



4th Field Survey Squadron

Operation EMU 93

Operation Report

An aerial photography operation
conducted in the Northern Territory

8 - 22 October 1993



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- I. Blue Mud Bay - Useable Photography Achieved

EXECUTIVE SUMMARY

1. Operation EMU 93 was conducted by 4 Fd Svy Sqn under direction from LHQ in the East Arnhem region of the Northern Territory during the period 8 Oct-22 Oct 93.
2. The aim of Operation EMU 93 was to acquire a 1:250 000 area of aerial photography suitable for 1:50 000 map production.
3. Det 4 Fd Svy Sqn was based out of RAAF Darwin utilising a chartered Gates Learjet aircraft to fly daily sorties over the Area of Operations (AO).
4. The detachment consisted of two 4 Fd Svy Sqn personnel supported by one camera operator from Army Survey Regiment, one photo technician from 6 Sqn RAAF and two civilian pilots.
5. Favourable weather conditions allowed the Det to achieve the Operational aim.

OPERATION EMU 93
OPERATION REPORT

- References:
- A. LHQAUST OPORD 71/93 Operation EMU 93 dated 132010Z OCT 93
 - B. DEFARM CAMPBELL SIC Z2Y/JQN SVY 1090
DTG 080130Z OCT 93
 - C. DSVY-A 941 FAX dated 08 OCT 93
 - D. DSVY-A 959 FAX dated 12 OCT 93
 - E. Specifications for Vertical Aerial Mapping Photography (undated draft)
 - F. Aircraft Contract - Standing Offer: PN 8260 dated 1 Oct 91

INTRODUCTION

1. Operation EMU 93 was an aerial photography operation in the East Arnhem area of the Northern Territory, conducted by 4 Fd Svy Sqn for LHQ in accordance with Reference A.
2. The Operation was conducted from 8 Oct - 22 Oct 93.

MISSION

3. 4 Fd Svy Sqn mission was to acquire a 1:250 000 area of aerial photography suitable for 1:50 000 map production, in accordance with Reference D.

AREA OF OPERATIONS

4. The AO included the Kimberley Region of Western Australia and the Arnhem Land area of the Northern Territory, however daily missions were concentrated in the East Arnhem area only. An illustration of the AO is provided at Annex A.

CONDUCT OF OPERATIONS

Timing of Operation

5. The dates of the Operation were dictated by the availability of an aircraft fitted with a camera, funding and prevailing non-typical weather conditions for the time of year.

Outline Technical Plan

6. Mapping photography was acquired using a Gates 35A Learjet aircraft. The film was processed by RAAF support personnel utilising a RAAF VERSAMAT film processor. Bromide print production and photo assessment were carried out by the camera operators utilising the Photo Section facilities of RAAF Darwin.

7. The Operation was conducted according to the sequence of events shown in Annex B. Significant events are discussed below.

Reconnaissance

8. No reconnaissance of the AO was conducted due to the lack of time, telephone contact determined facilities available.

Issue of Orders and Instructions

9. The Operation Order was issued on 13 Oct 93. There was barely sufficient time for the small number of personnel involved to make appropriate arrangements and carry out tasks.

10. Aerial film could not be supplied until after the Operation had commenced due to the short preparation time. Two rolls of film were borrowed from AIRESEARCH (a civilian company based in Brisbane) to allow acquisition of photography until ordered stock arrived on the 16 Oct 93.

11. The borrowed film was replaced on return to Brisbane at the completion of the operation.

Freight of Dangerous Cargo and Stores

12. All dangerous cargo (DC) items were transported to the AO by express road freight. All other stores were transported by civil and chartered air freight.

13. On extraction, unused aerial film returned to Adelaide by civil air freight and all other stores by road.

Insertion of Force

14. Insertion of the detachment was by a combination of civil and chartered air.

Establishment of Main Base

15. Upon arrival at RAAF Darwin, area liaison for aircraft fuel, accommodation and communications was conducted via the HQNA Executive Officer.

16. The RAAF Photo Section work area and dark room facilities were prepared and after hours access arranged.

Meteorological Information

17. Contact was established with the Darwin Bureau of Meteorology. Contact information is at Annex C.
18. Meteorological information for each 1:250 000 area was pre-arranged for access by phone immediately prior to take off. Weather interpretation by the Bureau utilising satellite imagery on a high resolution screen proved to be very accurate and allowed a positive method of flight planning.
19. The unusually dry weather conditions for the time of year was fundamental to the success of the Operation, however, smoke from resulting fires did provide some difficulty.

Air Photo Operations

20. Air photo operations began on 15 Oct 93. The mission flight plans were submitted direct to Operations at RAAF Darwin.

Technical Report

21. The technical report detailing equipment performance is shown in Annex D.

Extraction of Force

22. The Learjet under contract returned to Brisbane on 22 Oct 93 with two 4 Fd Svy Sqn personnel and the RAAF Photo Technician. The air camera was removed from the aircraft for return to Adelaide by road freight (via 1 Topo Svy Sqn). The RAAF member returned to Amberley and 4 Fd Svy Sqn personnel returned to Adelaide by civil air.
23. The Army Survey Regiment member flew civil air direct from Darwin to Melbourne on 22 Oct 93.

OPERATION RESULTS

24. All Air Photo classification was in accordance with Reference E. Operation Emu 93 was successful in achieving useable photographic coverage of the following areas:

a.	Roper River (East Arnhem Block 5)	100%
b.	Blue Mud Bay (East Arnhem Block 3)	17%
c.	Mount Marumba (East Arnhem Block 2)	44%

25. Total line kilometers of X and Y photography achieved during the Operation is as follows:

- a. 1770 line kilometres of X class photography, and

- b. 1385 line kilometres of Y class photography.

ADMINISTRATION AND LOGISTICS

Operation Manning

26. Personnel who participated in Operation Emu 93 are listed at Annex E. All personnel displayed great professionalism.

Support

27. RAAF. The following RAAF support was provided for the Operation:
- a. 6 Squadron Amberley provided the Darwin VERSAMAT facilities and an operator for the duration of the operation.
 - b. RAAF Darwin Photo Section facilities were provided for film assessing and print production.
28. Aircraft. A Gates 35A Learjet, contracted through Airscan Australia, flew a total of 28.8 hrs during the Operation.
29. Aircraft hire was charged at the Wet Rate which includes fuel. The POL requirements of the aircraft were provided by RAAF Darwin and were the responsibility of the contractor as specified in Reference F. A more cost effective method would have been to operate at Dry Rates with Army purchasing fuel from the RAAF.
30. VH-TPR proved to be an extremely reliable, fast, stable platform for aerial photography. The range and speed of the aircraft allowed maximum exploitation of the AO in the solar altitude window. Aircraft usage is shown at Annex F.
31. Aircraft problems included:
- a. late arrival to the AO due to a fuel control unit failure which required a replacement part to be shipped from Perth on the 14 Oct 93, and
 - b. the rupture of a pressurised heater hose inside the cabin on the 18 Oct 93 causing emergency repressurisation procedures to be implemented.
32. The aircraft had been continuously deployed on overseas tasking up to Op Emu 93.
33. Civilian Pilots. A change of pilots occurred on the 18 Oct 93 when Mr H. Morton replaced Mr T. Frost. All three pilots were professionals, who having considerable experience flying photographic missions, contributed significantly to the success of the operation.
34. Communications. Excellent communications were provided by headsets with voice activating microphones for hands off operation between pilots and crew.

Vehicles.

35. A DAS Fleet hire vehicle was booked through DC-A for the duration of the operation due to the non availability of a service vehicle at short notice.

Stores and Equipment

36. Minimal equipment was required as the facilities available at Darwin Photo Section provided for most requirements.

37. Chemical and film stock requirements were not on hand at time of deployment due to the late issue of cost codes. Fresh stocks of film are required and cannot be stockpiled due to limited shelf life, however a reserve stock of 4 rolls of film for any future rapid deployment tasking needs to be purchased and rotated.

38. Cost Codes must be issued a minimum of 2 weeks prior to deployment to allow ordering and delivery of stock.

39. RAAF chemistry used was replaced by 4 Fd Svy Sqn.

40. Air Camera. The aircraft was fitted with a PAV 11 camera mount and RC10 Aerial Camera No. 2611 in Adelaide on 8 July 93. The camera system was tested over the Bourke Test Range on the 11 July 93 and remained fitted until the completion of Operation EMU 93 when it was removed on 22 Oct 93.

Accommodation

41. Service accommodation was provided for all personnel at RAAF Base Darwin for the period 13 Oct - 22 Oct 93, excepting the 15th where the Pilots and SNO's were accommodated at the Darwin Travelodge due to Mess over booking.

42. Limited Sergeants Mess accommodation was available due to building refurbishment and prior bookings. Lack of booking time resulted in two members living in sub standard accommodation for the period.

43. Evening and morning meals for all personnel were provided by the Airmen's Mess.

44. Lunch for all personnel consisted of RAAF inflight meals.

Medical

45. No medical problems occurred during the operation.

Morale and Discipline

46. Morale remained high throughout the operation and there were no incidents requiring disciplinary action.

Finance

47. Expenditure was as follows:
- | | | |
|----|-----------------------------|--------------|
| a. | Travel and Subsistence | |
| | (1) Accommodation | \$ 701.55 |
| | (2) Allowances | \$ 988.50 |
| | (3) Air fares | \$ 3 168.40 |
| b. | Freight and Cartage | \$ 3 528.84 |
| c. | Petty Cash | nil |
| d. | Aircraft Hire | |
| | (1) Flying hours (28.8 hrs) | \$ 60 480.00 |
| | (2) Admin charges | \$ 700.00 |
| | (3) Standing charges | \$ 16 800.00 |
| e. | Hire Car/Taxi | \$ 425.01 |
| f. | Chemicals and Film | \$ 8 542.00 |
| g. | Stores | \$ 18.25 |
48. Total operational expenditure was \$ 95 352.55

COMMAND AND SIGNALCommand

49. Det 4 Fd Svy Sqn was under operational command of LHQ for the duration of Op EMU 93, with technical direction from DSvy-A. All personnel were under command IC Det 4 Fd Svy Sqn, 46446 SSGT W.J. Shephard. No problems were experienced with the command arrangements specified in Reference A.

Communications

50. Telephone. A DC-A Telecard was issued to the Det Comd for the Operation and utilised for all STD calls.

51. Facsimiles. Facsimiles were sent using facilities at RAAF Darwin Operations Centre.

52. SITREPS. Due to the short duration only one SITREP was sent in the time frame.

CONCLUSION

53. Operation EMU 93, although successful, was a rapid deployment, opportunity task which highlighted areas that must be addressed should short notice tasking occur again.

RECOMMENDATIONS

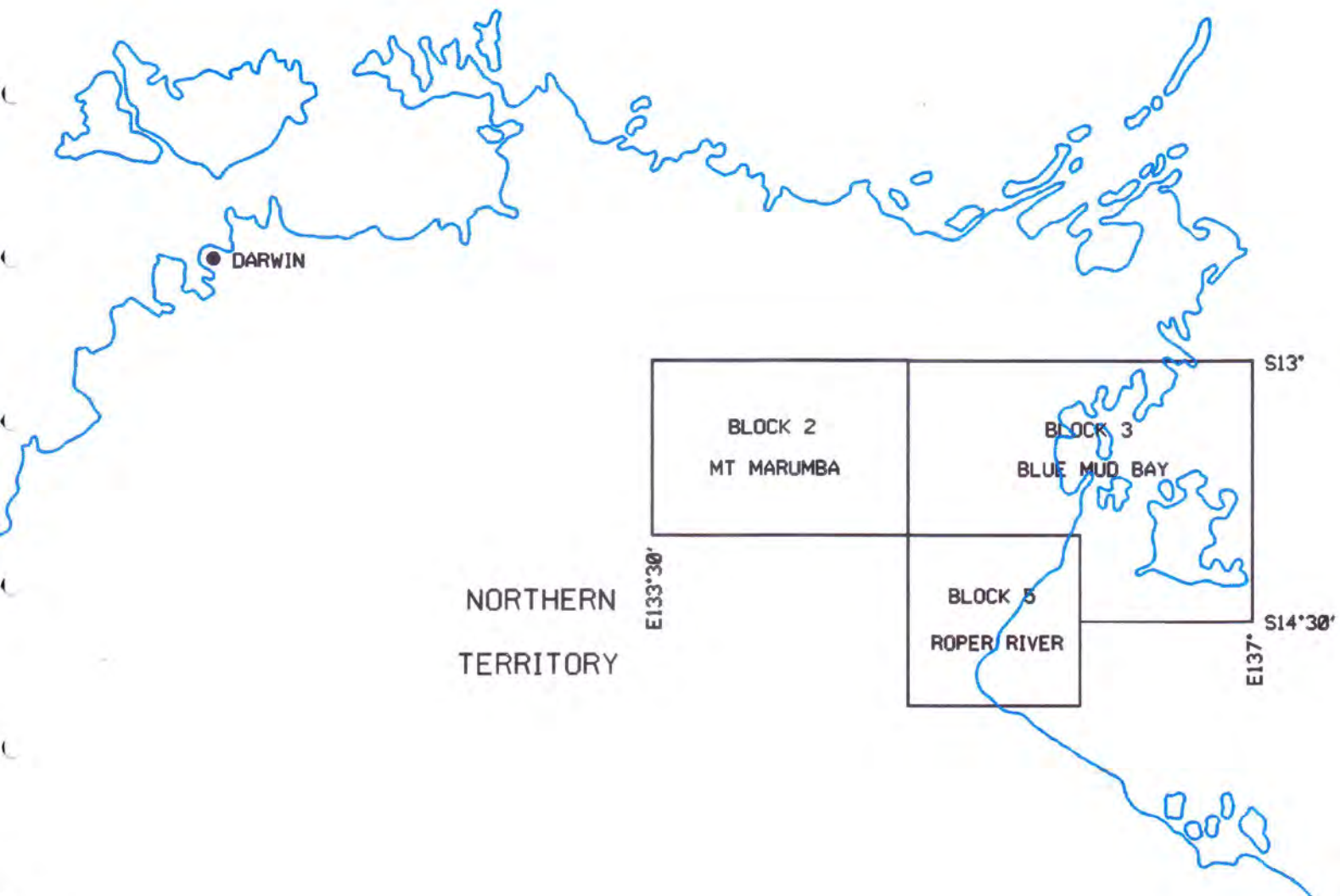
<u>Recommendation</u>	<u>Action by</u>
54. A minimum of 2 weeks notice (with Cost Codes) is required to mount an Australian Operation of this type.	DSvy-A
55. Reserve stocks of film and chemicals must be maintained.	4 Fd Svy Sqn
56. Where aircraft is based out of a RAAF facility, hire should be at dry rates with Army purchasing fuel from the RAAF.	DSvy-A



P. C. DEMAINE
MAJ
Officer Commanding

31 Jan 94

AREA OF OPERATIONS



OPERATION EMU 93
SEQUENCE OF EVENTS

Serial	Date	Event
(a)	(b)	(c)
1	8 Oct 93	Op EMU 93 is confirmed to go ahead. VH-TPR arrives in Brisbane from Op Belama 93 for servicing.
2	11 Oct	10 Rolls of film ordered.
3	12 Oct	Stores packed and despatched.
4	13 Oct	4 Fd Svy personnel transit Adelaide to Darwin. ASR member transit Melbourne to Darwin. 6 Sqn RAAF member transit Amberley to Brisbane and return as VH-TPR service incomplete.
5	14 Oct	Set up Photo Section. Stores arrive (no film) Contact AIRESEARCH via VH-TPR to borrow 2 rolls of film
6	15 Oct	LEAR arrives (0145 local) Photographic sorties commence. Versamat operational.
7	16 Oct	Film stocks arrive.
8	17 Oct	Camera malfunction (NF2). NF2 despatched by 4 Fd Svy Sqn and arrives Darwin.
9	18 Oct	Pilot changeover. Camera working, continue photo sorties Assessment discovers tip/tilt error with NF2, error remedied.
10	19 Oct	Continue Photo sorties.
11	20 Oct	Continue Photo sorties, extension to flying hours.
12	21 Oct	Assessing and cleanup.
13	22 Oct 93	VH-TPR and 3 passengers transit Darwin to Brisbane. Camera removed for return to Adelaide. RAAF member RTU. 4 Fd Svy Sqn members RTU. ASR member transits Darwin to Melbourne and RTU.

ANNEX C TO
4 FD SVY SQN
OPERATION EMU 93
OPERATION REPORT
DATED 31 JAN 94

Op EMU 93 CONTACT INFORMATION

Wing Commander Webb - Ph (089) 898 211
Executive Officer
HQNA
RAAF Darwin

Mr Ian Butterworth - Ph (089) 824 724
Bureau of Meteorology
Darwin

Photographic Section - Ph (089) 805 244
RAAF Darwin

Squadron Leader Mathie - Ph (07) 280 2002
6 Sqn
RAAF Amberley

TECHNICAL REPORT

References:

- A. Specifications for Vertical Aerial Mapping Photography undated (Draft)
- B. Army Survey Regiment Standing Operating Procedure for Assessment of Vertical Aerial Photography dated 4 Aug 93
- C. Army Survey Regiment Fax 985/93 dated 12 Oct 93

INTRODUCTION

1. Operation EMU 93 was an aerial photography operation conducted by a Detachment from 4 Fd Svy Sqn in the Arnhem Land area of the Northern Territory during the period 8 Oct - 22 Oct 93.
2. The aim of the operation was to acquire useable mapping photography of a 1:250 000 area suitable for 1:50 000 map production, in accordance with Reference A.

OPERATION RESULTS

3. A summary of results is detailed below:
 - a. Roper River (East Arnhem Block 5)
 - (1) 1 460 line kilometres of mapping photography was required, and
 - (2) 1 640 line kilometres of useable photography was achieved (includes Y photography which was reflowed).
 - b. Mount Marumba (East Arnhem Block 2)
 - (1) 2 320 line kilometres of mapping photography was required, and

- (2) 1 019 line kilometres of useable photography was achieved.
- c. Blue Mud Bay (East Arnhem Block 3)
 - (1) 3 662 line kilometres of mapping photography was required, and
 - (2) 632 line kilometres of useable photography was achieved.
4. Blue Mud Bay Run 10 (136 km) is included in Roper River figures as it is common to both blocks.
5. Annexes G, H, and I illustrate the useable photography achieved for each block.
6. Film and Technical Equipment. Minimal technical equipment was transported to the AO as the facilities at RAAF Darwin Photo Section were available. Not all facilities met RASvy technical requirements, replacement equipment was unavailable as it was in transit to Australia from Op Belama 93, as a result no Sensitometry was carried out. Equipment deficiencies could have been remedied with more preparation time.
7. As virtually no preparation time existed prior to deployment, film and chemistry orders had to be delivered direct to the AO. Flying operations commenced using film borrowed from a civilian company.
8. The Flight line package was delivered direct to Darwin not allowing time for checking prior to commencement of Operations.
9. A minimum of 2 weeks notice (with Cost Codes) is required to mount an operation of this type so that:
 - a. fresh film and chemical stocks (dangerous cargo) can be ordered and delivered to the AO by road prior to deployment.
 - b. all equipment requirements can be met, and
 - c. Flight line package can be checked.
10. Processing of Aerial Film. All aerial film was processed by the attached RAAF Photo Technician utilising a 6 Sqn RAAF C11 Versamat Processor.
11. No problems were experienced with processing however the film base on each roll emerged slightly pink, this was attributed to fixer strength, temperature, or process duration. The discolouration was not deemed to degrade the film quality but requires further investigation as to the cause.
12. Paper Print Developing. Print making was achieved with a Detachment PRO PHOTO portable contact printer and RAAF automatic processing equipment.
13. Focus problems were encountered with the contact printer as the foam contact pad caused uneven pressure and consequently many prints were remade. The RAAF print processor provided trouble free operation.

14. Sensitometry. RAAF sensitometry equipment was not suited for compliance with Reference A due to:
 - a. Sensi-strip exposure prior to development was restricted to a 9 step wedge,
 - b. Densitometer application caused concern as to possible negative damage as design was not for roll film, and
 - c. Densitometer was not calibrated and calibration strip not available.
15. As 4 Fd Svy Sqn sensitometry equipment was in transit to Adelaide from Op Belama 93 and the RAAF equipment not suited, specific negative qualities were unable to be determined.
16. Camera. The camera system performed well initially but a major fault occurred on 17 Oct where the camera would not fire when set for series. Fault diagnosis indicated a circuitry error located in the NF2 head.
17. 4 Fd Svy Sqn was notified and a replacement NF2 was delivered the same day.
18. Complete replacement was not attempted due the possibility of aircraft grounding should pressurisation seals not re-establish contact.
19. The NF2 heads were swapped and the camera appeared to operate normally, until the assessment of MSN 493 where it became apparent that a consistent 1.5 Degree tilt and 2.5 Degrees of tip was recorded on all exposures.
20. The problem was due to incompatibilities between NF2 head and tube. Two locally purchased spirit levels were utilised, instead of the inbuilt NF2 head level, to maintain accurate level and this rectified the problem.
21. Photo Assessment. Photo assessment in accordance with Reference B was carried out on each sortie after the completion of paper print production. The results were available prior to the next day's flying.
22. Contrary to Para 214 of Reference B, overall classification of a run was not downgraded on Key and Cabin diagrams in anticipation of future continuation runs as authorised at Reference C.
23. The volume of photography produced, necessitated round the clock print production / assessment prior to the next sortie.
24. Assessment prior to the next sortie is crucial to coordinate daily aircraft tasking, any increase in volume would have required an 'office' day to clear backlog and had the Operation been extended a rest day would have been required to curb fatigue.
25. A total of 4 camera operators / assessors is required for future deployment.

CONCLUSION

26. From a technical perspective Op EMU 93 was successful due to the favourable weather conditions over the AO for most of the Operation.
27. The high percentage of X class photography achieved can be attributed to:
- a. weather conditions allowing image capture, and
 - b. high quality processing of the image by the VERSAMAT film processor.
28. Although contending with the rapid deployment and limited flying hours, the Det proved versatile and maintained excellent morale.

RECOMMENDATIONSRecommendations:Action by:

- | | |
|---|---------------------|
| 29. A small operation of this nature requires a minimum of two weeks advance notice to allow purchase of photographic stores and check Flight Line package. | DSvy-A |
| 30. Operations producing high volume photography consist of four camera operators / assessors. | 4Fd Svy Sqn |
| 31. RAAF VERSAMAT Film Processors be utilised at every opportunity. | DSvy-A/4 Fd Svy Sqn |
| 32. Op EMU 93 films be tested by CPE for archival quality and assessment of film base dis-colouration. | 4 Fd Svy Sqn/CPE |



W.J. SHEPHARD
SSGT
DET COMD

2/ Jan 94

ANNEX E TO
4 FD SVY SQN
OPERATION EMU 93
OPERATION REPORT
DATED 31 JAN 94

OPERATION EMU 93
OPERATIONAL MANNING

Tabulated below are all personnel who were involved in Operation EMU 93:

Serial	Regt No	Rank	Name	Appoint	Unit
(a)	(b)	(c)	(d)	(e)	(f)
1	46446	SSGT	W.J. SHEPHARD	IC DET CAMERA OPERATOR	4 FD SVY SQN
2	49654	SGT	P.D. LONGBOTTOM	CAMERA OPERATOR	4 FD SVY SQN
3	554198	L/CPL	G. CRAGGS	CAMERA OPERATOR	ARMY SURVEY REGIMENT
4	W131907	CPL	N. GIDALL	PHOTO TECH	6 SQN RAAF
5	CIVILIAN	MR	T. FROST	PILOT	AIRSCAN
6	CIVILIAN	MR	H. MORTON	PILOT	AIRSCAN
7	CIVILIAN	MR	M.N. JUELG	PILOT	AIRSCAN

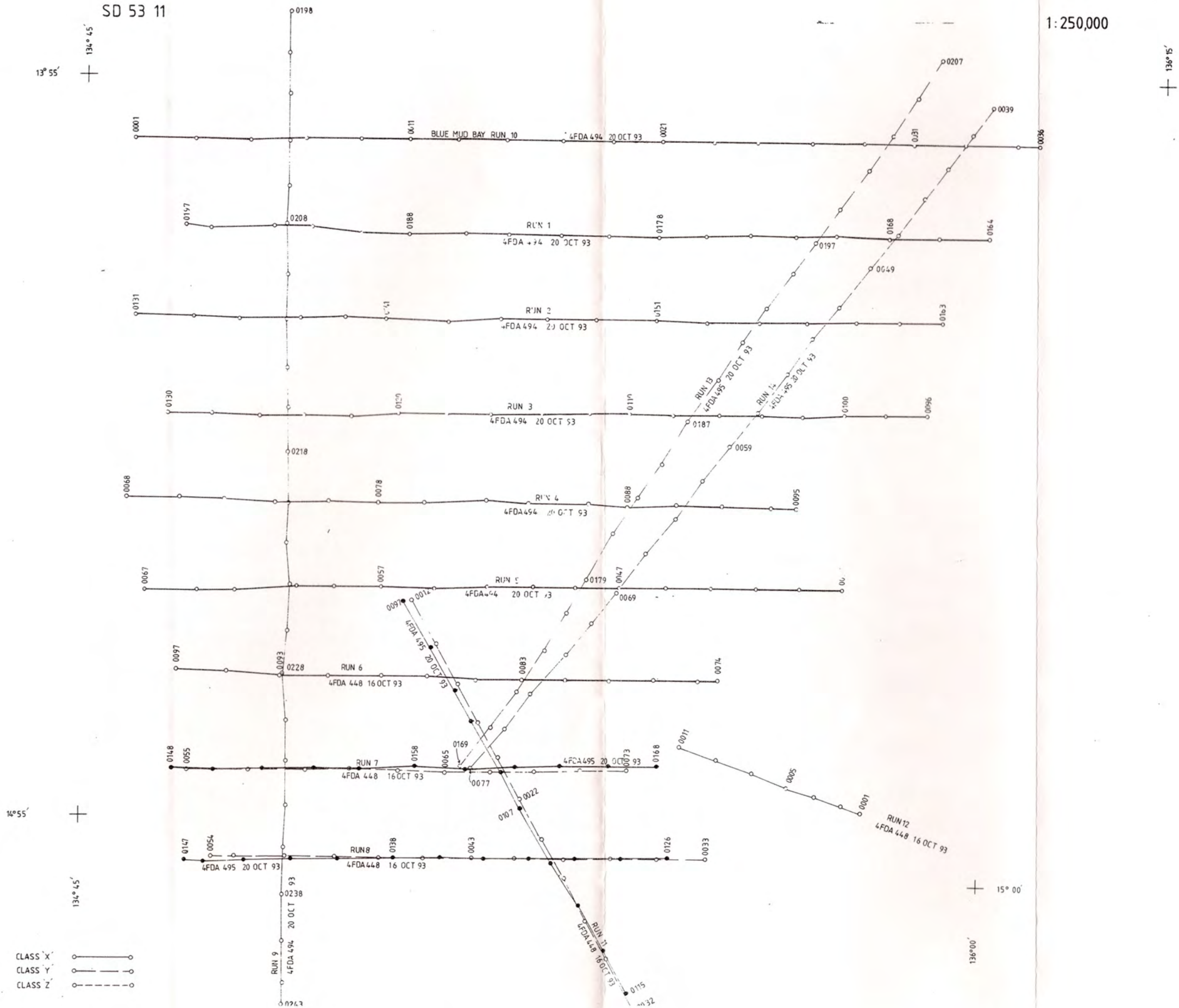
ANNEX F TO
4 FD SVY SQN
OPERATION EMU 93
OPERATION REPORT
DATED 31 JAN 94

AIRCRAFT USEAGE

Serial	Date	Personnel Involved	Base	Flying Hrs	Remarks
(a)	(b)	(c)	(d)	(e)	(f)
1	14-15 Oct 93	Frost, Juelg, Gidall	Brisbane	4.2	Transit to Darwin
2	15 Oct 93	Frost, Juelg, Shephard, Longbottom, Craggs	Darwin	1.7	East Arnhem AO
3	16 Oct 93	Frost, Juelg, Shephard, Longbottom, Craggs	Darwin	3	Roper River
4	17 Oct 93	Frost, Juelg, Longbottom, Craggs	Darwin	1.7	Mt Marumba
5	18 Oct 93	Frost, Morton, Longbottom, Craggs	Darwin	1.7	Mt Marumba
6	18 Oct 93	Juelg, Morton, Longbottom, Craggs	Darwin	3.3	Blue Mud Bay
7	19 Oct 93	Juelg, Morton, Shephard, Craggs	Darwin	2.7	Mt Marumba
8	20 Oct 93	Juelg, Morton, Longbottom, Craggs	Darwin	3.5	Roper River
9	20 Oct 93	Juelg, Morton, Longbottom	Darwin	3.6	Roper River
10	21 Oct 93		Darwin	nil	Office Assessment of Roper River Photography
11	22 Oct 93	Juelg, Morton, Shephard, Longbottom, Gidall	Darwin	3.4	Transit to Brisbane

ROPER RIVER
USEABLE PHOTOGRAPHY ACHIEVED

ANNEX G TO
4FD SVY SQN
OPERATION EMU 93
OPERATION REPORT
DATED 31 JAN 94



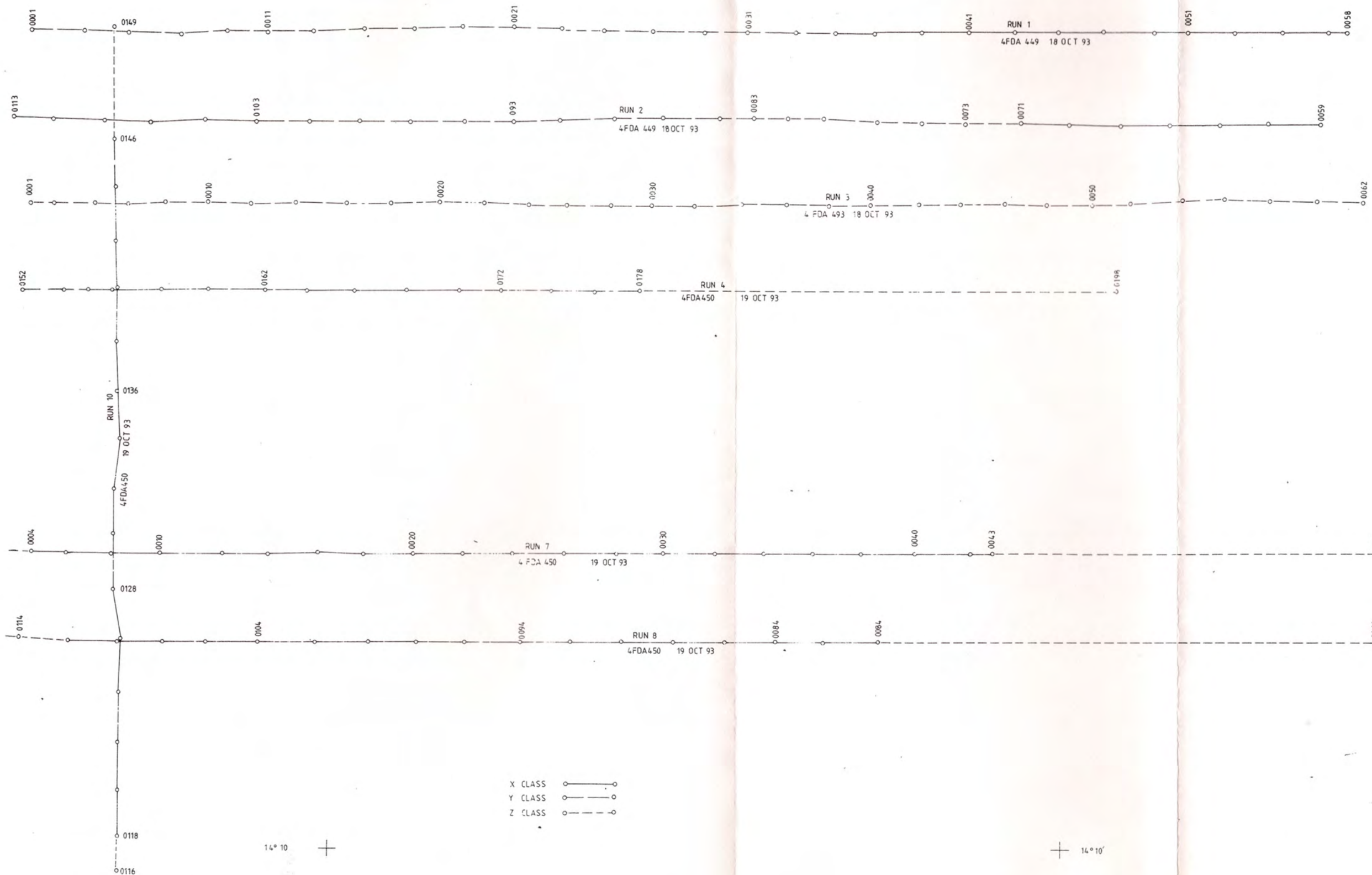
MT MARUMBA
USEABLE PHOTOGRAPHY ACHIEVED

ANNEX H TO
4 FD SVY SQN
OPERATION EMU 9
OPERATION REPOR
DATED 31 JAN 94

SD 53-6

1:250,000

135° 00'
12° 50'



BLUE MUD BAY
USEABLE PHOTOGRAPHY ACHIEVED

ANNEX I TO
4 FD SVY SQN
OPERATION EMU 93
OPERATION REPORT
DATED 31 JAN 94

S 13°00'



X CLASS ————○
 Y CLASS ————○
 Z CLASS - - - - -○

E 137°15'