a Hasselblad command unit specially acquired for the project, this unit being in turn connected to a Hasselblad intervalometer. Camera system power was drawn from the aircraft power supply, which is 24 VDC, through a 6VDC converter built by National Mapping electronics technicians. Use of the aircraft power supply was intended to obviate difficulties experienced in the past when operating Hasselblad cameras at very low temperatures with the standard nickel-cadmium battery power supply.

Both cameras were fitted with 50 mm focal length lens cones. These were chosen in preference to the alternative 40 mm cones in order to minimise relief displacement - a critical factor in terms of the possible use of the photography for the preparation of unrectified photomaps, or uncontrolled mosaics. Except in the latter area defined above, all photography was exposed at a mean sea level flying height of 3050 metres, or 10,000 feet, giving a natural photo scale of approximately 1:60,000. The latter area of photography already referred to was exposed at a flying height of 3,650 metres, or 12,000 feet, as in this area the average terrain elevation and relief range were considerably greater than in any of the other areas.

The tandem camera mount constructed by Vowells did not include any drift compensation facility. To include a drift sight and drift angle offset facility would have required a non-standard modification to the aircraft which, even if this had been structurally possible, would have required special Department of Aviation approval - a very time-consuming process.

Consequently, when flight line directions were planned some weight was given to the fact that upper level winds in Antarctica generally tend to be fairly light so that, for the purposes for which the photography was intended, flight line orientation was not critical and small drift angles could therefore be tolerated. Accordingly, in order to facilitate navigation and to minimise the amount of manoeuvering, flight lines were oriented to take advantage of the longest possible runs over ice-free areas of rock. Long runs over large areas of ice were avoided wherever possible as it is almost impossible to visually navigate an aircraft over these areas due to the almost total lack of ground detail. For the main areas of the Bunger Hills, Obruchev Hills and Highjump Archipelago, flight line planning and navigation were undertaken using the Soviet Antarctic Expedition (SAE) 1:100 000 map series. For the northern-most areas of the Highjump Archipelago, and for the ice-free areas of rock west of the Denman Glacier, it was necessary to use the SAE 1:200 000 map series. For the ice-free areas of rock south of Cape Jones, the 1:1M base compilation series map SQ47-48 was used in conjunction with Landsat imagery.

All photography was flown with a planned 70% forward overlap and 30% sidelap. Forward overlap was controlled by intervalometer settings related to the indicated air speed and the planned flight height. Indicated air speed was normally maintained at about 85 knots.

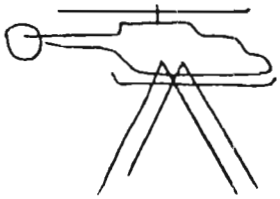
Apart from the pilot, the aircraft was crewed by a camera operator and a navigator. The camera operator sat in the rear seat on the starboard side where he monitored all camera functions, changed magazines as and when required and maintained the photographic log. The navigator sat alongside the pilot and visually navigated the aircraft along the planned flight lines.

Overall, the camera system worked extremely well except for occasional annoying multiple exposures, possibly triggered by a small electrical fault in the command unit/intervalometer interface.

"On-the-spot" processing of the black and white photography subsequently revealed a lack of sidelap in some areas. This problem was definitely due to the uncertainty inherent in visually estimating the aircraft's track over the ground from a height of 10 000 feet without the aid of a drift sight. At times, visual estimation of the ground track was made all the more difficult by aircraft attitude due to cross-wind component. Intermediate lines were subsequently flown in all areas where sidelap was lacking. Due to minor magazine film feed problems, short segments of one or two of the initial runs were also re-flown at this time.

AERIAL PHOTOGRAPHY PROCEDURE

BUNGER HILLS 1985-86



Expose film

Load magazine with feed and take-up cassettes.

CAS 8927

Label colour or B&W magazine with film number.

CAS 8927

Label colour or B&W take-up cassette with film number. Tape film leader to take-up spool and load into take-up cassette.

Cross film number off master list.

Fix film number to film leader, permanently.

Load film into feed cassette of correct code.

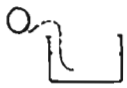
Unload cannister and cut film into 4.7 m lengths. Pack in bags.

START

Return empty feed cassettes.

Process film from take-up cassettes if required.

Load film into cannister for RTA.



Add film number to list on cannister.

Remove film number label from magazine and return magazine.

Remove film number label from take-up cassette and return take-up cassette.

Requires darkroom

The film types used were Kodak Tri-X (black and white) and Kodak Ektachrome 200. A total of 26 rolls of the former and 30 rolls of the latter were exposed. All rolls are 4.7 metres long, nominally containing 70 frames. The following film numbers were allocated:

Tri-X	Ektachrome 200
CAS 9502-9519 inclined.	CAS C 8911-8931 inclined.
CAS 9536-9543 inclined.	CAS C 8933-8935 inclined.
	CAS C 8953
	CAS C 8957
	CAS C 8960-8963 inclined.

These film numbers have been allotted by the Division of National Mapping for future reference purposes. However, as the cost of purchase and initial processing of the film is being borne equally between Antarctic Division and National Mapping, it has yet to be decided which authority will eventually archive the film. Apart from a possible requirement to produce uncontrolled mosaics, it is not foreseen that National Mapping will have any further use for this film.

A flow diagram showing how each film was handled and documented in the field, once it had been removed from the bulk film roll, is attached.

All 56 rolls of exposed film were handed to Mr R Butler of the Antarctic Division before the summer party departed from the Bunger Hills. Antarctic Division has made special arrangements to have all of the film processed, or re-processed, upon return to Australia.

Two sets of (4 times enlargement) paper prints from both the colour and black and white negatives have been requested. One set is to be retained by Antarctic Division whilst the other set, together with all negatives, will be required by National Mapping for title strip addition, preparation of flight line diagrams and assessment for possible production of uncontrolled mosaics.

2. Landsat Imagery Rectification

During the field season, a total of eleven control stations were permanently marked and observed for the purpose of controlling the rectification of Landsat imagery covering the general area of the Bunger Hills.

All eleven stations were fixed by the translocation technique from NMS 238 Edgeworth David, where a Magnavox MX 1502 Geoceiver was used. A JMR 1-A satellite receiver, on loan from Glaciology Section, was used for the observations required at each of the remote stations.

The general areas in which the remote station fixes were required had been determined beforehand. Selection of the final ground detail point for marking and observation was achieved by taking the Landsat scene into the field by helicopter and selecting an appropriate ground detail feature which was positively and unambiguously identifiable on the imagery e.g., small isolated island or rock outcrop.

Each of the control stations was marked with an aluminium plate approximately 75mm long and 25mm wide stamped with the station number and set in a small mound of quick-drying cement. All stations were marked on rock and surmounted by a small rock cairn about 0.5 metre high. In most cases, a sketch plan of the station site showing magnetic bearings and sometimes estimated distances to adjacent landmarks was prepared.

All eleven control stations were panelled and spot photographed from altitudes of 750, 1500 and 3000 feet above the station mark. This photography was undertaken using Kodak Ektachrome 200 film in one of the tandem-mounted Hasselblad cameras intended for the high level photography.

Details of the stations fixed are as follows:

Station Number	Approx. Latitude	Approx. Longitude
NMS 239	66°20' South	100°56' East
" 240	66°19' "	100°31' "
" 244	66°01' "	100°48' "
" 245	66°11' "	101°05' "
" 246	66°30' "	99°57' "
" 248	65°47' "	101°48' "
" 249	65°57' "	101°33' "
" 276	66°25' "	99°56' "
" 279	65°55' "	99°31' "
" 281	65°58' "	101°09' "
" 282	66°39' "	99°24' "

During the period in which the above fixes were undertaken, a considerable number of precise ephemeris passes were observed and recorded at NMS 238 Edgeworth David. Precise ephemerides for the relevant satellites have already been requested from the U.S.A. Upon return to Canberra, and upon receipt of the ephemerides, the precise ephemeris latitude, longitude and spheroidal height values (in terms of the NSWC 9Z-2 reference system) will be computed for NMS 238 Edgeworth David and subsequently transformed to World Geodetic System 1972 (WGS 72) values. The WGS 72 latitude, longitude and approximate mean sea level height of NMS 238 will then be used to compute, using the translocation technique, the final WGS 72 latitude, longitude and approximate mean sea level height of each of the eleven remote stations listed above. The WGS 72 latitudes and longitudes of these stations will then be used in the Landsat imagery rectification process in such a way that when a WGS 72 graticule is superimposed upon the relevant (Landsat) scenes, the true WGS co-ordinates for any feature appearing on these scenes can then be accurately scaled off without measurable error.

During the observations at NMS 238 Edgeworth David, several connections were made to nearby sea level in order to determine the approximate mean sea level elevation of NMS 238. These connections will be analysed to see how closely the elevation so determined compares with the value computed from the predictions derived from the harmonic constants published for Mirny (and possibly Casey). Indirect checks on the determination of the approximate mean sea level elevation for NMS 238 were also obtained as follows:

- Translocation between NMS 238 and NMS 237 Dobrowolski Astro site which is shown on the Russian and Polish maps to have a mean sea level elevation of 35.26 metres. (This translocation has yet to be computed).

- A trigonometrical heighting traverse, using Wild T2 theodolites and Siemens Albis MD-60 EDM equipment, from NMS 237 Dobrowolski Astro through NMS 241 and NMS 242 to NMS 238.

Although the trigonometrical heighting traverse has yet to be rigorously computed, preliminary computations show that if the Russian/Polish value for the mean sea level elevation of NMS 237 Dobrowolski Astro is adopted and carried through the traverse, then there is less than 0.3 metre discrepancy between our provisionally adopted value for NMS 238 and that derived from NMS 237.

3. Glaciology

Due primarily to the high priority given to the aerial photography requirement and also to the provision of Landsat imagery rectification control, it was not possible to undertake any of the glaciological tasks as outlined in the brief prepared by Mr N Young of Glaciology Section.

However, it was possible to fix a number of control points, which should be of considerable value during the 1986/87 glaciological season, in the following locations:

Station Number	Approx. Latitude	Approx. Longitude
NMS 243	66°18' South	100°29' East
" 247	66°11' "	100°16' "
" 250	66°34' "	99°47' "
" 277	66°25' "	98°57' "
" 280	66°04' "	100°16' "

Control stations NMS 243, 247, 277 and 280 were fixed by Wild T2 theodolite and Siemens Albis MD60 EDM traverse, whilst NMS 250 was fixed by translocation. All of these stations command extensive views of the lower reaches of the Denman and Scott Glaciers. Control stations NMS 250 and 277 were positioned in the approximate locations indicated in Mr N Young's brief where it is proposed to establish DME transponder sites for the purposes of the 1986/87 glaciological work.

The following control stations, fixed during the provision of Landsat imagery rectification control, may also be of value as possible DME transponder sites during the 1986/87 glaciological surveys:

Station Number	Approx. Latitude	Approx. Longitude
NMS 241	66°17' South	100°41' East
" 242	66°15' "	100°37' "
" 248	65°47' "	101°48' "
" 249	65°57' "	101°33' "
" 276	66°25' "	98°56' "
" 279	65°55' "	99°31' "
" 281	65°58' "	101°09' "