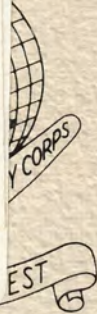


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ROYAL AUSTRALIAN SURVEY CORPS

OPERATION ALGUM 86

VANUATU

PROJECT REPORT



4 FIELD SURVEY SQUADRON

88

4FD3

ROYAL AUSTRALIAN SURVEY CORPS

OPERATION ALGUM 86

VANUATU

PROJECT REPORT

4 FIELD SURVEY SQUADRON

4FD3

ii

ROYAL AUSTRALIAN SURVEY CORPS

4 FIELD SURVEY SQUADRON

OPERATION ALGUM 86

AMENDMENTS

Amendment No	Date of Issue	Details	Signature/Date
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<u>Distribution:</u>		COPY NO
(DGOP-A) Dept of Defence (Army Office)	(5)	01-05
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OPERATION ALGUM 86

PROJECT REPORT

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Operational Support	2	7
Operations	4	19
Administration and Logistics	4	20

OPERATION ALGUM 86
PROJECT REPORT

- References:
- A. Headquarters Field Force Command Mounting Instruction 6/86 dated 18 Jun 86
 - B. 4 MD Operation Order 4/86 dated 19 Jun 86
 - C. Dept of Defence SVY 105438 dated 23 Jun 86

INTRODUCTION

General

1. Vanuatu is a recently independent nation of the South West Pacific. It's government requested Australian assistance to acquire aerial photography and establish survey control to enable the determination of its Exclusive Economic Zone (EEZ). The request was accepted as a Defence Co-operation Programme (DCP) project.

2. The project has been conducted over three years. Op ALGUM 84 was conducted during the period 30 Jun 84 to 22 Sep 84. Op ALGUM 85 was conducted during the period 15 Jun 85 to 29 Sep 86. This report covers the third year of the project and was conducted during the period 22 Jun 86 to 14 Nov 86.

Area of Operations

3. The Republic of Vanuatu lies between latitude 13°S and 20°30'S and longitude 166°E and 170°30'E. A map of the AO is shown at Annex A.

Allocated Tasks

4. The following tasks were allocated for completion:
- a. provide technical advice and assist the Vanuatu Survey Dept to obtain survey control by Doppler satellite techniques and conventional survey to determine maritime base point co-ordinates by occupation or photogrammetric surveys.
 - b. provide technical advice and assist the Vanuatu Survey Dept to obtain survey control by recovery of existing suitable stations, Doppler satellite techniques, and conventional survey, to permit aerotriangulation of the proposed 1:80,000 (nominal) scale photography.
 - c. provide technical advice and assist the Vanuatu Survey Dept to obtain survey control by Doppler satellite techniques at existing stations to enable a survey adjustment of existing UK DOS and French IGN observations to produce a high quality homogeneous network.
 - d. provide technical advice and assist the Vanuatu Survey Dept to prepare observation and station records of all stations visited and established.
 - e. provide technical training to Vanuatu in accordance with the Memorandum of Understanding (MOU).

- f. assist the Vanuatu Survey Dept to connect Doppler Satellite Stations to sea level where practicable.
- g. obtain available tide gauge data (observed and reduced) for stations in the AO for the period of Doppler observations and sea level connections.
- h. obtain from Vanuatu Survey Dept, survey intelligence from UK DOS and French IGN surveys which has not previously been obtained, and which will enhance the network adjustment.
- i. obtain identification photography of stations listed in paragraphs 4a, 4b and 4c.
- j. obtain mapping quality photography at a nominal scale of 1:30,000 for all areas of Vanuatu.
- k. obtain large scale aerial photography as requested by the Government of Vanuatu and approved by Australia.

Background

5. A recon for OP ALGUM 86 was conducted during the period 17 Sep 85 to 21 Sep 85 by LTCOL K.J. Murphy SO1 (SVY) FF Comd, MAJ P.M. Bion, OC 4 Fd Svy Sqn and LT M.J. Hentschel, IC Det 4 Fd Svy Sqn. This formed the detailed plan for OP ALGUM 86.

6. A further recon to finalise arrangements was conducted during the period 18 Mar 86 to 23 Mar 86 by LTCOL K.J. Murphy SO1 (SVY) FF Comd, MAJ D. Taylor, OC 4 Fd Svy Sqn and LT M. Hentschel, IC Det 4 Fd Svy Sqn.

OPERATION SUPPORT

Air Support

7. Movement to and from the AO was as follows:

- a. Movement of IC Det 4 Fd Svy Sqn on 22 Jun 86 by civil aircraft.
- b. Movement of Det 4 Fd Svy Sqn on 1 Jul 86 by RAAF C130 Hercules.
- c. Return of Det 4 Fd Svy Sqn (Phase 2) on 27 Aug 86 by RAAF C130 Hercules.
- d. Return of Det 4 Fd Svy Sqn (Phase 1) on 14 Nov 86 by civil aircraft.

8. RW Aircraft. One Bell 206B Jetranger ZK-HTS on charter from Pacific Crown Aviation of Fiji, was in support for the period 30 Jun 86 to 12 Aug 86.

9. Photographic Aircraft. One Beechcraft Queenair VH-MWK fitted with a WILD RC-10 aerial camera was in support for the period 3 Jul 86 to 12 Nov 86. The aircraft is on charter from Airsearch Aviation Pty Ltd of Melbourne.

Sea Support

10. HMFS 'KULA' from the RFMF Naval Division was in support for the period 30 Jun 86 to 12 Aug 86..

Transport

11. Two vehicles were used in Port Vila for the duration of the operation:

- a. A Daihatsu Charade which was hired from Budget Rent a Car, and
- b. A Toyota Twin Cab 4 WD which was provided by the Vanuatu Survey Dept.

12. A Toyota Twin Cab 4 WD was provided by the Vanuatu Survey Dept in Luganville for use as required during the operation.

Main Base

13. Port Vila was used as the main base with accommodation and office space being provided at the Solaise Hotel.

Vanuatu Survey Department

14. The Vanuatu Survey Dept committed surveyors Moses Kalsale Williams and Ngpan Norbert for the period 2 Jul 86 to 15 Aug 86.

Australian High Commission

15. The Australian High Commission provided telex and postal services together with accounting for all financial matters. In addition they organised diplomatic clearances for all aircraft involved in the operation.

POL

16. Vehicle Fuel. Petrol for the Daihatsu Charade was purchased from local kerbside supplies. Diesel for the Toyota Twin Cab 4 WD was provided by the Public Works Dept out of the Survey Dept fuel allocation.

Communications

17. Internal. Radio equipment as follows was provided by the Communications Cell of the Vanuatu Police Dept:

- a. Survey Teams - CODAN 7924 HF Manpack Radios, and
- b. Main Base - CODAN 6B01 HF Radio.

18. Rear Link. Communications with Australia were as follows:

- a. The Australian High Commission provided telex and mail facilities and,
- b. The Solaise Hotel provided telephone facilities.

OPERATIONSGeneral

19. The operation was conducted as two separate phases:
- a. Phase One. This phase acquired the outstanding line and identification photography in the AO and was conducted during the period 1 Jul 86 to 14 Nov 86. A detailed report of this phase is given in Annex B.
 - b. Phase Two. This phase established the remaining control stations by Doppler and conventional survey techniques and was conducted during the period 1 Jul 86 to 27 Aug 86. A detailed report of this phase is given in Annex C.

ADMINISTRATION AND LOGISTICSManning

20. Manning was as follows:
- a. Phase One
 - (1) Det Comd: 231963 LT M. Hentschel
 - (2) Camera Operator: 2790227 LCPL R. Graf
 - (3) Civilian FW Pilot: Mr P.T. Hirst and
 - (4) Civilian FW LAME: Mr K.M. Reardon
 - b. Phase Two
 - (1) Det Comd: As for Phase One
 - (2) Control Survey Adviser: 6708956 SSGT B.J. Lutwyche
 - (3) Party Leader: 219056 SGT W.J. Chilcott
 - (4) Party Leader: 226540 CPL P.M. Drury
 - (5) Party Member: 323295 LCPL P.A. McCurdy
 - (6) Party Member: 232083 SPR S.F. Wainwright
 - (7) Radar Mech: 323256 CFN K.L. Blacker
 - (8) Civilian FW Pilot: Mr R. MacKenzie
 - (9) Vanuatu Survey Dept: Mr Moses Kalsale Williams and
 - (10) Vanuatu Survey Dept: Mr Ngpan Norbert

Visits

21. COL A. Laing D-SVY and LTCOL K. Murphy SO1 (SVY) FF COMD visited from 20 Jul 86 to 25 Jul 86.

22. MAJ D. Taylor OC 4 Fd Svy Sqn visited from 17 Aug to 27 Aug 86.

Passports/Visas

23. All members were in possession of an Australian Passport prior to departure for Vanuatu. No visas were required for entry into Vanuatu.

Finance

24. Support. OAI No 15480-0 funded at \$138,000 was forwarded to the Australian High Commission to cover expenditure made in Vanuatu.

25. Local Purchase. All purchases made followed the procedures recommended by the Australian High Commission. Details of all expenditure made in Vanuatu are shown at Annex D.

26. Petty Cash. A petty cash advance of 50,000 VT was maintained by the Det Comd. Acquittal of all expenditure was made through the Australian High Commission. Details are included in Annex D.

27. Overseas Allowances. Whilst in hotel accommodation members were in receipt of Short Term Duty Travelling Allowance at the rate of 4560 VT per day. Whilst onboard HMFS KULA members were in receipt of In Port Allowance at the rate of 715 VT per day.

28. Outfit Allowance. All members except LT M. Hentschel were paid the tropical element of Outfit Allowance. LT Hentschel received the allowance in 1985.

29. Pay. All members received pay in advance prior to their departure from Australia.

Accommodation

30. Hotel accommodation was maintained for the duration of the operation at the Hotel Solaise in Port Vila. Hotel accommodation was provided at the Hotel Santo in Luganville as required.

31. As no accommodation element was included in the member's allowances all payment for accommodation was made direct from the Australian High Commission.

Medical

32. No major health problems requiring medical treatment were encountered during the operation. All members were innoculated against Hepatitis B prior to departure from Australia. Malarial prophylaxis were taken each week by all members.

Morale

33. Morale remained high throughout the operation.

Stores and Equipment

34. Vanuatu Survey Department. At the completion of Phase Two of the operation the following stores were handed over to the Vanuatu Survey Dept:

- a. 2 x AGA Geodimeter 14 Short Range EDM,
- b. 2 x Yamaha EF 2000 generators,
- c. 1 x Robin R600 generator, and
- d. 2 x Aluminium dinghies complete with Evinrude 40 H.P. outboard motors and accessories.

CONCLUSION

35. OP ALGUM 86 completed the control requirements which will allow the Vanuatu Government to establish turning points for the delineation of the Vanuatu EEZ. The operation also provided further training and experience for members of the Vanuatu Survey Department.

36. Identification photography has been acquired for all control stations visited during the three year project. The only task now incomplete is the acquisition of the remaining 7% of the 1:30,000 scale mapping photography.



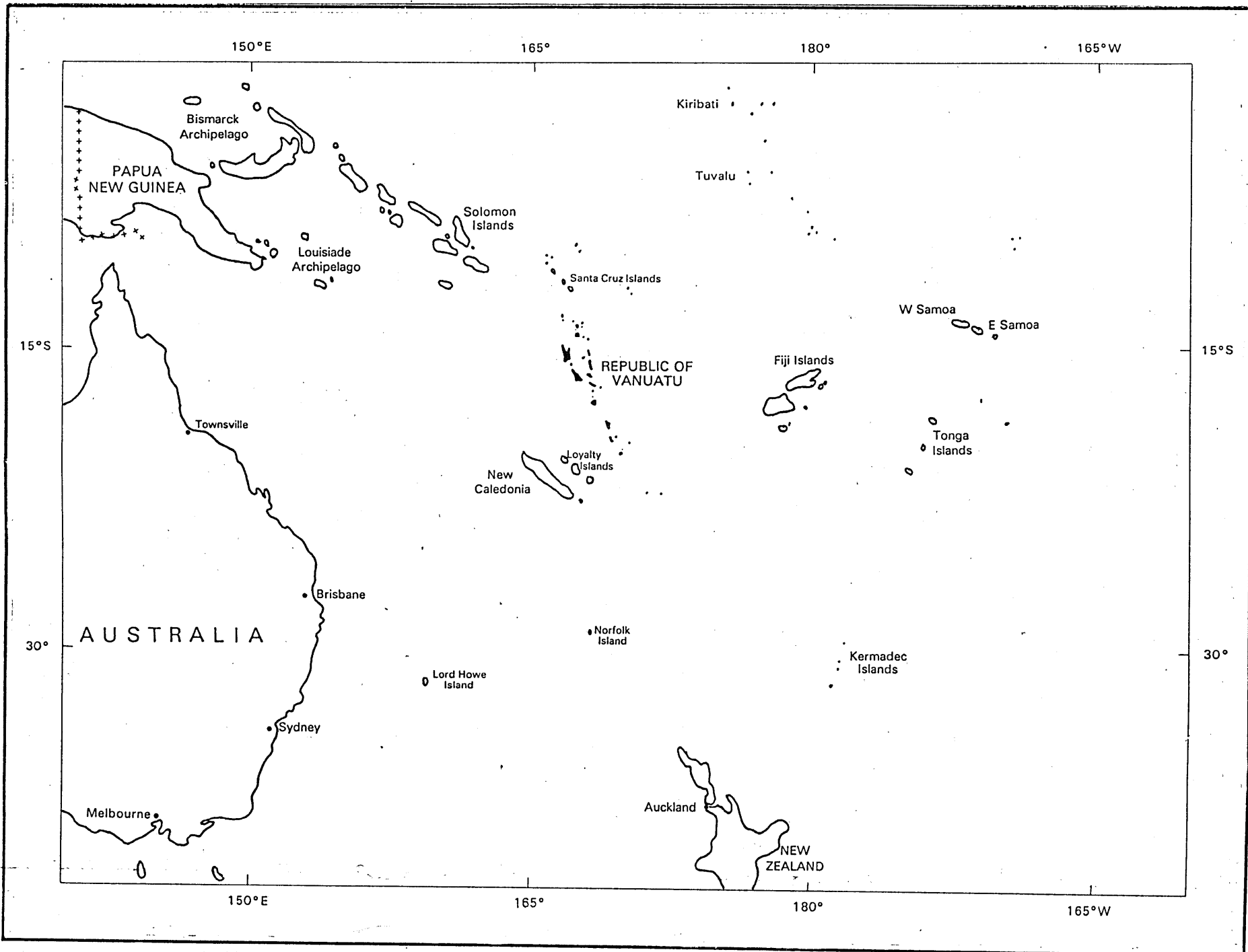
(D. TAYLOR)
MAJ
OC

12 December 1986

- Annexes:
- A. Area of Operations
 - B. Operations - Phase One
 - C. Operations - Phase Two
 - D. Financial Expenditure

Enclosures:

1. After Action Report OP ALGUM 86 (Phase Two) dated 4 Sep 86
2. After Action Report OP ALGUM 86 (Phase One) dated 27 Nov 86



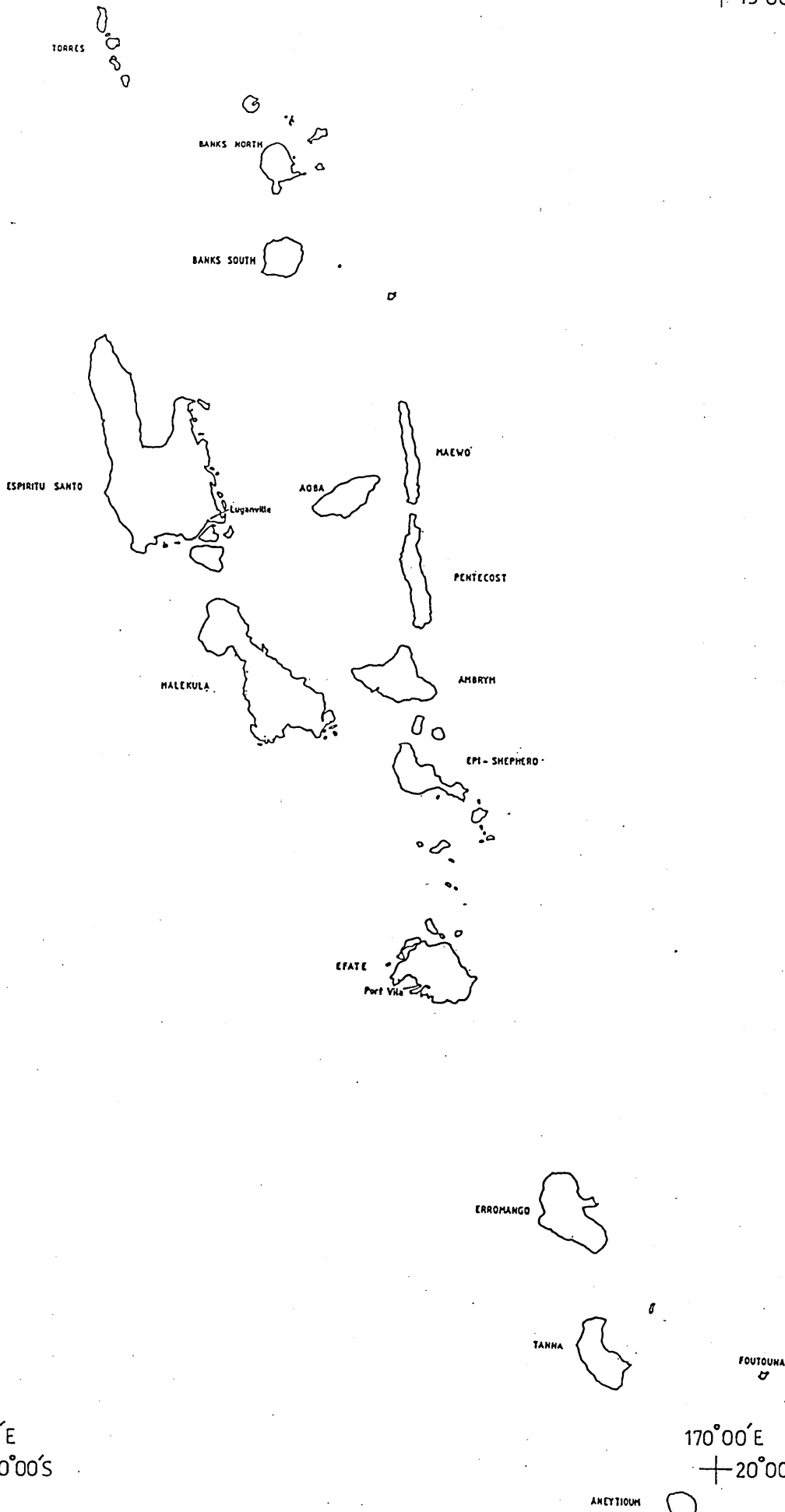
AREA OF OPERATION

ANNEX A TO
 OP AIGUM 86
 PROJECT REPORT
 DATED 12 DEC 86

166°00'E
+13°00'S

AREA OF OPERATION

170°00'E
+13°00'S



OPERATION ALGUM 86 PHASE ONE
AERIAL PHOTOGRAPHY REPORT

INTRODUCTION

General

1. This annex covers aspects of the aerial photography phase of Op ALGUM 86 and was conducted during the period 1 Jul 86 to 14 Nov 86.

OPERATION SUPPORT

Air Support

2. A Beechcraft Queenair VH-MWK fitted with a WILD RC10 aerial camera was used to acquire all photography. The aircraft is on charter from Airsearch Aviation Pty Ltd of Melbourne.

3. Total flying time was 269 hr 26 min including 24 hr 05 min ferry time to and from Melbourne. Details of aircraft usage are shown at Appendix 1.

4. A total of 10 days were lost due to aircraft unserviceability and servicing.

Darkroom Facilities

5. The X-Ray room of the Georges Pompidou Hospital was used for the processing of all black and white film and bromides. The facility was available for use at any time as the hospital is no longer operational.

POL

6. Aviation Fuel. Bulk AVGAS was available in ground at Port Vila and Luganville with accounts being tendered to the Australian High Commission. All fuel was supplied by Air BP. Total fuel usage in Vanuatu was 46 123 lit.

7. Aero Oil. Aero Oil was provided from supplies held by Air Melanesiae.

OPERATIONS

8. Ident Photography. Photography was obtained for all 23 new and existing control stations visited during Phase Two using a WILD RC10 aerial camera fitted with a wide angle (f=153.09 mm) lens. Details of all ident photography obtained are shown at Appendix 2.

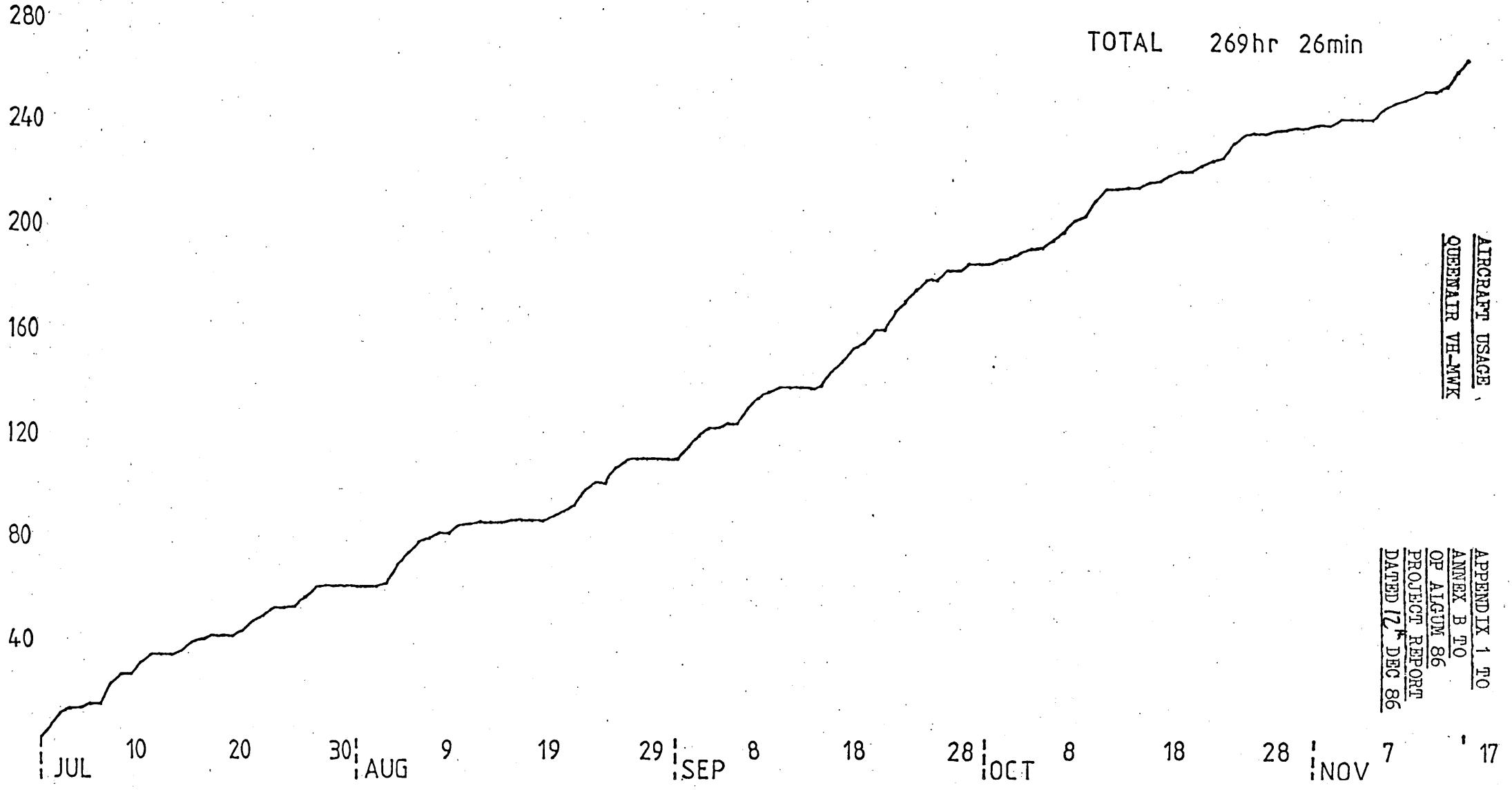
9. Line Photography. Monochrome photography was acquired at 1:30,000 nominal scale using a WILD RC10 aerial camera fitted with a wide angle (f=153.09mm) lens. A total of 3424 line km of photography was acquired from a requirement of 3724 line km. Combined with the results from Op ALGUM 84 and Op ALGUM 85 a total of 3960 line km have been acquired from an overall requirement of 4260 line km. 300 line km or 7% remains outstanding.

10. Photography was flown in weather conditions of 2/8 cloud or less. 2600 line km were reflown on runs which were originally cloud effected.
11. Photography Classification. Line photography was classified as follows:
- a. Class X - 2700 line km
 - b. Class Y - 1370 line km and
 - c. Class Z - 390 line km.
12. Details of photography obtained are shown at Appendix 3.
13. Urban Photography. Colour photography at 1:10,000 nominal scale was acquired of Port Vila. Combined with the results from Op ALGUM 85 the requirements for Port Vila have been completed. The requirements for Luganville remain outstanding. Details of colour urban photography obtained are shown at Appendix 4.
14. Film Processing. All monochrome film was processed in Port Vila using the facilities mentioned in para 5. All colour film was returned to Australia and processed by Air Photographics Pty Ltd of Melbourne.

CONCLUSION

15. The aerial photography phase of Op ALGUM has now acquired 1:30,000 scale mapping photography for approx 93% of Vanuatu. The outstanding photography is generally confined to the BANKS ISLANDS and MAEWO and comprises approx 300 line km.
16. It is recommended that the Survey Advisor to be seconded to the Vanuatu Survey Department from Dec 86 be empowered to investigate the feasibility of hiring an aircraft and camera from the Fiji Lands Department to obtain the outstanding photography at a time when suitable weather conditions prevail.

QUEENAIR VH-MWK



TOTAL 269hr 26min

AIRCRAFT USAGE
QUEENAIR VH-MWK

APPENDIX 1 TO
ANNEX B TO
OP AIGUM 86
PROJECT REPORT
DATED 17 DEC 86

STATION NO	PROCESS NO	LAT (S)	LONG (E)	JULIAN DAY FROM TO	3D PASSES	SEA LEVEL CONNECT	PANEL DIAG	MISSION NO	RUN NO	PHOTO NO	LENS MM	FLYING HEIGHT
D4	11133	17 15	168 25	195 197	23	TRIG		272	1	0001-0002	153	11200
D16	11134	17 03	168 17	196 198	24	LEVEL		273	1	0001-0002	153	11200
D20	11135	16 32	168 22	199 201	21	LEVEL		274	1	0001-0003	153	11200
D35	11143	14 19	167 48	211 213	27	LEVEL		281	6	0042-0045	153	17000
D36	11144	14 19	167 48	211 213	27	LEVEL		281	6	0042-0045	153	17000
D51	11192	13 16	167 38	216 218	23	LEVEL		282	1	0001-0006	153	11200
D52	11194	13 16	167 39	215 217	23	LEVEL		282	1	0001-0006	153	11200
D53	11195	14 19	167 26	211 213	32	LEVEL		281	9	0078-0080	153	17000
D54	11196	15 18	166 54	187 190	35	TRIG		287	4	0039-0042	153	14000
D55	11203	15 31	166 57	185 186	28	TRIG		287	14	0190-0192	153	17000
D56	11204	16 12	167 59	202 204	21	LEVEL		278	3	0074-0076	153	17000
D57	11205	16 17	168 18	202 204	23	LEVEL		278	1	0003-0005	153	17000
D58	11206	16 31	168 19	199 201	29	LEVEL		274	2	0004-0009	153	11200
D59	11891	17 01	168 35	195 197	24	SHORT BASE		272	2	0003-0007	153	11200
D60	11903	15 40	167 07	186 189	42	TRIG		287	2	0032-0036	153	11000

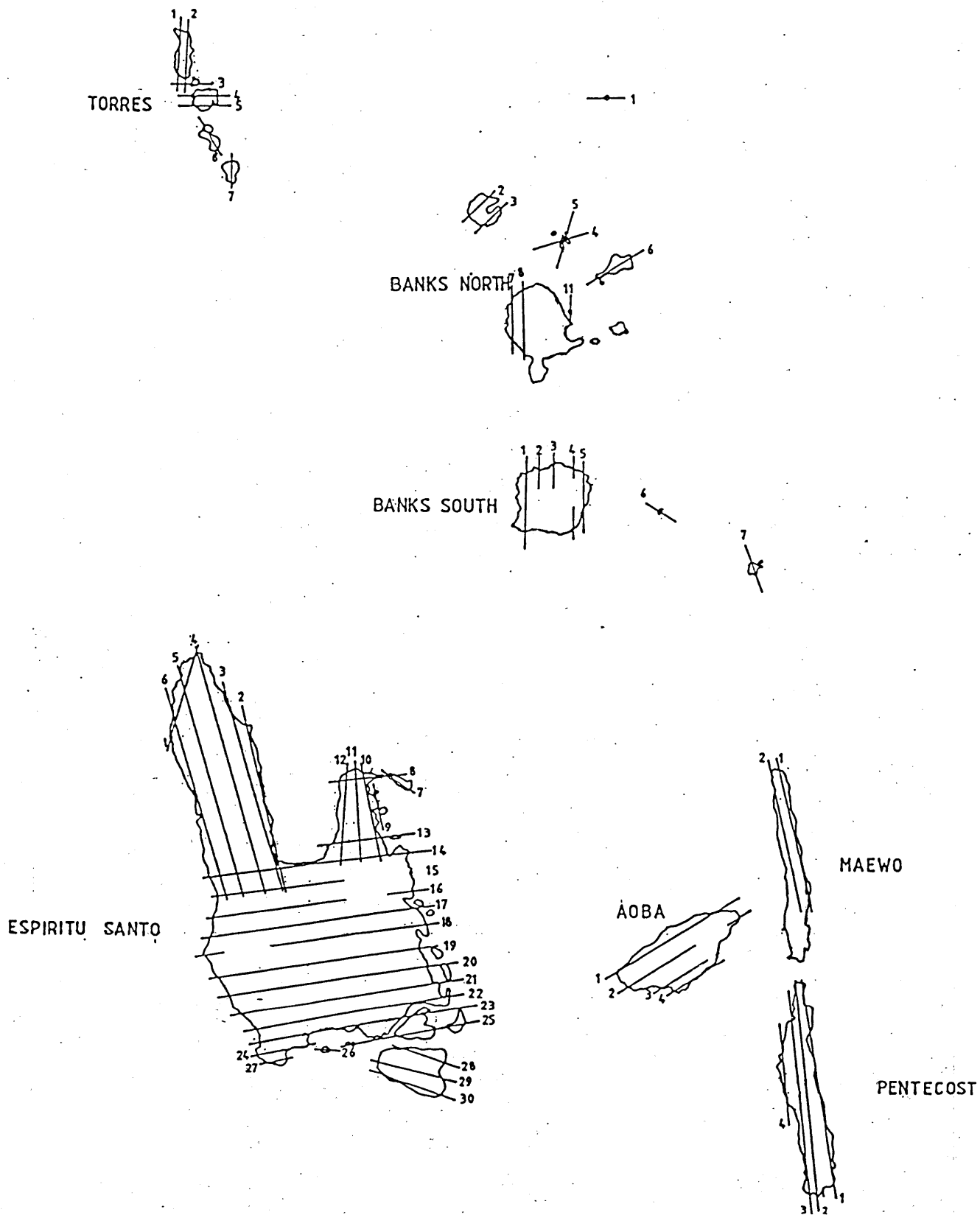
IDENTIFICATION PHOTOGRAPHY
DOPPLER STATIONS

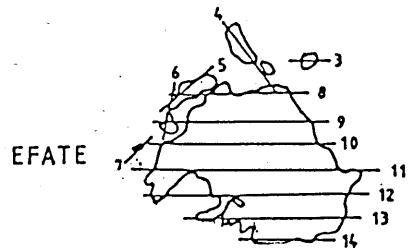
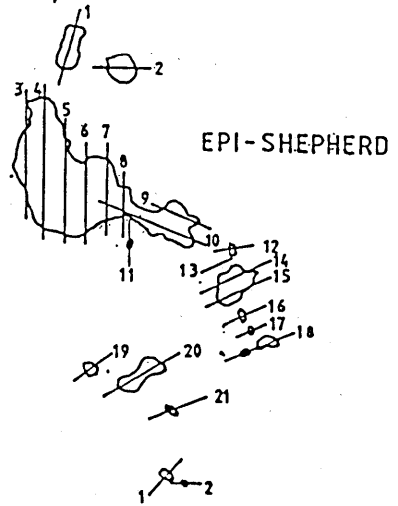
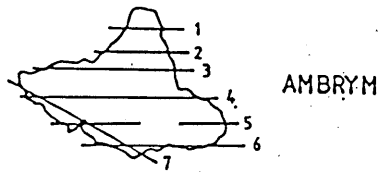
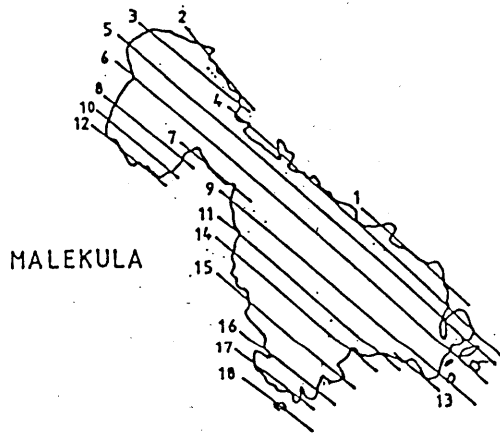
APPENDIX 2 TO
ANNEX B TO
OP ALGUM 86
PROJECT REPORT
DATED 12th DEC 86

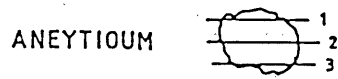
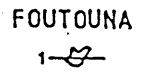
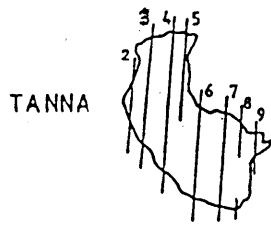
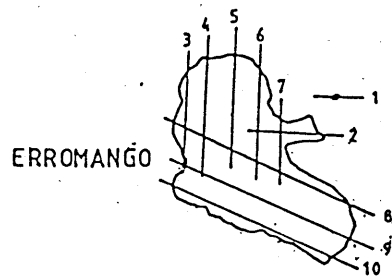
STATION NO	LAT (S)	LONG (E)	PANEL DIAGRAM	MISSION NO	RUN NO	PHOTO NO	LENS MM	FLYING HEIGHT	REMARKS
MLY 12	16 08	167 18		270	1	0001-0006	153	11200	
MLY 8	16 05	167 09		270	2	0007-0013	153	11200	Eccentric
AMY 2	16 06	168 11		279	1	0001-0005	153	11200	
ST 9	15 24	167 55		279	2	0006-0009	153	11200	
ST 6	15 17	167 54		279	3	0010-0014	153	11200	
ESZ 63	15 05	166 49		280	1	0001-0003	153	11000	Replacement for ESZ 53
ESZ 79	14 44	166 33		281	1	0001-0004	153	11200	Replacement for ESZ 78
ESZ 37	15 09	167 06		281	11	0102-0104	153	11200	

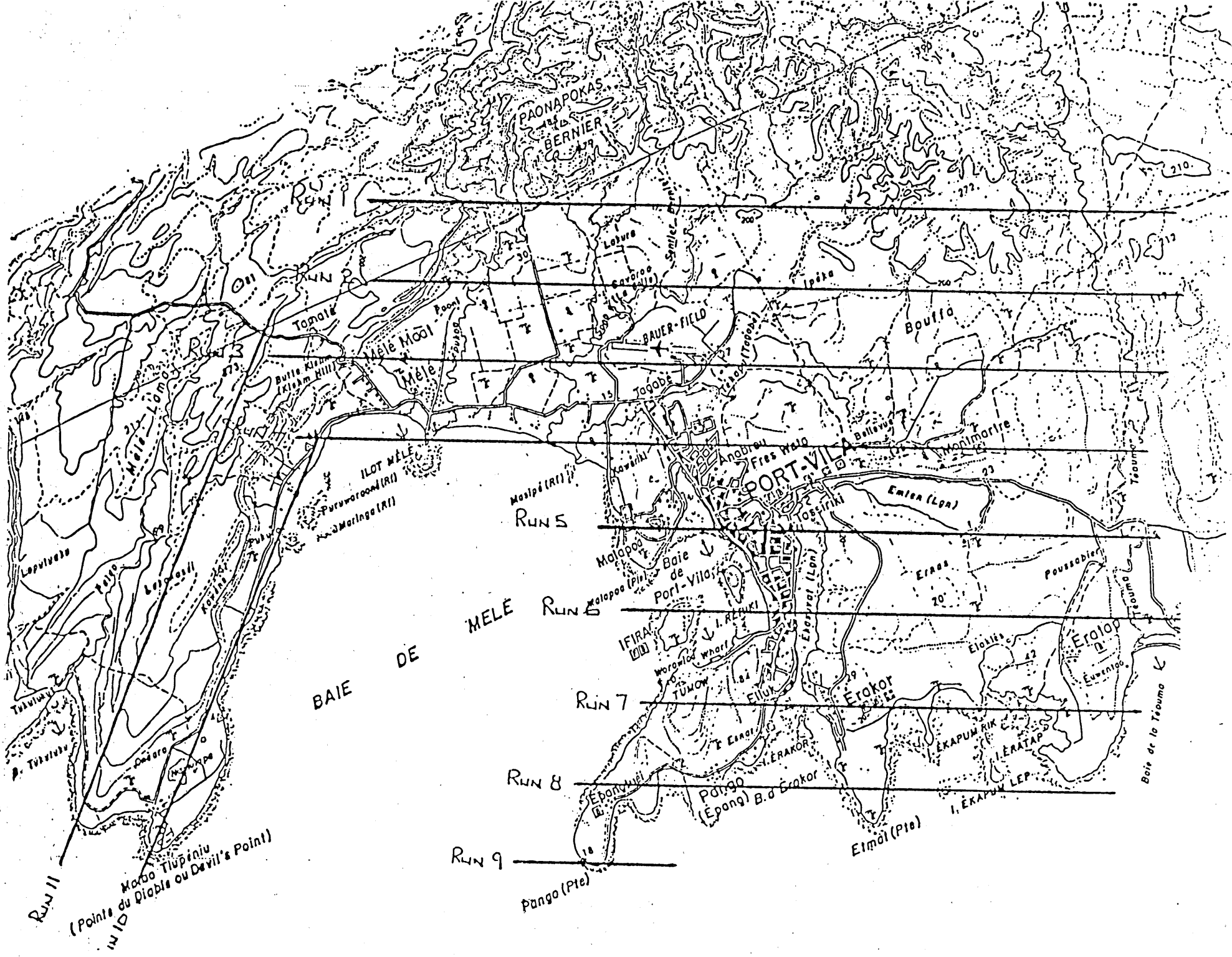
IDENTIFICATION PHOTOGRAPHY
PANEL STATIONS

LINE PHOTOGRAPHY FLOWN









URBAN PHOTOGRAPHY FLOWN

ANNEX B TO
OP ALGUM 86
PROJECT REPORT
DATED 17 DEC 86

OPERATION ALGUM 86 PHASE TWO
CONTROL SURVEY REPORT

INTRODUCTION

General

1. This annex covers aspects of the control survey phase of Op ALGUM 86 and was conducted during the period 1 Jul 86 to 27 Aug 86.

Area of Operations

2. The location of stations established and islands visited is shown at Appendix 1.

OPERATION SUPPORT

Sea Support

3. General. Sea support was provided by the Royal Fiji Military Forces Naval Division vessel HMFS Kula. HMFS Kula is fitted with a helipad on the stern deck and has been used previously in support of 2 Fd Svy Sqn during Operation ANON in 1984 and 1985. The ship was used as a mobile operating base for transporting and positioning field parties within the AO during the period 2 Jul 86 to 11 Aug 86.

4. Facilities. Facilities onboard HMFS Kula were adequate for the duration of the phase as time away from port did not exceed 11 days at any one time. Details of facilities are as follows:

a. Storage Space. Ample storage space was available on the ship. Survey stores and tinned rations were stowed below deck in a storage hold with landing boats, Hilomast towers, LP gas supplies and POL related stores being stored on deck.

b. Accommodation. Bunk space was available for five of the eight members of the control survey team with the remaining members utilising deck space for sleeping. Work space for checking survey observations and computations was limited to the wardroom between meals and the ship's communications room when it was not in use.

c. Water. The water storage capacity of HMFS Kula proved adequate, with rationing, for periods of up to 11 days. The ships water supply was replenished with good quality drinking water whenever in port at Luganville or Port Vila. Both the ship's crew and survey team members took advantage of fresh water on land for bathing and washing, whenever possible.

d. Catering. Refrigerator and storage space onboard HMFS Kula was used for storage of fresh survey party rations. The ship's cook prepared meals for survey base members and field

party members when onboard. Meals were generally basic and nutritious however field parties were usually relieved to return to the field to prepare and eat survey party rations.

- e. Communications. The HF radio onboard HMFS Kula was made available for communications between the operating base on ship and field parties and for daily sitreps to main base.
- f. Battery Charging. HMFS Kula has a 240 V power supply which was utilised for charging most portable power sources.

5. Serviceability. HMFS Kula shattered a propellor shaft near the completion of the passage from Fiji to Vanuatu. The ship, with minimal weight onboard, was required to steam to the slipway at Palikulo on Espiritu Santo to effect repairs at the start of the phase. The resulting downtime for the ship had little effect on progress of the operation.

6. Crew Support. The co-operation and assistance of the HMFS Kula crew was exceptional throughout the phase and great camaraderie developed between the ships company and the survey team. Crew members regularly assisted with station clearing and were keen to become involved in operational survey tasks whenever possible.

Rotary Wing Air Support

7. A Bell 206 Jetranger aircraft, ZK-HTS, on charter from Pacific Crown Aviation of Fiji provided support for the phase. The aircraft was based on HMFS Kula and was utilised for 80 hr 48 min for the following tasks:

- a. reconnaissance of Doppler stations;
- b. insertion and extraction of field parties within the AO, and
- c. panelling existing stations.

8. The aircraft was equipped with fixed floats and an external cargo hook. A motorised fuel pump was supplied by 4 Fd Svy Sqn for refuelling from 200 L fuel drums positioned on the stern deck below the helipad.

9. The pilot maintained the aircraft during the phase and no downtime occurred.

10. The support provided by the pilot was excellent. He had worked previously with 2 Fd Svy Sqn in 1984 and 1985 in the South West Pacific region and was familiar with survey operations. His experience was evidenced when positioning field parties at difficult survey station sites and landing on the ships helipad in unfavourable weather conditions.

Communications

11. Communications were provided by CODAN HF manpack radios on loan from the Vanuatu Police Force. These radios proved reliable and simple to operate and communications throughout the AO were adequate.

12. The operating base on HMFS Kula made use of the HF radio onboard due to the difficulty in erecting and maintaining a suitable antenna for a CODAN radio while at sea.

13. A voice operations net was used within the AO linking field parties, the operating base onboard HMFS Kula and main base. Daily scheduled sitreps were maintained between the operating base and main base.

14. The frequency allocated was 5.267 MHz. This was the same frequency as that used by the Vanuatu Police Force and minor problems occurred with crowding on the net.

15. Communications between the RW acft and the operating base were via VHF acft radio and a portable VHF transceiver provided by the pilot. No direct communication was available between the acft and field parties.

OPERATIONS

General

16. The control survey team was deployed in the AO as follows:
- a. 1 Jul 86. Arrived Port Vila and unloaded stores from C130.
 - b. 2 Jul 86. Loaded initial operating stores onto HMFS Kula at Port Vila.
 - c. 3 Jul 86 - 11 Jul 86. Two geoceiver parties and one panelling party operated in the Santo Island Group.
 - d. 12 Jul 86 - 13 Jul 86. Loaded remaining stores and resupplied at Port Vila (after repairs to HMFS Kula completed at Palikulo).
 - e. 14 Jul 86 - 17 Jul 86. Three geoceiver parties operated in the Shepherd Islands Group.
 - f. 18 Jul 86 - 24 Jul 86. Two geoceiver parties and one panelling party operated in the Paama and Ambrym Island Groups.
 - g. 25 Jul 86 - 27 Jul 86. Two conventional survey parties and one panelling party operated in the Santo Island Group.
 - h. 28 Jul 86. Reconditioned stores and resupplied at Luganville.
 - i. 29 Jul 86 - 2 Aug 86. Three geoceiver parties operated in the South Banks Islands Group.
 - j. 3 Aug 86 - 7 Aug 86. Two geoceiver parties operated in the North Banks Islands Group.
 - k. 8 Aug 86 - 10 Aug 86. Three conventional survey parties operated in the Santo Island Group.
 - l. 11 Aug 86. Unloaded stores from HMFS Kula at Port Vila.
 - m. 12 Aug 86 - 26 Aug 86. Reconditioned and packed stores, finalised documentation, duplicated geoceiver data cassettes and prepared station summaries.
 - n. 27 Aug 86. Loaded stores onto C130 and departed Port Vila.

17. Geceiver parties were generally composed of two RASVY members and one member from the Vanuatu Survey Department. The RAEME geceiver mech was employed as a survey assistant in a third geceiver party on occasions when it was operationally expedient to establish three stations concurrently.

18. The panelling party generally consisted of one RASVY member and a member from the Vanuatu Survey Department.

Geceiver Operations

19. A total of 15 new Doppler stations were established during the period 4 Jul 86 to 6 Aug 86. A minimum of 20 well balanced passes were observed at 14 of the stations with the remaining station being observed with in excess of 40 well balanced passes. The 40 pass station was connected to an existing station by conventional survey methods.

20. Point positioning mode was used to coordinate Doppler stations and all observations were in accordance with specifications outlined in Ref C.

21. Serial numbers of observed satellites are as follows:

- a. 30110;
- b. 30130;
- c. 30200;
- d. 30480, and
- e. 30500.

22. The location of each Doppler station is shown on the map at Appendix 1 and observation details are included at Annex B Appendix 2.

23. Station Marking. With the exception of station D16, station marking was in accordance with specifications outlined in Ref C. Station D16 was established on an intertidal reef and was marked with a star iron picket driven into the reef at low tide with the exposed picket base encased in reinforced concrete set in a 20 litre capacity steel drum. Three recovery marks were positioned in exposed reef areas for station recovery.

24. Vertical Connection. Vertical connections between all new Doppler stations and sea level were observed by various methods and were in accordance with specifications outlined in Ref C. Observation details are listed at Appendix 2.

25. Station Documentation. Station documentation was compiled in accordance with specifications outlined in Ref C. Computations were completed, geceiver data cassettes duplicated and station summaries drafted prior to departure from the AO.

Panelling Operations

26. A total of 8 existing stations were visited and panelled during the period 3 Jul 86 and 27 Jul 86. Two existing stations were not found or had been destroyed with nearby stations being panelled as substitutes.

27. The location of existing stations panelled are included on the map at Appendix 1 and photo identification details are listed at Annex B Appendix 2.

Operational Difficulties

28. Existing station ESY1 was originally planned to have been occupied and observed with a minimum of 40 satellite passes. As a consequence of the owners of the land in the area refusing permission to clear at ESY1 for Doppler observations and panelling, a new Doppler station, D60, was established approximately 800 metres South of ESY1. Further negotiations with the land owners resulted in permission being granted to clear a small narrow lane to provide line of sight between the two stations. Horizontal connection between ESY1 and D60 was then completed by conventional survey methods.

29. Doppler station D54 was established during the period 6-9 Jul 86 but was not connected to sea level at that time. On revisiting the station on 26 Jul 86 to undertake the vertical connection it was found that all station marks had been removed. This act of vandalism is suspected of being the work of members of a pro secessionist group believed to be still active in this part of the country. Vertical connection to ground level immediately adjacent to the hole left after removal of the ground mark was completed and is considered satisfactory as the ground mark was originally placed at ground level.

Relationship with Local Inhabitants

30. With the exception of the instances described in para's 28 and 29 the relationship between field parties and local inhabitants was good. Once the detachment's objectives were explained by a member of the Vanuatu Survey Department the attitude of locals was generally one of interest and cooperation.

Post Operation Records Processing

31. On return to Australia all documentation was checked and a copy of all station notes, summaries and geociever data cassettes forwarded to DSVY-A on 25 Sep 86.

ADMINISTRATION AND LOGISTICS

Medical

32. Comprehensive medical kits were carried by the operating base and field parties. No health problems requiring use of local medical facilities arose during the phase.

Rations

33. Tinned and fresh rations were purchased in bulk at Port Vila and Luganville, as required. Supplies of fresh rations, consisting mainly of fruit and vegetables, were purchased at some of the outlying islands.

34. Supplementary, non perishable rations were purchased in Australia and transported to Port Vila on insertion by RAAF C130.

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35. MSP. Two by 200 litre drums of MSP were purchased locally for field party equipment requirements.
36. Oil. MT and outboard engine oil supplies were purchased locally. RW acft oil was supplied by the contractor.
37. Avtur. A total of 8260 litres of avtur was used during the phase. Details are as follows:
- a. Drummed. Twenty 200 litre drums of avtur were shipped from Fiji onboard HMFS Kula. A total of eighteen drums were used throughout the AO.
 - b. Bulk. 4660 litres of bulk avtur were purchased from AIR BP, Luganville for operational tasks in the Luganville area and for refilling of empty drums.
 - c. Contamination. Six drums of avtur were rejected because of water contamination.
38. Return of Drums. On completion of the phase, twenty empty avtur drums were returned to Fiji and two MSP drums were returned to the agent in Port Vila for credit.
39. LP Gas. Twenty empty 2 kg LP gas bottles were transported to Port Vila on insertion of the detachment by RAAF C130 and bulk gas supplies purchased at Port Vila.

Stores and Equipment

40. General. Stores and equipment were provided from 4 Fd Svy Sqn resources and accompanied phase two personnel on insertion to and withdrawal from the AO by RAAF C130. No difficulties were encountered gaining customs clearance on entry to Vanuatu or on return to Australia.
41. Satellite Surveying Sets. Three Magnavox MX1502 satellite surveying sets, Ser No's 003, 004 and 005, plus one spares kit and one tape duplicating set were used. All equipments performed without failure for the duration of the phase. The RAEME mechanic's report is attached at Appendix 3.
42. Short Range EDM. Two AGA Geodimeter 14 EDM equipments were used and were ideal for the distances involved. The equipment is light and quickly set up and performed without trouble for the duration of the phase.
43. Telescopic Masts. Two 21 metre pneumatic telescopic Hilomasts were used on three of the Doppler stations. The masts were reasonably quick to erect and dismantle and performed without trouble. In all cases the masts were sling carried and this was awkward and slow, however the shortened station occupation time compensated for the increase in ferry time.
4. Lightweight Tents. Six 8 ft by 10 ft lightweight tents were purchased in Australian prior to the start of the operation. Each field party utilised two tents, one for equipment and the other for accommodation. The tents were quick and simple to erect and proved to be ideal for the phase.

45. Power Generating Equipment. Three Suzuki SE700A generators were purchased in Australia prior to the start of the operation. The generators are compact and light and proved to be extremely reliable and easy to operate. They performed without trouble for the duration of the phase.

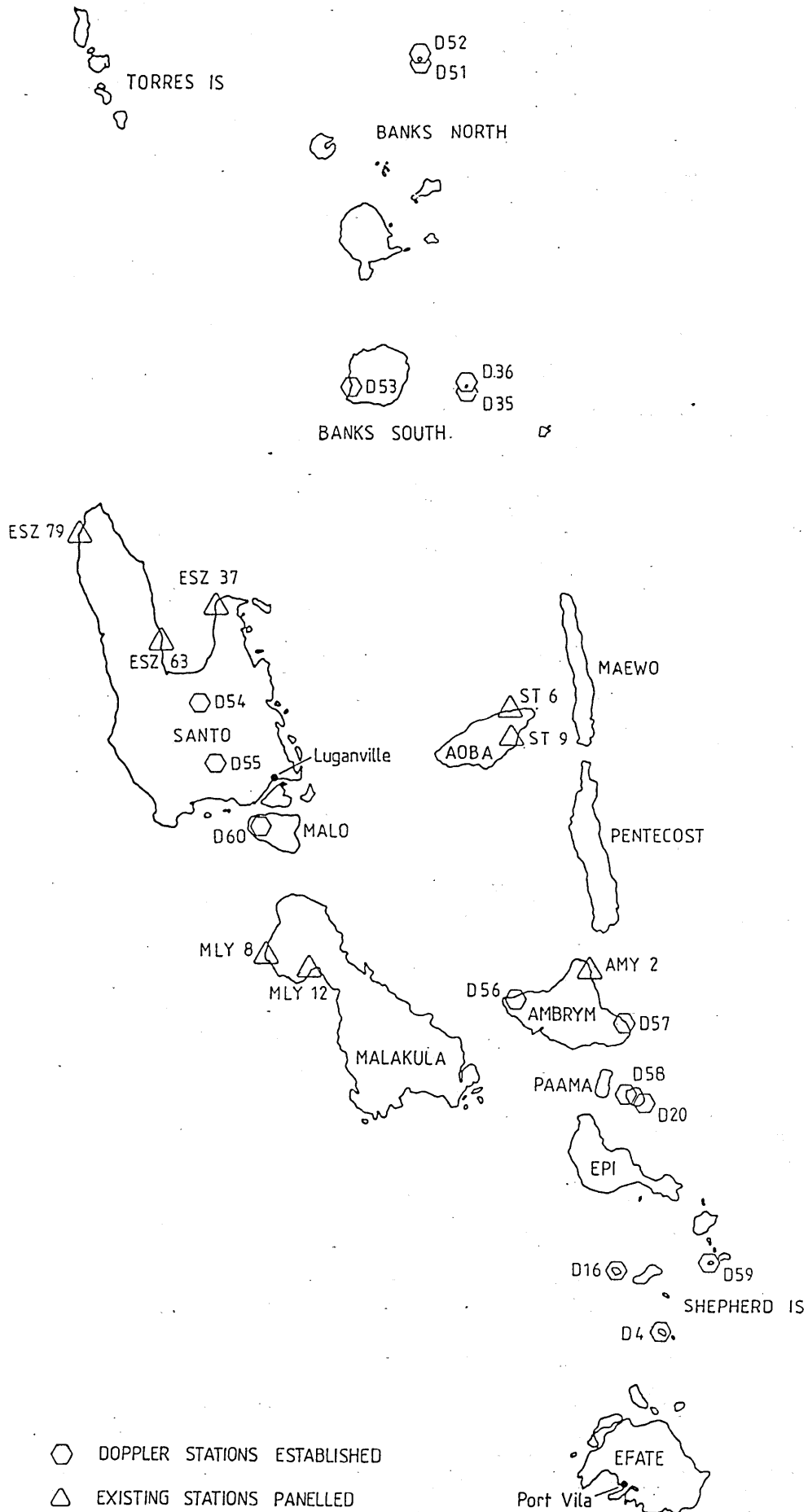
46. Aluminium Boats. Two 4.2 metre aluminium boats with 40 HP Evinrude outboard motors were purchased in 1985. The boats are extremely bouyant and each has a large flat floor. One boat was utilised for transporting stores and personnel between HMFS Kula and Doppler station D16 on Cook Reef. The boat was also used to form a panel arm for photo identification purposes at this station.

CONCLUSION

47. The survey control phase of Operation ALGUM 86 was successfully concluded with all allocated tasks being completed.

48. The results achieved can be largely attributed to the determination and enthusiasm of all phase two members and the cooperation of support personnel.

OPERATION ALGUM 86



STATION NO	DATE	LOCAL TIME	CONNECTION METHOD	DIFF HEIGHT SL TO STN(m)	TIDE READING(m)	MEAN TIDE LEVEL(m)	MSL HEIGHT (m)	ADOPTED HT(m)
D4	16 JUL 86	1430	TRIG	467.452	+0.802	0.75	467.504	467.5
D16	16 JUL 86	1200	LEVEL	1.030	+0.802	0.75	1.082	1.1
D20	20 JUL 86	1009	LEVEL	21.768	+0.052	0.75	21.070	21.1
D35	31 JUL 86	0945	LEVEL	4.094	+0.398	0.75	3.742	3.7
D36	31 JUL 86	1340	LEVEL	3.330	+0.688	0.75	3.268	3.3
D51	05 AUG 86	1430	LEVEL	57.811	+0.502	0.75	57.563	57.6
D52	05 AUG 86	1430	LEVEL	66.095	+0.502	0.75	65.847	65.8
D53	31 JUL 86	1020	LEVEL	14.973	+0.441	0.75	14.664	14.7
D54	26 JUL 86	1545	TRIG	191.845	+0.272	0.75	191.367	191.4
D55	25 JUL 86	1315	TRIG	215.594	+0.326	0.75	215.170	215.2
D56	22 JUL 86	1745	LEVEL	2.830	+0.930	0.75	3.010	3.0
D57	22 JUL 86	1400	LEVEL	8.820	+0.199	0.75	8.269	8.3
D58	19 JUL 86	1500	LEVEL	2.878	+0.809	0.75	2.937	2.9
D59	15 JUL 86	1540	SHORT BASE	54.568	+0.556	0.75	54.374	54.4
D60	08 AUG 86	1203	TRIG	274.114	+0.334	0.75	273.698	273.7

SEA LEVEL CONNECTIONS AND TIDAL CORRECTIONS

DATUM: STANDARD FORT - VILA HARBOUR, EFATE ISLAND, VANUATU

APPENDIX 2 TO
ANNEX C TO
OF AUGUST 86
PROJECT REPORT
DATED 12 DEC 86

OP ALGUM 86

RAEME TECH A.A.R.

Serviceability of Equipment Throughout Operation:

1. MX 1502:
 - a. All three performed without failure except for a broken antenna cable.
2. Tape Duplicators:
 - a. Both performed without failure.
3. Generators:
 - a. The salty conditions and moisture caused minor problems in starting several times, otherwise all three worked well.
4. Chainsaws:
 - a. Numerous problems occurred with the chainsaws.
 - b. Due to inexperience in repairing such equipments, repairing and maintaining them was difficult at first. As the operation continued repair and maintenance became easier and the performance of the chainsaws increased.
5. Other:
 - a. Hilomasts and Geodimeters performed without failure.
6. Recommendations:
 - a. A list of all equipments to be maintained and repaired by the RAEME Tech be forwarded to Sydney Wksp Coy prior to the operation, to enable knowledge and experience to be gained where necessary on such equipments as chainsaws.
7. Summary:
 - a. Overall operation of MX1502 and supporting equipments was excellent, enabling completion of all stations within the allotted time space.

FINANCIAL EXPENDITURE

1. Expenditure made in Vanuatu through funds advanced to the Australian High Commission Port Vila is as follows:

<u>Serial</u>	<u>Item</u>	<u>VATU</u>	<u>\$</u>
1	AVGAS/AVTUR	3 395 836	51 572
2	Allowances	1 864 980	28 326
3	Solaise Hotel	1 460 800	22 187
4	Rations	513 075	7 793
5	External Airfares & Freight	222 297	3 376
6	Hire Car	207 766	3 156
7	Hotel Santo	183 800	2 792
8	Aero Oil	98 973	1 503
9	Internal Airfares & Freight	87 992	1 336
10	Telephone	84 000	1 276
11	Petrol	61 458	933
12	Clearing/Compensation	40 000	608
13	Container Hire	30 800	468
14	Forklift Hire & Wharf Fees	30 454	463
15	Spare Parts & Repairs	20 487	311
16	Miscellaneous	45 268	688
TOTAL		8 347 986	126 788

NOTE: Average Exchange Rate AUS \$1.00 = 65.8 VATU